PLANT COMMUNITIES OF THE MIDWEST

CLASSIFICATION IN AN ECOLOGICAL CONTEXT

Don Faber-Langendoen, Editor

A contribution to the
U.S. National Vegetation Classification and
International Classification of Ecological Communities

The Nature Conservancy®
Saving the Last Great Places

ASSOCIATION FOR BIODIVERSITY INFORMATION

PLANT COMMUNITIES OF THE MIDWEST
CLASSIFICATION IN AN ECOLOGICAL CONTEXT

Editor:

Don Faber-Langendoen — Association for Biodiversity Information

Contributors:

Norman Aaseng	Minnesota County Biological Survey
Dennis Albert	Michigan Natural Features Inventory
Pat Comer[1]	Michigan Natural Features Inventory
Robert Dana	Minnesota Natural Heritage and Nongame Research
Jim Drake	Association for Biodiversity Information
Hannah Dunevitz	Minnesota Natural Heritage and Nongame Research
Eric Epstein	Wisconsin Natural Heritage Program
Mike Homoya	Indiana Natural Heritage Program
Max Hutchison	The Nature Conservancy, Illinois Field Office
Kelly Kindscher	Kansas Natural Heritage Inventory
Chris Lauver	Kansas Natural Heritage Inventory
Mike Leahy	Missouri Department of Conservation
Darla Lenz [2]	North Dakota Natural Heritage Inventory
Bill McClain	Illinois Natural Heritage Division
Shannon Menard	Association for Biodiversity Information
Tim Nigh	Missouri Department of Conservation
Dave Ode	South Dakota Natural Heritage Database
John Pearson	Iowa Natural Areas Inventory
Kurt Rusterholz	Minnesota Natural Heritage and Nongame Research
Greg Schneider	Ohio Department of Natural Resources
Rick Schneider	Nebraska Natural Heritage Program
Kristin Snow	Association for Biodiversity Information
Gerry Steinauer	Nebraska Natural Heritage Program

[1]Currently with The Nature Conservancy, Western Conservation Science Center
[2]Currently with the USDA Forest Service, Region 1, Dakota National Grasslands

A contribution to the
U.S. NATIONAL VEGETATION CLASSIFICATION and
INTERNATIONAL CLASSIFICATION OF ECOLOGICAL COMMUNITIES

Association for Biodiversity Information
in cooperation with **The Nature Conservancy**

ISBN 0-9711053-0-8

©2001 Association for Biodiversity Information

Cover Photos: The larger inset photo shows a summer view of **Central Mesic Tallgrass Prairie** grading into **Central Bur Oak Openings**. The site is along a railroad right-of-way at Carlinville Prairie in Macoupin County, Illinois. The smaller inset photo is of a winter burn of the same prairie type at Sac Prairie, Cuivre River State Park, Lincoln County, Missouri. The background photo shows greater prairie chickens (*Tympanuchus cupido pinnatus*) mating in early spring at the Bluestem Prairie Preserve of The Nature Conservancy, western Minnesota. All photos by D. Faber-Langendoen.

Citation:

Faber-Langendoen, D., editor. 2001. Plant communities of the Midwest: Classification in an ecological context. Association for Biodiversity Information, Arlington, VA. 61 pp. + appendix (705 pp.).

Plant Communities of the Midwest: Classification in an Ecological Context consists of this main report and a 705-page appendix of Midwest plant community descriptions. The appendix is available both as an Adobe Acrobat file and as a bound volume. The Adobe Acrobat file is provided on the CD insert (see inside back cover) and on the internet at http://www.abi.org/publications/midwest/. The bound volume is available at cost; send requests to the Association for Biodiversity Information.

The CD and website also contain individual state subsets of the appendix and a copy of this main report. State subsets have the name of the state "stamped" on the title page, and do not include a cover, addendums, or bibliography (although the latter 2 items are available separately). Pagination on state subsets mirrors that of the complete appendix; thus, page numbers are not sequential.

ACKNOWLEDGEMENTS

It is no trivial matter to compile a description of midwestern plant communities using a classification framework that is part of a national and international effort. As Midwest Regional Ecologist for The Nature Conservancy, I could not hope in any reasonable time to develop on my own a classification that covered all twelve states in the Midwestern Region (Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin). I was fortunate to have the support of the network of ecologists in the state Natural Heritage programs that are listed as contributors on the title page of this document. They, along with various Conservancy field office staff, formed the core team that provided the expertise and the many hours in review and at meetings that ensured the accuracy of this classification. These individuals worked closely with me to define the various plant community types in the Midwest. Through their own extensive field experience, they provided the best and most current knowledge of midwestern vegetation and ensured that this classification is tied directly to state classifications. Although not all agreed with all of the decisions and approaches taken in producing this classification, they nevertheless helped to ensure its quality.

When I joined The Nature Conservancy's Midwest Conservation Science Center in 1992 to further the work of a national vegetation classification, Steve Chaplin, (Director, Midwest Conservation Science Center) lent his full support to this effort. Time and again, when the demands of my job threatened to distract me from this goal, he kept me focused, and I thank him for those efforts. Since 1993, I have been fortunate to have Jim Drake and Kristin Snow working with me in the Midwest. Their contributions were instrumental in completing this document. Early on, Jim helped with the writing of many of the association descriptions, and he co-authored the alliance descriptions. Kristin Snow put her innovative database skills to great use, helping with database design, data management, and reporting. My move from Minneapolis to Syracuse in 1997 only complicated her work, but she successfully kept me from straying too far from good database practices while I wrote and edited the descriptions. I thank Mary Russo, our database manager, particularly for her care in updating all of the plant species taxonomy to Kartesz (1999) standards. I am pleased to now work with Shannon Menard, who succeeded me as Midwest Regional Ecologist in April of 2000. She has already begun to improve the classification, including assisting with the final review of all descriptions.

Regional integration of information on midwestern vegetation did not begin in 1992. Starting in 1985, Kim Chapman, Midwest Regional Ecologist at the time, began synthesizing the midwestern natural community concepts used among many of the state Natural Heritage programs. His classification (Chapman 1988) provided a detailed cross-reference to the different state vegetation classifications in the region and helped set the stage for the work presented here.

A number of ecologists wrote plant community descriptions as a part of their work on Midwest Office projects: Donn Ambrose assisted with the writing of some of the rare plant community types; Carol Reschke completed a major synthesis of information on all of the alvar types in the Great Lakes region and on all vegetation types on Isle Royale National Park (Michigan); Peter Lesica worked on a number of the rare types in the Northern Great Plains; Steve Rolfsmeier worked on types found in Scotts Bluff National Monument (Nebraska); Michael Smith and Norm Aaseng worked on types at Voyageurs National Park (Minnesota); and Hollis Marriott provided an invaluable service in helping to write up information on all types in the Black Hills region of South Dakota and Wyoming.

Without the help of Rick Schneider during his time with the Great Plains Program of the Conservancy, I would still be riding the Plains in an effort to understand how midwestern types fit in with surrounding regions. His shuttle diplomacy over a two-year period enabled ecologists from the Conservancy's Midwestern, Western, and Southern Resource Offices and from state Natural Heritage programs to resolve many classification differences in the Great Plains.

This work has also benefited from input by academic scientists, Conservancy field staff, and other ecologists. Among them are Lee Frelich and Charles Umbanhowar, who helped with early drafts of Minnesota, Michigan, and Wisconsin types. Charles also reviewed North Dakota types. Tom Blewett, Paul Christiansen, Don Farrar, Susan Galatowitsch, David Glenn-Lewin, Tom Rosburg, and Daryl Smith reviewed drafts of the Iowa portion of the classification. Greg Gremaud, Doug Ladd, and Paul Nelson helped review drafts for Missouri, and Mark Guetersloh and Cynthia Olmstead reviewed those for Illinois. Marilyn Ortt and Alison Cusick provided review for the Ohio drafts. Bonnie Heidel compiled a great deal of information on North Dakota natural communities during her time at the Natural Heritage program there. Collaboration with Jason Greenall and Wasyl Bakowsky (ecologists at the conservation data centres in Manitoba and Ontario, respectively) allowed me to develop a more global perspective on the community types presented here. I thank them all for their input.

For an even broader perspective, our ecology team was fortunate to be invited in April of 1994 to a workshop in Britain, led by John Rodwell of the Unit of Vegetation Science at Lancaster University. John adapted the one-week workshop on the British National Vegetation Classification to our team's specific interests. We had the opportunity to learn firsthand about European classification methods (with a British twist). At that time, John was in the midst of his monumental five-volume series on the classification of British vegetation, now complete (Rodwell 2000), and he proved an able teacher and inspiration to our efforts here, particularly regarding the role of quantitative plot sampling in vegetation classification.

As this project neared its end, Shannon Menard and I were struggling with how best to handle the revisions to the ecological groups. These groups, drafted in 1999, were defined based on a midwestern perspective. We were fortunate that Rob Evans, Terrestrial Ecologist with the Conservancy's Southeastern Conservation Science Center, was more than willing to join in the fray. Working with a similar set of ecological groups drafted by Alan Weakley and others in the South, we were able to resolve many of the differences that existed between the regions. As a result, the version presented in this document is much more coherent across regional lines.

Nationally, Dennis Grossman, Kathy Goodin, and Kat Maybury at the Conservancy's Home Office were instrumental in leading and coordinating efforts to develop a U.S. National Vegetation classification. They supported the work of the regional ecology staff, including, over the years, Alan Weakley, Karen Patterson, Milo Pyne, Sally Landaal, and Dorothy Allard of the Southeastern Region; Lesley Sneddon, Mark Anderson, and Ken Metzler of the Eastern Region; Pat Bourgeron, Lisa Engelking, Rex Crawford, and Marion Reid of the Western Region; and the staff of the Midwestern Region mentioned above. These colleagues helped to ensure that all the types described here in the Midwest are also understood throughout their range in the United States. Many of us have now transferred from the Conservancy to the Association for Biodiversity Information, where we continue the work on the national classification.

Funding support was received from a number of federal partners for various projects relating to classification of midwestern plant communities. We gratefully acknowledge their support, in particular the U.S. Geological Survey GAP Analysis Program, the U.S. Forest Service, U.S. Geological Survey Biological Resources Division, the National Park Service, and the Environmental Protection Agency.

Many others have contributed to this effort, and though they go unmentioned here, their marks have been made in various ways. I especially want to thank many of my friends and family who helped me maintain a healthy attitude toward work. I have not always been as free with my time as they might have liked. And I owe a great deal to my wife, Kathy Faber-Langendoen, who sometimes refers to herself as my Senior Field Assistant because of all the trips she has been on with me, and who has all-too-often put up with my absences during my road trips. I am thankful that she, like me, does not tire of looking at the natural diversity of the world God has so wonderfully made and shaped.

—Don Faber-Langendoen

CONTENTS

LISTS OF TABLES AND FIGURES

List of Tables

List of Figures

I. INTRODUCTION

For many years conservationists and resource managers have recognized the need to address biological diversity at multiple levels, from species to communities, ecosystems, and landscapes. The community level, which emphasizes assemblages of species and their interactions within a system, is widely used to help assess and protect the full suite of species and ecological processes across landscapes and ecoregions. Communities also provide an important tool for characterizing the current biotic condition of ecological systems. But the variability and diversity of community patterns has not been easy to describe and classify. Classifications provide useful organizing tools that can help measure how well biological diversity is being protected and managed. The lack of a consistent, standardized classification of communities has often hindered conservation efforts that require such tools.

The utility of having a standardized vegetation classification for conservation is now becoming apparent. Consider the following examples in the Midwest. In 1986, Victoria Nuzzo found that no single definition of Midwest oak savanna was universally accepted in the region, and she attempted to provide a general definition that could guide the synthesis of information across an eight-state area (Nuzzo 1986). Because of inconsistencies from state-to-state, she was unable to provide a standardized set of information that was consistent across the region. As a result, the summary information for Indiana included what were called "savannas" (northern Indiana), but not "barrens" (southern Indiana), whereas the summaries for Illinois included both savannas and barrens. Furthermore, although Missouri doesn't use the term "barrens," their bedrock savanna types (such as "chert savanna") would be called "barrens" in both Illinois and Indiana. These definitional problems (which still persist today; see Anderson et al. 1999b) hindered abilities to do rangewide conservation of Midwest oak savannas, and they indicate the value of a standardized classification for conservation (Leach and Ross 1995).

By contrast, a recent effort by the International Alvar Working Group to conduct a rangewide review of alvar communities across North America began with the recognition that a consistent, standardized classification would allow partners to work across state and provincial lines (Reschke et al. 1999). By working with, and helping to develop, the International Classification of Ecological Communities (ICEC)/ U.S. National Vegetation Classification (USNVC) framework, the group was able to provide an integrated assessment of alvar communities rangewide, from New York to Ontario and Michigan. This work catalogued the various types of alvars and identified the alvar sites of highest conservation priority (Figure 1). The development and use of an agreed-upon standard classification for alvars does not preclude the use of alternative ones (e.g., Catling and Brownell 1999, Brownell and Riley 2000). The needs of the user and the issues to be addressed will determine which classification(s) are the most useful. However, where a rangewide perspective is needed, the ICEC/USNVC can provide a strong ecological and conservation tool.

The Nature Conservancy and the Association for Biodiversity Information (ABI), two organizations dedicated to inventorying and protecting biological diversity, recognized the need for a consistent ecological community classification some years ago. Over the last 25 years, scientists from these two organizations have worked collaboratively with a number of partners to develop an International Classification of Ecological Communities, which includes freshwater, marine, and terrestrial systems. A primary emphasis was placed on the terrestrial systems, which led to the development of the U.S. National Vegetation Classification (USNVC) (Grossman et al. 1998, Anderson et al. 1998). This classification is now a national standard for U.S. federal agencies (FGDC 1997), is supported by academic and professional ecologists (Loucks 1996, Glenn-Lewin and Jennings 2001), and is receiving widespread application for resource management, inventory, and conservation planning. The ICEC framework for terrestrial communities is now also being implemented in Canada (Ponomarenko et al. 2000, Alvo and Ponomarenko 2001) and Latin America (Carmen Josse, *pers. comm.*).

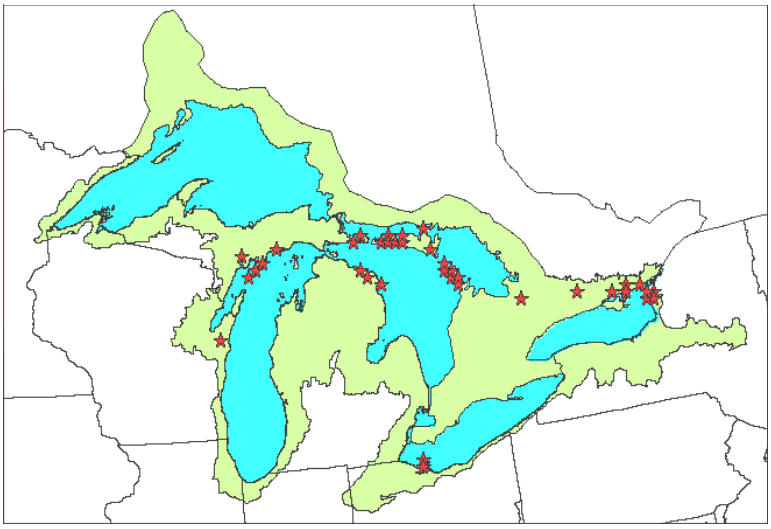


Figure 1a. Distribution of alvar sites across their entire range. Sites are marked with a star. Map shows the outline of the Great Lakes basin. Used with permission from The Nature Conservancy's Great Lakes Program.

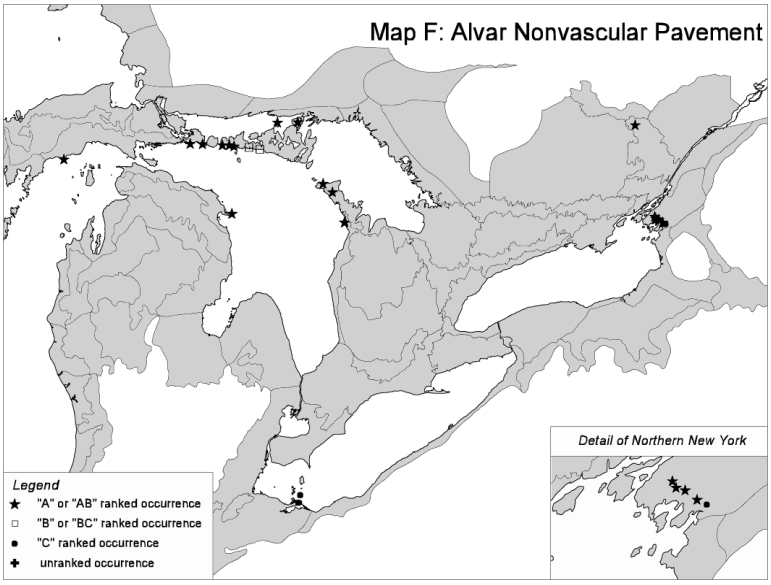


Figure 1b. Distribution of Alvar Non-vascular Pavement (*Tortella tortuosa - Cladonia pocillum - Placynthium spp.* Sparse Vegetation – CEGL005192) across its range. The sites are labeled as to their conservation value for this type, from A (high) to C (fair). From Reschke et al. (1999), used with permission from The Nature Conservancy's Great Lakes Program.

Figure 1c. Photo of Alvar Non-vascular Pavement with lakeside daisy *(Hymenoxis herbacea)* in bloom. Misery Bay Provincial Park on Manitoulin Island, Ontario, Canada. *D. Faber-Langendoen.*

The development of a standard vegetation classification for conservation, resource management, and vegetation ecology research is not without controversy. Concerns range from continuum issues to single versus multi-factor approaches, and to questions about the most practical ways to protect biodiversity above the species level. For example, should conservation be based on ecological communities, ecological land units, or functional landscapes? The rationale for the approach used by the ICEC/USNVC, of which the Midwest classification is a part, is more fully explained by Grossman et al. (1998). However, a core feature of this approach is that it provides the tools needed to define "naturalness" or "ecological integrity" of an ecological community. The classification categorizes types based on existing or actual vegetation, thereby describing the current condition of the system, including whether the vegetation is native, planted, or exotic, and whether it is maintained by disturbances (e.g., fire, grazing, or flooding), either natural or cultural (Grossman et. al. 1998). By using this approach to describe the *natural* ecological communities across the Midwest, we can define the native assemblages of species that occur there and the ecological processes that they depend on. Naturalness, which is not a static or discrete concept, doesn't preclude human activity in native systems, but it emphasizes the degree to which native systems function without regular human intervention (Grossman et al. 1998, Angermeier 2000). It is a key criterion for assessing the conservation status of systems, from global to local scales (Hannah et al. 1995).

Although the USNVC, and the Midwest portion described here, was developed primarily to address conservation and resource management issues, it also provides a systematic way to describe natural vegetation patterns and processes across the region. The descriptions provided here attempt to place the midwestern vegetation in a new perspective. Such an effort is sorely needed. Braun's (1950) approach to describing the eastern deciduous forests of North America—an outstanding work in its day—is still widely used whenever syntheses of forest patterns in the eastern United States are needed (Greller 1988, Barnes 1991, Delcourt and Delcourt 2000). However, early on it was recognized to have some limitations because of the climax approach used (Whittaker 1957). The seminal work by Curtis (1959), who described the vegetation of Wisconsin, led to no other comparable state-level efforts in the Midwest. The hundreds of more local vegetation studies have not been integrated into any single, coherent framework to interpret the diverse and dynamic patterns of vegetation, although many Natural Heritage programs have developed systematic classifications and descriptions for conservation applications in their states (White and Madany 1978, Anderson 1982, Nelson 1985, Minnesota Natural Heritage Program 1993, Lauver et al. 1999, Steinauer and Rolfsmeier 2000). The North American-wide surveys edited by Barbour and Billings (1988, 2000), although very valuable, are broadly synoptic, and omit many of the more regional and local vegetation patterns, such as cliff communities, alvars, and "Great Lakes Dunes." The approach used here works from broad-based to fine-scale patterns, and relies on existing vegetation concepts to describe the patterns and condition of the midwestern landscape. In this way, users can compare the vegetation patterns defined here to ones defined by others, whatever the scale of presentation. We hope this first qualitative synthesis of midwestern natural terrestrial vegetation will spur others to review, critique, and refine the patterns of vegetation—at all scales—that are outlined here.

The Midwest classification presented here is an integral part of the USNVC. Through that system's hierarchy, associations can be organized hierarchically based primarily on their floristic and physiognomic relationships (Grossman et al. 1998, Anderson et al. 1998). Such an arrangement is important for many purposes, many of them of national or international scope. However, when attempting to convey the information available at the association level to a wide audience of midwestern ecologists, we have found that such a vegetation-based, international framework is unfamiliar and can be somewhat cumbersome. As the purpose of this report is to present detailed descriptions at the association level within the Midwest, we chose to organize the associations by a more ecological, or habitat-based, approach that we call "ecological groups." Developing this alternative arrangement for associations, based on the purpose and audience, is not new; such alternatives have been used when presenting similar association-based approaches in Europe (e.g., Ellenberg 1988; Rodwell 1991, 2000; Muchina 2001). The decision to use ecological groups to organize the associations was made late in the classification process

(most associations were defined and reviewed by the Natural Heritage Network prior to 1999); as such, the ecological groups are experimental and need more review.

Our main objective is to provide a classification and description of natural plant communities found in the Midwest. The information is based on a combination of literature review, data analyses, existing classification documents, expert opinion, and peer review from colleagues throughout the Natural Heritage Network, many of whom have contributed their time and expertise in reviewing the material presented here. Each description provides a link to the state classifications used by Natural Heritage programs. The description also includes an assessment of the rarity and rangewide distribution of the type, which is consistent with the mission of ABI to apply this classification to conservation issues.

II. A BRIEF INTRODUCTION TO THE ECOLOGICAL REGIONS OF THE MIDWEST

The Midwestern Region covers a twelve state area in the northcentral United States, totaling some 752,000 square miles (1,946,000 square kilometers). Canada forms the border to the north. The Central Lowlands Province dominates the physiographic landscape of the Midwest. It extends westward to the Great Plains and eastward to the Allegheny Plateau (southeastern Ohio). Southward, it is bordered by the Interior Highlands (Interior Low Plateau and Ozark Plateau), which is divided by the northern extension of the Mississippi River Alluvial Plain into the bootheel of Missouri and adjacent Illinois. Northward, the Central Lowlands extend into the mixed conifer-hardwood region around the Great Lakes, except for a small part of northern Wisconsin and northeastern Minnesota that are on the Canadian Shield.

An integrated perspective on the ecological diversity of the region is provided by ecological land classifications of the region. Among the best developed and most widely used is that of Robert Bailey (1995, 1998), who has produced a series of ecoregional maps (Bailey et al. 1994, 1998). To address issues of scale, Bailey's system is hierarchical, distinguishing four ecological levels—domain, division, province, and section—at increasingly finer levels of scale. Finer scale units, such as the subsection level, have been developed by others (Keys et al. 1995). Units at each level are established based on interacting biotic and abiotic factors. Macroclimate is the principal factor used to identify continental-scale regions at the division and domain levels. Climatic subzones, assessed in part by broad-scale vegetation formations, form the basis for subdividing the divisions into provinces. Mountain provinces are those that exhibit altitudinal zonation within a shared climatic division of the adjacent lowland (in the Midwest these occur only in the Black Hills on the South Dakota - Wyoming border). Within provinces, landforms exert the major control over climate, and are used to subdivide the provinces into sections (Bailey 1995). The ecoregional map for the Midwest displays broad climatic and vegetation formation gradients across the regions, as well as some of the major landforms that shape regional vegetation patterns. The ecological features (including landforms, soils, climate, and vegetation) of these regions are described down to the province level by Bailey (1995) and at the section level by McNab and Evers (1994) (see also Plate 11).

Great Plains Region

The Great Plains (Temperate Steppe Division) contains two provinces (see Plate 11). This semi-arid continental climate has cold and dry winters with warm to hot summers. Precipitation ranges from about 10 inches (26 cm) in the north and west (Province 331) to as much as 30 inches (77 cm) along the eastern portions of Nebraska and Oklahoma (Province 332). Evaporation typically exceeds precipitation. The Black Hills, geologically a part of the Rocky Mountains, are tall enough (7200 feet) to create a mountain climate. At higher elevations they contain montane grasslands, ponderosa pine (*Pinus ponderosa*) and white spruce (*Picea glauca*) forests. Mixedgrass prairie or steppe (0.5 to 1 m tall) dominates the northern parts of the Great Plains. Dominants include western wheatgrass (*Pascopyrum smithii*), green needle-and-thread (*Hesperostipa comata*), little bluestem (*Schizachyrium scoparium*) and side-oats grama (*Bouteloua curtipendula*). The central and southern parts of Province 331 transition to

shortgrass prairies, where the vegetation rarely exceeds 0.5 m. Dominants there include blue grama (*Bouteloua gracilis*) and buffalo grass (*Buchloe dactyloides*). Much of the landscape consists of rolling plains and tablelands, but some extensive badlands formations occur in the White River Badlands of South Dakota and the Little Missouri Badlands of western North Dakota (Section 331F). Soils are primarily Mollisols and can be quite saline (or haline). The northern part of Province 332 and adjacent parts of 331E were glaciated (more or less north of the Missouri River), creating geologically young, glacially-derived soils and dissected till plains. Water is much more extensive, and prairie potholes are numerous. South of the Missouri River, loess and sand deposits cover much of the area, including the large Sandhills region of western Nebraska (Section 332C). Eastern cottonwood (*Populus deltoides*) and green ash (*Fraxinus pennsylvanica*) are common floodplain trees. Drought, fires, and grazing herbivores (e.g., prairie dogs, bison) have historically influenced the vegetation.

Prairie Parkland Region

Within the Prairie Division, the Prairie Parkland Province extends southward from the Canadian border to Oklahoma and extends eastward in the "prairie peninsula" to northwest Indiana (see Plate 11). The subhumid climate varies in annual precipitation from 20 to 40 inches (51 to 100 cm), with precipitation and evaporation more or less equal. Soils are primarily Mollisols. In the northern regions glaciation has left extensive rolling glacial till uplands and prairie potholes. Southward, soils vary from loess (sometimes formed into Loess Hills east of the Missouri River in Iowa) to thin soils over bedrock, especially in the Flint Hills region of Kansas and Oklahoma (Section 251F). The vegetation in this climate is a mixture of deciduous (especially oak) forest, woodland, savanna, and grassland (or prairie). Prairies are dominated by tall grasses, often 1 to 2 m tall. Big bluestem (*Andropogon gerardii*), yellow Indian grass (*Sorghastrum nutans*), little bluestem (*Schizachyrium scoparium*), switchgrass (*Panicum virgatum*), prairie dropseed (*Sporobolus heterolepis*), and porcupine grass (*Hesperostipa spartea*) are common. The alternation of these types in the western part of the parkland is partly a function of the local soil conditions and slopes; forests and woodlands are restricted to more moist and well-protected areas. In the eastern part of the parkland, forests and woodlands are more widespread, but prairies and savannas predominate in the flattest and most exposed areas. Fire and grazing (and more recently, haying) play a critical role in the balance between prairie and woodland. Floodplains are dominated by eastern cottonwood (*Populus deltoides*) and green ash (*Fraxinus pennsylvanica*), along with willows and oaks.

Eastern Dry Deciduous (Broadleaf) Forests Region

This dry (or continental) eastern deciduous forest region is part of the Hot Continental Division, where hot summers and cool winters prevail (see Plate 11). In this province (222), precipitation varies from 20 inches (51 cm) on the western edge to over 40 inches (100 cm) in the east. Most of the central area has rolling topography that was mostly glaciated, but some parts are nearly flat. The soils show some degree of podzolization and are typically Alfisols. Further south in the Ozark Highlands region (Section 222A), the relief is moderate, up to 1,000 feet (300 m). Low rolling hills and dissection plateaus are found in the Interior Low Plateau region (Sections 222D, E, and F). Together, these two unglaciated regions are sometimes referred to as the Interior Highlands. Ultisols tend to predominate. The vegetation across this province is dominated by broadleaf, deciduous hardwoods, including sugar maple (*Acer saccharum*) and American basswood (*Tilia americana*), but the dry conditions towards the west tend to favor a diverse mix of oaks and hickories, which are often less than 60 feet (20 m) tall. Northward the oaks are typically white oak (*Quercus alba*), northern red oak (*Quercus rubra*), black oak (*Quercus velutina*) and bur oak (*Quercus macrocarpa*). Southward (especially in the unglaciated border regions), these mix with post oak (*Quercus stellata*) and blackjack oak (*Quercus marilandica*). Prairie and savannas predominate in the border regions with the Prairie Parkland (especially in Sections 222A, 222G, 222K, 222M, and 222N). The dissected regions of the Interior Highlands often have open cliffs and rocky ledges with grassy or scrubby glade communities. The Paleozoic Plateau (or Driftless Area) in Section 222L is more dissected and favorable to forested conditions. Further east in the province,

particularly in Indiana and western Ohio, American beech (*Fagus grandifolia*) - maple forests are dominant on the glaciated till plains. A variety of unique dune and wetland communities occurs along the southern Great Lakes shores.

Eastern Moist Deciduous (Broadleaf) Forests Region

This eastern deciduous forest region is also part of the Hot Continental Division, but the region contains a moister climate than the Eastern Dry Deciduous Forest Region (see Plate 11). Only a small portion of the Midwest occurs in this province (221); most of the province extends further east and south. Precipitation in the Midwest part of this province (southeastern Ohio) varies from 35 to 45 inches (89 to 115 cm), some of the highest levels in the Midwest. Droughts are much less frequent than elsewhere in the Midwest. Soils show varying degrees of podzolization and are typically Alfisols. Eastern Ohio is on the Allegheny Plateau, one of a series of Appalachian Plateaus that border the western side of the Appalachian Mountains. Much of this area has never been glaciated, and elevations are rarely over 1,500 feet (450 m). The vegetation in the Ohio region contains a diverse set of deciduous broadleaf hardwoods, especially mixed mesophytic forests of tulip tree (*Liriodendron tulipifera*), sugar maple (*Acer saccharum)*, American beech (*Fagus grandifolia)*, basswoods (*Tilia americana* and *Tilia heterophylla*) and yellow buckeye (*Aesculus flava*). This area also contains a mix of Appalachian oaks, including rock chestnut oak (*Quercus prinus*), scarlet oak (*Quercus coccinea*), white oak (*Quercus alba)*, and northern red oak (*Quercus rubra)*. Some eastern white pine (*Pinus strobu*s) and eastern hemlock (*Tsuga canadensis*) may mix with the oaks and other hardwoods.

Laurentian Mixed Forests Region

The northcentral areas of the Midwest are part of the Warm Continental Division, which is located between the source regions of polar continental air masses to the north and tropical continental air masses to the south (see Plate 11). Winters are cold and summers warm. Average annual precipitation in the midwestern part of this province varies from 21 to 36 inches (53 to 92 cm). Much of the area has low relief, but rolling hills occur in many places, and elevations may rise to over 2,200 feet (675 m) in limited areas of the region. This area was completely glaciated and is characterized by lakes, poorly drained depressions, moraines, drumlins, eskers, outwash plains, and other glacial features. Paleozoic sedimentary rocks underlay the glaciated surface; however, the igneous materials of the Canadian Shield are exposed in some areas of the province. Soils vary from peat, muck, marl, clay, silt, sand, and gravel, to glacially scoured boulders and ridges. Spodosols are common along the Great Lakes, with Inceptisols and Alfisols located further inland. Vegetation includes pure to mixed stands of eastern white pine (*Pinus strobus*), red pine (*Pinus resinosa*) or jack pine (*Pinus banksiana*). Jack pine and northern pin oak (*Quercus ellipsoidalis)* forests and barrens can predominate on dry sand plains. Extensive stands of eastern hemlock (*Tsuga canadensis)* and northern hardwoods, including sugar maple (*Acer saccharum)*, American basswood (*Tilia americana)*, American beech (*Fagus grandifolia)*, and yellow birch (*Betula alleghaniensis*) are common. Further north, in the boreal transition, forests of white spruce-balsam fir (*Picea glauca-Abies balsamea*) and trembling aspen-paper birch (*Populus tremuloides-Betula papyrifera*) mix in various combinations. Peatlands dominated by both black spruce-tamarack (*Picea mariana-Larix laricina*) and leatherleaf (*Chamaedaphne calyculata*) bogs may occupy extensive areas or occur in kettle bog depressions. Fires and windstorms are important disturbances in the region.

Conservation Challenges

The wide array of plant community diversity present in the Midwest has been a source of inspiration to conservationists and ecologists in their efforts to understand and conserve this region. But it is also apparent that this diversity has been extensively modified by human activity. Activities in the last 100 years have converted what were once extensive tallgrass prairies into prime agricultural fields. Wetlands in the United States have been so extensively drained that, of the seven states with greater than 75% loss of wetlands, five are found in the Midwest (Illinois, Indiana, Iowa, Missouri, Ohio) (Dahl

1990). As a result, the percentage of imperiled plant communities in the Midwest is higher than in any other part of the country: of eight states reporting greater than 30% of their communities imperiled, six were found in the Midwest (Illinois, Indiana, Iowa, Kansas, Missouri, and Nebraska) (Grossman et al. 1998).

While the broad patterns of habitats, and of habitat loss and degradation, have become apparent, no accounting of the particular plant communities across the region has been available. The classification outlined below attempts to portray the entire array of natural plant communities across the Midwest in order to better understand it and to assist with conservation efforts across the region.

III. THE U.S. NATIONAL VEGETATION CLASSIFICATION

BACKGROUND

In the late 1990s, the Conservancy published the first edition of the U.S. National Vegetation Classification (USNVC), including both a detailed introduction to the classification system (Grossman et al. 1998) and a list of the units across the country (Anderson et al. 1998). This work was based on the efforts of the Conservancy's national and regional ecology staff, working closely with state Natural Heritage program ecologists, international conservation data centers, and with cooperators in federal agencies, colleges and universities. Earlier, in 1994, the Natural Heritage programs and conservation data centers founded the Association for Biodiversity Information (ABI) as a membership organization to represent the Natural Heritage Network's interests. In 1999, the Conservancy and ABI joined together to build a stronger, fully independent organization to strengthen the Network and to provide regional, national, and international biodiversity information products. ABI was reconstituted from existing Conservancy staff and the Heritage-related databases, software, and methodology that the Conservancy had developed over the years. The work of refining the classification was also transferred to ABI. The principles of the classification, and its development, current status, and future plans are detailed by Grossman et al. (1998; see also Maybury 1999), but a brief summary of the four key attributes is needed to put the Midwest subset in context.

Key Attributes

1. It is based on vegetation.

Classifications of ecological systems can be based on a variety of factors, such as vegetation, soils, and landforms that can be used either singly or in combination. The terrestrial classification presented here is based primarily on vegetation, for several reasons. First because the mission of the Conservancy and ABI is to protect biodiversity, a classification that emphasizes the biotic component of ecological systems was seen as being most directly relevant to this mission. Second, vegetation is an easily measured component of an ecological system. It is often chosen as the most useful single factor for classifying terrestrial ecological systems because it integrates the environmental conditions, ecological processes, and biogeographical dynamics of a site or landscape more measurably than any other factor. Third, vegetation can serve to describe many facets of biological and ecological patterns across the landscape. Plants provide the habitat and structure for many other organisms in an ecological community, and vegetation is often used to infer soil and climate patterns. Fourth, building a single-factor system was simply more practical than building a more complex, multifactor system.

2. It has been applied to natural vegetation.

The USNVC may be used to classify all vegetation, from the extremes of natural (those that appear to be unmodified by human activities) to cultural (planted and maintained types, such as annual croplands, tree plantations, orchards, and vineyards). However, because much of the conservation focus is on the protection of natural vegetation, only the more natural types are being classified and described

by ABI and the Natural Heritage Network. Natural vegetation is defined as vegetation that occurs without regular human management, maintenance, or planting, and that generally has a strong component of native species.

3. It is based on existing vegetation.

Vegetation classifications are typically based on either existing or potential natural vegetation (PNV). PNV types represent the projected mature or stable end points of vegetation development over time (late seral types). These types are projected to occur and persist on a site in the absence of disturbance, whether human-caused or natural (though some PNV concepts, such as those of Küchler [1964] recognize vegetation maintained by natural disturbances as PNV). PNV classifications offer insight into vegetation-site relationships and can be helpful in projecting the type of vegetation expected under a certain set of ecological factors. Nevertheless, disturbances have a strong influence on the structure and composition of vegetation, and each major successional stage following a natural disturbance (or a human-caused disturbance that closely mimics a natural one) may be biologically and ecologically distinct. Early successional communities also provide important habitat for many species. In addition to its usefulness for conservation purposes, a classification of existing vegetation makes fewer assumptions about natural processes or vegetation dynamics than PNV and allows the classification to be grounded in what is directly observable and measurable. Finally, the focus on existing vegetation can support a wide number of uses, including inventorying and monitoring the current status of ecological systems. For these reasons, the USNVC classification is based on existing vegetation, inclusive of all major stages of plant community dynamics.

Although the USNVC framework is comprehensive with regard to existing vegetation—encompassing the spectrum from natural to cultivated—ABI has focused on the natural types, both naturally disturbed (early and mid-seral) and naturally undisturbed (late-seral).

4. It is a hierarchical system, defined by physiognomy and floristics.

The USNVC has a hierarchical taxonomic structure with physiognomic criteria used at the coarsest levels of the hierarchy and floristic criteria used at the finest. Physiognomy refers to the structure (height and spacing) and overall shape of plants, and to leaf characteristics, such as seasonality, shape, size, and texture. These features provide a fast, efficient way to categorize vegetation on broad geographic scales. Physiognomic features can often be linked to remote sensing signatures, are easily recognized in the field, and can be applied even in places where very little information about the flora exists. Floristics refers to species composition. Using species composition or species groups to characterize vegetation reveals finer-scale local and regional patterns than are likely to be perceived using physiognomic characteristics.

A combined physiognomic-floristic system allows for most of the advantages of both approaches and provides a unifying framework within which to relate typically coarse-scale physiognomic systems to more local and regional floristic systems. Structuring the USNVC in a hierarchical fashion allows it to be used at different taxonomic scales, depending on the amount of information available and the resolution needed.

Hierarchy

A key requirement of the classification system was that it would work not only in the United States, but also internationally. For this reason, the Conservancy and ABI chose to work with a physiognomic classification, the UNESCO world vegetation classification (UNESCO 1973). Several factors contributed to this decision. First, the UNESCO classification is the result of an international collaboration of scientists with considerable vegetation expertise, and has been used in many parts of the world. Second, it has a hierarchical arrangement, allowing it to be used at various conceptual and mapping scales, depending on the level of detail available or needed for a specific purpose. Third, its units are vegetation formations, i.e., vegetation types defined by physiognomy, with clear identification

criteria associated with each. This means that the system creates standard, easily identifiable units that may apply to many areas of the globe. Finally, the UNESCO formation levels contained associated ecological criteria (especially climate, topography, and hydrology) that helped clarify the geographic and ecologic scope of the units.

The Conservancy and ABI made some amendments to the UNESCO classification in order to provide better representation of physiognomic conditions and more coherent links to floristic levels, which are not included in the UNESCO classification. An additional level was added between the "formation group" and the "formation" levels in order to allow a separation between cultural vegetation (e.g., corn fields, pine plantations) and natural vegetation. The USNVC system uses floristic units at the lowest levels—the association and alliance—that are similar in many respects to the Braun-Blanquet approach (Braun-Blanquet 1932, Mueller-Dombois and Ellenberg 1974). These floristic units are nested within the physiognomic units (Tables 1 and 2).

Table 1. The framework of the International Classification of Ecological Communities (ICEC) and the U.S. National Vegetation Classification (Grossman et al. 1998). The top five levels are physiognomic, the bottom two levels are floristic.

LEVEL	PRIMARY BASIS FOR CLASSIFICATION	EXAMPLE
Class	Growth form and structure of vegetation	Forest
Subclass	Growth form characteristics (e.g., leaf phenology)	Deciduous Forest
Group	Leaf type, corresponding to climate	Cold-deciduous Forest
Subgroup	Relative human impact (natural/semi-natural or cultural)	Natural/Semi-natural
Formation	Additional physiognomic and environmental factors, including hydrology	Lowland or Submontane Cold-Deciduous Forest
Alliance	Diagnostic/dominant species of uppermost or dominant stratum	*Acer saccharum - Tilia americana - (Quercus rubra)* Forest Alliance
Association	Additional diagnostic/dominant species in all strata	*Acer saccharum - Tilia americana / Ostrya virginiana - Carpinus caroliniana* Forest

Association Concept

The association is the lowest level of the hierarchy, and the proposed basic unit for vegetation classification in North America north of Mexico (Grossman et al. 1998, Ponomarenko et al. 2000). It is defined as "a plant community type of definite floristic composition, uniform habitat conditions, and uniform physiognomy" (see Flahault and Schroter 1910). It is the combination of these interrelated criteria that conceptually defines the association (Figure 2). Typically, primary emphasis is given to floristics and physiognomy, with habitat features assessed through correlation with the vegetation. "Uniform" physiognomy and habitat may include patterned fine-scale heterogeneity (e.g., the canopy heterogeneity of grass-dominated and shrub-dominated patches in a shrub steppe or savanna). "Habitat" refers to the combination of environmental (site) conditions and ecological processes (such as disturbances or nutrient cycling) that influence the community.

Table 2. Illustration of the USNVC hierarchy showing all classes and subclasses and some examples of lower levels. The subgroup level is not shown; it simply divides the groups into either Natural/Semi-natural or Planted/Cultivated. The association level is also not shown.

PHYSIOGNOMIC LEVELS				**FLORISTIC LEVELS**
CLASS	**SUBCLASS**	**GROUP (example)**	**FORMATION (example)**	**ALLIANCE (example)**
FOREST	EVERGREEN DECIDUOUS MIXED	Temperate or subpolar needle-leaved evergreen forest	Rounded-crowned temperate or subpolar needle-leaved evergreen forest	*Pinus banksiana* Forest Alliance
WOODLAND	EVERGREEN DECIDUOUS MIXED	Temperate or subpolar needle-leaved evergreen woodland	Rounded-crowned temperate or sub-polar needle-leaved evergreen woodland	*Pinus (banksiana, resinosa)* Woodland Alliance
SHRUBLAND	EVERGREEN DECIDUOUS MIXED	Needle-leaved evergreen shrubland	Needle-leaved evergreen shrubland (e.g., krummholz)	*Juniperus communis* Shrubland Alliance
DWARF- SHRUBLAND	EVERGREEN DECIDUOUS MIXED	Needle-leaved or microphyllous evergreen dwarf-shrubland	Creeping or matted needle-leaved or microphyllous evergreen dwarf-shrubland	*Juniperus horizontalis* Dwarf-shrubland Alliance
HERBACEOUS VEGETATION	PERENNIAL GRAMINOID PERENNIAL FORB HYDROMORPHIC ROOTED ANNUAL GRAMINOID OR FORB	Temperate or subpolar grassland	Tall sod temperate grassland	*Andropogon gerardii – (Sorghastrum nutans)* Herbaceous Alliance
NONVASCULAR	BRYOPHYTE LICHEN ALGA	Temperate or subpolar lichen vegetation	Lichen vegetation with a sparse tree layer	*Pinus banksiana / Cladonia* spp. Nonvascular Alliance
SPARSE VEGETATION	CONSOLIDATED ROCK BOULDER, GRAVEL, COBBLE, TALUS UNCONSOLIDATED MATERIAL	Sparsely vegetated pavement	Pavement with sparse vascular vegetation	Open pavement Sparsely Vegetated Alliance

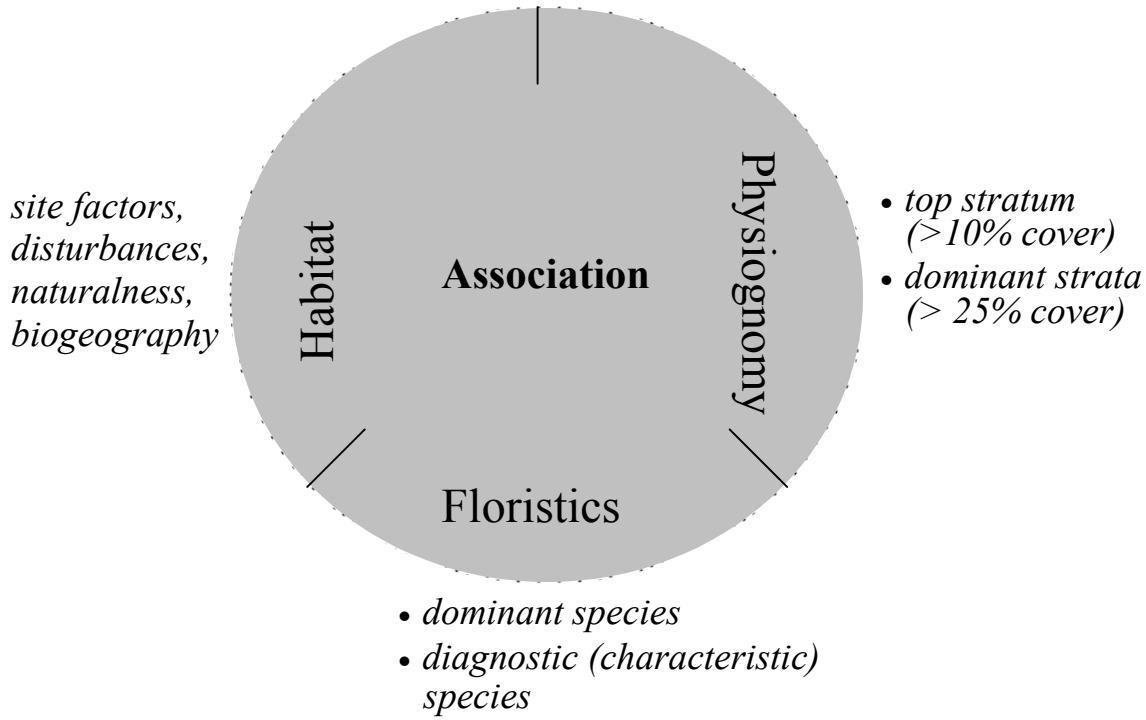


Figure 2. Schematic presentation of the various components of the association concept.

The association concept uses both the dominant species (those covering the largest area in a stand or plot) and the diagnostic species (those particularly helpful in discriminating stands of one type from another, whether dominant or not). Dominant species contribute to the overall structure and physiognomy of the stand, but they may also be widespread and occur with a wide variety of species in many different habitats. For example, in northcentral Minnesota and central Wisconsin, jack pine (*Pinus banksiana*) occurs over a broad range of glacially scoured bedrock and outwash sand plains, with cover ranging from sparse to dense, depending on habitat features. On sand plain habitats, the combination of physiognomy, floristics, and disturbance factors can be used to further distinguish the denser forests with blueberries (*Vaccinium* spp.) and feathermoss (*Pleurozium schreberi*) from more open stands, maintained by a 25 to 50 year fire rotation, where oaks (*Quercus* spp.), little bluestem (*Schizachyrium scoparium*), and other prairie forbs may be common. Stands of the former are called the *Pinus banksiana / Vaccinium spp. / Pleurozium schreberi* Forest, while those of the latter are included in *Pinus banksiana – (Quercus ellipsoidalis) / Schizachyrium scoparium* Prairie Forbs Wooded Herbaceous Vegetation.

The association (and related alliance) concept contrasts with the forest cover type approach, which is based on existing vegetation but relies entirely on the dominant canopy species (e.g., the Jack Pine type as defined by Eyre 1980). The concept also contrasts with that of habitat typing, which is based on potential natural vegetation and relies more on ground-layer species that reflect the undisturbed, mature, or climax stages of vegetation (e.g., in Wisconsin, the open jack pine barrens are treated together with the late successional pine types that occur on sand substrates [Kotar 1988]).

Associations may occur at a variety of spatial scales driven by steepness of the environmental gradients and the patterning of disturbance processes across the landscape. For example, a number of upland eastern forest and western grassland associations occur naturally in patches of thousands or even tens of thousands of acres, extending across relatively modest slopes where gradients change gradually over many miles. Some wet meadow associations, on the other hand, occur in small patches that contain steep hydrologic gradients over a few acres or less, and these conditions can shift dramatically from year

to year. In addition, the same association can occur at different spatial scales depending on the environmental and disturbance conditions within a landscape.

Associations are grouped into the next level of the USNVC hierarchy, the alliance, primarily through shared canopy dominants and physiognomic structure. These characteristics along with some habitat features such as climate and hydrology, are used to place alliances into the physiognomic parts of the hierarchy (Tables 1 and 2).

The USNVC and the Natural Heritage Network

The development of the Midwest portion of the USNVC began in the context of numerous local and state vegetation or natural community classifications that had been developed in different jurisdictions. There has never been a strong tradition of vegetation classification among academics in the Midwest, which is perhaps a reflection of the influence of the individualistic concept of the association developed by Gleason (1926) and extended into the continuum concept by Curtis (1959) and others.

The various needs for classification by both academic and applied ecologists led to a wide variety of approaches to classification, including the approach used by Curtis himself to summarize vegetation patterns, i.e., that of segmenting vegetation along an inferred or measured environmental continuum. Other examples of various classifications produced in the Midwest include those of Braun (1936), Tolstead (1942), Braun (1950), Bliss and Cox (1964), Voigt and Mohlenbrock (1964), Weaver (1965), Redmann (1972), Küchler (1974), Grigal and Ohmann (1975), Pell and Mack (1977), Cahayla-Wynne and Glenn-Lewin (1978), White and Madany (1978), and Jackson (1979).

Beginning in the 1970s, The Nature Conservancy recognized the need for systematically collecting information on biological diversity, including natural ecological communities. The Conservancy began working with state agencies in the United States to establish state Natural Heritage programs. It also worked with provincial and territorial agencies in Canada, and with national partners in Latin American and other countries, to establish conservation data centers (CDCs). Programs were successfully established in all 50 U.S. states, and in most provinces and territories in Canada, and in a number of nations in Latin America and elsewhere. These programs, collectively referred to as the Natural Heritage Network, have as one of their missions to collect and disseminate information on exemplary occurrences of natural communities in their jurisdiction (Jenkins 1988, 1996; Stein and Davis 2000). Many of these programs, including those in the Midwest, developed classifications to assist their work in conducting ecological community surveys. Examples include White and Madany (1978) for Illinois, Nelson (1985) for Missouri, and the Minnesota Natural Heritage Program (1993) for Minnesota. These systems used a variety of factors, such as physiognomy, floristics, and abiotic site characteristics, for identification of their types. Although they work well within their states, these classifications were not consistent with each other, preventing conservation efforts from being easily prioritized at the regional, national, or international levels. This pointed to the need for a nationwide, and indeed worldwide, ecological community classification that would still have a high resolution on a local level. Only by building a classification that crosses political lines, and by working in partnership with the Natural Heritage Network that gathers critical conservation information on ecological communities, would the Conservancy (and later ABI) be able to provide accurate, timely information for conservation decision-making.

The USNVC that resulted from this partnership was developed through a long, collaborative process led by the Conservancy and ABI and involving Natural Heritage programs, U.S. governmental agencies, and a number of scientific institutions. The collaboration of ABI and Conservancy ecologists with the Natural Heritage Network has been particularly important during this process. The USNVC was developed by coordinating efforts across four major U.S. regions (Figure 3). A team of ecologists in each region took the lead in developing and describing the vegetation types in their jurisdiction, but they worked collaboratively across regions (and across national borders) to ensure that a truly national and global perspective was maintained when describing the units.

Figure 3. Map of the United States showing the states included in ABI's four regions. Each region has been responsible for the development of the USNVC in their region, as well as for working with partners in adjacent areas of North America. Abbreviations are provided for each of the twelve states in the Midwestern Region.

In the Midwest, the collaboration led to a series of draft Midwest classification documents (Chapman 1988, Faber-Langendoen 1993, Faber-Langendoen and Midwest state Heritage program ecologists 1996) that helped contribute to the national list of vegetation units, including alliances and associations (Anderson et al. 1998). But that list was indeed only a list. There were no descriptions to guide the users in understanding how the types were defined. Subsequent descriptive work focused on the alliance level, driven in part by the desire of the U.S. Geological Survey GAP Analysis Program to use alliances as a classification standard for mapping existing vegetation across the country (Jennings 1993). Currently about 85% all of the alliances in the United States have been described (Sneddon et al.1996, Drake and Faber-Langendoen 1997, Weakley et al. 1997, Reid et al. 1999).[1] More pressing, however, is a need to describe the associations, because although the USNVC was designed for conservation applications at multiple hierarchical levels, the association is a basic unit of the hierarchy and a key level for conservation decision-making.

METHODS

Assembling the Information

Three key review steps were used to develop an initial set of associations and alliances for the Midwest portion of the USNVC: literature review; state Natural Heritage program review; and regional, national, and international review. Literature review consisted of cataloguing a large number of published

[1] These alliance descriptions, along with all developed association descriptions presented here, are available at www.natureserve.org, a searchable online resource provided by ABI. NatureServe provides critical biological and conservation status data on species and ecological communities across North America.

journal articles, books, agency reports, and other publications that contained information on the vegetation ecology of the Midwest. Chapman (1988) assembled many of these during earlier stages of classification development in the Midwest. Thousands of articles have been catalogued and their citations computerized in the ABI Ecology Databases. Additional articles have been compiled at the state level by state programs.

All twelve midwestern state Natural Heritage programs had drafted some type of state community classification by the early 1990s. Some states had only preliminary lists of types that were still in the process of refinement (Iowa, North Dakota, and South Dakota); others had developed relatively brief qualitative summaries (Illinois, Indiana, Kansas, and Michigan); and still others had developed relatively detailed qualitative summaries (Minnesota, Missouri, Nebraska, and Ohio). More rarely, both detailed qualitative and quantitative information were available, such as in Wisconsin, where the landmark publication on the vegetation of Wisconsin by Curtis (1959) guided the types defined by the Natural Heritage program. Some of the classifications were based on extended field surveys conducted by ecologists across the state over a period of five to ten or more years. In those states, even when the ecologists collected plot data, vegetation information was typically summarized qualitatively. Conversely, in cases where no plot data were collected, the state types may have been based on quantitative data summarized in the literature. Based on the literature and the state classification information, preliminary definitions of associations and alliances were created and placed within the USNVC hierarchy. Given the sources of information, which were often descriptive and lacking in quantitative stand tables, these preliminary units relied on dominance patterns and characteristic species patterns (see *Defining the Association* on page 16 for definitions of dominant and characteristic species). These units were then compared to those developed in other states, provinces, and regions outside the Midwest to assess possible redundancies in types. This review was summarized as the first approximation of midwestern plant associations (Faber-Langendoen 1993).

Cross-walking and Integration

A series of meetings was then held with state Natural Heritage program ecologists to review the first approximation and to ensure that it was linked, or "cross-walked," to the state classifications. Typically, meetings were first held with ecologists from three to four states that shared types, followed by subsequent one-on-one meetings that focused on key issues within a state. Academic and other experts on the vegetation of the state attended some of these meetings. Beginning in 1995-1996, Canadian provincial ecologists from Manitoba and Ontario also began reviewing the types.

The process of "cross-walking" is a key step in the building of the midwestern plant associations, and requires further explanation. The Midwest portion of the USNVC was developed in partnership with the Natural Heritage Network in order that the classification be used as both a basic vegetation description tool and to provide critical information for conservation decision-making across jurisdictional lines. However, individual Natural Heritage programs have, for a variety of reasons and to varying degrees, maintained their own state classifications at the same time that they use and support the "global" types in the USNVC. In order to improve the degree of synonymy between USNVC and state classifications, types were subjected to a series of reviews and revisions and, wherever possible, a standardized unit at both the state and global level was agreed upon. Where this was not possible, the nature of the relationship between the two units was explicitly stated (i.e., if not equivalent to the USNVC type, the state type may be broader than, finer than, or may intersect in some way with it).

These expert-driven meetings helped produce a draft list of types that received widespread review throughout the Network, in the Midwest and beyond (Faber-Langendoen et al. 1996). The links between the USNVC associations and the state classification types were defined and stored in the Conservancy/ ABI databases (Table 3). In turn, various states can report the USNVC types that correspond to their state types (e.g., Lauver et al. 1999, Steinauer and Rolfsmeier 2000).

TABLE 3. Illustration of the relationship (cross-walk) between USNVC global association types and selected state Natural Heritage program classification types. For each USNVC type, the global name is given, followed by the database code ("elcode," see Addenum II in the Appendix). The state scientific name or names are shown for each example state in which the USNVC type occurs. To the right of each state name, the relationship between the state and global type is shown. If not directly equal (=) to the USNVC type, the state type may be broader than (B), finer than (F), or intersect in some way (I) with the global type. Names for state types come from the following sources: Illinois, White and Madany (1978, modified); Indiana, Homoya et al. (1988); Iowa, Pearson (unpublished); Missouri, Nelson (1985). Additional states in which the USNVC type occurs are listed in the right-hand column.

	STATE CLASSIFICATION NAMES with CROSSWALK RELATIONSHIPS for SELECTED STATES				
USNVC type global name (database code)	ILLINOIS	INDIANA	IOWA	MISSOURI	OTHER STATES where USNVC type occurs
Andropogn gerardii – Sorghastrum nutans – (Sporobolus heterolepis) – Liatris spp. – Ratibida pinnata Herbaceous Vegetation (CEGL002203)	Mesic Prairie (North) F Mesic Prairie (South) F	Mesic Sand Prairie =	[Same as global name] =	Mesic Prairie B	KS, MI, MN, OH, WI
Andropogon gerardii – Sorghastrum nutans – Schizachyrium scoparium – Aletris farinosa Herbaceous Vegetation (CEGL005096)	Mesic Sand Prairie =	Mesic Sand Prairie =	[*Does not occur in state*]	[*Does not occur in state*]	MI, OH, WI, ON
Andropogon gerardii – Calamagrostis canadensis – Helianthus grosseserratus Herbaceous Vegetation (CEGL002024)	Wet-mesic Prairie (North) F Wet-mesic Prairie (South) F	Wet-mesic Prairie =	[Same as global name] =	Wet-mesic Prairie =	AR, KS?, KY?, MI, MN, MO, NE, OK, WI

Once the cross-walk and review of the USNVC types were complete, ABI regional ecologists began to describe the associations. In many cases, the literature compiled for the alliance descriptions of the Midwest (see Drake and Faber-Langendoen 1997) also helped to begin the process of describing associations. Some earlier work was also revisited, such as the "Rare Plant Communities of the Midwest" (Ambrose et al. 1994), which describes some of the rarest plant communities based on the preliminary list from Faber-Langendoen (1993). Many more new references were also consulted to complete the descriptions. Regional, state, and provincial ecologists from across the Network contributed their comments and review, which helped to integrate the concepts and descriptions across the country and into Canada. These descriptions, funded by the Conservancy, ABI, and a variety of federal projects, were then reviewed again by various state ecologists in the Midwest.

Defining the Association in the Midwest

The definition and description of each association was guided by the association concept. However, the definition of the association used in the USNVC (see *Association Concept* on page 9) is broad and flexible, using floristics, physiognomy, and habitat (Figure 2). The floristic component encompasses both the dominant species (those covering the largest area in a stand or plot), and the diagnostic species (those species, whether dominant or not, that are particularly helpful in discriminating stands of one type from stands of another type). Given the qualitative process used to derive the units (literature review, state classification cross-walking, and expert review), the definitions of dominant and diagnostic species are equally qualitative. In fact, in this qualitative stage, the diagnostic species are best described as "characteristic species" (see also Lincoln et al. 1982):

> **dominant species:** a plant species which predominates in a community because of its size, abundance, or coverage.
>
> **characteristic species:** a plant species that is almost always found in a particular community and is used in the delimitation of that community.

Both of these terms stand in contrast to more formal diagnostic species criteria for associations (such as "character species," "differential species," or "constant species") that are typically based on quantitative sampling of stands (Mueller-Dombois and Ellenberg 1974). Nevertheless, the dominant and characteristic species criteria are valuable for defining associations (and alliances).

In the midwestern literature, dominance is defined using a variety of abundance measures. For forested stands, abundance for tree species is typically assessed from measures of basal area, density, or frequency (sometimes combined into a single measurement called the Importance Value [Curtis 1959, Mueller-Dombois and Ellenberg 1974]). Less often, at least historically, abundance is assessed from estimates of canopy cover. Abundance for shrub and herbaceous species in both forested and non-forested communities is often assessed using measures of frequency or estimates of cover, or occasionally using biomass. In the USNVC, emphasis is placed on estimates of cover, as it is the most efficient and widely used method for assessing abundance for classification purposes. Nevertheless, measures using basal area or biomass are also helpful.

Because the USNVC uses both physiognomy and floristics to define the association, species dominance patterns in the top or dominant strata are particularly important in the definition of a type (more so for the alliance, but also for the association). The uppermost stratum is recognized when it covers at least 10% of a stand. However, the uppermost stratum is considered the dominant stratum only when it covers at least 25% of the stand (Grossman et al. 1998). For example, in an oak savanna, the tree layer is recognized as a stratum because it has between 10 and 25% cover, but the herbaceous layer is recognized as the uppermost dominant stratum because it consistently covers at least 25% (and typically much more) of the stand. Thus, oak species that are common in the tree stratum and grass species that are dominant in the herbaceous stratum may be particularly important for the definition of a type. By contrast, in a forested stand where the uppermost tree stratum is also the dominant stratum (typically covering at least 60% of the stand), the dominant species in that layer are the more important in helping to

define the type. Other lower strata, whatever their cover, are somewhat less critical in terms of identifying dominant species to define the type.

Since dominant species lend themselves to delimiting types, they may also be characteristic species, especially where quantitative data on all plant species present in a community are not available. But characteristic species often have at least three other interrelated features. First, they may be fairly constant in any stratum in a community type. Second, because of their geographic range relative to community types with similar dominant species, they may help distinguish the geographic limits of a type. For example, flowering dogwood (*Cornus florida*) is more typically abundant in unglaciated, southern oak forests compared to glaciated, northern oak forests. Third, characteristic species may be particularly restricted to certain environmental conditions. For example, chinquapin oak (*Quercus muehlenbergii*) is typically found on thin soils over alkaline bedrock and is thus characteristic of oak types in those settings. A species may contain multiple features that make it characteristic of a type. The choice of characteristic species, then, is partly made in relation to the definition of other types; it is chosen because it helps discriminate one type from another. Information on characteristic species was often developed from the characteristic species listed by a local or state classification which, upon rangewide review, also held up regionally.

Characteristic species identified as such from a regional and rangewide perspective may, from a local or state perspective, either be rather widespread and not helpful in discriminating types or, conversely, be rather rare and not constant enough in stands of a particular type. These issues can be difficult to resolve given the different geographic perspectives between regional or global definitions and state or local definitions. This is one of the reasons that state Natural Heritage programs sometimes prefer to develop their own names for types within a state, even when those types are conceptually equivalent to those in the USNVC.

Finally, in addition to the more primary floristic and physiognomic criteria, the association concept also uses criteria based on "uniform habitat conditions." This component has also proven to be of value in the qualitative stages of development. Habitat criteria are helpful when using studies that have assessed vegetation patterns in relation to environmental gradients, or when working with state Natural Heritage program classifications based on "natural community" concepts that rely as much on abiotic and geographic criteria as on vegetation criteria. For example, the Missouri Natural Heritage Program recognizes two kinds of alkaline glade types in the state: "Dolomite Glades" and "Limestone Glades" (Nelson 1985). These units, named and identified primarily through physical habitat features, nevertheless also contain some floristic and geographic differences that suggest they may represent two different associations: the *Schizachyrium scoparium – Bouteloua curtipendula – Rudbeckia missouriensis – Mentzelia oligosperma* Wooded Herbaceous Vegetation (on limestone), and the *Schizachyrium scoparium – Sorghastrum nutans – Bouteloua curtipendula – Rudbeckia missouriensis – Hedyotis nigricans* Wooded Herbaceous Vegetation (on dolomite). The 2 types share many species in common, but at least at the outset, the requirement for uniform habitat conditions led them to be recognized as distinct associations. It is hoped that future collection and analysis of quantitative plot data from these two habitats can be used to clarify the distinction at the association level.

The habitat criteria are particularly helpful for more sparsely vegetated community types, such as some cliffs, talus, or gravel bar habitats, where species assemblages may be highly variable or not well described across their range. In some cases, associations are often named based entirely on habitat criteria (e.g., the Basalt-Diabase Cobble-Gravel Great Lakes Shore Sparse Vegetation). Emphasizing habitat over vegetation criteria is perhaps an interim solution, and when better data are collected on these types, vegetation criteria may play a more predominant role in their definition.

Occasionally, associations form distinctive spatial aggregations that lend themselves to being defined as complexes. In the Midwest, several of these complexes have been described in order to facilitate conservation applications of the associations. Complexes include the patterned (string and flark)

PLATE 1

1. 

2. 

1.1. Acid Peatlands

1. Leatherleaf Poor Fen (CEGL005277) at edge of beaver pond. Junction Bay, Voyageurs National Park, northern Minnesota. *D. Faber-Langendoen*
2. Leatherleaf Bog (CEGL005278). Trygg Island, Voyageurs National Park, northern Minnesota. *D. Faber-Langendoen*
3. Black Spruce - (Tamarack) / Labrador Tea Poor Swamp (CEGL005271). Chequamegon National Forest, northern Wisconsin. *D. Faber-Langendoen*

3. 

1.2. Rich Peat Fens

4. Prairie Transition Rich Fen (CEGL002383). Neufolden Fen, Marshall County, northwest Minnesota. *D. Faber-Langendoen*
5. Western Allegheny Cinquefoil - Sedge Rich Fen (CEGL005140). Beck Fen Nature Preserve, Portage County, northeast Ohio. *D. Faber-Langendoen*

4. 

5. 

PLATE 2

1. 

1.4. Open and Emergent Marshes

1. Midwest Cattail Deep Marsh (CEGL002233). Island View area, Voyageurs National Park, northern Minnesota. *D. Faber-Langendoen*

1.5. Wet Prairies and Wet Meadows

2. Northern Sedge Wet Meadow (CEGL002257). Itasca State Park, northern Minnesota. *D. Faber-Langendoen*
3. Northern Prairie Pothole Wetland Complex (CECX002005). Mallard South Unit, Fort Pierre National Grassland Lymon County, South Dakota. *D. Ode*

2. 

3. 

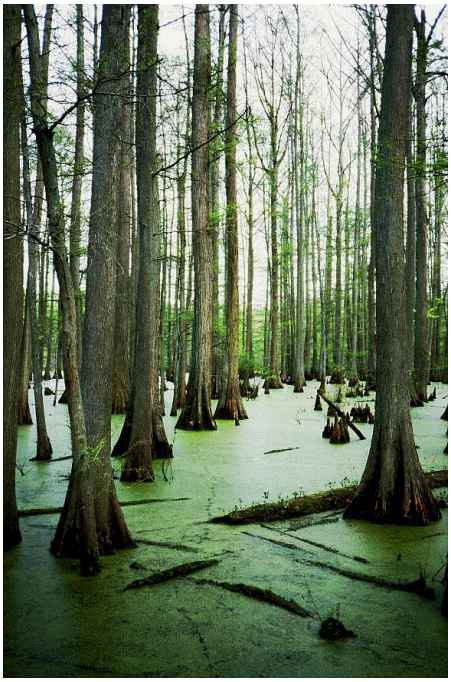
1. 

2. 

1.6. Wooded Swamps and Floodplains

1. Black Ash - Mixed Hardwood Swamp (CEGL002105). Near Hwy 77, west of Minong, northern Wisconsin. *D. Faber-Langendoen*
2. Silver Maple - Elm - (Cottonwood) Forest (CEGL002586). View from Wyalusing State Park, Wisconsin, where Wisconsin River joins Mississippi River. *D. Faber-Langendoen*
3. Cottonwood - Black Willow Forest (CEGL002018). Mississippi River east of Franklin Avenue bridge, Minneapolis, Minnesota. *C. Zabinski*
4. Bald-cypress Swamp (CEGL002420). Heron Pond Nature Preserve, southern Illinois. *D. Faber-Langendoen*
5. Cottonwood/Switchgrass Floodplain Woodland (CEGL001454). Quivira National Wildlife Refuge in central Kansas. *S. Chaplin*

3. 

4. 

5. 

PLATE 4

1.

2.

2.1. Shoreline Sand/Mud Strands, Beaches and Dunes

1. Great Lakes Beachgrass Dune (CEGL005098). Lost Valley, Lake Michigan, west of Whitehall, Michigan. *D. Faber-Langendoen*
2. Great Lakes Pine Barrens (CEGL005125). Stockton Island, Apostle Islands National Park, Wisconsin. *D. Faber-Langendoen*
3. Sand Cherry Dune Shrubland (CEGL005075). Stockton Island, Apostle Islands National Park, Wisconsin. *D. Faber-Langendoen*
4. Great Lakes Beach (CEGL005162). Mainland Unit, Apostle Islands National Park, northern Wisconsin. *D. Faber-Langendoen*

3.

2.2. Rocky Shores

5. Great Lakes Limestone Cobble-Gravel Shore (CEGL005169). Bruce Peninsula, Ontario, Canada. *D. Faber-Langendoen*
6. Great Lakes Basalt-Diabase Cobble-Gravel Shore (CEGL005250). Hollow Rock Bay on Lake Superior, near Hovland, northern Minnesota. *D. Faber-Langendoen*

4.

5.

6.

1. 

2. 

2.3. Rocky Uplands (Glades, Rock Barrens, Outcrops and Alvars)

1. Alvar Nonvascular Pavement (CEGL005192). Unit 20, Misery Bay Provincial Park, Manitoulin Island, Ontario, Canada. *D. Faber-Langendoen*
2. Tufted Hairgrass Wet Alvar Grassland (CEGL005110). Chaumont Barrens, Conservancy preserve, central New York. *D. Faber-Langendoen*
3. Juniper Alvar Shrubland (CEGL005212). Chaumont Barrens, New York. *D. Faber-Langendoen*
4. White-cedar - Jack Pine /Shrubby-cinquefoil Alvar Savanna (CEGL005132). Bruce Peninsula, Ontario, Canada. *D. Faber-Langendoen*
5. Mixed Pine - (Oak) Igneous-Metamorphic Rock Outcrop (CEGL002491). Daley Bay, Voyageurs National Park, Minnesota. *D. Faber-Langendoen*

3. 

4. 

5. 

PLATE 6

1. 

2.

3. 

2.3. Rocky Uplands (Glades, Rock Barrens, Outcrops and Alvars) *(continued)*

1. Ozark Dolomite Glade (CEGL002398). Henning Conservation Area, southwestern Missouri. *J. Rathert*
2. Central Limestone Glade (CEGL005131). Mosquito Creek State Nature Preserve, Harrison Co., southern Indiana. *D. Faber-Langendoen*
3. Ozark Dolomite Glade (CEGL002398). Henning Conservation Area, southwestern Missouri. *J. Rathert*
4. Black Hills Granite-Metamorphic Rock Outcrop (CEGL002295). Cathedral Spires, Custer State Park, Black Hills, South Dakota. *D. Faber-Langendoen*

4.

2.4. Cliffs, Talus, Buttes and Badlands

5. Midwest Moist Sandstone Cliff (CEGL002287). Fern Rocks Nature Preserve at Giant City State Park, southern Illinois. *D. Faber-Langendoen*
6. Eroding Great Plains Badlands (CEGL002050). North Dakota Badlands. *D. Faber-Langendoen*
7. Ponderosa Pine Scree Woodland (CEGL000878). Bear Butte, South Dakota. *D. Faber-Langendoen*

6. 

5. 

7. 

1. 

2. 

2.5. Forests and Woodlands

1. Paper Birch / Fir Forest (CEGL002463). Mainland Unit, Apostle Islands National Park, northern Wisconsin. *D. Faber-Langendoen*
2. Red Pine / Blueberry Dry Forest (CEGL002443). Boundary Waters Canoe Area, Superior National Forest, northern Minnesota. *D. Faber-Langendoen*
3. North-Central Dry-mesic Oak Woodland (CEGL002142). Glacial Parks County Park, McHenry County, Illinois. *D. Faber-Langendoen*
4. North Central Hemlock - Hardwood Forest (CEGL005044). Porcupine Mountains State Park, Upper Peninsula, Michigan. *D. Faber-Langendoen*

3. 

4. 

PLATE 8

1. 

2. 

2.5. Forests and Woodlands *(continued)*

1. Post Oak Flatwoods (CEGL002405). Posen Woods Nature Preserve, Washington County, central Illinois. *D. Faber-Langendoen*
2. Beech - Maple Unglaciated Forest (CEGL002411). Bell Smith Springs, southern Illinois. *D. Faber-Langendoen*
3. White Oak - Post Oak / Bluestem Woodland (CEGL002150). Ha Ha Tonka State Park, Missouri. *D. Faber- Langendoen*
4. Rocky Mountain Juniper / Little-seed Ricegrass Woodland (CEGL000747). Columnar Juniper Overlook, Little Missouri National Grasslands, western North Dakota. *D. Faber-Langendoen*
5. Ponderosa Pine / Little Bluestem Woodland (CEGL000201). Black Hills National Forest, South Dakota. *D. Faber-Langendoen*

3. 

4. 

5. 

1. 

2.6. Shrublands/Dwarf-Shrublands

1. Aspen - Oak Brush Prairie (CEGL002182). Caribou Wildlife Management Area, Kittson County, northwestern Minnesota. *D. Faber-Langendoen*

2.8. Savannas and Non-Rock Barrens 2.

2. North-central Bur Oak Openings (CEGL002020). St. Croix Savanna, east-central Minnesota, overlooking the St. Croix River. *D. Faber-Langendoen*
3. Northern Oak Barrens (CEGL002160). Agassiz Beach Ridges, northwest Minnesota. *D. Faber-Langendoen*
4. Jack Pine / Prairie Forbs Barrens (CEGL002490). Bauer/Brockway Road Barrens, Jackson County, central Wisconsin. *D. Faber-Langendoen*
5. Central Bur Oak Openings (CEGL002159). Daughmer Savanna, Crawford County, Ohio. *D. Faber-Langendoen*

3.

4.

5.

PLATE 10

1. 

2. 

2.9. Prairies/Grasslands

1. Northern Mesic Tallgrass Prairie (CEGL002202). Goose Lake, Minnesota. *D. Faber-Langendoen*
2. Central Wet-mesic Tallgrass Prairie (CEGL002024). Black Dog Preserve, along the Minnesota River just south of Minneapolis, Minnesota. *D. Faber-Langendoen*
3. Little Bluestem Bedrock Bluff Prairie (CEGL002245). Morgan Conlee Road Prairie, Pierce County, northern Driftless Area of Wisconsin. *D. Faber-Langendoen*
4. Flint Hills Tallgrass Prairie (CEGL002201). Flint Hills region of east-central Kansas. *G. Steinauer*
5. Northern Great Plains Little Bluestem Prairie (CEGL001681). Burning Coal Vein Campsite, Little Missouri National Grassland, western North Dakota. *D. Faber-Langendoen*
6. Northern Great Plains Little Bluestem Prairie (CEGL001681). Custer State Park, Black Hills of western South Dakota. *D. Faber-Langendoen*

3. 

4. 

5. 

6. 

PLATE 11

Map of the ecological provinces and sections for the Midwestern part of the United.States (from Bailey et al. 1994).

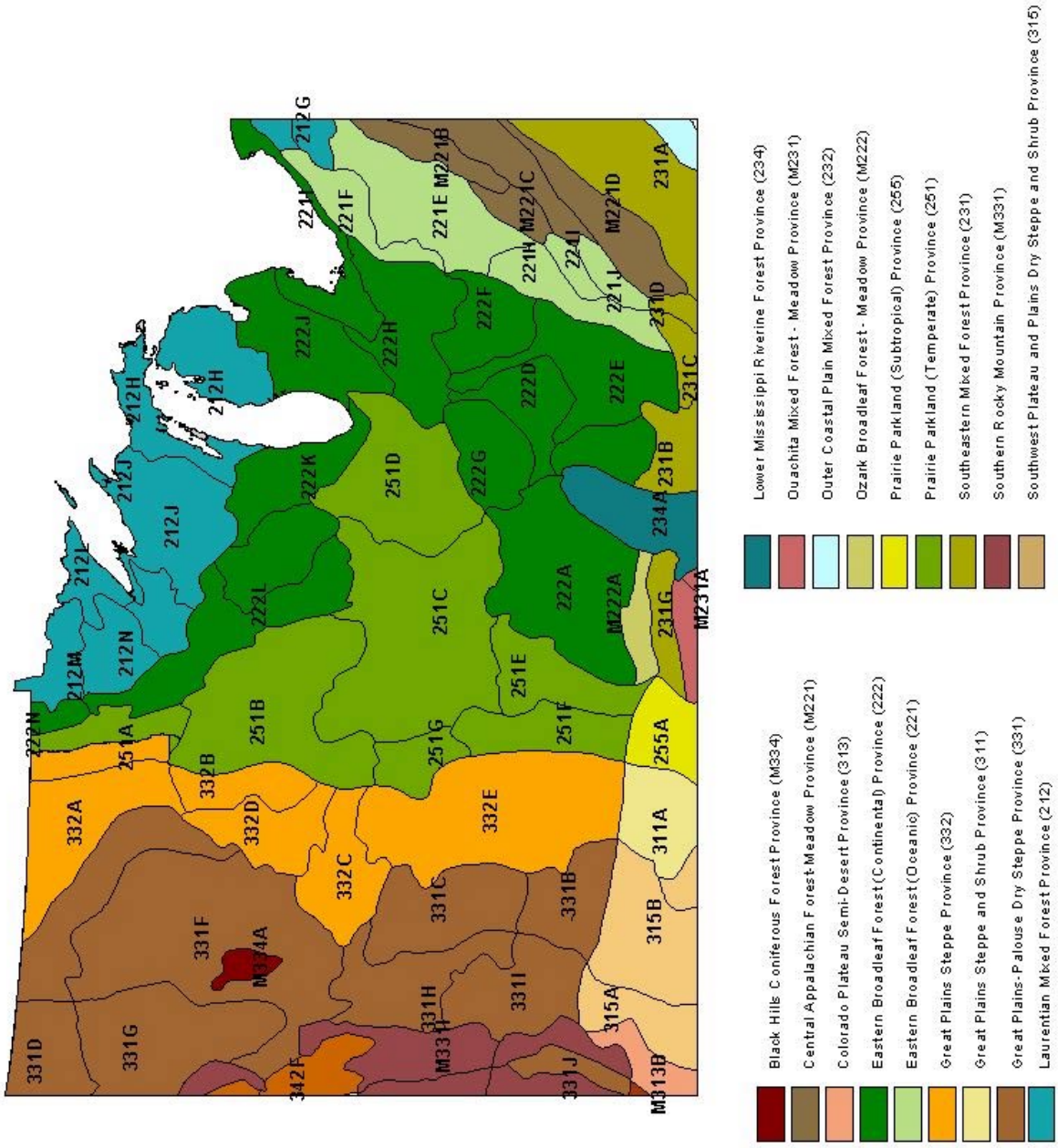
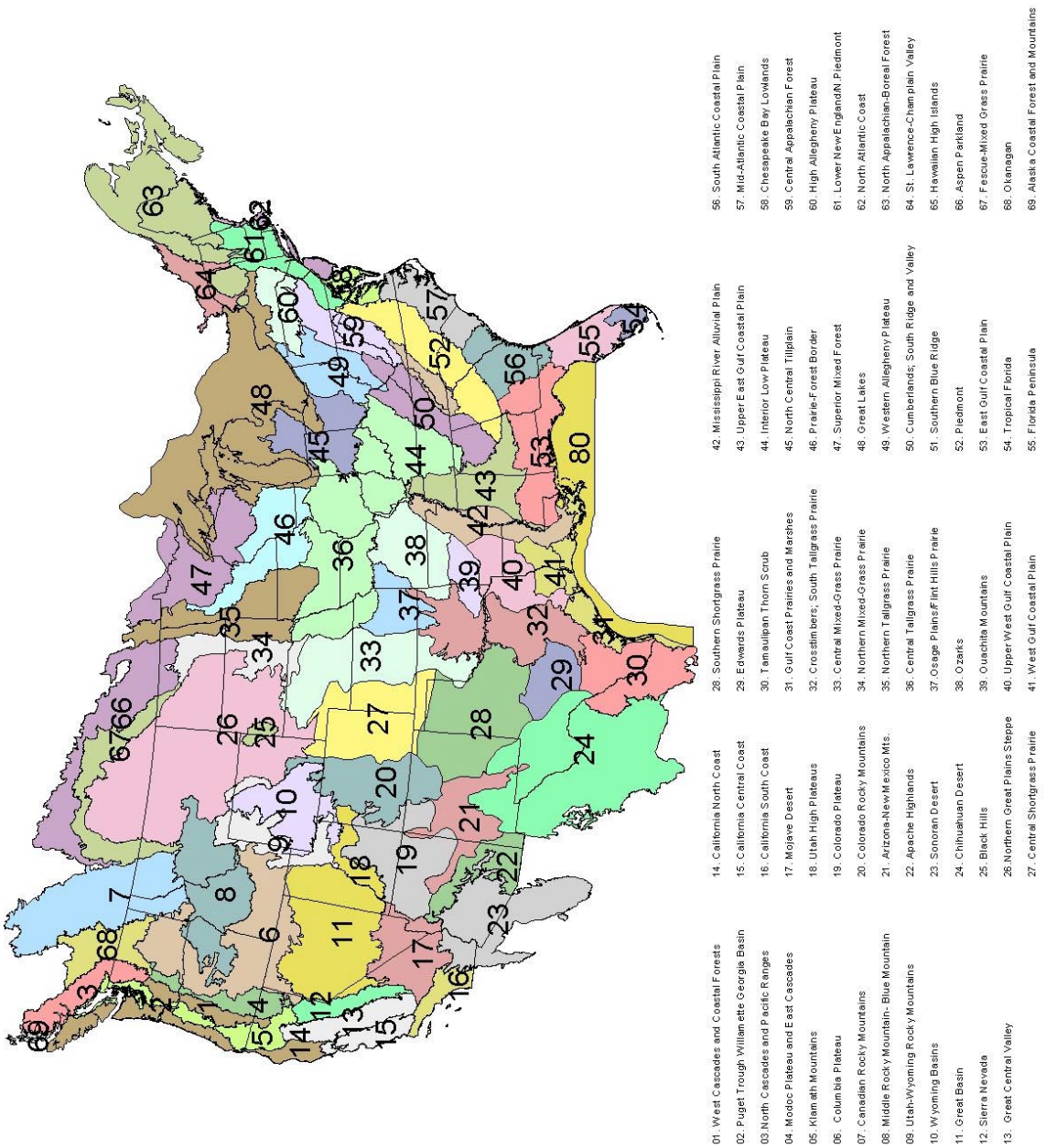


PLATE 12

Map of The Nature Conservancy's conservation planning ecoregions of the lower 48 United States (TNC 1997).



peatland, Great Lakes dune-swale complex, Great Lakes coastal marsh complex, prairie pothole, prairie dog town, and Great Plains badlands. The component associations that comprise these complexes are noted in the description.

In summary, the definitions and criteria used in applying the association concept in the Midwest rely on a combination of dominant species (particularly in the uppermost or uppermost dominant strata) and characteristic species, both of which are assessed in relation to habitat conditions. These criteria have helped to guide the synthesis of information from the literature, existing state classifications, and comments from others. The descriptions that have been compiled for each association were written and reviewed over the past two years. An effort was made to highlight the specific criteria and sources of information used to define each type. Outstanding problems and questions regarding classification issues are presented. Crosswalks are provided to all state Natural Heritage and provincial conservation data center classifications as they existed in December 2000. Other distributional information is likewise presented. The conservation status of the community type is also summarized using a global ranking system. Details on the various fields that comprise these descriptions are given in Box 1 on page 34. All of the information is managed in ABI's Heritage Data Management System (ABI 2001).

APPLICATIONS OF THE CLASSIFICATION

There are many applications of the USNVC in the United States. The U.S. Geological Survey (USGS) Gap Analysis Program (GAP) adopted the USNVC as a standard for assisting with satellite-based vegetation maps of each state in the country (Jennings 1993). The USGS Biological Resources Division and the National Park Service have also adopted the USNVC as the vegetation classification standard for mapping National Parks (Grossman et al. 1994). The U.S. Fish and Wildlife Service funded a survey of all rare plant USNVC types across the U.S. (Grossman et al. 1994, see Ambrose et al. 1994 for the Midwest portion). The USNVC was used to characterize the vegetation component of ecological land units developed by the U.S. Forest Service (Keys et al. 1995), demonstrating its ability to be used in conjunction with an ecological lands classification approach. In 1997, the USNVC was adopted by the U.S. Federal Geographic Data Committee (FGDC) as the Vegetation Classification and Information Standard, making it the national standard for reporting of all vegetation data by federal agencies (FGDC 1997). In the mid-1990s, the Ecological Society of America recognized the USNVC as a basis for developing a comprehensive vegetation classification for the United States. Since then, ESA has been assisting with the definition of standards for the further development of the classification (Loucks 1996, Glenn-Lewin and Jennings 2001).

There have been a number of specific applications of the USNVC by federal agencies in the Midwest. The GAP project has completed or nearly completed maps in Iowa, Kansas, Missouri, Nebraska, Wisconsin and South Dakota. Each of these state-wide vegetation maps has units that are linked in various ways to alliances or associations. Various national parks in the Midwest have now been mapped using the USNVC, including Badlands, Isle Royale, Jewel Cave, Mount Rushmore, Scotts Bluff, Theodore Roosevelt, Voyageurs, and Wind Cave (e.g., Von Loh et al. 1999, Hop et al. 2001). The U.S. Forest Service has used the USNVC in the Midwest for a comprehensive Research Natural Areas Assessment across all National Forests in Region 9 (midwestern and northeastern states) of the Forest Service (Faber-Langendoen et al., in press). It has also supported various community surveys on national forest lands such as the Shawnee National Forest (TNC 1995) and the Black Hills National Forest (Marriott et al. 1999, Marriott and Faber-Langendoen 2000). The Environmental Protection Agency, among others, helped fund the Midwest Oak Ecosystems Recovery Plan, which included the oak savannas and woodlands portion of the classification (Leach and Ross 1995).

The Conservancy has been using the Midwest portion of the USNVC for ecoregional planning, and plans are now complete for many of the midwestern ecoregions (e.g., TNC 1998). The Conservancy

also helped to conduct a rangewide conservation assessment for alvar communities, working in conjunction with state and provincial partners (Reschke et al. 1999, Brownell and Riley 2000).

ABI has recently developed web-based access to the classification, providing select information on all USNVC types, including much of the descriptive information provided here, to the public. All documented associations in the United States are listed. The information can be accessed at the web site maintained by ABI (http://www.natureserve.org).

Among state agencies, state Natural Heritage programs use the USNVC in many different ways for conservation, particularly where there is a need to bring in both a state-level perspective and a national or global perspective. Individual programs are working to provide better links among the USNVC associations and their state classification types (e.g., Lauver et al. 1999, Steinauer and Rolfsmeier 2000, Minnesota Natural Heritage Program, in preparation). These efforts will help provide consistent information on the types themselves, and on the exemplary locations where they are found. This information can help guide the decision-making process during land-use planning. In this way, the ability to prioritize conservation activities both within the state and across state lines, as was done by the International Alvar Working Group (Reschke et al. 1999), can be realized by the network of programs.

IV. ECOLOGICAL GROUPS

BACKGROUND

As mentioned previously, we chose to organize the catalogue of association descriptions based on an ecological or habitat-based approach that we call "ecological groups." Our working definition of ecological groups is: *plant communities within a biogeographic region that share similar habitats (e.g., ecological processes, abiotic factors, and environmental gradients) and that have broadly similar species composition*. The principle underlying ecological groups is organizing associations based primarily on broadly shared ecological processes and vegetation, rather than primarily on vegetation alone. Such groupings provide a more ecological perspective on associations, emphasizing the shared geographic, site, and disturbance factors that shape vegetation patterns.

Where associations occur in very distinctive habitats, the habitat may take precedence over vegetation composition and structure. For example, associations found in dune habitats along the Great Lakes are placed together in a "Great Lakes Dune" group. By contrast, the USNVC organizes associations based primarily on vegetation structure and floristics, so that, for example, forests on dunes are placed in different parts of the hierarchy from grasslands on dunes.

An additional benefit of using ecological groups is that information related to the conservation of community types may be more readily available. For example, although we may not have good information on the distribution, abundance, or rarity of all the associations included in the "Midwestern Deep-Soil Tallgrass Prairies" ecological group, we do have good distribution maps at the group level and can document that the group is very imperiled (e.g., Küchler 1964, Robertson et al. 1997). Ecological groups may also provide units that are more mappable at coarser scales than the coarser-level vegetation units of the USNVC.

METHODS

Ecological groupings of various kinds have been used in a variety of community classifications. Brown et al. (1998) used physiognomic, hydrologic, and biogeographic criteria to organize North American biotic communities down to the association level. In the United States, many state Natural Heritage programs that use the natural community concept organize their types by broad ecological

groupings, such as "forested peatlands," "fen," "shrub swamp," "coniferous woodland," or "cliff" (e.g., White and Madany 1978, Nelson 1985, Reschke 1990, Minnesota Natural Heritage Program 1993). In Ontario, Lee et al. (1998) also used ecological categories at higher levels ("community class" and "community series") above their vegetation types.

In Canada, something similar to an ecological groups approach was used to define wetland types (National Wetlands Working Group 1988). The Working Group used five broad wetland classes to organize wetland types: bog, fen, swamp, marsh, and shallow open water. Their reason for retaining familiar terms for broad ecological groups is worth highlighting: "It is not surprising that a close examination shows that there are many subtly or substantially different definitions of these terms. One solution is to abandon them completely.....the other solution is to define them, keeping in mind the possibility of other usage…" Cowardin et al. (1979) chose the former approach; the Wetlands Working Group chose the latter, as did we. Thus, even though users will be familiar with many of the terms used for ecological groups, we recommend that all users read the definitions (see Table 5) to ensure that they understand the usage intended here.

Midwestern ecological groups were developed using the above-mentioned sources. A first draft was outlined in 1999 in consultation with the southeastern regional ecology teams of both ABI and the Conservancy, who had also begun to experiment with an ecological groups approach. In August of 2000, both teams began to work closely together to resolve differences, at least at the finest level. That work was completed late in 2000. As a result, the ecological groups approach presented below has been integrated across both regions. The groups are experimental and still need more review, both at state/provincial levels and globally.

Currently, each association is reported in only one ecological group; that is, the groups are mutually exclusive. In this way the groups facilitate the listing of associations in this report.[2] However, individual alliances are often divided among ecological groups. This is not surprising, given that alliances are typically defined by patterns of dominant canopy species, which often range quite widely across environmental conditions.

STRUCTURE

Overview

Ecological groups are defined based on habitat, ecological processes, vegetation and biogeography. Criteria vary somewhat among groups, but generally groups share similar macro- to meso-climate, geology/parent material, substrate, and physiognomy. The ecological groups are organized hierarchically into four levels above the association. Given the preliminary nature of this hierarchy, the levels have not been formally named; instead, they are numbered from 1 (broadest) to 4 (finest) (Table 4). Level 2 groups form the backbone of the system and each is defined in Table 5.

---

[2] However, associations *could* be listed under multiple ecological groups, depending on how those groups are defined. In what could be termed a more "systems-based" approach, ecological groups would be defined based more on their spatial relationships and shared processes than on similar vegetation. For example, currently the "Midwestern Riverfront Floodplain Forests" group contains associations that are all found in floodplains (Table 6). There are also several more generic wetland ecological groups, such as "Midwestern Rich Shrub Swamps" and "Midwestern Wet Prairies and Meadows," whose associations are found in both floodplains and in upland depression wetlands (the same association may be found in both settings). Using the "systems-based" approach, the "Midwestern Riverfront Floodplain Forests" group could be generalized to be a "Midwestern Riverfront Floodplains" system that includes forest, shrubland, and marsh associations that are often spatially contiguous and that share similar floodplain processes. Since the same shrubland and marsh associations that occur in floodplains also occur in upland depressional wetlands, they would be listed under other system types encompassing those wetlands. Such an approach, which may be termed an "ecological systems" approach, is currently being considered by the Conservancy and ABI.

Table 4. Definitions and criteria used to define the various levels of ecological groups.

Level 1. This level is more or less the "System Level" of Cowardin et al. (1979). This level differentiates the uplands from all types of wetlands, and differentiates among the wetland types in terms of their major hydrologic, geomorphic, chemical and biological factors, separating freshwater palustrine wetlands from tidal marine and estuarine wetlands (see Cowardin et al. 1979). Ecological groups only cover the vegetated or sparsely vegetated parts of these systems. Lakes and rivers are not included. Note that some wetland associations are placed within upland groups, in cases where they occur together spatially with upland assocations (e.g., 2.1. Shoreline Sand/Mud Strands, Beaches and Dunes).

Level 2. Among the wetland types, the primary distinctions are based on hydrology, water quality and vegetation physiognomy. Peatlands (defined as wetlands with a peat depth of at least 30 cm) are divided at this level into acid peatlands and rich fens. Other types include seeps, marshes, wet prairies and meadows, and wooded swamps and floodplains (swamps may contain both minerotrophic peatlands and mineral soils).

Among the upland types, the primary distinctions are based on parent material and substrate type and their interaction with physiognomy. Groups with parent material or parent mineral material (sand, clays) extensively exposed at the surface, and with up to 60% herbaceous, shrub, or tree cover (e.g., cliffs, talus slopes), are separated from types where sufficient mineral soil exists to permit a more or less complete cover (> 60% cover of the dominant strata of vegetation), whether herbaceous, shrub, or tree-dominated.

Level 3. Both upland and wetland types are grouped by floristic and ecoregionally-based categories. The categories used are based on the division and province level ecoregions of the U.S. Forest Service ECOMAP (Bailey et al. 1994, Keys et al. 1995), as interpreted from a midwestern perspective, within the larger framework of Takhtajan's floristic province level (Figure 4).

- The "Northern (Laurentian)" group more or less equates to Province 212 (Bailey 1994). "Laurentian," a term used by Bailey, is used to qualify "Northern" from a North American perspective.
- "Great Lakes" refers to shoreline or near-shoreline communities around the Great Lakes.
- "Midwestern" includes the central and northern (primarily glaciated) portion of Province 222 and much of Province 251, the Tallgrass Prairie Region.
- "Interior Highlands" includes the Ozarks and Interior Low Plateau, both unglaciated.
- The Appalachian Highlands include the areas of Provinces 221 (Allegheny and Cumberland Regions) M221 (the Appalachian Mountains), and Section 231A (the Piedmont).
- "Southeastern" equates more or less with Province 232.
- "Great Plains" equates to Division 330.
- "Rocky Mountains" includes the Black Hills.

Level 4. A variety of factors are used to distinguish groups at this level. In many cases physiognomy is important, e.g., Northern (Laurentian) Acid Peatlands are separated into Conifer versus Shrub/Graminoid groups. Other factors include dominant species, substrate, or water salinity.

Level 5. The association. This is the lowest level of the classification and is taken from the USNVC hierarchy (Grossman et al. 1998).

Table 5. Definitions of ecological groups for Level 2. These definitions are preliminary and exploratory. Citations given with each definition are the general source of the definitions, but modifications may have been made to improve their application in the Midwest.

Ecological Group	DESCRIPTION
NON-TIDAL WETLANDS	
1.1 Acid Peatlands	An acid peatland is a peatland, generally with the water table at or near the surface. The surface of the peatland, which may be raised or level with the surrounding terrain, is virtually unaffected by the nutrient-rich groundwaters from the surrounding mineral soils, and thus is generally acidic and low in nutrients (ombrotrophic or bog), but may also be minimally minerotrophic (poor fen). The dominant materials are weakly to moderately decomposed sphagnum and woody peat, underlain at times by sedge peat. Bogs and poor fens may be treed or treeless, and they are usually covered with *Sphagnum* spp. and ericaceous shrubs (modified from National Wetlands Working Group 1988).
1.2 Rich Peat Fens	A rich fen is a peatland with the water table usually at or just above the surface. The waters are nutrient-rich and minerotrophic from mineral soils. The dominant materials are moderately- to well-decomposed sedge and/or brown moss peat of variable thickness. The vegetation consists predominately of sedges, grasses, reeds, and brown mosses with some shrubs and, at times, a sparse tree layer (modified from National Wetlands Working Group 1988).
1.3 Seeps	A seep is a wetland with saturated soil caused by water flowing to the surface in a diffuse, rather than concentrated, flow (White and Madany 1978). Soils can be muck or peat, the latter leading to some overlap with the definition of fens (e.g., calcareous seepage fens). The vegetation consists of graminoids, forbs, ferns, mosses, shrubs, or trees.
1.4 Open and Emergent Marshes	An aquatic marsh is a wetland with intermittently or permanently flooded, or seasonally stable water regimes, featuring open expanses of standing or flowing water which are variously called ponds, pools, shallow lakes, oxbows, reaches, channels, or impoundments. The water may vary from fresh to highly saline. Marshes are distinguished from deep-water (lakes) by mid-summer depths of less than 2 m and open water generally less than 8 ha, and from other wetlands by either summer open water occupying 75% or more of the wetland surface, or having standing water present for most or all of the year. The vegetation in open marshes, if present, is confined to submerged or floating aquatic plant forms. Emergent marshes characteristically show zonal or mosaic surface patterns composed of pools or channels interspersed with clumps of emergent sedges, grasses, rushes, and reeds (modified from National Wetlands Working Group 1988).
1.5 Wet Prairies and Wet Meadows	The wet prairies and wet meadows are mineral wetlands or peatlands that are periodically inundated by standing or slowly moving water or subject to seasonal saturation. Surface water levels may fluctuate seasonally, with declining levels exposing drawdown zones of matted vegetation or mudflats, or drying out of the surface horizon. The waters are rich in nutrients, varying from fresh to highly saline. The substrate usually consists of mineral material, although occasionally it consists of well-decomposed peat. The closed-canopy meadows are typically dominated by grasses and sedges (modified from National Wetlands Working Group 1988).
1.6 Wooded Swamps and Floodplains	A swamp is a mineral wetland or peatland with standing water or water gently flowing through pools or channels. The water table is at or near the surface. There is pronounced internal water movement from the margin or other mineral sources; hence, the waters are rich in nutrients. If peat is present, it is mainly well-decomposed wood, underlain at times by sedge peat. The vegetation is characterized by a dense cover of deciduous or coniferous trees, with an understory of shrubs, herbs, and some mosses. A floodplain or riparian wetland is an area, typically with channel features, where annual or periodic inundation of water occurs over the surface, often with subsequent drying by early- or mid-growing season. Areas with slower draw downs, such as back water sloughs, may overlap in concept with swamps (modified from National Wetlands Working Group 1988).

Table 5, cont.

UPLANDS	
2.1 Shoreline Sand/Mud Strands, Beaches and Dunes	These areas contain exposed parent mineral material and are subject to active shoreline processes, such as ice scour, wave energy, erosion and deposition. Substrate varies from coarse grained sands, gravel, and rocks to fine-grained muds. Areas may be above the seasonal high water mark. They may be subject to moisture and temperature extremes. Vegetation cover varies from patchy and barren to more closed and tree covered (rarely up to 60%), but the soil surface often remains > 50% exposed. A dune is an area where active rolling sand hills are formed by shoreline and aeolian processes. The substrate stability is variable, and there is little to no accumulation of organic materials. Nutrient availability is poor. (Lee et al. 1998).
2.2 Rocky Shores	These areas contain exposed parent material and are subject to active shoreline processes such as ice scour, wave energy, erosion and deposition. Substrate is generally bedrock, but may include cobble/gravel shores. Areas may be above or below the seasonal high water mark. They may be subject to moisture and temperature extremes. Vegetation cover varies from patchy and barren to more closed and tree covered (up to 25%), but the rock surface often remains > 50% exposed.
2.3 Rocky Uplands (Glades, Rock Barrens, Outcrops and Alvars)	These areas contain exposed parent material on moderate to steep slopes (but typically less than 60% slope), with variable bedrock features, including rolling rock knobs and hollows, rock reefs, blocks and fissures, rock ledges, and glacially scraped limestone pavements. Rock type can be important to vegetation patterns. Soil development is patchy, and substrate depth is typically < 15 cm, though variable. Sites may be subject to extremes in moisture and temperature. The vegetation cover varies from patchy and barren, with very low cover to a fairly good cover of herbaceous or shrubby vegetation (sometimes over 60% cover) and to a moderately closed tree cover (up to 60%) (Nelson 1985, Lee et al. 1998).
2.4 Cliffs, Talus, Buttes and Badlands	Cliffs and buttes are vertical or near vertical (including overhangs) exposed bedrock > 3 m in height, with associated exposed cliff rims. The bedrock type can be important, as can aspect, which affects degree of shading. Soils are virtually non-existent, accumulating only on ledges or rock shelves. Sites may be subject to moisture and temperature extremes, particularly if unshaded with southerly exposures. A talus area contains slopes of rock rubble at the base of cliffs or steep rocky slopes. Coarse rocky debris covers > 50% of substrate surface, and the average substrate depth is < 15 cm. Bedrock type is often important. The vegetation cover varies from patchy and barren to more closed and tree covered (up to 60%), but the soil surface often remains > 50% exposed (Nelson 1985, Lee et al. 1998). Bluffs and badlands are vertical or near vertical exposed parent mineral soils such as loess, clays, or badlands soils, and the associated eroded clay plains at the base of these slopes. Soils generally have no horizons. Sites are subject to moisture and temperature extremes. The vegetation is typically sparse, rarely exceeding 25%.
2.5 Forests and Woodlands	Forests and woodlands occur on mineral soils (rarely on unconsolidated materials) over a wide range of depths, but soils generally are > 15 cm deep. Where rocks are exposed at the surface (such as in boulderfields or glacially scoured bedrock regions), they have a fairly continuous vegetation cover. Tree canopy cover varies from 25% to 100%.
2.6 Shrublands/ Dwarf-Shrublands	Shrublands and dwarf-shrublands occur on mineral soils (rarely on unconsolidated materials) over a wide range of depths. Soils are at least 15 cm deep. Temperature, droughts, and/or fire limit shrub cover (which ranges from 25% to 100%); herbaceous cover is generally continuous.
2.7 Shrub Grasslands	Shrub Grasslands occur on mineral soils (rarely on unconsolidated materials) over a wide range of depths. Soils are at least 15 cm deep. Temperature, droughts, and fire limit shrub canopy cover (which ranges from 10 to 25%), herbaceous cover is generally continuous.
2.8 Savannas and Non-Rock Barrens	Savannas and Non-Rock Barrens occur on mineral soils (rarely on unconsolidated materials) over a wide range of depths. Soils are at least 15 cm deep, and rocks are rarely exposed at the surface. Temperature, droughts, and fire limit tree canopy cover (which ranges from 10% to 25%), but herbaceous cover is generally continuous (Lee et al. 1998). Thin soil or bedrock savannas are sometimes termed barrens, but such "Non-Rock Barrens are distinct from Rock Barrens (see 2.3 above) which contain exposed bedrock at the surface and where the vegetation is discontinuous to sparse.
2.9 Prairies/ Grasslands	Prairies/Grasslands occur on mineral soils (rarely on unconsolidated materials) over a wide range of depths. Soils are at least 15 cm deep. Temperature, droughts, and fire limit woody canopy encroachment (woody cover does not typically exceed 10%); herbaceous cover is generally continuous.

Level 1 distinguishes wetland ecological groups from upland ones. **Non-tidal wetlands** include wetlands that vary from permanently saturated to intermittently flooded. The water table is usually at or near the surface, or the surface is covered by water. Non-tidal wetlands are also referred to as *palustrine wetlands* (Cowardin et al. 1979). No wetlands in the Midwest are subject to tidal movements so no other Level 1 wetland group is necessary in the Midwest. **Uplands** contain well-drained soils that range from xeric to very moist. Some strand and rocky shore ecological groups overlap with wetlands.

Level 2 groups are more diverse (see Table 5). Among the wetland types, the primary distinctions are based on hydrology, water quality and vegetation physiognomy. The wetland groups are defined, in part, using the Canadian Wetland classification system (National Wetlands Working Group 1988). Among the upland groups, the primary distinctions are based on parent material and substrate type and their interaction with physiognomy. The upland ecological groups fall into two main categories: those where the parent material is exposed or prominent and vegetation cover is discontinuous (e.g., talus, dunes, rock flats), and those where vegetation cover is continuous (e.g., forests and woodlands, prairies/grasslands).

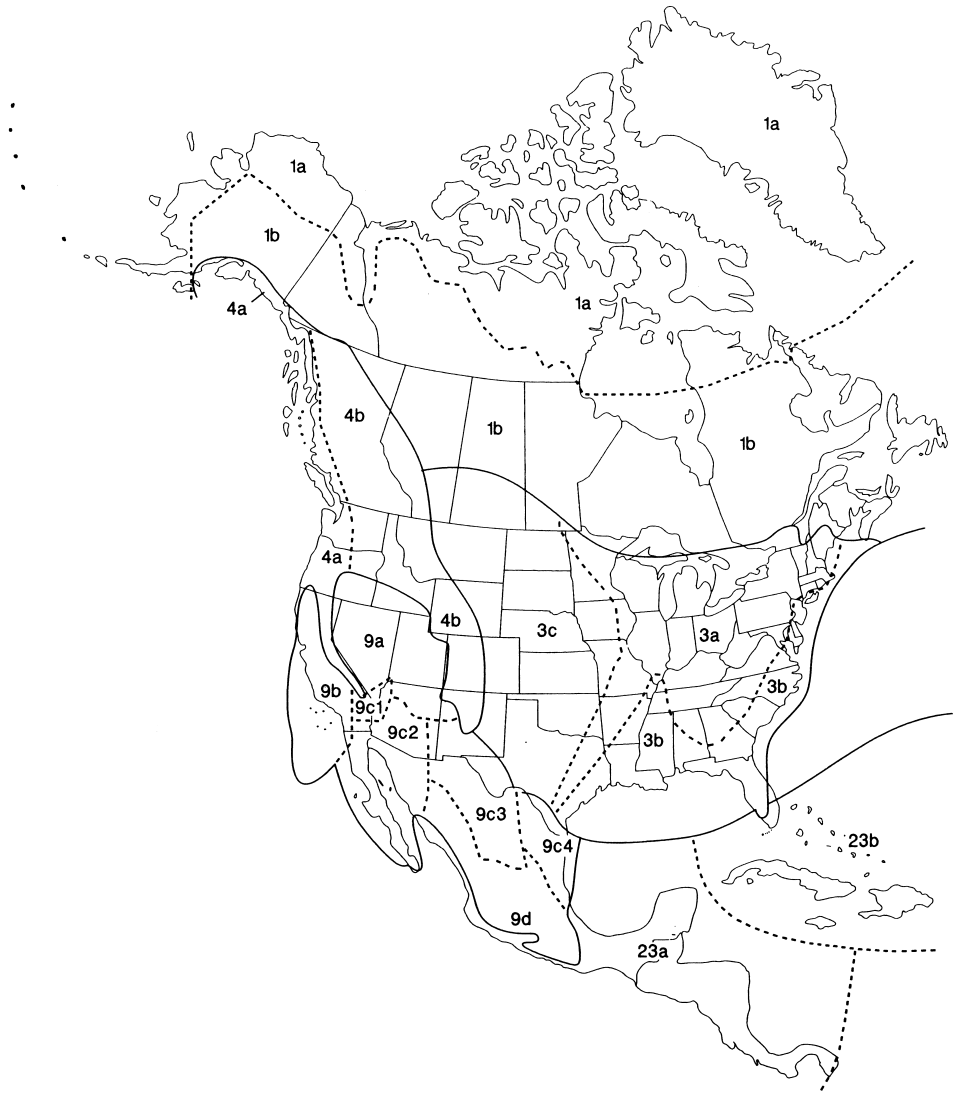
Level 3 groups are based on biogeographic factors that help to aggregate groups that share similar broad patterns of vegetation and ecological processes. Biogeographic regions are defined using information on the distribution of flora and fauna (and their evolutionary history) and information on large-scale vegetation structure. Biogeographic regions, even at their finest scales, are expected to contain a wide number of endemic species, and even endemic genera. They also contain distinctive vegetation features (Brown et al. 1998).

To define biogeographic units for the midwestern ecological groups, we used the floristic provinces or regions approach of Takhtajan (1986) and the biotic communities approach of Brown et al. (1998). In the Midwest, these two approaches have three virtually identical units (Takhtajan's names are in parentheses): the Northeastern (Appalachian), the Southeastern (Atlantic and Gulf Coastal Plain) and the Plains (North American Prairies) (Figure 4a). A fourth region, the Canadian (Takhtajan uses the same name) comes very near to the United States-Canada border north of Minnesota and Michigan. These broad regions serve as a useful framework for organizing North American-wide vegetation patterns. Associations are readily placed into these regions. The boundaries for these regions are used somewhat flexibly, depending on the pattern of associations; that is, associations placed within a biogeographic region are expected to be concentrated in that region, but occurrences may extend "outside" the region.

Within these regions, a number of subregions were helpful in organizing the associations (Figure 4b). These subregions show some similarities to the vegetational or ecological regions of Braun (1950) and of Bailey (1995). Within the Northeastern Region, subregions include the Northern Laurentian, Midwestern (upper part of Bailey's Dry Deciduous Forest), the Interior Highlands (the lower part of Bailey's Dry Deciduous Forest, including both the Ozarks and the Interior Low Plateau), and the Appalachian Highlands (Bailey's Moist Deciduous Forest). In the Plains, the only subregion is the Great Plains.

These major regions and subregions provide a useful biogeographic component to the definitions of ecological groups. Again, the regions and subregions are primarily conceptual units, and have flexible geographical boundaries. For example, the Northern (Laurentian) Acid Peatlands are concentrated in the area defined as the Northern Laurentian Subregion (Figure 4b), but individual associations may extend southward into the Midwestern Subregion (and probably northward into the Canadian Region).

Level 4 groups, where needed, add finer level groupings based on a variety of vegetation structure, species dominants, substrate, and hydrogeomorphic criteria that further refine the vegetational and ecological processes that the various associations share. Level 4 has been standardized between the



A. Holarctic Kingdom

(BOREAL SUBKINGDOM)

1. Circumboreal Region
   - 1a. Arctic Province
   - 1b. Canadian Province
3. North American Atlantic Region
   - 3a. Appalachian Province
   - 3b. Atlantic and Gulf Coastal Plain Province
   - 3c. North American Prairies Province
4. Rocky Mountain Region
   - 4a. Vancouverian Province
   - 4b. Rocky Mountain Province

(MADREAN OR SONORAN SUBKINGDOM)

9. Madrean Region
   - 9a. Great Basin Province
   - 9b. Californian Province
   - 9c. Sonoran Province
     - 9c.1. Mojavean Subprovince
     - 9c.2. Sonoran Subprovince
     - 9c.3. Chihuahuan Subprovince
     - 9c.4. Tamaulipan Subprovince
   - 9d. Mexican Highlands Province

B. Neotropical Kingdom

23. Caribbean Region
   - 23a. Central American Province
   - 23b. West Indian Province

Figure 4a. Map of Takhtajan (1986) floristic regions and provinces. Used with permission of Oxford University Press.

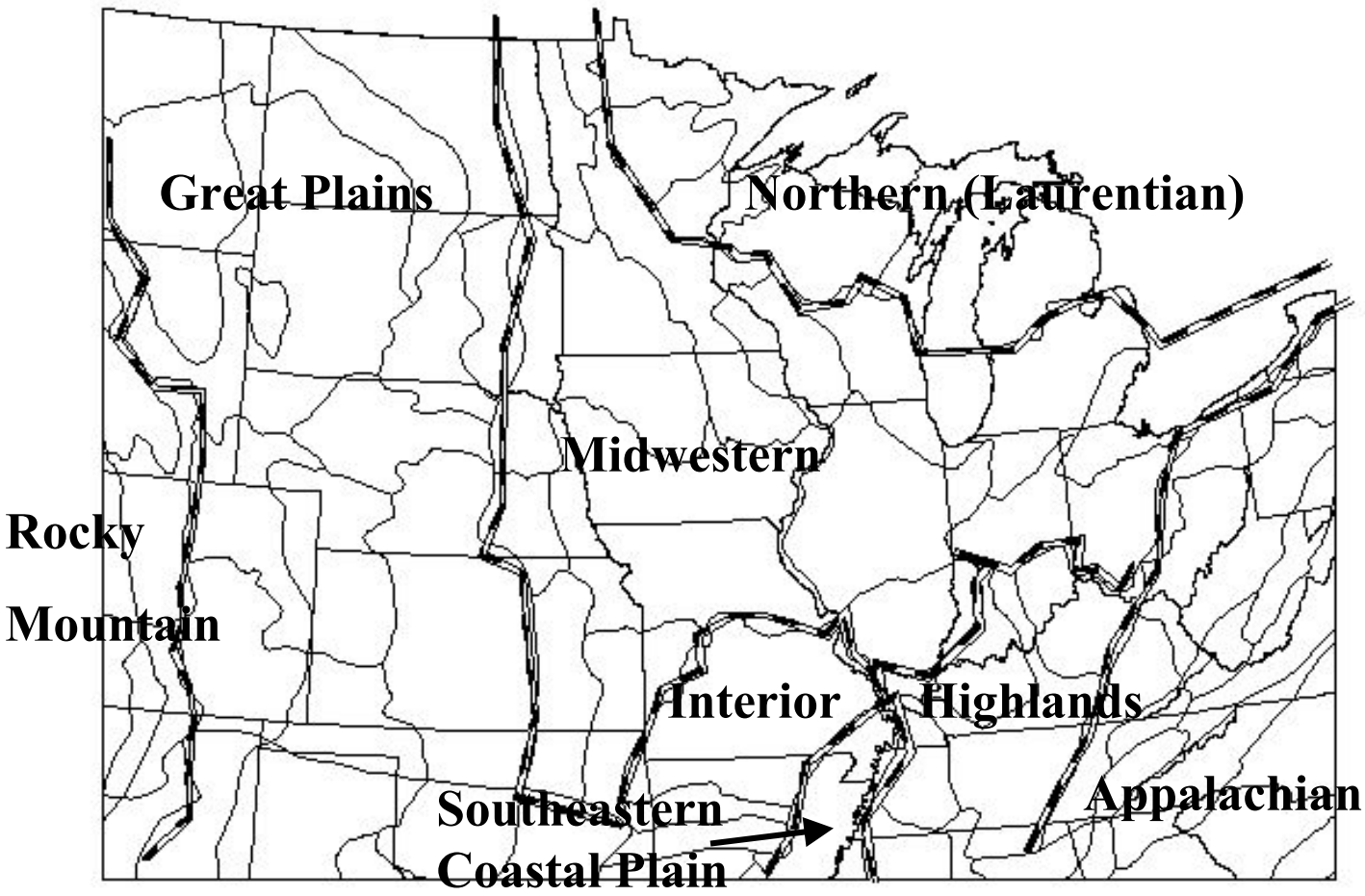


Figure 4b. Map of "subprovinces" within the Takhtajan provinces. The subprovinces define the biogeographic units for ecological groups. They are shown in dotted lines because they are not fixed spatial units; rather, they indicate the rough extent of many of the associations within ecological groups defined by these biogeographic units. These subprovinces have some similarities to the ecoregions map of Bailey et al. (1994), which is shown as the background map. (See also Plate 11.)

Midwestern and Southeastern regions of ABI (see Figure 3). That is, all associations found in the two regions are uniquely placed into a single agreed-upon ecological group at this level. Higher levels of organization at Levels 1-3 are undergoing more extensive review. The hierarchy of ecological groups for Levels 1-3 in the Midwest is shown in Table 6.

In this report, only those associations found in ABI's Midwestern region are reported for an ecological group, but there may be other associations in that group that are found in other regions. Thus, some ecological groups that appear to contain few member associations would be much larger if a complete list of associations were included. (For example, there is only one association in the Midwest reported for the Rocky Mountains Rich Fens group, but there are many other fen associations in the Rocky Mountains of the Western United States).

Illustration of the Ecological Groups Approach

The process of developing ecological groups to portray the ecological relationships among associations is an iterative one. That is, the member associations help determine the criteria for ecological groups, and the groups in turn highlight some of the major ecological characteristics that are shared among the associations. An illustration of how ecological groups and associations can be determined may help demonstrate this relationship.

Tallgrass prairies were a dominant feature of the midwestern landscape. These prairies are defined by the one to two meter tall grass physiognomy and the dominance of a number of grass species, including big bluestem (*Andropogon gerardii*), Indian grass (*Sorghastrum nutans*), little bluestem (*Schizachyrium scoparium*), switchgrass (*Panicum virgatum*), prairie dropseed (*Sporobolus heterolepis*), porcupine grass (*Hesperostipa spartea*) and others. Tallgrass prairies also form a complex ecotone with midwestern oak forests, woodlands, and savannas (see Anderson 1983, Sims and Risser 2000). Numerous studies of tallgrass prairies have interpreted the vegetation patterns using a topographic moisture and substrate gradient (Curtis 1959, Dix and Smeins 1967, Nelson and Anderson 1983, White and Glenn-Lewin 1984, Faber-Langendoen and Maycock 1987, Umbanhowar 1992, Robertson et al. 1997), and many midwestern state Natural Heritage programs have used similar approaches in their classifications (White and Madany 1978, Nelson 1985, Minnesota Natural Heritage Program 1993). These studies helped inform the association units recognized here and suggest some useful ecological group categories that might clarify the underlying abiotic gradients.

To demonstrate how these ecological groups can help bridge the association concept and an ecological-type perspective, we can use Nelson's (1985) natural community types in Missouri. Tallgrass prairie types in Missouri were defined using moisture and substrate. Nelson provides a schematic illustration of the range of types from dry prairie to wet-mesic prairie vegetation along a topographic gradient of substrate and moisture (Figure 5). Associations in the Midwest were defined in part using this information, and the "cross-walk" links can be readily shown (see also Table 3). The associations and natural community are then categorized into two ecological groups, the "Midwestern Deep Soil Tallgrass Prairies" and the "Midwestern Thin Soil Tallgrass Prairies," which in turn are grouped into "Midwestern Tallgrass Prairies" (Figure 5). Thus, the original habitat criteria used for the associations and natural community types (substrate and physiognomy) are used to define their ecological group membership. The overall presentation of ecological groups is familiar to many ecologists, and the linkage of these groups to both associations and state types clarifies the scale of resolution provided by the associations.

Table 6. Ecological groups for the Midwest (Levels 1-3). (See also Tables 4 and 5.)

1. Wetlands - Non Tidal

1. Acid Peatlands
1. Northern (Laurentian) Acid Peatlands

2. Rich Peat Fens
1. Northern (Laurentian) Rich Fens
2. Midwestern Rich Fens
3. Interior Highlands Rich Fens
4. Great Plains Rich Fens
5. Rocky Mountains Rich Fens

3. Seeps
1. Northern (Laurentian) Seeps
2. Midwestern Seeps
3. Appalachian and Interior Highlands Seeps
4. Great Plains Seeps

4. Open and Emergent Marshes
1. Eastern Open and Emergent Marshes
2. Great Plains Open and Emergent Marshes
3. Rocky Mountains Open and Emergent Marshes

5. Wet Prairies and Wet Meadows
1. Northern (Laurentian) Wet Meadows
2. Great Lakes Shores Wet Meadows
3. Midwestern Wet Prairies and Wet Meadows
4. Appalachian and Interior Highlands Wet Prairies and Wet Meadows
5. Great Plains Wet Prairies and Wet Meadows
6. Rocky Mountains Wet Meadows

6. Wooded Swamps and Floodplains
1. Northern (Laurentian) Wooded Swamps and Floodplains
2. Midwestern Wooded Swamps, Floodplains and Wet Flatwoods
3. Appalachian and Interior Highlands Wooded Swamps, Ponds, Floodplains, and Wet Flatwoods
4. Southern Wooded Swamps, Depression Ponds and Floodplains
5. Great Plains Wooded Riparian Vegetation
6. Rocky Mountains Wooded Riparian Vegetation

2. Uplands

1. Shoreline Sand/Mud Strands, Beaches and Dunes
1. Great Lakes Shore Strands and Dunes
2. Midwestern Strands and Mudflats
3. Great Plains Strands and Mudflats

2. Rocky Shores
1. Northern (Laurentian) Lakes and Rivers Rocky Shores
2. Great Lakes Rocky Shores
3. Appalachian and Interior Highlands Riverine Rocky Shores

3. Rocky Uplands (Glades, Rock Barrens, Outcrops and Alvars)
1. Northern (Laurentian) Rock Outcrops and Rock Barrens
2. Great Lakes Alvars
3. Midwestern Rock Outcrops and Glades
4. Appalachian and Interior Highlands Glades (Rock Barrens)
5. Great Plains Rock Outcrops
6. Rocky Mountains Rock Outcrops

4. Cliffs, Talus, Buttes and Badlands
1. Northern (Laurentian) Cliffs and Talus
2. Great Lakes Shore Cliffs
3. Eastern Cliffs and Talus
4. Great Plains Cliffs, Talus, Buttes and Badlands
5. Rocky Mountains Cliffs, Buttes and Talus

5. Forests and Woodlands
1. Northern (Laurentian) Forests and Woodlands
2. Midwestern Forests and Woodlands
3. Appalachian and Interior Highlands Forests and Woodlands
4. Aspen Parkland Forests and Woodlands
5. Great Plains Forests and Woodlands
6. Rocky Mountains Forests and Woodlands

6. Shrublands/Dwarf-Shrublands
1. Northern (Laurentian) Shrublands
2. Midwestern Shrub Prairie and Barrens
3. Great Plains Shrublands

7. Shrub Grasslands
1. Great Plains Shrub Steppe

8. Savannas and Non-Rock Barrens
1. Northern (Laurentian) Pine Barrens
2. Midwestern Oak Savannas and Non-Rock Barrens
3. Interior Highlands Oak Savannas and Non-Rock Barrens
4. Great Plains Oak Savannas

9. Prairies/Grasslands
1. Midwestern Tallgrass Prairies
2. Southeastern Coastal Plain Prairies
3. Great Plains Prairies
4. Rocky Mountains Montane Grasslands

Ecological groups can also help clarify other dynamic processes that shape vegetation patterns of tallgrass prairie on the landscape. Prairies in the central Midwest are found in what is called the "prairie-forest border" region (Anderson 1983), with types ranging from open prairie to closed forest (Figure 6). The structural gradient from prairie to forest is often caused by the variability in fire frequency in the landscape, with prairies dependent on more frequent fire (Anderson 1983, Collins and Wallace 1990). Grazing (and more recently, haying) also affected this gradient. The prairie-forest structural/fire frequency continuum forms a second set of gradients that can be related to the topographic soil moisture/substrate continuum (Figure 7). Thus the tallgrass prairie ecological groups are dynamically related to tallgrass oak savannas and oak woodlands and forests. Using ecological groups, it is possible to show, in schematic fashion, these dynamic relationships, and thereby to gain a perspective on the ecological dynamics of the component associations.

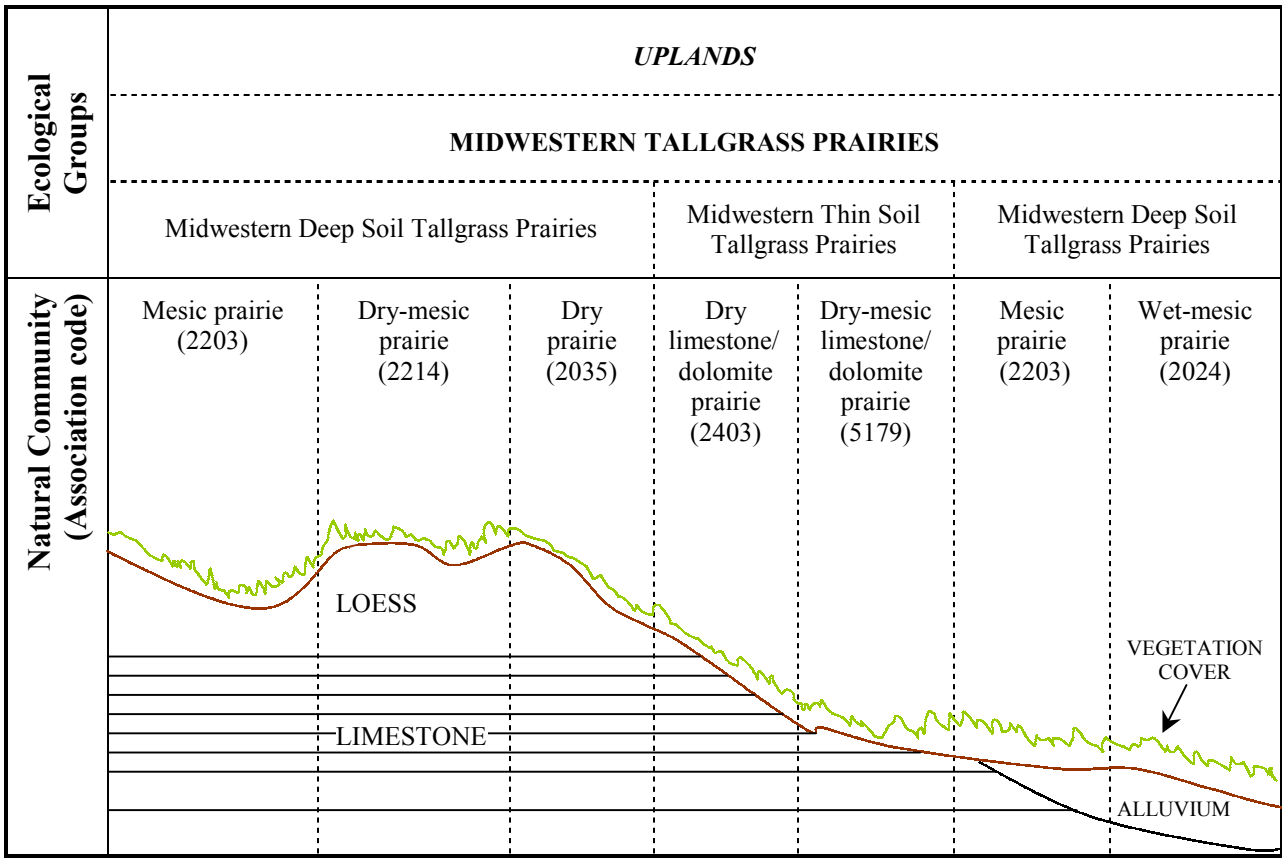


Figure 5. A schematic diagram showing natural communities distributed along a topographic/soil moisture gradient in northern Missouri, and their relationship to ecological groups. The natural community types (and equivalent USNVC associations) are placed into ecological groups based on similarity in ecological processes, structure, and composition. The Missouri state name and the last 4 digits of the corresponding USNVC association code (elcode) are shown; the code may be used to look up the association name in Addendum II of the Appendix. The natural community types and their distribution along the gradient is adapted with permission from Nelson (1985).

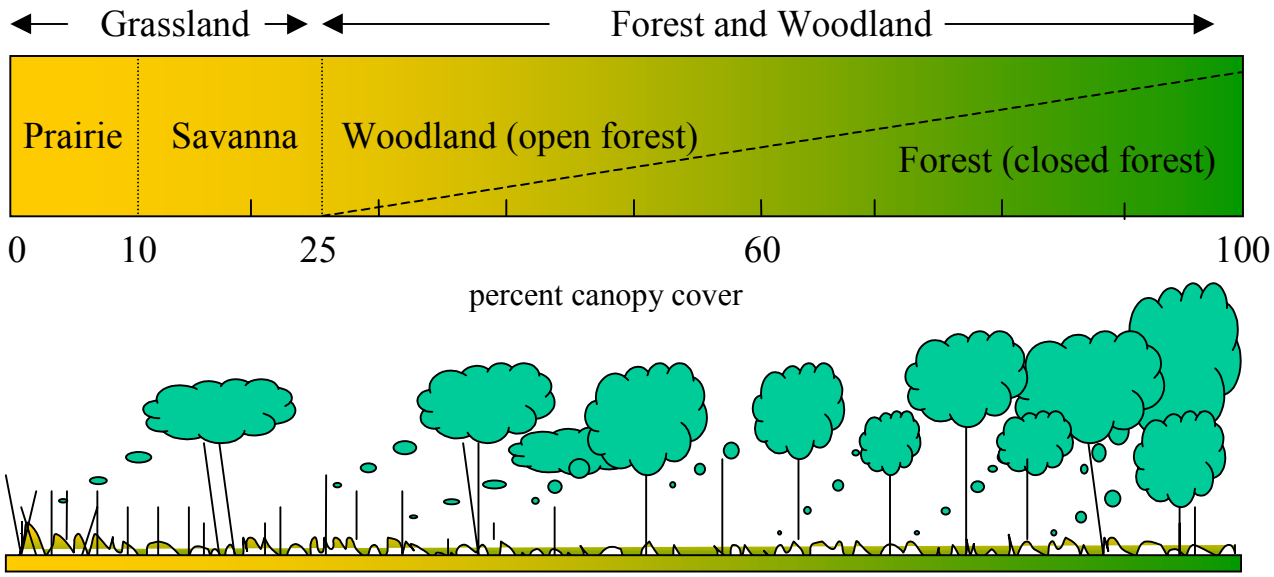


Figure 6. Schematic diagram showing the changes in structure along a gradient from prairie to forest. This structural gradient is often reflective of a fire frequency gradient, with prairies maintained by more frequent fires.

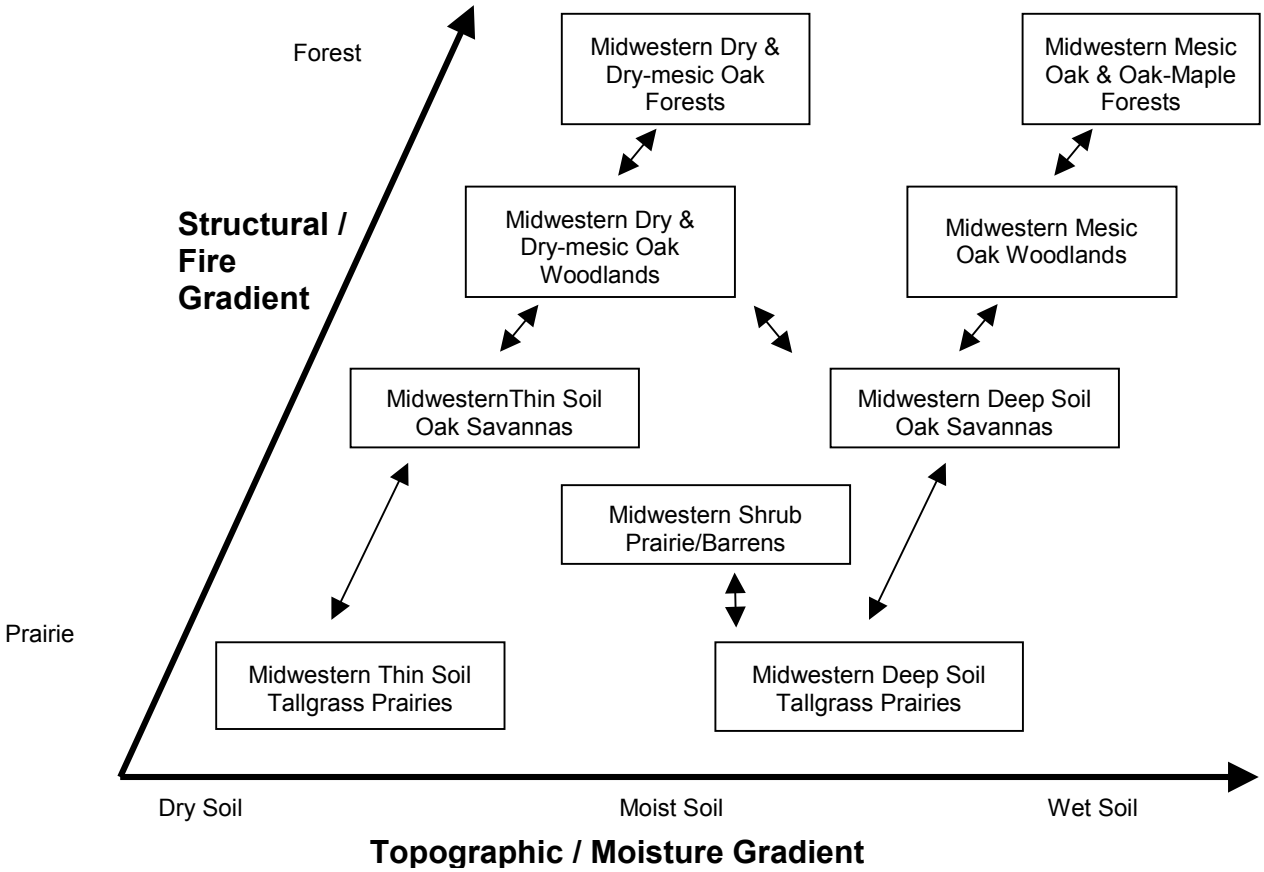


Figure 7. Schematic diagram showing simplified two-dimensional gradients that influence ecological groups in the midwestern prairie-forest border region. The dynamic relationships that may occur among the various ecological groups depend on changes in climate, fire, and other factors (see also Figure 8).

Ecological groups allow us to think at bigger scales and consider ecological factors that may not be readily apparent at the association level. As Grimm (1983, 1984) demonstrated in his studies of the prairie-forest border in Minnesota (Figure 8), ecological groups can extend our understanding of vegetation pattern beyond site and disturbance factors to historical and climatic factors. By working at the scale of "Midwestern Tallgrass Prairies" and "Midwestern Oak Woodlands" we can incorporate ecological studies that occur over much larger spatial and temporal scales than do many association studies, and thereby we gain a perspective on the dynamics of individual associations within those groups. So, this approach allows us to address the variety of ecological processes and abiotic factors affecting midwestern plant communities, from the moisture/substrate gradient and the prairie-forest physiognomic/fire gradient to the interactions of both of these gradients with climate.

V. PLANT COMMUNITIES OF THE MIDWEST

At this time, there are 588 associations (including 21 of uncertain status) and 258 alliances in the Midwest (Table 7). The total number of associations in various states of the Midwest ranged from 74 in Kansas and Nebraska to 185 in Michigan. By comparison, in 1991, the number of types catalogued in natural community classifications from state to state varied from 25 in North Dakota to 191 in Minnesota. Thus, the USNVC has helped to standardize the scale of community type definition across the region.

The midwestern associations can also be aggregated by ecological groups. The number of units by ecological group level is summarized in Table 8. The total number of ecological groups in the Midwest at Level 4 is 152, ranging from 38 in Kansas to 63 in Illinois and Michigan. The complete list of associations in order of Ecological Group is presented in Table 9. Descriptions of each association are provided in the Appendix. A summary of the fields, as laid out in each association description, is presented in Box 1, followed by an example description.

Given the qualitative but extensive nature of the work completed to date, it is difficult to estimate the degree to which associations may be added or subtracted in the Midwest. All twelve states in the Midwest have helped review the associations presented here, and every attempt has been made to include only vegetation types that meet the association concept. Many associations, however, are described only briefly, and further research is needed to understand these types.

There is an urgent need for more extensive, quantitative-based surveys of many of these types. Some states, such as Nebraska and Minnesota, are engaged in detailed, plot-based surveys across the entire state. In Wisconsin, the entire Plant Ecology Laboratory vegetation data set that was developed by Curtis and his students has been computerized (Umbanhower 1990). Analysis of these data at the local or state level will, in turn, assist with more rigorous definitions of the associations. Other states are collecting data on a project-by-project basis. Ultimately, a national plots database, which allows analyses to be conducted across jurisdictional lines, will provide the quantitative data that will augment and inform the qualitative global descriptions provided here. A collaborative project to develop such a plots database is now underway at the National Center for Ecological Analysis and Synthesis (Peet et al. 2000).

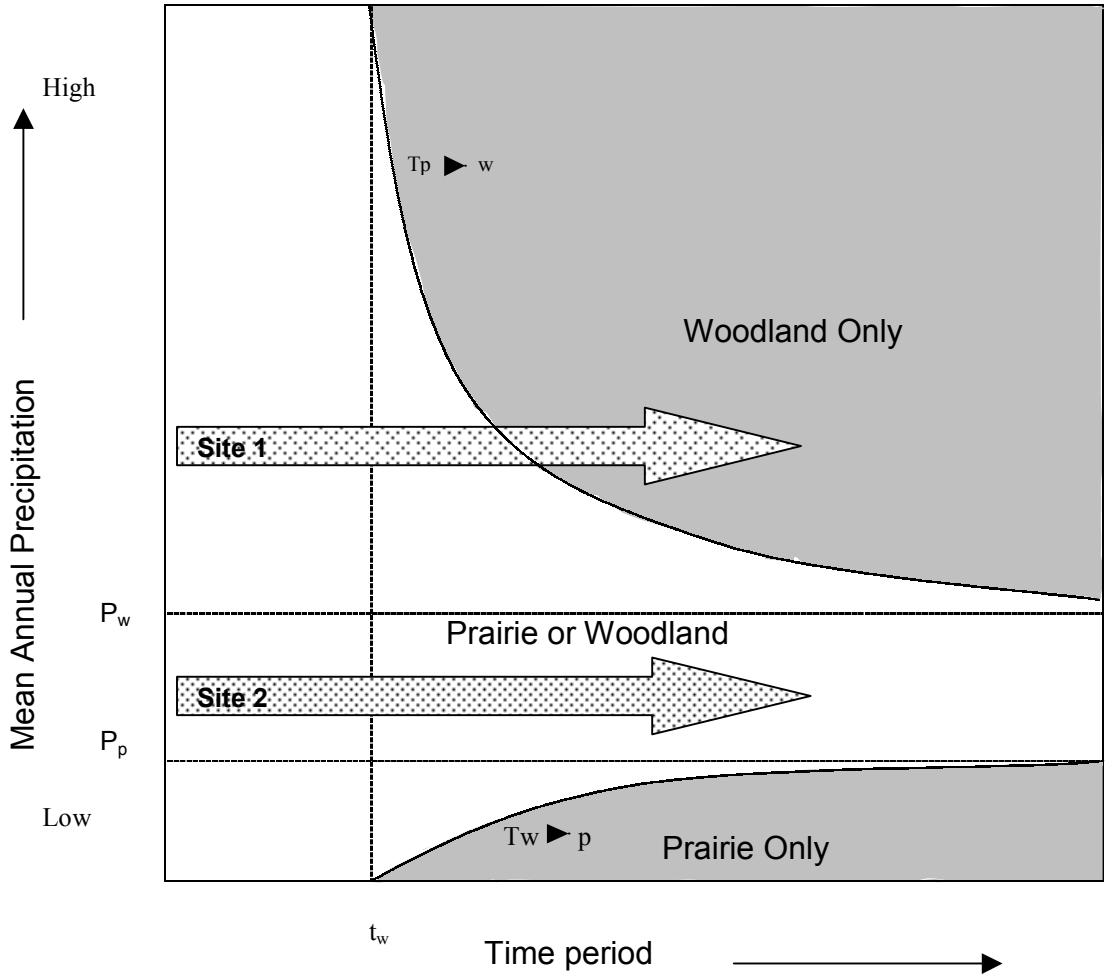


Figure 8. Schematic diagram showing the thresholds in which prairie or woodland will persist across a two-dimensional gradient of mean annual precipitation (and its effect on fire frequency) and time. In the upper, shaded area only woodlands will persist; in the lower, shaded area only prairie will persist; in the unshaded area either woodland or prairie will persist once established. The amount of climate change necessary to *change* an established woodland to prairie (or vice versa) is greater than that necessary for an established woodland (or prairie) to *persist*. The curves shown are the climatic thresholds (T) for the change from an existing prairie to a woodland (T_p ► w), and the reverse change from an existing woodland to a prairie (T_w ► p). P_w = the precipitation level below which existing prairies will never be invaded by woodland. As precipitation increases above P_w, the time period necessary for woodland to invade prairie decreases until it approaches tw, the minimum time period in which woodland can invade prairie. P_p= the precipitation level above which an existing woodland will never be invaded by prairie. As precipitation falls below P_p, the time period necessary for prairie to invade woodland decreases until reaching t_w. If we assume unchanging precipitation levels over time at site 1, then the site could start as either prairie or woodland, but if it were prairie, it would change over time to woodland (where it crosses the threshold of change from prairie to woodland (T_p ► w). Conversely, at site 2, if we assume uniform (but lower) precipitation levels over time, the site would likely remain in whatever condition it started at, whether prairie or woodland. Adapted with permission from Grimm (1983).

Table 7. Total number of vegetation types occurring in each state at each level of the USNVC (Formation Subgroup not shown).

	Number of Types												
Level	All States	IA	IL	IN	KS	MI	MN	MO	ND	NE	OH	SD	WI
Class	7	5	6	6	5	7	7	5	6	5	6	6	7
Subclass	18	9	13	11	8	16	15	14	11	11	13	13	15
Group	29	10	17	15	11	22	20	16	15	14	17	18	21
Formation	70	25	36	33	23	44	39	30	33	26	32	39	41
Alliance	258	63	82	87	43	100	91	71	84	49	64	84	92
Associations	588	85	136	128	74	185	170	121	121	74	91	139	150
Complexes	7		2	2	1	4	2		3	2	2	3	2
Associations + complexes	595	85	138	130	75	189	172	121	124	76	93	142	152

Table 8. Total number of types occurring in each state at each level of the ecological groups hierarchy.

	Number of Types												
Level	All States	IA	IL	IN	KS	MI	MN	MO	ND	NE	OH	SD	WI
Level 1	2	2	2	2	2	2	2	2	2	2	2	2	2
Level 2	15	12	14	14	12	14	14	12	12	13	13	12	13
Level 3	59	22	26	25	20	26	28	21	25	20	25	28	25
Level 4	152	40	63	61	38	63	59	54	46	38	54	51	57
Associations + complexes	595	85	138	130	75	189	172	121	124	76	93	142	152

Box 1. Summary of information used in the association descriptions.

Ecological Group Level 2: Ecological Group Level 4

Global Community Name (scientific): scientific name for a community

Global Community Name (translated) : common species names

Global Common Name: A commonly used, more colloquial, name for a type. Code (CEGL00xxxx) for the USNVC

DESCRIPTION: This is a summary of three key components of the community type description (each in its own paragraph): a vegetation summary, an environmental summary, and, where available, a summary of the dynamics and natural disturbances of the community.

COMMENTS: *#, ABI Region Code.* Classification Comments.

The number gives the classification confidence, on a scale of 1 (strong confidence) to 3 (weak confidence). The ABI Region code is the regional team that has responsibility for maintaining the classification of the type. The classification comments discuss issues relating to the classification of the type.

CONSERVATION RANK: *Global Rank*: Reasons.

The global rank assesses the relative rarity of the association across its entire range on a scale of 1 to 5: G1 (critically imperiled); G2 (imperiled); G3 (vulnerable); G4 (apparently secure); G5 (secure). G? and GU indicate that the association is not yet ranked or is considered unrankable, respectively. A "?" indicates the rank is somewhat uncertain and a range rank (e.g., G2G3) indicates an even higher degree of uncertainty. A "Q" indicates that the taxonomy of the type is in question, and, if resolved, may result in a less imperiled rank.

DISTRIBUTION: Distribution of the type is briefly summarized across its entire range.

USFS ECOREGIONS: Distribution of the type across its entire range is summarized using the U.S. Forest Service ECOMAP Ecological Land Classification, giving province, section, and subsection codes, and the confidence of assignment to that region (C = 95% confidence, P = 80-95% confident, ? = 10-80% confident). (See Plate 11.) *Example*: 212He:CP? indicates that the type is confidently believed to occur in province 212, probably occurs in section 212H, and might occur in subsection 212He.

CONSERVATION REGIONS: Distribution of the type across its entire range is given for The Nature Conservancy ecoregional planning units, which are numbered from 1-64, followed by a confidence code (see details above under *USFS Ecoregions*). (See Plate 12.)

STATES, PROVINCES: Distribution of each type is given for states and provinces in the United States and Canada, respectively.

MIDWEST HERITAGE SYNONYMY: The name used by the state classification is provided for the eight states in the Midwest using an independent state classification (Illinois, Indiana, Michigan, Minnesota, Missouri, Nebraska, Ohio, and Wisconsin). A symbol (+, -, =, I) indicates whether the state type is broader than, finer than, equivalent to, or intersects in a complex manner, respectively.

OTHER SYNONYMY: A selected cross-walk to names used in other classifications that have helped described this type.

USNVC HIERARCHY: The ***alliance name*** and the ***alliance code*** are provided for the level above the association in the USNVC hierarchy.

EXAMPLE DESCRIPTION:

Acid Peatlands: Northern Shrub/Graminoid Bogs and Poor Fens

Carex oligosperma - Carex pauciflora - Eriophorum vaginatum / Sphagnum spp. Herbaceous Vegetation

Few-seed Sedge - Few-flower Sedge - Tussock Cottongrass / Peatmoss Species Herbaceous Vegetation

Open Graminoid / Sphagnum Bog CEGL005256

DESCRIPTION: The vegetation is either dominated by sedges, especially *Carex oligosperma*, or by *Sphagnum* spp. (sphagnum lawns). Shrub cover is less than 25%, and tree cover is less than 10%. Microtopography in more northern stands is high hummocks and weakly developed hollows, but some stands can be flat. The ground cover is a continuous layer of *Sphagnum* spp., including *Sphagnum angustifolium, Sphagnum fuscum*, and *Sphagnum magellanicum*. Graminoid-dominated examples contain *Carex oligosperma* and *Carex pauciflora*, as well as *Eriophorum vaginatum* and *Eriophorum virginicum*. Herbs include *Sarracenia purpurea* and *Scheuchzeria palustris*. Scattered low shrubs may occur, such as *Andromeda polifolia, Chamaedaphne calyculata, Kalmia polifolia, Ledum groenlandicum*, and *Vaccinium oxycoccos*. Minerotrophic indicators may be present at low cover when rooted in minerotrophic peat beneath the mat. Species include *Betula pumila, Carex aquatilis*, and *Carex stricta*. (Minnesota Natural Heritage Program 1993, Harris et al. 1996)

Stands occur in drainageways at margins of raised bogs in large peatland complexes, or occasionally on shores, but they are isolated from groundwater influence. The substrate is a saturated, fibric peat (Harris et al. 1996).

COMMENTS: *2, MCS*. Type may occur as small patches within low-shrub bog types, *Chamaedaphne calyculata / Carex oligosperma - Eriophorum virginicum* Dwarf-shrubland (CEGL005092), *Chamaedaphne calyculata / Carex oligosperma / Sphagnum* spp. Poor Fen Dwarf-shrubland (CEGL005277), and *Chamaedaphne calyculata - Ledum groenlandicum - Kalmia polifolia* Bog Dwarf-shrubland (CEGL005278). Tracking occurrences of these sphagnum mats in Ontario and Michigan should be checked.

CONSERVATION RANK: *G4G5*. This type is expected to be fairly common and widespread in peatlands in Canada.

DISTRIBUTION: This open sedge/sphagnum bog type is found widely in the boreal/sub-boreal regions of the Great Lakes, and more widely in Canada. It ranges from Minnesota to possibly Maine, and northward in Canada from Quebec to Manitoba and possibly elsewhere.

USFS ECOREGIONS: 212A:C?, 212La:CCC, 212Mb:CCC, M212A:C?
CONSERVATION REGIONS: 47:C, 48:?, 63:?
STATES: ME? MI? MN WI? **PROVINCES:** MB ON QC

MIDWEST HERITAGE SYNONYMY: MI? bog
MN open sphagnum bog =
WI? open bog (graminoid subtype?) ?

OTHER SYNONYMY: open graminoid bog: sedge / Sphagnum (W23) = (Harris et al. 1996), Nonforested bog (Glaser 1992) B

USNVC HIERARCHY: CAREX OLIGOSPERMA - CAREX LASIOCARPA SATURATED HERBACEOUS ALLIANCE (V.A.5.N.m)

Table 9. A list of plant communities (associations) for the Midwest by ecological group. The associations are nested within the four levels of ecological groups (see also Tables 4 and 6). The scientific name for the association is given in the left hand column and a common name is provided on the right.

1. Wetlands - Non Tidal

1.1. ACID PEATLANDS

1.1.1. Northern (Laurentian) Acid Peatlands

1.1.1.1. Northern Conifer Bogs and Poor Swamps

Larix laricina / Photinia melanocarpa / Sphagnum spp. Forest	*Central Tamarack Poor Swamp*
Picea mariana - (Larix laricina) / Ledum groenlandicum / Sphagnum spp. Forest	*Black Spruce - (Tamarack) / Labrador Tea Poor Swamp*
Picea mariana / Alnus incana / Sphagnum spp. Forest	*Black Spruce / Alder Swamp*
Picea mariana / Ledum groenlandicum / Carex trisperma / Sphagnum spp. Forest	*Black Spruce Bog*
Pinus banksiana - (Picea mariana) - Mixed Hardwoods / Sphagnum spp. Forest	*Jack Pine Swamp*

1.1.1.2. Northern Shrub/Graminoid Bogs and Poor Fens

Carex lasiocarpa - Carex oligosperma - (Lysimachia terrestris) / Sphagnum spp. / Spiraea tomentosa Herbaceous Vegetation	*Midwestern Graminoid Poor Fen*
Carex lasiocarpa - Carex oligosperma / Sphagnum spp. Herbaceous Vegetation	*Northern Sedge Poor Fen*
Carex lasiocarpa - Rhynchospora alba - Scheuchzeria palustris Herbaceous Vegetation	*Open Schlenke Bog*
Carex oligosperma - Carex pauciflora - Eriophorum vaginatum / Sphagnum spp. Herbaceous Vegetation	*Open Graminoid / Sphagnum Bog*
Chamaedaphne calyculata - Ledum groenlandicum - Kalmia polifolia Bog Dwarf-shrubland	*Leatherleaf Bog*
Chamaedaphne calyculata / Carex oligosperma - Eriophorum virginicum Dwarf-shrubland	*Leatherleaf Kettle Bog*
Chamaedaphne calyculata / Carex oligosperma / Sphagnum spp. Dwarf-shrubland	*Great Lakes Leatherleaf Intermittent Wetland*
Chamaedaphne calyculata / Carex oligosperma / Sphagnum spp. Poor Fen Dwarf-shrubland	*Leatherleaf Poor Fen*
Larix laricina / Chamaedaphne calyculata / Carex lasiocarpa Shrubland	*Tamarack Scrub Poor Fen*
Picea mariana / Chamaedaphne calyculata / Sphagnum spp. Dwarf-shrubland	*Black Spruce / Leatherleaf Semi-treed Bog*
Vaccinium corymbosum - Gaylussacia baccata - Photinia melanocarpa / Calla palustris Shrubland	*Highbush Blueberry Poor Fen*

1.1.1.3. Northern Patterned Peatlands

Northern Patterned Poor Fen Complex	*Northern Patterned Poor Fen Complex*
Northern Patterned Rich Fen Complex	*Northern Patterned Rich Fen Complex*

1.2. RICH PEAT FENS

1.2.1. Northern (Laurentian) Rich Fens

1.2.1.1. Northern Rich Fens

Betula pumila - Dasiphora fruticosa ssp. floribunda / Carex lasiocarpa - Trichophorum alpinum Shrubland	*Bog Birch - Shrubby-cinquefoil Rich Boreal Fen*
Betula pumila / Chamaedaphne calyculata / Carex lasiocarpa Shrubland	*Bog Birch - Leatherleaf Rich Fen*
Carex lasiocarpa - Carex buxbaumii - Trichophorum caespitosum Boreal Herbaceous Vegetation	*Boreal Sedge Rich Fen*
Carex lasiocarpa - Trichophorum caespitosum - Rhynchospora capillacea / Andromeda polifolia Herbaceous Vegetation	*Boreal Extremely Rich Seepage Fen*
Myrica gale Fen Shrubland	*Sweet Gale Shrub Fen*
Thuja occidentalis - (Myrica gale) / Trichophorum alpinum / Drepanocladus spp. Shrubland	*White-cedar - Sweet Gale Scrub Fen*

1.2.1.2. Northern Shore Fens

Alnus incana - Salix spp. - Betula pumila / Chamaedaphne calyculata Shrubland	*Bog Birch-Willow Shore Fen*
Calamagrostis canadensis - Carex viridula - Cladium mariscoides - Lobelia kalmii Herbaceous Vegetation	*Great Lakes Sedge Rich Shore Fen*
Carex lasiocarpa - (Carex rostrata) - Equisetum fluviatile Herbaceous Vegetation	*Wiregrass Sedge Shore Fen*
Chamaedaphne calyculata - Myrica gale / Carex lasiocarpa Dwarf-shrubland	*Leatherleaf - Sweetgale Shore Fen*
Dasiphora fruticosa ssp. floribunda - Myrica gale Rich Shore Fen Shrubland	*Shrubby-cinquefoil - Sweetgale Rich Shore Fen*

1.2.1.3. Northeastern Rich Fens

Cornus sericea - Cornus amomum - Photinia melanocarpa - Viburnum lentago Fen Shrubland ..... *Western Allegheny Tall Shrub Rich Fen*

Dasiphora fruticosa ssp. floribunda / Carex interior - Carex flava - Sarracenia purpurea Shrub Herbaceous Vegetation ..... *Western Allegheny Cinquefoil - Sedge Rich Fen*

1.2.2. Midwestern Rich Fens

1.2.2.1. Midwestern Prairie Rich Fens

Betula pumila - Salix spp. Prairie Fen Shrubland ..... *Bog Birch - Willow Prairie Fen*

Carex lasiocarpa - Calamagrostis spp. - (Eleocharis rostellata) Herbaceous Vegetation ..... *Prairie Transition Rich Fen*

Carex prairea - Schoenoplectus pungens - Rhynchospora capillacea Herbaceous Vegetation ..... *Northern Tallgrass Calcareous Fen*

Carex stricta - Valeriana edulis - Parnassia palustris Herbaceous Vegetation ..... *Tussock Sedge Fen*

Cornus amomum - Salix spp. - Toxicodendron vernix - Rhamnus lanceolata Fen Shrubland ..... *Dogwood - Willow - Poison Sumac Shrub Fen*

Dasiphora fruticosa ssp. floribunda / Carex sterilis - Andropogon gerardii - Arnoglossum plantagineum Shrub Herbaceous Vegetation ..... *Cinquefoil - Sedge Prairie Fen*

1.2.3. Interior Highlands Rich Fens

1.2.3.1. Interior Highlands Alkaline Fens

(Carex interior, Carex lurida) - Carex leptalea - Parnassia grandifolia - Rhynchospora capillacea Herbaceous Vegetation ..... *Ozark Fen*

Carex interior - Carex lurida - Andropogon gerardii - Parnassia grandifolia Herbaceous Vegetation ..... *Ozark Prairie Fen*

1.2.4. Great Plains Rich Fens

1.2.4.1. Great Plains Rich Fens

Carex interior - Eleocharis elliptica - Thelypteris palustris Herbaceous Vegetation ..... *Sandhills Fen*

Carex pellita - Carex spp. - Schoenoplectus tabernaemontani Fen Herbaceous Vegetation ..... *Central Tallgrass Fen*

Carex spp. - Triglochin maritima - Eleocharis quinqueflora Marl Fen Herbaceous Vegetation ..... *Great Plains Marl Fen*

1.2.5. Rocky Mountains Rich Fens

1.2.5.1. Rocky Mountains Rich Fens

Salix candida / Carex rostrata Shrubland ..... *Sage Willow Fen*

1.3. SEEPS

1.3.1. Northern (Laurentian) Seeps

1.3.1.1. Northern Alkaline Seeps

Clay Seeps Sparse Vegetation ..... *Clay Seeps*

1.3.2. Midwestern Seeps

1.3.2.1. Midwestern Seepage Meadows

Symplocarpus foetidus Herbaceous Vegetation ..... *Skunk Cabbage Seepage Meadow*

1.3.3. Appalachian and Interior Highlands Seeps

1.3.3.2. Interior Highlands Acid Herbaceous Seeps

Carex crinita - Osmunda spp. / Physocarpus opulifolius Seep Herbaceous Vegetation ..... *Midwest Sand Seep*

Carex crinita - Osmunda spp. / Sphagnum spp. Herbaceous Vegetation ..... *Midwest Acid Seep*

1.3.4. Great Plains Seeps

1.3.4.1. Great Plains Seeps

Typha latifolia - Equisetum hyemale - Carex (hystericina, pellita) Seep Herbaceous Vegetation ..... *Great Plains Neutral Seep*

Typha spp. - Carex spp. Acid Seep Herbaceous Vegetation ..... *Great Plains Acid Seep*

1.4. OPEN AND EMERGENT MARSHES

1.4.1. Eastern Open and Emergent Marshes

1.4.1.1. Eastern Open Marshes and Ponds

Nelumbo lutea Herbaceous Vegetation ..... *American Lotus Aquatic Wetland*
Nuphar lutea ssp. advena - Nymphaea odorata Herbaceous Vegetation ..... *Water Lily Aquatic Wetland*
Nymphaea odorata - Nuphar lutea (ssp. pumila, ssp. variegata) Herbaceous Vegetation ..... *Northern Water Lily Aquatic Wetland*
Nymphaea tetragona - Nuphar lutea (ssp. pumila, ssp. variegata) Herbaceous Vegetation ..... *Boreal Water Lily Aquatic Wetland*
Potamogeton spp. - Ceratophyllum spp. Midwest Herbaceous Vegetation ..... *Midwest Pondweed Submerged Aquatic Wetland*
Vallisneria americana Herbaceous Vegetation ..... *Tape Grass Submerged Aquatic Wetland*

1.4.1.2. Eastern Emergent Marshes

Equisetum fluviatile - (Eleocharis palustris) Herbaceous Vegetation ..... *Water Horsetail-Spikerush Marsh*
Polygonum spp. - Mixed Forbs Herbaceous Vegetation ..... *Midwest Ephemeral Pond*
Rhynchospora capitellata - Rhexia virginica - Rhynchospora scirpoides - Schoenoplectus hallii Herbaceous Vegetation ..... *Inland Coastal Plain Marsh*
Sagittaria latifolia - (Sagittaria rigida) Herbaceous Vegetation ..... *Arrowhead Marsh*
Schoenoplectus acutus - (Schoenoplectus fluviatilis) Freshwater Herbaceous Vegetation ..... *Freshwater Bulrush Marsh*
Schoenoplectus fluviatilis - Schoenoplectus spp. Herbaceous Vegetation ..... *River Bulrush Marsh*
Schoenoplectus maritimus - Atriplex patula - Eleocharis parvula Herbaceous Vegetation ..... *Inland Saline Marsh*
Schoenoplectus tabernaemontani - Typha spp. - (Sparganium spp., Juncus spp.) Herbaceous Vegetation ..... *Bulrush - Cattail - Burreed Shallow Marsh*
Typha spp. - Schoenoplectus acutus - Mixed Herbs Midwest Herbaceous Vegetation ..... *Midwest Mixed Emergent Deep Marsh*
Typha spp. Midwest Herbaceous Vegetation ..... *Midwest Cattail Deep Marsh*
Zizania (aquatica, palustris) Herbaceous Vegetation ..... *Wild Rice Marsh*

1.4.1.3. Great Lakes Coastal Marshes and Complex

Great Lakes Coastal Wetlands Complex ..... *Great Lakes Coastal Wetlands Complex*
Potamogeton gramineus - Potamogeton natans Northern Great Lakes Shore Herbaceous Vegetation ..... *Northern Great Lakes Shore Submergent Marsh*
Potamogeton zosteriformis - Ceratophyllum demersum - Elodea canadensis Southern Great Lakes Shore Herbaceous Vegetation ..... *Southern Great Lakes Submergent Marsh*
Schoenoplectus acutus - Schoenoplectus subterminalis - Eleocharis palustris - (Schoenoplectus americanus) Northern Great Lakes Shore Herbaceous Vegetation ..... *Northern Great Lakes Emergent Marsh*
Typha spp. - Schoenoplectus tabernaemontani - Mixed Herbs Southern Great Lakes Shore Herbaceous Vegetation ..... *Southern Great Lakes Shore Emergent Marsh*

1.4.1.4. Interior Highlands Open Ponds and Marshes

Carex comosa - Carex decomposita - Dulichium arundinaceum - Lycopus rubellus Herbaceous Vegetation ..... *Sinkhole Pond Marsh*

1.4.2. Great Plains Open and Emergent Marshes

1.4.2.1. Great Plains Open Marshes and Ponds

Potamogeton spp. - Ceratophyllum demersum Great Plains Herbaceous Vegetation ..... *Great Plains Pondweed Submerged Aquatic Wetland*
Stuckenia pectinata - Myriophyllum spicatum Herbaceous Vegetation ..... *Sago Pondweed - Water-milfoil Submerged Wetland*
Stuckenia pectinata - Ruppia maritima Herbaceous Vegetation ..... *Sago Pondweed Submerged Wetland*
Stuckenia pectinata - Zannichellia palustris Herbaceous Vegetation ..... *Sago Pondweed - Horned Pondweed Submerged Wetland*

1.4.2.2. Great Plains Freshwater Emergent Marshes

Schoenoplectus acutus - Typha latifolia - (Schoenoplectus tabernaemontani) Sandhills Herbaceous Vegetation ..... *Sandhills Bulrush Marsh*
Typha (angustifolia, domingensis, latifolia) - Schoenoplectus americanus Herbaceous Vegetation ..... *Southern Great Plains Cattail - Bulrush Marsh*

1.4.2.3. Great Plains Saline Emergent Marshes

Schoenoplectus maritimus - Schoenoplectus acutus - (Triglochin maritima) Herbaceous Vegetation ..... *Northern Plains Bulrush Brackish Marsh*
Schoenoplectus pungens - Suaeda calceoliformis Alkaline Herbaceous Vegetation ..... *Western Great Plains Alkaline Marsh*
Schoenoplectus pungens Herbaceous Vegetation ..... *Bulrush Wet Meadow*
Typha spp. - Schoenoplectus spp. - Mixed Herbs Great Plains Herbaceous Vegetation ..... *Northern Great Plains Cattail - Bulrush Marsh*
Typha spp. Great Plains Herbaceous Vegetation ..... *Northern Great Plains Cattail Marsh*

1.5. WET PRAIRIES AND WET MEADOWS

1.5.1. Northern (Laurentian) Wet Meadows

1.5.1.1. Northern Wet Meadows

Calamagrostis canadensis - Phalaris arundinacea Herbaceous Vegetation ..... *Bluejoint Wet Meadow*
Carex rostrata - Carex lacustris - (Carex vesicaria) Herbaceous Vegetation ..... *Northern Sedge Wet Meadow*

1.5.2. Great Lakes Shores Wet Meadows

1.5.2.1. Great Lakes Interdunal Wetlands

Dasiphora fruticosa ssp. floribunda / Cladium mariscoides - Juncus balticus - (Rhynchospora capillacea) Herbaceous Vegetation ..... *Interdunal Wetland*

1.5.3. Midwestern Wet Prairies and Wet Meadows

1.5.3.1. Midwestern Wet Prairies and Meadows

Carex aquatilis - Carex spp. Herbaceous Vegetation ..... *Water Sedge Wet Meadow*
Carex atherodes Herbaceous Vegetation ..... *Awned Sedge Wet Meadow*
Carex lacustris Herbaceous Vegetation ..... *Lake Sedge Wet Meadow*
Carex pellita - Calamagrostis stricta Herbaceous Vegetation ..... *Bluejoint - Woolly Sedge Wet Meadow*
Carex spp. - (Carex pellita, Carex vulpinoidea) Herbaceous Vegetation ..... *Central Midwest Sedge Meadow*
Carex stricta - Carex spp. Herbaceous Vegetation ..... *Tussock Sedge Wet Meadow*
Cladium mariscoides - (Carex lasiocarpa, Hypericum kalmianum, Oligoneuron riddellii, Eleocharis elliptica) Herbaceous Vegetation ..... *Twigrush Wet Prairie*
Salix petiolaris - (Betula pumila) / Spartina pectinata - Carex pellita Shrubland ..... *Willow Wet Brush Prairie*
Spartina pectinata - Calamagrostis stricta - Carex spp. Herbaceous Vegetation ..... *Northern Cordgrass Wet Prairie*
Spartina pectinata - Carex spp. - Calamagrostis canadensis - Lythrum alatum - (Oxypolis rigidior) Herbaceous Vegetation ..... *Central Cordgrass Wet Prairie*
Spartina pectinata - Carex spp. - Calamagrostis canadensis Lakeplain Herbaceous Vegetation ..... *Lakeplain Wet Prairie*
Spartina pectinata - Carex spp. - Calamagrostis canadensis Sand Herbaceous Vegetation ..... *Central Cordgrass Wet Sand Prairie*

1.5.4. Appalachian and Interior Highlands Wet Prairies and Wet Meadows

1.5.4.2. Appalachian and Interior Highlands Herbaceous Depression Ponds and Pondshores

Scirpus cyperinus - Panicum rigidulum var. elongatum - Rhynchospora corniculata - (Dulichium arundinaceum) Herbaceous Vegetation ..... *Highland Rim Pond (Woolgrass Bulrush - Threeway Sedge Subtype)*

1.5.5. Great Plains Wet Prairies and Wet Meadows

1.5.5.1. Great Plains Freshwater Wet Prairies and Meadows

Calamagrostis canadensis - Juncus spp. - Carex spp. Sandhills Herbaceous Vegetation ..... *Sandhills Wet Prairie*
Carex nebrascensis Herbaceous Vegetation ..... *Nebraska Sedge Wet Meadow*
Eleocharis palustris Herbaceous Vegetation ..... *Creeping Spikerush Wet Meadow*
Juncus balticus Herbaceous Vegetation ..... *Baltic Rush Wet Meadow*
Panicum virgatum - (Pascopyrum smithii) Herbaceous Vegetation ..... *Switchgrass Wet-mesic Tallgrass Prairie*
Pascopyrum smithii - Eleocharis spp. Herbaceous Vegetation ..... *Western Wheatgrass - Spikerush Mixedgrass Prairie*
Scolochloa festucacea Herbaceous Vegetation ..... *Sprangletop Marsh*
Spartina pectinata - Carex spp. Herbaceous Vegetation ..... *Prairie Cordgrass - Sedge Wet Meadow*
Spartina pectinata - Eleocharis spp. - Carex spp. Herbaceous Vegetation ..... *Southern Great Plains Cordgrass Wet Prairie*

1.5.5.2. Great Plains Saline Wet Prairies and Meadows

Calamagrostis stricta - Carex sartwellii - Carex praegracilis - Plantago eriopoda Saline Herbaceous Vegetation ..... *Northern Tallgrass Saline Wet Meadow*
Distichlis spicata - (Hordeum jubatum, Poa arida, Sporobolus airoides) Herbaceous Vegetation ..... *Southern Great Plains Saline Meadow*
Distichlis spicata - Hordeum jubatum - (Poa arida, Iva annua) Herbaceous Vegetation ..... *Central Tallgrass Saline Meadow*
Distichlis spicata - Hordeum jubatum - Puccinellia nuttalliana - Suaeda calceoliformis Herbaceous Vegetation ..... *Northern Great Plains Saltgrass Saline Meadow*
Distichlis spicata - Schoenoplectus maritimus - Salicornia rubra Herbaceous Vegetation ..... *Eastern Great Plains Saline Marsh*
Hordeum jubatum Herbaceous Vegetation ..... *Foxtail Barley Meadow*
Pascopyrum smithii - Distichlis spicata Herbaceous Vegetation ..... *Western Wheatgrass - Saltgrass Saline Prairie*
Pascopyrum smithii - Hordeum jubatum Herbaceous Vegetation ..... *Western Wheatgrass - Foxtail Barley Saline Prairie*
Salicornia rubra Herbaceous Vegetation ..... *Slender Glasswort Saline Meadow*
Sporobolus airoides Northern Plains Herbaceous Vegetation ..... *Northern Plains Alkali Sacaton Saline Meadow*
Sporobolus airoides Southern Plains Herbaceous Vegetation ..... *Alkali Sacaton Southern Plains Grassland*

1.5.5.3. Great Plains Prairie Pothole Complex

Northern Prairie Pothole Wetland Complex ..... *Northern Prairie Pothole Wetland Complex*

1.5.5.4. Great Plains Playas

Eleocharis palustris - (Eleocharis compressa) - Leptochloa fusca ssp. fascicularis Herbaceous Vegetation ..... *Spikerush Playa Lake*

Heteranthera limosa - Bacopa rotundifolia - Sagittaria latifolia Herbaceous Vegetation ..... *Forb Playa Marsh*

Pascopyrum smithii - Buchloe dactyloides - (Phyla cuneifolia, Oenothera canescens) Herbaceous Vegetation ..... *Wheatgrass Playa Grassland*

Polygonum spp. - Echinochloa spp. - Distichlis spicata Playa Lake Herbaceous Vegetation ..... *Playa Marsh*

1.5.6. Rocky Mountains Wet Meadows

1.5.6.1. Rocky Mountains Wet Meadows

Calamagrostis canadensis Western Herbaceous Vegetation ..... *Canadian Reedgrass Wet Meadow*

1.6. WOODED SWAMPS AND FLOODPLAINS

1.6.1. Northern (Laurentian) Wooded Swamps and Floodplains

1.6.1.1. Northern Rich Conifer Swamps

Larix laricina - Acer rubrum / (Rhamnus alnifolia, Vaccinium corymbosum) Forest ..... *Central Tamarack - Red Maple Rich Swamp*

Larix laricina / Alnus incana Forest ..... *Northern Tamarack Rich Swamp*

Pinus strobus - (Acer rubrum) / Osmunda spp. Forest ..... *White Pine - Red Maple Swamp*

Thuja occidentalis - (Larix laricina) Seepage Forest ..... *White-cedar Seepage Swamp*

Thuja occidentalis - (Picea mariana, Abies balsamea) / Alnus incana Forest ..... *White-cedar - (Mixed Conifer) / Alder Swamp*

Thuja occidentalis - Fraxinus nigra Forest ..... *White-cedar - Black Ash Swamp*

Thuja occidentalis - Larix laricina / Sphagnum spp. Forest ..... *White-cedar - Tamarack Peat Swamp*

Tsuga canadensis - Betula alleghaniensis Saturated Forest ..... *Hemlock - Yellow Birch Swamp Wet-mesic Forest*

1.6.1.2. Northern Rich Hardwood Swamps

Acer rubrum - Fraxinus spp. - Betula papyrifera / Cornus canadensis Forest ..... *Red Maple - Ash - Birch Swamp Forest*

Fraxinus nigra - Mixed Hardwoods - Conifers / Cornus sericea / Carex spp. Forest ..... *Black Ash - Mixed Hardwood Swamp*

Populus tremuloides - Populus balsamifera - Mixed Hardwoods Lowland Forest ..... *Aspen - Balsam Poplar Lowland Forest*

1.6.1.3. Northern Rich Shrub Swamps

Alnus incana Swamp Shrubland ..... *Speckled Alder Swamp*

Alnus serrulata Eastern Shrubland ..... *Smooth Alder Swamp*

1.6.2. Midwestern Wooded Swamps, Floodplains and Wet Flatwoods

1.6.2.1. Midwestern Rich Hardwood Swamps

Acer (rubrum, saccharinum) - Fraxinus spp. - Ulmus americana Forest ..... *Maple - Ash - Elm Swamp Forest*

Fraxinus pennsylvanica - Celtis occidentalis - Tilia americana - (Quercus macrocarpa) Forest ..... *Ash - Elm - Mixed Lowland Hardwood Forest*

Fraxinus pennsylvanica - Celtis spp. - Quercus spp. - Platanus occidentalis Bottomland Forest ..... *Ash - Oak - Sycamore Mesic Bottomland Forest*

Quercus palustris - Quercus bicolor - (Liquidambar styraciflua) Mixed Hardwood Forest ..... *Pin Oak Mixed Hardwood Forest*

1.6.2.2. Midwestern Rich Shrub Swamps

Cephalanthus occidentalis / Carex spp. Northern Shrubland ..... *Northern Buttonbush Swamp*

Cornus sericea - Salix (bebbiana, discolor, petiolaris) / Calamagrostis stricta Shrubland ..... *Dogwood - Mixed Willow Shrub Meadow*

Cornus sericea - Salix spp. - (Rosa palustris) Shrubland ..... *Dogwood - Willow Swamp*

Cornus spp. - Salix spp. - Vaccinium corymbosum - Rhamnus alnifolia - Toxicodendron vernix Shrubland ..... *Dogwood - Willow - Blueberry Swamp*

1.6.2.3. Midwestern Riverfront Floodplain Forests

Acer saccharinum - Ulmus americana - (Populus deltoides) Forest ..... *Silver Maple - Elm - (Cottonwood) Forest*

Fraxinus pennsylvanica - Ulmus americana - (Acer negundo, Tilia americana) Northern Forest ..... *Northern Ash - Elm Floodplain Forest*

Fraxinus pennsylvanica - Ulmus spp. - Celtis occidentalis Forest ..... *Central Green Ash - Elm - Hackberry Forest*

Populus deltoides - Salix nigra Forest ..... *Cottonwood - Black Willow Forest*

1.6.2.4. Midwestern Bottomland Hardwood Forests

Acer saccharum - Carya cordiformis / Asimina triloba Floodplain Forest ..... *Maple - Hickory Mesic Floodplain Forest*

Quercus macrocarpa - Quercus bicolor - Carya laciniosa / Leersia spp. - Cinna spp. Forest ..... *Bur Oak - Swamp White Oak Mixed Bottomland Forest*

1.6.2.5. Midwestern Wet Flatwoods

Fagus grandifolia - Acer saccharum - Quercus bicolor - Acer rubrum Flatwoods Forest ..... *Beech - Hardwoods Till Plain Flatwoods*
Fagus grandifolia - Quercus alba - (Quercus michauxii) - Acer rubrum Flatwoods Forest ..... *Beech - Oak - Red Maple Flatwoods*
Quercus palustris - Quercus bicolor - Acer rubrum Flatwoods Forest ..... *Northern (Great Lakes) Flatwoods*
Quercus palustris - Quercus bicolor - Nyssa sylvatica - Acer rubrum Sand Flatwoods Forest ..... *Pin Oak - Swamp White Oak Sand Flatwoods*

1.6.3. Appalachian and Interior Highlands Wooded Swamps, Ponds, Floodplains, and Wet Flatwoods

1.6.3.1. Appalachian and Interior Highlands Limesink and Karst Wooded Ponds

Nyssa aquatica / Cephalanthus occidentalis Pond Forest ..... *Water Tupelo Sinkhole Pond Swamp*

1.6.3.2. Interior Highlands Forested Upland Depression Ponds

Quercus lyrata Pond Forest ..... *Overcup Oak Pond Forest*
Quercus palustris - (Quercus bicolor) / Carex crinita / Sphagnum spp. Forest ..... *Pin Oak - Swamp White Oak Sinkhole Flatwoods*

1.6.3.3. Appalachian and Interior Highlands Upland Depression Shrub Ponds

Cephalanthus occidentalis / Hibiscus moscheutos ssp. moscheutos Shrubland ..... *Buttonbush Sinkhole Pond Swamp*

1.6.3.4. Appalachian Highlands Riverfront and Levee Forests and Shrublands

Platanus occidentalis - Acer saccharinum - Juglans nigra - Ulmus rubra Forest ..... *Sycamore-Silver Maple Floodplain Forest*

1.6.3.5. Interior Highlands Small Stream Floodplain / Terrace Forests

Acer rubrum - Fraxinus pennsylvanica / Carex spp. / Climacium americanum Forest ..... *Red Maple Forested Seep*
Acer saccharum - Quercus rubra - Carya cordiformis / Asimina triloba Forest ..... *Sugar Maple - Oak - Bitternut Hickory Mesic Bottomland Forest*
Fagus grandifolia - Quercus spp. - Acer rubrum - Juglans nigra Forest ..... *Beech - Mixed Hardwood Floodplain Forest*

1.6.3.6. Interior Highlands Riverbank Shrublands

Arundinaria gigantea ssp. gigantea Shrubland ..... *Floodplain Canebrake*

1.6.3.7. Interior Highlands Wet Flatwoods

Quercus falcata Flatwoods Forest ..... *Southern Red Oak Flatwoods Forest*
Quercus palustris - (Quercus stellata) - Quercus pagoda / Isoetes spp. Forest ..... *Pin Oak - Post Oak Lowland Flatwoods*

1.6.4. Southern Wooded Swamps, Depression Ponds and Floodplains

1.6.4.1. Southeastern Coastal Plain Upland Depression Shrub Ponds

Decodon verticillatus Seasonally Flooded Shrubland ..... *Swamp-loosestrife Pond*

1.6.4.2. Southeastern Coastal Plain Bottomland Hardwood Forests

Acer negundo Forest ..... *Box-elder Floodplain Forest*
Fraxinus pennsylvanica - Ulmus americana - Celtis laevigata / Ilex decidua Forest ..... *Southern Green Ash - Elm - Sugarberry Forest*
Quercus lyrata - Carya aquatica - (Quercus texana) / Forestiera acuminata Forest ..... *Overcup Oak - Nuttall Oak Bottomland Forest*
Quercus lyrata - Liquidambar styraciflua / Forestiera acuminata Forest ..... *Overcup Oak - Sweetgum Bottomland Forest*
Quercus michauxii - Quercus shumardii - Liquidambar styraciflua / Arundinaria gigantea Forest ..... *Swamp Chestnut Oak - Sweetgum Mesic Floodplain Forest*
Quercus phellos - (Quercus lyrata) / Carex spp. - Leersia spp. Forest ..... *Willow Oak Bottomland Forest*

1.6.4.3. Southeastern Coastal Plain Backswamp/Slough Floodplain Forests

Acer rubrum - Gleditsia aquatica - Planera aquatica - Fraxinus profunda Forest ..... *Red Maple - Water Locust Mixed Bottomland Forest*
Nyssa aquatica Forest ..... *Water Tupelo Swamp Forest*
Quercus lyrata - Quercus palustris / Acer rubrum var. drummondii / Itea virginica - Cornus foemina - (Lindera melissifolia) Forest ..... *Mixed Oak-Hardwood Sand Pond Forest*
Taxodium distichum - (Nyssa aquatica) / Forestiera acuminata - Planera aquatica Forest ..... *Bald Cypress - (Water Tupelo) Swamp*
Taxodium distichum - Populus heterophylla Forest ..... *Bald Cypress - Swamp Cottonwood Forest*
Taxodium distichum / Lemna minor Forest ..... *Bald-cypress Swamp*

1.6.4.4. Southeastern Coastal Plain Riverfront and Levee Bottomland Forests

Acer saccharinum - Betula nigra / Cephalanthus occidentalis Forest .....
Acer saccharinum - Celtis laevigata - Carya illinoinensis Forest ..... *Silver Maple - Sugarberry - Pecan Floodplain Forest*
Betula nigra - Platanus occidentalis Forest ..... *River Birch - Sycamore Forest*
Salix caroliniana Temporarily Flooded Shrubland ..... *Carolina Willow Shrubland*
Salix nigra Forest ..... *Black Willow Riparian Forest*
Salix nigra Temporarily Flooded Shrubland ..... *Black Willow Riverbank Shrubland*

2. Uplands

2.1. SHORELINE SAND/MUD STRANDS, BEACHES AND DUNES

2.1.2.2. Midwestern Mudflats

Lake Mud Flats Sparse Vegetation ..... *Lake Mud Flats*
River Mud Flats Sparse Vegetation..... *River Mud Flats*
Saline Spring Mud Flats Sparse Vegetation ..... *Saline Spring Mud Flats*

2.1.3. Great Plains Strands and Mudflats

2.1.3.1. Great Plains Sand and Gravel Strands

Riverine Gravel Flats Great Plains Sparse Vegetation ..... *Great Plains Riverine Gravel Flats*

2.2. ROCKY SHORES

2.2.1. Northern (Laurentian) Lakes and Rivers Rocky Shores

2.2.1.1. Northern Lakes Rocky Shores

Igneous - Metamorphic Bedrock Inland Lake Shore Sparse Vegetation ..... *Inland Lake Igneous - Metamorphic Bedrock Shore*
Igneous - Metamorphic Cobble - Gravel Inland Lake Shore Sparse Vegetation ..... *Inland Lake Igneous - Metamorphic Cobble - Gravel Shore*

2.2.1.2. Northern Rivers Rocky Shores

Igneous - Metamorphic Cobble - Gravel River Shore Sparse Vegetation ..... *Riverine Igneous - Metamorphic Cobble - Gravel Shore*
Sandstone Bedrock River Shore Sparse Vegetation ..... *River Ledge Sandstone Pavement*

2.2.2. Great Lakes Rocky Shores

2.2.2.1. Great Lakes Alkaline Rocky Shores

Dasiphora fruticosa ssp. floribunda / Clinopodium arkansanum - Argentina anserina - Primula mistassinica Sparse Vegetation..... *Great Lakes Limestone - Dolostone Bedrock Shore*
Limestone Cobble - Gravel Great Lakes Shore Sparse Vegetation ..... *Great Lakes Limestone Cobble - Gravel Shore*

2.2.2.2. Great Lakes Non-Alkaline Rocky Shores

Basalt - Conglomerate Bedrock Great Lakes Shore Sparse Vegetation..... *Great Lakes Basalt - Conglomerate Bedrock Shore*
Basalt - Diabase Cobble - Gravel Great Lakes Shore Sparse Vegetation ..... *Great Lakes Basalt - Diabase Cobble - Gravel Shore*
Granite - Metamorphic Bedrock Great Lakes Shore Sparse Vegetation..... *Great Lakes Granite - Metamorphic Bedrock Shore*
Non-alkaline Cobble - Gravel Great Lakes Shore Sparse Vegetation ..... *Great Lakes Non-alkaline Cobble - Gravel Shore*
Picea glauca - Abies balsamea Basalt - Conglomerate Woodland..... *Great Lakes Spruce - Fir Basalt Bedrock Shore*
Sandstone Bedrock Great Lakes Shore Sparse Vegetation..... *Great Lakes Sandstone Bedrock Shore*

2.2.3. Appalachian and Interior Highlands Riverine Rocky Shores

2.2.3.1. Appalachian Highlands Floodplain Pools and Rocky Riverbeds

Justicia americana Herbaceous Vegetation ..... *Water-willow Wetland*

2.2.3.2. Appalachian Highlands Riverscour Vegetation

Andropogon gerardii - Panicum virgatum - Baptisia australis Herbaceous Vegetation..... *Riverwash Bedrock Prairie*

2.2.3.3. Interior Highlands Riverscour Vegetation

Alnus serrulata - Amorpha fruticosa Shrubland .....
Hamamelis vernalis - Cornus obliqua - Hypericum prolificum Shrubland..... *Witch-hazel - Dogwood Gravel Wash*
Salix spp. / Andropogon gerardii - Sorghastrum nutans Gravel Wash Herbaceous Vegetation..... *Brush Prairie Gravel Wash*

2.3. ROCKY UPLANDS (GLADES, ROCK BARRENS, OUTCROPS AND ALVARS)

2.3.1. Northern (Laurentian) Rock Outcrops and Rock Barrens

2.3.1.1. Northern Alkaline Rock Outcrops/Barrens

Thuja occidentalis Limestone Bedrock Woodland..... *White-cedar Limestone Bedrock Woodland*

2.3.1.2. Northern Acid Rock Outcrops/Barrens

(Pinus strobus, Quercus rubra) / Danthonia spicata Acid Bedrock Wooded Herbaceous Vegetation ..... *White Pine - Oak Acid Bedrock Glade*
Corylus cornuta - Amelanchier spp. - Prunus virginiana Rocky Shrubland ..... *Boreal Hazelnut - Serviceberry Rocky Shrubland*
Danthonia spicata - Poa compressa Granite Herbaceous Vegetation ..... *Poverty Grass Granite Barrens*
Juniperus communis - (Quercus rubra) / Juniperus horizontalis - Arctostaphylos uva-ursi Shrubland ..... *Common Juniper Rocky Krummholz*
Picea glauca - (Betula papyrifera) / Danthonia spicata Woodland ..... *White Spruce Rocky Woodland*
Pinus banksiana - (Picea mariana, Pinus strobus) / Vaccinium spp. Rocky Woodland ..... *Boreal Pine Rocky Woodland*
Pinus banksiana - Pinus strobus - (Quercus rubra) / Cladina spp. Nonvascular Vegetation ..... *Mixed Pine - (Oak) Igneous - Metamorphic Rock Outcrop*
Pinus banksiana / (Quercus rubra, Quercus ellipsoidalis) Forest ..... *Jack Pine / Scrub Oak Forest*
Populus tremuloides - (Populus grandidentata) Rocky Woodland ..... *Mixed Aspen Rocky Woodland*
Quercus ellipsoidalis - Quercus macrocarpa - (Pinus banksiana) Rocky Woodland ..... *Boreal Oak - (Pine) Rocky Woodland*

2.3.2. Great Lakes Alvars

2.3.2.1. Alvar Savannas and Woodlands

Pinus banksiana - Thuja occidentalis - Picea glauca / Juniperus communis Woodland ..... *Mixed Conifer / Common Juniper Alvar Woodland*
Thuja occidentalis - Pinus banksiana / Dasiphora fruticosa ssp. floribunda / Clinopodium arkansanum Wooded Herbaceous Vegetation ..... *White-cedar - Jack Pine / Shrubby-cinquefoil Alvar Savanna*

2.3.2.2. Alvar Shrublands

Juniperus communis - (Juniperus virginiana) - Rhus aromatica - Viburnum rafinesquianum / Oligoneuron album Shrubland ..... *Juniper Alvar Shrubland*
Juniperus horizontalis - Dasiphora fruticosa ssp. floribunda / Schizachyrium scoparium - Carex richardsonii Dwarf-shrubland ..... *Creeping Juniper - Shrubby-cinquefoil Alvar Pavement*
Picea glauca - Thuja occidentalis - Juniperus communis / Iris lacustris - Carex eburnea Shrubland ..... *Scrub Conifer / Dwarf Lake Iris Alvar Shrubland*

2.3.2.3. Alvar Grasslands and Pavement

Danthonia spicata - Poa compressa - (Schizachyrium scoparium) Herbaceous Vegetation ..... *Poverty Grass Dry Alvar Grassland*
Deschampsia caespitosa - (Sporobolus heterolepis, Schizachyrium scoparium) - Carex crawei - Packera paupercula Herbaceous Vegetation ..... *Tufted Hairgrass Wet Alvar Grassland*
Spartina pectinata - Muhlenbergia richardsonis - Sporobolus heterolepis - Oligoneuron album - Euthamia graminifolia Herbaceous Vegetation ..... *River Ledge Limestone Pavement*
Sporobolus heterolepis - Schizachyrium scoparium - (Carex scirpoidea) / (Juniperus horizontalis) Herbaceous Vegetation ..... *Little Bluestem Alvar Grassland*
Tortella tortuosa - Cladonia pocillum - Placynthium spp. Sparse Vegetation ..... *Alvar Nonvascular Pavement*

2.3.3. Midwestern Rock Outcrops and Glades

2.3.3.1. Midwestern Acid Rock Outcrops and Glades

Quartzite - Granite Rock Outcrop Sparse Vegetation ..... *Northern Tallgrass Quartzite - Granite Rock Outcrop*
Quercus alba - Carya ovata / Carex pensylvanica - Heuchera richardsonii Quartzite Glade Woodland ..... *Midwestern Oak Woodland - Quartzite Glade*

2.3.4. Appalachian and Interior Highlands Glades (Rock Barrens)

2.3.4.2. Interior Highlands Carbonate Glades and Barrens

Juniperus ashei / Cotinus obovatus / Carex eburnea - Rudbeckia missouriensis Woodland ..... *Ozark Ashe's Juniper Glade Woodland*
Juniperus virginiana Alkaline Bluff Woodland ..... *Red Cedar Alkaline Bluff Woodland*
Quercus muehlenbergii - Juniperus virginiana / Schizachyrium scoparium - Manfreda virginica Wooded Herbaceous Vegetation ..... *Central Limestone Glade*
Schizachyrium scoparium - Bouteloua curtipendula - Rudbeckia missouriensis - Mentzelia oligosperma Wooded Herbaceous Vegetation ..... *Ozark Limestone Glade*
Schizachyrium scoparium - Sorghastrum nutans - Bouteloua curtipendula - Rudbeckia missouriensis - Hedyotis nigricans Wooded Herbaceous Vegetation ..... *Ozark Dolomite Glade*

2.3.4.3. Interior Highlands Sandstone Glades and Barrens

Quercus marilandica - Juniperus virginiana var. virginiana / Schizachyrium scoparium - Hypericum gentianoides Wooded Herbaceous Vegetation ..... *Shawnee Sandstone Glade*
Schizachyrium scoparium - Aristida dichotoma - Croton willdenowii / Lichens Wooded Herbaceous Vegetation ..... *Ozark Sandstone Glade*
Schizachyrium scoparium - Sedum nuttallianum - Selaginella rupestris - Portulaca pilosa / Lichens Wooded Herbaceous Vegetation ..... *Ozark Chert Glade*

2.3.4.4. Interior Highlands Shale Glades and Barrens

Quercus marilandica - (Juniperus virginiana) / Schizachyrium scoparium - Danthonia spicata Wooded Herbaceous Vegetation ..... *Central Shale Glade*

2.3.4.5. Interior Highlands Igneous/Metamorphic Glades and Barrens

Schizachyrium scoparium - Sorghastrum nutans - Coreopsis lanceolata - Croton willdenowii Wooded Herbaceous Vegetation ..... *Ozark Igneous Glade*

2.3.5. Great Plains Rock Outcrops

2.3.5.1. Great Plains Rock Outcrops

Redbeds (Siltstone, Sandstone, Gypsum) Sparse Vegetation ..... *Redbeds (Siltstone) Rock Outcrop*
Shale Barren Slopes Sparse Vegetation ..... *Shale Barren Slopes*
Siltstone - Sandstone Rock Outcrop Sparse Vegetation ..... *Siltstone - Clay Rock Outcrop*

2.3.6. Rocky Mountains Rock Outcrops

2.3.6.1. Rocky Mountains Rock Outcrops

Granite - Metamorphic Black Hills Rock Outcrop Sparse Vegetation ..... *Black Hills Granite - Metamorphic Rock Outcrop*

2.4. CLIFFS, TALUS, BUTTES AND BADLANDS

2.4.1. Northern (Laurentian) Cliffs and Talus

2.4.1.1. Northern Alkaline Cliffs

Maderate Cliff Sparse Vegetation ..... *Maderate Cliff*
Thuja occidentalis Cliff Woodland ..... *White-cedar Cliff Woodland*

2.4.1.2. Northern Acid Cliffs

Acer spicatum - Thuja occidentalis - Betula papyrifera / Taxus canadensis Shrubland ..... *Northern (Laurentian) Igneous - Metamorphic Moist Cliff Scrub*
Igneous - Metamorphic Northern Dry Cliff Sparse Vegetation ..... *Northern (Laurentian) Igneous - Metamorphic Dry Cliff*

2.4.1.3. Northern Alkaline Talus

Impatiens pallida - Cystopteris bulbifera - Adoxa moschatellina - (Chrysosplenium iowense, Aconitum noveboracense) Herbaceous Vegetation ..... *Algific Talus Slope*
Thuja occidentalis Carbonate Talus Woodland ..... *White-cedar Limestone Talus Woodland*

2.4.1.4. Northern Acid Talus

Basalt - Diabase Northern Open Talus Sparse Vegetation ..... *Northern Basalt - Diabase Open Talus*
Betula papyrifera - Picea glauca / Acer spicatum - Alnus viridis / Polypodium virginianum Talus Shrubland [Provisional] ..... *Northern Basalt - Diabase Scrub Talus*
Boreal Glaciere Talus Sparse Vegetation ..... *Glaciere Talus*
Granite - Metamorphic Talus Northern Sparse Vegetation ..... *Northern Granite - Metamorphic Talus*
Sandstone Talus Northern Sparse Vegetation ..... *Northern Sandstone Talus*

2.4.2. Great Lakes Shore Cliffs

2.4.2.1. Great Lakes Shore Alkaline Cliffs

Basalt - Diabase Great Lakes Shore Cliff Sparse Vegetation ..... *Great Lakes Shore Basalt - Diabase Cliff*
Limestone - Dolostone Great Lakes Shore Cliff Sparse Vegetation ..... *Great Lakes Shore Limestone - Dolostone Cliff*

2.4.2.2. Great Lakes Shore Acid Cliffs

Granite - Metamorphic Great Lakes Shore Cliff Sparse Vegetation ..... *Great Lakes Shore Granite - Metamorphic Cliff*
Sandstone Great Lakes Shore Cliff Sparse Vegetation ..... *Great Lakes Shore Sandstone Cliff*

2.4.3. Eastern Cliffs and Talus

2.4.3.1. Eastern Dry Alkaline Cliffs

Juniperus ashei Ozark Clifftop Woodland ..... *Ozark Ashe's Juniper Clifftop Woodland*
Limestone - Dolostone Midwest Dry Cliff Sparse Vegetation ..... *Midwest Dry Limestone - Dolostone Cliff*
Thuja occidentalis / Carex eburnea - Pellaea atropurpurea Woodland ..... *Appalachian Cliff White-cedar Woodland*

2.4.3.2. Eastern Moist Alkaline Cliffs

Limestone - Dolostone Midwest Moist Cliff Sparse Vegetation ..... *Midwest Moist Limestone -Dolostone Cliff*

2.4.3.3. Eastern Dry Acid Cliffs

Chert Ozark Dry Cliff Sparse Vegetation ..... *Ozark Dry Chert Cliff*
Igneous Ozark Dry Cliff Sparse Vegetation ..... *Ozark Dry Igneous Cliff*
Sandstone Dry Cliff Sparse Vegetation ..... *Midwest Dry Sandstone Cliff*

2.4.3.4. Eastern Moist Acid Cliffs

Chert Ozark Moist Cliff Sparse Vegetation ..... *Ozark Moist Chert Cliff*
Igneous Ozark Moist Cliff Sparse Vegetation ..... *Ozark Moist Igneous Cliff*
Sandstone Midwest Moist Cliff Sparse Vegetation ..... *Midwest Moist Sandstone Cliff*

2.5.2.3. Midwestern Mesic Hardwood Forests

Acer saccharum - Acer nigrum - Tilia americana - Quercus rubra / Ostrya virginiana Forest ..... *Central Maple - Basswood Forest*
Acer saccharum - Tilia americana / Ostrya virginiana - Carpinus caroliniana Forest ..... *North-central Maple - Basswood Forest*
Fagus grandifolia - Acer saccharum Glaciated Midwest Forest ..... *Beech - Maple Glaciated Forest*

2.5.2.4. Midwestern Dry and Dry-mesic Oak Woodlands

Quercus alba - (Carya ovata) / Carex pensylvanica Glaciated Woodland ..... *Central Midwest White Oak - Mixed Oak Woodland*
Quercus alba - Quercus macrocarpa - Quercus rubra / Corylus americana Woodland ..... *North-Central Dry-mesic Oak Woodland*
Quercus muehlenbergii - Quercus (alba, velutina) Bluff Woodland ..... *Chinquapin Oak Bluff Woodland*
Quercus muehlenbergii - Quercus macrocarpa / Andropogon gerardii Ravine Woodland ..... *Chinquapin Oak - Bur Oak Ravine Woodland*
Quercus stellata - Quercus velutina / Schizachyrium scoparium Woodland ..... *Central Tallgrass Post Oak Woodland*
Quercus velutina - (Quercus ellipsoidalis) - Quercus alba / Deschampsia flexuosa Woodland ..... *Black Oak - Northern Pin Oak / Common Hairgrass Woodland*

2.5.2.5. Midwestern Mesic Oak Woodlands

Quercus alba - Quercus velutina - Quercus palustris / Carex pensylvanica Woodland ..... *Lakeplain Mesic Oak Woodland*
Quercus bicolor - (Quercus macrocarpa, Quercus stellata) Woodland ..... *Swamp White Oak Woodland*
Quercus macrocarpa - Quercus bicolor - (Celtis occidentalis) Woodland ..... *Bur Oak Bottomland Woodland*
Quercus macrocarpa / Andropogon gerardii - Hesperostipa spartea Woodland ..... *Western Tallgrass Bur Oak Woodland*
Quercus macrocarpa / Andropogon gerardii - Panicum virgatum Woodland ..... *Western Tallgrass Bur Oak Mesic Woodland*

2.5.2.6. Midwestern Dry Flatwoods

Quercus stellata / (Danthonia spicata, Croton willdenowii) Woodland ..... *Post Oak Clay Barrens*
Quercus stellata / Cinna arundinacea Flatwoods Forest ..... *Post Oak Flatwoods*

2.5.3. Appalachian and Interior Highlands Forests and Woodlands

2.5.3.1. Appalachian Highlands Xeric Virginia / Shortleaf Pine Woodlands

Pinus virginiana - Pinus (rigida, echinata) - (Quercus prinus) / Vaccinium pallidum Forest ..... *Appalachian Low Elevation Mixed Pine Forest*

2.5.3.2. Appalachian Highlands Dry-mesic Oak Forests and Woodlands

Quercus alba - Quercus rubra - Quercus prinus - Acer saccharum / Lindera benzoin Forest ..... *White Oak - Chestnut Oak - Maple Acid Forest*
Quercus prinus - Quercus (alba, coccinea, velutina) / Viburnum acerifolium - (Kalmia latifolia) Forest ..... *Appalachian / Interior Low Plateau Oak - (Chestnut) Forest*
Quercus rubra - Acer saccharum - Liriodendron tulipifera Forest ..... *High Allegheny Rich Red Oak - Sugar Maple Forest*

2.5.3.3. Appalachian Highlands Mixed Mesophytic/Cove Forests

Liriodendron tulipifera - Tilia americana var. heterophylla - Aesculus flava - Acer saccharum / Magnolia tripetala Forest ..... *Northern Mixed Mesophytic Forest*

2.5.3.4. Appalachian Highlands Hemlock-Hardwood Forests

Tsuga canadensis - Fagus grandifolia - Acer saccharum / (Hamamelis virginiana, Kalmia latifolia) Forest ..... *East-Central Hemlock Hardwood Forest*

2.5.3.5. Interior Highlands Shortleaf Pine Forests and Woodlands

Pinus echinata - Quercus (alba, rubra) / Vaccinium (arboreum, pallidum) / Schizachyrium scoparium - Chasmanthium sessiliflorum - Solidago ulmifolia Forest ..... *Interior Highlands Shortleaf Pine - Oak Dry-mesic Forest*
Pinus echinata - Quercus alba / Schizachyrium scoparium Woodland ..... *Shortleaf Pine - Oak Dry-mesic Woodland*
Pinus echinata - Quercus stellata - Quercus marilandica / Schizachyrium scoparium Woodland ..... *Shortleaf Pine - Oak Dry Woodland*
Pinus echinata - Quercus velutina - Quercus stellata / Vaccinium spp. Forest ..... *Shortleaf Pine - Black Oak Forest*
Pinus echinata / Rock Outcrop Interior Highland Woodland ..... *Shortleaf Pine / Little Bluestem Woodland*
Pinus echinata / Schizachyrium scoparium - Solidago ulmifolia - Monarda russeliana - Echinacea pallida Woodland ..... *Ouachita Shortleaf Pine Savannah*
Pinus echinata / Vaccinium (arboreum, pallidum, stamineum) Forest ..... *Shortleaf Pine / Blueberry Forest*

2.5.3.6. Interior Highlands Xeric Oak Forests and Woodlands

Quercus marilandica / Vaccinium arboreum / Danthonia spicata Scrub Woodland ..... *Blackjack Oak Xeric Scrub*
Quercus stellata - Quercus alba - (Quercus falcata) / Schizachyrium scoparium Woodland ..... *Post Oak - White Oak Dry-mesic Barrens*
Quercus stellata - Quercus marilandica - Carya (glabra, texana) / Vaccinium arboreum Forest ..... *Midwest Post Oak - Blackjack Oak Forest*
Quercus stellata - Quercus marilandica - Quercus falcata / Schizachyrium scoparium Sand Woodland ..... *Post Oak - Blackjack Oak / Bluestem Sand Woodland*
Quercus stellata - Quercus marilandica - Quercus velutina - Carya texana / Schizachyrium scoparium Woodland ..... *Post Oak-Blackjack Oak / Little Bluestem Woodland*
Quercus stellata - Quercus velutina - Quercus alba - (Quercus falcata) / Croton michauxii Sand Woodland ..... *Post Oak - Mixed Oak Sand Woodland*

2.5.3.7. Interior Highlands Dry-mesic Oak Forests and Woodlands

Quercus alba - Carya alba - (Quercus velutina) / Desmodium nudiflorum - (Carex picta) Forest ..... *Interior Dry-mesic White Oak - Hickory Forest*
Quercus alba - Quercus rubra - Carya (alba, ovata) / Cornus florida Acid Forest ..... *White Oak - Red Oak Dry-mesic Acid Forest*
Quercus alba - Quercus rubra - Quercus muehlenbergii / Cercis canadensis Forest ..... *White Oak - Mixed Oak Dry-mesic Alkaline Forest*
Quercus alba - Quercus stellata - Quercus velutina / Schizachyrium scoparium Woodland ..... *White Oak - Post Oak / Bluestem Woodland*
Quercus alba / Cornus florida Unglaciated Forest ..... *White Oak / Dogwood Dry-Mesic Forest*
Quercus falcata - Quercus alba - Quercus stellata - Quercus velutina Forest ..... *Southern Red Oak - Mixed Oak Forest*
Quercus prinus / Smilax spp. Forest ..... *Chestnut Oak Forest*
Quercus velutina - Quercus coccinea - Carya texana Ozark Forest ..... *Ozark Black Oak - Scarlet Oak Forest*

2.5.3.8. Interior Highlands Circumneutral/Basic Dry-mesic Hardwood Forests and Woodlands

Quercus muehlenbergii - Fraxinus (quadrangulata, americana) / Schizachyrium scoparium Woodland ..... *Chinquapin Oak - Ash / Little Bluestem Woodland*
Quercus muehlenbergii - Juniperus virginiana - Acer saccharum / Frangula caroliniana Forest ..... *Chinquapin Oak - Red Cedar Dry Alkaline Forest*
Quercus muehlenbergii - Quercus (falcata, shumardii, stellata) / Cercis canadensis / Viburnum rufidulum Forest ..... *Interior Low Plateau Chinquapin Oak - Mixed Oak Forest*

2.5.3.9. Interior Highlands Mesic Hardwood Forests

Fagus grandifolia - Acer saccharum - Liriodendron tulipifera Unglaciated Forest ..... *Beech - Maple Unglaciated Forest*
Fagus grandifolia - Quercus alba / Cornus florida Forest ..... *Central Beech - White Oak Forest*
Quercus alba - Quercus rubra - Acer saccharum - Carya cordiformis / Lindera benzoin Forest ..... *White Oak - Red Oak - Sugar Maple Mesic Forest*

2.5.4. Aspen Parkland Forests and Woodlands

2.5.4.1. Aspen Parkland Forests and Woodlands

Populus tremuloides - Populus balsamifera / Calamagrostis canadensis Forest ..... *Aspen Prairie Lowland Forest*
Populus tremuloides / Corylus spp. / Andropogon gerardii Woodland ..... *Aspen Parkland Tallgrass Woodland*
Quercus macrocarpa - Populus tremuloides / Corylus spp. Woodland ..... *Bur Oak - Aspen Woodland*

2.5.5. Great Plains Forests and Woodlands

2.5.5.1. Northern Great Plains Juniper and Pine Forests and Woodlands

Juniperus scopulorum / Piptatherum micranthum Woodland ..... *Rocky Mountain Juniper / Little-seed Ricegrass Woodland*
Pinus flexilis / Pseudoroegneria spicata Woodland ..... *Limber Pine / Bluebunch Wheatgrass Woodland*

2.5.5.2. Northern Great Plains Bur Oak Forests and Woodlands

Quercus macrocarpa / (Amelanchier alnifolia, Cornus drummondii) / Aralia nudicaulis Forest ..... *Northern Bur Oak Mesic Forest*
Quercus macrocarpa / Carex inops ssp. heliophila Woodland ..... *Bur Oak / Sedge Woodland*
Quercus macrocarpa / Corylus americana - Amelanchier alnifolia Woodland ..... *Bur Oak / Hazelnut Woodland*
Quercus macrocarpa / Corylus cornuta Woodland ..... *Northwestern Great Plains Bur Oak Woodland*
Quercus macrocarpa / Ostrya virginiana Forest ..... *Bur Oak / Ironwood Forest*
Quercus macrocarpa / Prunus virginiana - Symphoricarpos occidentalis Woodland ..... *Bur Oak / Chokecherry - Western Snowberry Woodland*
Tilia americana - (Quercus macrocarpa) / Ostrya virginiana Forest ..... *Basswood - Bur Oak Forest*

2.5.5.3. Northern Great Plains Ash-Elm Forests and Woodlands

Fraxinus pennsylvanica - Ulmus americana / Prunus virginiana Woodland ..... *Green Ash - Elm Woody Draw*
Fraxinus pennsylvanica - Ulmus americana / Symphoricarpos occidentalis Forest ..... *Ash - Elm / Wolfberry Forest*

2.5.5.4. Northern Great Plains Aspen-Birch Forests and Woodlands

Betula papyrifera - (Tilia americana, Quercus macrocarpa) Canyon Forest ..... *Paper Birch Canyon Forest*
Betula papyrifera / Corylus cornuta Forest ..... *Paper Birch / Hazel Forest*
Betula papyrifera / Corylus cornuta Woodland ..... *Paper Birch / Beaked Hazel Woodland*
Betula papyrifera / Juniperus horizontalis Shale Woodland ..... *Paper Birch / Creeping Juniper Woodland*
Populus tremuloides / Prunus virginiana Woodland ..... *Aspen / Chokecherry Woodland*

2.5.5.5. Cross Timbers Upland Oak Forests and Woodlands

Quercus stellata - Quercus marilandica - (Carya texana) Forest ..... *Cross Timbers Post Oak - Blackjack Oak Forest*
Quercus stellata - Quercus marilandica / Schizachyrium scoparium Woodland ..... *Post Oak - Blackjack Oak Cross Timbers Woodland*

2.5.6. Rocky Mountains Forests and Woodlands

2.5.6.1. Rocky Mountains Dry Ponderosa Pine Forests and Woodlands

Pinus ponderosa / Arctostaphylos uva-ursi Woodland ..... *Ponderosa Pine / Bearberry Woodland*
Pinus ponderosa / Carex inops ssp. heliophila Woodland ..... *Ponderosa Pine / Sedge Woodland*
Pinus ponderosa / Juniperus scopulorum Woodland ..... *Ponderosa Pine / Rocky Mountain Juniper Woodland*
Pinus ponderosa / Mahonia repens Forest ..... *Ponderosa Pine / Oregon Grape Forest*
Pinus ponderosa / Pascopyrum smithii Woodland ..... *Ponderosa Pine / Western Wheatgrass Woodland*
Pinus ponderosa / Physocarpus monogynus Forest ..... *Ponderosa Pine / Mountain Ninebark Forest*
Pinus ponderosa / Pseudoroegneria spicata Woodland ..... *Ponderosa Pine / Bluebunch Wheatgrass Woodland*
Pinus ponderosa / Schizachyrium scoparium Woodland ..... *Ponderosa Pine / Little Bluestem Woodland*

2.5.6.2. Rocky Mountains Mesic Ponderosa Pine Forests and Woodlands

Pinus ponderosa / Juniperus communis Woodland ..... *Ponderosa Pine / Common Juniper Woodland*
Pinus ponderosa / Oryzopsis asperifolia Woodland ..... *Ponderosa Pine / Rough-leaf Ricegrass Woodland*
Pinus ponderosa / Prunus virginiana Forest ..... *Ponderosa Pine / Chokecherry Forest*
Pinus ponderosa / Quercus macrocarpa Woodland ..... *Ponderosa Pine / Bur Oak Woodland*
Pinus ponderosa / Symphoricarpos albus Forest ..... *Ponderosa Pine / Snowberry Forest*

2.5.6.3. Rocky Mountains White Spruce Forests

Picea glauca / Linnaea borealis Forest ..... *White Spruce / Twinflower Forest*
Picea glauca / Vaccinium scoparium Forest ..... *White Spruce / Grouseberry Forest*

2.5.6.4. Rocky Mountains Aspen Forests

Populus tremuloides / Corylus cornuta Forest ..... *Aspen / Beaked Hazel Forest*
Populus tremuloides / Prunus virginiana Forest ..... *Aspen / Chokecherry Forest*
Populus tremuloides / Pteridium aquilinum Forest ..... *Aspen / Bracken Fern Forest*
Populus tremuloides / Spiraea betulifolia Forest ..... *Aspen / Shiny-leaf Spiraea Forest*

2.6. SHRUBLANDS/DWARF-SHRUBLANDS

2.6.1. Northern (Laurentian) Shrublands

2.6.1.1. Northern Acid Rocky Shrublands

Sorbus decora - Acer spicatum / Dryopteris carthusiana Shrubland ..... *Mountain Ash - Mountain Maple Shrubland*
Taxus canadensis - Viburnum edule - Cornus sericea - Alnus viridis - Oplopanax horridus Shrubland ..... *Canada Yew Mixed Shrubland*

2.6.2. Midwestern Shrub Prairie and Barrens

2.6.2.1. Midwestern Shrub Prairie/Barrens

Corylus americana - Malus ioensis - Ceanothus americanus Shrubland ..... *Hazelnut - Prairie Apple Loam Shrubland*
Corylus americana - Salix humilis / Schizachyrium scoparium Shrubland ..... *Hazelnut Sand Barrens*
Populus tremuloides - Quercus macrocarpa - Salix spp. / Andropogon gerardii Shrubland ..... *Aspen - Oak Brush Prairie*
Spiraea tomentosa - Salix humilis / Andropogon gerardii - Panicum virgatum Shrubland ..... *Hardhack Wet-mesic Sand Shrub Meadow*

2.6.3. Great Plains Shrublands

2.6.3.1. Northern and Central Great Plains Dry Shrublands

Artemisia filifolia / Calamovilfa longifolia Shrubland ..... *Sand Sage / Prairie Sandreed Shrubland*
Artemisia tridentata - Atriplex confertifolia Shrubland ..... *Big Sagebrush – Shadscale Shrubland*
Artemisia tridentata ssp. wyomingensis - Atriplex confertifolia Shrubland ..... *Wyoming Big Sagebrush - Shadscale Shrubland*
Artemisia tridentata ssp. wyomingensis / Pascopyrum smithii Shrubland ..... *Big Sagebrush / Western Wheatgrass Shrubland*
Artemisia tridentata ssp. wyomingensis / Pseudoroegneria spicata Shrubland ..... *Wyoming Big Sagebrush / Bluebunch Wheatgrass Shrubland*
Betula occidentalis - Juniperus horizontalis / Calamovilfa longifolia Shrubland ..... *Water Birch - Creeping Juniper / Prairie Sandreed Shrubland*
Ceanothus velutinus Shrubland ..... *Mountain Balm Shrubland*
Cercocarpus montanus / Bouteloua curtipendula Shrubland ..... *Mountain Mahogany / Side-oats Grama Shrubland*
Ericameria nauseosa / Pseudoroegneria spicata Shrubland ..... *Common Rabbitbrush / Bluebunch Wheatgrass Shrubland*
Juniperus horizontalis / Carex inops ssp. heliophila Dwarf-shrubland ..... *Creeping Juniper / Sedge Dwarf-shrubland*
Juniperus horizontalis / Schizachyrium scoparium Dwarf-shrubland ..... *Creeping Juniper / Little Bluestem Dwarf-shrubland*

2.6.3.2. Northern and Central Great Plains Mesic Shrublands

Artemisia cana / Pascopyrum smithii Shrubland ..... *Silver Sagebrush / Western Wheatgrass Shrubland*
Cornus drummondii - (Rhus glabra, Prunus spp.) Shrubland ..... *Sumac - Dogwood Shrubland*
Crataegus douglasii - (Crataegus chrysocarpa) Shrubland ..... *Black Hawthorne Shrubland*
Elaeagnus commutata / Pascopyrum smithii Shrubland ..... *American Silverberry Shrubland*
Prunus virginiana - (Prunus americana) Shrubland ..... *Choke Cherry - (American Plum) Shrubland*
Shepherdia argentea Shrubland ..... *Buffaloberry Shrubland*
Symphoricarpos occidentalis Shrubland ..... *Western Snowberry Shrubland*

2.6.3.3. Southern Great Plains Xeric Shrublands

Artemisia filifolia / Andropogon hallii Shrubland ..... *Sand Sagebrush / Sand Bluestem Shrubland*
Artemisia filifolia / Bouteloua (curtipendula, gracilis) Shrubland ..... *Sand Sagebrush / Grama Grass Shrubland*
Artemisia filifolia / Schizachyrium scoparium - Andropogon hallii Shrubland ..... *Sand Sagebrush / Little Bluestem Shrubland*
Atriplex canescens / Bouteloua gracilis Shrubland ..... *Four-wing Saltbush / Blue Grama Shrubland*

2.7. SHRUB GRASSLANDS

2.7.1. Great Plains Shrub Steppe

2.7.1.1. Great Plains Sagebrush-Steppe

Artemisia cana / Hesperostipa comata Shrub Herbaceous Vegetation ..... *Silver Sagebrush / Needle-and-Thread Shrub Prairie*
Artemisia tridentata ssp. wyomingensis / Pseudoroegneria spicata Shrub Herbaceous Vegetation ..... *Big Sagebrush / Bluebunch Wheatgrass Shrub Prairie*

2.7.1.2. Great Plains Deciduous Shrub Steppe

Dasiphora fruticosa ssp. floribunda / Schizachyrium scoparium Shrub Herbaceous Vegetation ..... *Shrubby-cinquefoil / Little Bluestem Shrub Prairie*
Krascheninnikovia lanata / Bouteloua gracilis Dwarf-shrub Herbaceous Vegetation ..... *Winter Fat / Blue Grama Shrub Prairie*
Rhus trilobata / Carex filifolia Shrub Herbaceous Vegetation ..... *Ill-scented Sumac / Thread-leaved Sedge Shrub Prairie*
Yucca glauca / Calamovilfa longifolia Shrub Herbaceous Vegetation ..... *Soapweed / Prairie Sandreed Shrub Prairie*

2.7.1.3. Great Plains Saline Shrub Steppe

Sarcobatus vermiculatus / Distichlis spicata - (Puccinellia nuttalliana) Shrub Herbaceous Vegetation ..... *Greasewood Saline Shrub Prairie*
Sarcobatus vermiculatus / Pascopyrum smithii - (Elymus lanceolatus) Shrub Herbaceous Vegetation ..... *Greasewood / Western Wheatgrass Shrub Prairie*

2.8. SAVANNAS AND NON-ROCK BARRENS

2.8.1. Northern (Laurentian) Pine Barrens

2.8.1.1. Great Lakes Pine Barrens

Pinus banksiana - (Quercus ellipsoidalis) / Schizachyrium scoparium - Prairie Forbs Wooded Herbaceous Vegetation ..... *Jack Pine / Prairie Forbs Barrens*
Pinus banksiana - Pinus resinosa - (Quercus ellipsoidalis) / Carex pensylvanica Wooded Herbaceous Vegetation ..... *Jack Pine - Red Pine Barrens*
Pinus banksiana - Pinus resinosa / Quercus ellipsoidalis Woodland ..... *Jack Pine - Red Pine / Scrub Oak Woodland*
Pinus strobus - Quercus alba - (Quercus velutina) / Andropogon gerardii Wooded Herbaceous Vegetation ..... *White Pine - White Oak Barrens*
Populus tremuloides - Quercus (ellipsoidalis, macrocarpa) / Andropogon gerardii Shrubland ..... *Aspen - Oak Scrub Barrens*
Pteridium aquilinum - Bromus kalmii Herbaceous Vegetation ..... *Bracken Grassland*

2.8.2. Midwestern Oak Savannas and Non-Rock Barrens

2.8.2.1. Midwestern Deep Soil Oak Savannas

Quercus alba - Quercus macrocarpa / Andropogon gerardii Wooded Herbaceous Vegetation ..... *White Oak - Bur Oak Openings*
Quercus macrocarpa - (Quercus alba, Quercus stellata) / Andropogon gerardii Wooded Herbaceous Vegetation ..... *Central Bur Oak Openings*
Quercus macrocarpa - (Quercus alba, Quercus velutina) / Andropogon gerardii Wooded Herbaceous Vegetation ..... *North-central Bur Oak Openings*
Quercus macrocarpa - Quercus palustris - Quercus bicolor / Calamagrostis canadensis Wooded Herbaceous Vegetation ..... *Lakeplain Wet-mesic Oak Openings*
Quercus macrocarpa Northern Tallgrass Wooded Herbaceous Vegetation ..... *Northern Bur Oak Openings*

2.8.2.2. Midwestern Sand Oak Savannas/Barrens

Quercus macrocarpa - (Quercus ellipsoidalis) / Schizachyrium scoparium - Koeleria macrantha Wooded Herbaceous Vegetation ..... *Northern Oak Barrens*
Quercus velutina - (Quercus alba) - Quercus ellipsoidalis / Schizachyrium scoparium - Lupinus perennis Wooded Herbaceous Vegetation ..... *Black Oak / Lupine Barrens*

2.8.3. Interior Highlands Oak Savannas and Non-Rock Barrens

2.8.3.1. Interior Highlands Thin Soil Oak Savannas/Barrens

Quercus muehlenbergii / Schizachyrium scoparium - Bouteloua curtipendula Wooded Herbaceous Vegetation ..... *Chinquapin Oak Limestone - Dolomite Savanna*
Quercus stellata - Quercus marilandica / Schizachyrium scoparium - Silphium terebinthinaceum Wooded Herbaceous Vegetation ..... *Post Oak Chert Barrens*
Quercus stellata - Quercus marilandica / Schizachyrium scoparium Wooded Herbaceous Vegetation ..... *Post Oak Central Dry Barrens*

2.8.4. Great Plains Oak Savannas

2.8.4.1. Northern Great Plains Oak Savannas

Quercus macrocarpa / Mixedgrass Loam Wooded Herbaceous Vegetation ..... *Bur Oak Mixedgrass Loam Savanna*
Quercus macrocarpa / Mixedgrass Sand Wooded Herbaceous Vegetation ..... *Bur Oak Mixedgrass Sand Savanna*
Quercus macrocarpa / Mixedgrass Shale Wooded Herbaceous Vegetation..... *Bur Oak Shale Savanna*

2.9. PRAIRIES/GRASSLANDS

2.9.1. Midwestern Tallgrass Prairies

2.9.1.1. Midwestern Sand and Gravel Tallgrass Prairies

Andropogon gerardii - Calamagrostis canadensis Sand Herbaceous Vegetation..... *Central Wet-mesic Sand Tallgrass Prairie*
Andropogon gerardii - Sorghastrum nutans - Schizachyrium scoparium - Aletris farinosa Herbaceous Vegetation..... *Mesic Sand Tallgrass Prairie*
Schizachyrium scoparium - Bouteloua curtipendula Gravel Herbaceous Vegetation..... *Midwest Dry Gravel Prairie*
Schizachyrium scoparium - Bouteloua spp. - Hesperostipa spartea Gravel Herbaceous Vegetation..... *Northern Little Bluestem Gravel Prairie*
Schizachyrium scoparium - Carex tonsa var. rugosperma - Carex muehlenbergii - Lithospermum caroliniense - Opuntia humifusa Herbaceous. Vegetation..... *Midwest Sand Barrens*
Schizachyrium scoparium - Danthonia spicata - Carex pensylvanica - (Viola pedata) Herbaceous Vegetation..... *Midwest Dry Sand Prairie*
Schizachyrium scoparium - Hesperostipa spartea - Bouteloua (curtipendula, gracilis) Sand Herbaceous Vegetation..... *Little Bluestem - Porcupine Grass - Grama Grass Sand Prairie*
Schizachyrium scoparium - Sorghastrum nutans - Andropogon gerardii - Lespedeza capitata Sand Herbaceous Vegetation..... *Midwest Dry-mesic Sand Prairie*
Schizachyrium scoparium - Sorghastrum nutans - Bouteloua curtipendula Gravel Herbaceous Vegetation..... *Midwest Dry-mesic Gravel Prairie*

2.9.1.2. Midwestern Thin-soil Tallgrass Prairies

Andropogon gerardii - Panicum virgatum - Schizachyrium scoparium - (Tradescantia tharpii) Herbaceous Vegetation..... *Dakota Sandstone Tallgrass Prairie*
Andropogon gerardii - Sorghastrum nutans - Schizachyrium scoparium Flint Hills Herbaceous Vegetation..... *Flint Hills Tallgrass Prairie*
Deschampsia caespitosa - Spartina pectinata - Schizachyrium scoparium - Oligoneuron ohioense Herbaceous Vegetation..... *Midwest Wet-mesic Dolomite Prairie*
Schizachyrium scoparium - Bouteloua curtipendula - Muhlenbergia cuspidata - Symphyotrichum sericeum Alkaline Herbaceous Vegetation ..... *North-central Dry Limestone - Dolomite Prairie*
Schizachyrium scoparium - Bouteloua curtipendula Bedrock Bluff Herbaceous Vegetation..... *Little Bluestem Bedrock Bluff Prairie*
Schizachyrium scoparium - Sorghastrum nutans - Andropogon ternarius - Coreopsis grandiflora Sandstone - Shale Herbaceous Vegetation..... *Midwest Sandstone / Shale Prairie*
Schizachyrium scoparium - Sorghastrum nutans - Clinopodium arkansanum Alkaline Herbaceous Vegetation ..... *North-central Dry-mesic Limestone - Dolomite Prairie*
Schizachyrium scoparium - Sorghastrum nutans - Danthonia spicata - Silene regia Chert Herbaceous Vegetation..... *Midwest Chert Prairie*
Schizachyrium scoparium - Sorghastrum nutans - Tradescantia bracteata Alkaline Bedrock Herbaceous Vegetation..... *Central Dry-mesic Limestone - Dolomite Prairie*

2.9.1.3. Midwestern Deep Soil Tallgrass Prairies

Andropogon gerardii - (Panicum virgatum) - Muhlenbergia richardsonis Herbaceous Vegetation..... *Northern Wet-mesic Tallgrass Prairie*
Andropogon gerardii - Calamagrostis canadensis - Pycnanthemum virginianum - Oligoneuron ohioense Herbaceous Vegetation..... *Lakeplain Wet-mesic Prairie*
Andropogon gerardii - Hesperostipa spartea - Sporobolus heterolepis Herbaceous Vegetation..... *Northern Mesic Tallgrass Prairie*
Andropogon gerardii - Panicum virgatum - Helianthus grosseserratus Herbaceous Vegetation..... *Central Wet-mesic Tallgrass Prairie*
Andropogon gerardii - Sorghastrum nutans - (Sporobolus heterolepis) - Liatris spp. - Ratibida pinnata Herbaceous Vegetation..... *Central Mesic Tallgrass Prairie*
Andropogon gerardii - Sorghastrum nutans - Hesperostipa spartea Loess Hills Herbaceous Vegetation..... *Central Tallgrass Big Bluestem Loess Prairie*
Andropogon gerardii - Sorghastrum nutans Unglaciated Herbaceous Vegetation..... *Unglaciated Mesic Tallgrass Prairie*
Schizachyrium scoparium - Bouteloua curtipendula - Agrostis hyemalis - Eleocharis spp. Hardpan Herbaceous Vegetation..... *Little Bluestem Hardpan Prairie*
Schizachyrium scoparium - Bouteloua curtipendula - Bouteloua hirsuta - (Yucca glauca) Herbaceous Vegetation..... *Loess Hills Little Bluestem Dry Prairie*
Schizachyrium scoparium - Bouteloua curtipendula - Hesperostipa spartea - (Pascopyrum smithii) Herbaceous Vegetation..... *Little Bluestem - Porcupine Grass Dry-mesic Prairie*
Schizachyrium scoparium - Sorghastrum nutans - Bouteloua curtipendula Herbaceous Vegetation..... *Midwest Dry-mesic Prairie*
Schizachyrium scoparium - Sorghastrum nutans - Bouteloua curtipendula Loess-Till Herbaceous Vegetation..... *Midwest Glacial Drift-Loess Hill Prairie*

2.9.2. Southeastern Coastal Plain Prairies

2.9.2.1. Southeastern Coastal Plain Patch Prairies

Schizachyrium scoparium - Sorghastrum nutans - Aristida lanosa - Polypremum procumbens Herbaceous Vegetation ..... *Mississippi Embayment Sand Prairie*

2.9.3. Great Plains Prairies

2.9.3.1. Great Plains Tallgrass Prairies

Andropogon gerardii - Schizachyrium scoparium Northern Plains Herbaceous Vegetation ..... *Northern Plains Big Bluestem Prairie*
Andropogon gerardii - Sorghastrum nutans Western Great Plains Herbaceous Vegetation ..... *Big Bluestem - Indiangrass Western Great Plains Prairie*
Andropogon gerardii - Sporobolus heterolepis - Schizachyrium scoparium - Pascopyrum smithii Herbaceous Vegetation ..... *Northern Plains Transition Bluestem Prairie*

2.9.3.2. Great Plains Mixedgrass Prairies

Blacktailed Prairie Dog Town Grassland Complex ..... *Blacktailed Prairie Dog Town Grassland Complex*
Festuca altaica - (Hesperostipa spp., Achnatherum spp.) Herbaceous Vegetation ..... *Rough Fescue - Needlegrass Mixedgrass Prairie*
Hesperostipa comata - Bouteloua gracilis - Carex filifolia Herbaceous Vegetation ..... *Needle-and-Thread - Blue Grama Mixedgrass Prairie*
Pascopyrum smithii - (Elymus trachycaulus) Clay Pan Herbaceous Vegetation ..... *Wheatgrass Clay Flats Mixedgrass Prairie*
Pascopyrum smithii - Bouteloua gracilis - Carex filifolia Herbaceous Vegetation ..... *Western Wheatgrass - Blue Grama - Threadleaf Sedge Prairie*
Pascopyrum smithii - Bouteloua gracilis Herbaceous Vegetation ..... *Western Wheatgrass - Blue Grama Mixedgrass Prairie*
Pascopyrum smithii - Hesperostipa comata Central Mixedgrass Herbaceous Vegetation ..... *Wheatgrass - Needle-and-Thread Mixedgrass Prairie*
Pascopyrum smithii - Nassella viridula Herbaceous Vegetation ..... *Western Wheatgrass - Green Needlegrass Mixedgrass Prairie*
Pascopyrum smithii Herbaceous Vegetation ..... *Western Wheatgrass Mixedgrass Prairie*
Pseudoroegneria spicata - Bouteloua curtipendula Herbaceous Vegetation ..... *Bluebunch Wheatgrass - Sideoats Grama Mixedgrass Prairie*
Schizachyrium scoparium - Bouteloua (curtipendula, gracilis) - Carex filifolia Herbaceous Vegetation ..... *Northern Great Plains Little Bluestem Prairie*
Schizachyrium scoparium - Bouteloua curtipendula - Bouteloua gracilis Central Plains Herbaceous Vegetation ..... *Central Great Plains Little Bluestem Prairie*
Schizachyrium scoparium - Bouteloua curtipendula Chalkflat Herbaceous Vegetation ..... *Little Bluestem Chalkflat Mixedgrass Prairie*
Schizachyrium scoparium - Bouteloua curtipendula Loess Mixedgrass Herbaceous Vegetation ..... *Little Bluestem Loess Mixedgrass Prairie*
Schizachyrium scoparium - Bouteloua curtipendula Red Hills Herbaceous Vegetation ..... *Red Hills Little Bluestem Mixedgrass Prairie*
Schizachyrium scoparium - Bouteloua curtipendula Western Great Plains Herbaceous Vegetation ..... *Western Great Plains Little Bluestem Mixedgrass Prairie*
Schizachyrium scoparium - Muhlenbergia cuspidata Herbaceous Vegetation ..... *Little Bluestem - Plains Muhly Bunchgrass Prairie*

2.9.3.3. Great Plains Shortgrass Prairies

Bouteloua gracilis - Buchloe dactyloides Herbaceous Vegetation ..... *Blue Grama - Buffalograss Shortgrass Prairie*
Bouteloua gracilis - Buchloe dactyloides Xeric Soil Herbaceous Vegetation ..... *Blue Grama - Buffalo Grass Xeric Soil Shortgrass Prairie*

2.9.3.4. Great Plains Sand Prairies

Andropogon gerardii - Panicum virgatum Sandhills Herbaceous Vegetation ..... *Sandhills Wet-mesic Prairie*
Andropogon hallii - Calamovilfa longifolia Herbaceous Vegetation ..... *Sand Bluestem - Prairie Sandreed Sand Prairie*
Andropogon hallii - Carex inops ssp. heliophila Herbaceous Vegetation ..... *Sand Bluestem - Sedge Sand Prairie*
Calamovilfa longifolia - Carex inops ssp. heliophila Herbaceous Vegetation ..... *Prairie Sandreed - Sedge Prairie*
Calamovilfa longifolia - Hesperostipa comata Herbaceous Vegetation ..... *Prairie Sandreed - Needle-and-Thread Prairie*
Schizachyrium scoparium - Aristida basiramea - Sporobolus cryptandrus - Eragrostis trichodes Herbaceous Vegetation ..... *Central Plains Sand/Gravel Prairie*

2.9.4. Rocky Mountains Montane Grasslands

2.9.4.1. Rocky Mountains Montane Grasslands

Sporobolus heterolepis - Achnatherum richardsonii - Danthonia intermedia Herbaceous Vegetation ..... *Black Hills Montane Grassland*

BIBLIOGRAPHY

ABI [Association for Biodiversity Information]. 2001. International Classification of Ecological Communities: Terrestrial Vegetation. Natural Heritage Central Databases. The Association for Biodiversity Information, Arlington, VA.

Alvo, R. and S. Ponomarenko. 2001. International Workshop on Vegetation Classification Standards (Hull, Quebec). Bulletin of the Ecological Society of America 82:80-81.

Ambrose, D. M., J. F. Drake, and D. Faber-Langendoen. 1994. Rare plant communities of the coterminous United States: Midwestern region. Pages 211-304 *in* D. Grossman, K.L. Goodin, and C.L. Reuss, editors. Rare plant communities of the conterminous United States. The Nature Conservancy, Arlington, VA.

Anderson, D. M. 1982. Plant communities of Ohio: A preliminary classification and description. Division of Natural Areas and Preserves, Ohio Department of Natural Resources, Columbus, OH. Unpublished manuscript.

Anderson, M., P. Bourgeron, M. T. Bryer, R. Crawford, L. Engelking, D. Faber-Langendoen, M. Gallyoun, K. Goodin, D. H. Grossman, S. Landaal, K. Metzler, K. D. Patterson, M. Pyne, M. Reid, L. Sneddon, and A. S. Weakley. 1998. International classification of ecological communities: Terrestrial vegetation of the United States. Volume II. The National Vegetation Classification System: List of types. The Nature Conservancy, Arlington, VA.

Anderson, M., P. Comer, D. Grossman, C. Groves, K. Poiani, M. Reid, R. Schneider, B. Vickery, and A. Weakley. 1999a. Guidelines for representing ecological communities in ecoregional conservation plans. The Nature Conservancy, Arlington, VA.

Anderson, R.C. 1983. The eastern prairie-forest transition – an overview. Pages 86-92 *in* R. Brewer, editor. Proceedings of the Eighth North American Prairie Conference. Western Michigan University, Kalamazoo, MI.

Anderson, R. C., J. S. Fralish, and J. M. Baskin, editors. 1999b. Savannas, barrens, and rock outcrop plant communities of North America. Cambridge University Press, New York, NY.

Angermeier, P. L. 2000. The natural imperative for biological conservation. Conservation Biology 14: 373-381.

Bailey, R. B. 1995. Description of the ecoregions of the United States. Second edition, revised and expanded. U.S. Forest Service Miscellaneous Publication 1391 (revised), with separate map at a scale of 1:7,500,000. U.S. Forest Service, Washington, D.C.

Bailey, R. B. 1998. Ecoregions map of North America: Explanatory Note. Miscellaneous Publication 1548. U.S. Forest Service, Washington, D.C. [1:15,000,000 scale map of North America included].

Bailey, R. B., P. E. Avers, T. King, and W. H. McNab, editors. 1994. Ecoregions and subregions of the United States. U.S. Forest Service, Washington, D.C. [scale 1:7,500,000, with supplementary table of map unit descriptions].

Barbour, M. G. and W. D. Billings, editors. 1988. North American terrestrial vegetation. First edition. Cambridge University Press, Cambridge, UK.

Barbour, M. G. and W. D. Billings. 2000. North American terrestrial vegetation. Second edition. Cambridge University Press, Cambridge, UK.

Barnes, B. V. 1991. Deciduous forests of North America. Pages 219-344 *in* E. Rohrig and B. Ulrich, editors. Ecosystems of the World 7: Temperate deciduous forests. Elsevier Publishing, Amsterdam, The Netherlands.

Bliss, L. C. and G. W. Cox. 1964. Plant community and soil variation within a northern Indiana prairie. The American Midland Naturalist 72:115-128.

Braun, E. L. 1936. Forests of the Illinoian till plain of southwestern Ohio. Ecological Monographs 6:90-149.

Braun, E. L. 1950. Deciduous forests of eastern North America. Hafner Press, New York, NY.

Braun-Blanquet, J. 1932. Plant sociology: The study of plant communities (translated by G.D. Fuller and H.S. Conrad). Translation of First edition of *Planzensoziologie* (1928). McGraw-Hill, New York, NY.

Brown, D. E., F. Reichenbacher, and S. E. Franson. 1998. A classification of North American biotic communities. University of Utah Press, Salt Lake City.

Brownell, V. R. and J. L. Riley. 2000. The alvars of Ontario: Significant alvar natural areas in the Ontario Great Lakes region. Federation of Ontario Naturalists. Don Mills, Ontario.

Cahayla-Wynne, R. and D. C. Glenn-Lewin. 1978. The forest vegetation of the driftless area, northeast Iowa. The American Midland Naturalist 100:307-319.

Catling, P. and V. R. Brownell. 1999. Alvars of the Great Lakes region. Pages 375-391 *in* Anderson, R. C., J. S. Fralish, and J. M. Baskin, editors. Savannas, barrens, and rock outcrop plant communities of North America. Cambridge University Press, New York, NY.

Chapman, K. A. 1988. Crosswalk classification of terrestrial and palustrine natural community types used by state Natural Heritage programs in the Midwest. Version 2.2, January 15, 1988. The Nature Conservancy, Midwest Heritage Task Force, Minneapolis, MN.

Collins, S. L. and L. L. Wallace, editors. 1990. Fire in North American tallgrass prairies. University of Oklahoma Press, Norman.

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish and Wildlife Service, FWS/OBS-79/31, Washington, D.C.

Curtis, J. T. 1959. The vegetation of Wisconsin: An ordination of plant communities. University of Wisconsin Press, Madison.

Dahl, T. E. 1990. Wetland losses in the United States 1780s to 1980s. U.S. Fish and Wildlife Service, Washington, D.C.

Delcourt, H. R. and P. A. Delcourt. 2000. Eastern deciduous forests. Pages 357-395 *in* M. G. Barbour and W. D. Billings, editors. North American terrestrial vegetation. Second edition. Cambridge University Press, Cambridge, UK.

Dix, R. L. and F. E. Smeins. 1967. The prairies, meadows, and marsh vegetation of Nelson County, North Dakota. Canadian Journal of Botany 45:21-58.

Drake, J. and D. Faber-Langendoen. 1997. An alliance level classification of the vegetation of the Midwestern United States. The Nature Conservancy, Midwest Conservation Science Department, Minneapolis, MN.

Ellenberg, H. 1988. Vegetation ecology of central Europe. Fourth edition. Cambridge University Press, New York, NY.

Eyre, F. H., editor. 1980. Forest cover types of the United States and Canada. Society of American Foresters, Washington, D.C.

Faber-Langendoen, D. 1993. Midwest regional community classification. Preliminary draft. The Nature Conservancy, Midwest Heritage Task Force, Minneapolis, MN.

Faber-Langendoen, D. and P. F. Maycock. 1987. Composition and soil-environment analysis of prairies on Walpole Island, southwestern Ontario. Canadian Journal of Botany 65:2410-2419.

Faber-Langendoen, D. and Midwest state Heritage program ecologists. 1996. Terrestrial vegetation of the Midwest United States. Draft. The Nature Conservancy, Arlington, VA.

Faber-Langendoen, D., K. Snow, and L. Tyrrell (in press). Establishing a region-wide network of representative research natural areas: An assessment for the U.S. Forest Service Eastern Region (Region 9). Overview. The Nature Conservancy, Midwest Conservation Science Department, Minneapolis, MN and U.S. Forest Service, North-Central Forest Experiment Station, St. Paul, MN.

Federal Geographic Data Committee. 1997. Vegetation classification standard, FGDC-STD-005. Web address: http://www.fgdc.gov/standards/status/sub2_1.html.

Flahault, C. and C. Schroter. 1910. Rapport sur la nomenclature phytogeographique. Proceedings of the Third International Botanical Congress, Brussels 1:131-164.

Gleason, H. A. 1926. The individualistic concept of the plant association. Bulletin of the Torrey Botanical Club 53:7-26

Glenn-Lewin, D. and M. Jennings. 2001. ESA Panel on Vegetation Classification (January 2001). Bulletin of the Ecological Society of America 82:68-69.

Greller, A. M. 1988. Deciduous forest. Pages 287-316 *in* M. G. Barbour and W. D. Billings, editors. North American terrestrial vegetation. First edition. Cambridge University Press, Cambridge, UK.

Grigal, D. F. and L. F. Ohmann. 1975. Classification, description, and dynamics of upland plant communities within a Minnesota wilderness area. Ecological Monographs 45:389-407.

Grimm, E. C. 1983. Chronology and dynamics of vegetation change in the prairie-woodland region of southern Minnesota, U.S.A. New Phytologist 93:311-350.

Grimm, E. C. 1984. Fire and other factors controlling the Big Woods vegetation of Minnesota in the mid-nineteenth century. Ecological Monographs 54:291-311.

Grossman, D. H., K. L. Goodin, and C. L. Reuss, editors. 1994. Rare plant communities of the conterminous United States: An initial survey. The Nature Conservancy, Arlington, VA.

Grossman, D.H., D. Faber-Langendoen, A. W. Weakley, M. Anderson, P. Bourgeron, R. Crawford, K. Goodin, S. Landaal, K. Metzler, K.D. Patterson, M. Pyne, M. Reid, and L. Sneddon. 1998. International classification of ecological communities: Terrestrial vegetation of the United States. Volume I. The national vegetation classification system: Development, status, and applications. The Nature Conservancy, Arlington, VA.

Hannah, L., J. L. Carr, and A. Lankerani. 1995. Human disturbance and natural habitat: A biome level analysis of a global set. Biodiversity and Conservation 4:128-155.

Homoya, M. A., J. Aldrich, J. Bacone, L. Casebere, and T. Post. 1988. Indiana natural community classification. Indiana Natural Heritage Program, Indianapolis, IN. Unpublished manuscript.

Hop, K., D. Faber-Langendoen, M. Lew-Smith, N. Aaseng, and S. Lubinski. 2001. Voyageurs National Park, Minnesota: USGS Vegetation Mapping Program – Project report February 2. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI.

Jackson, M. T. 1979. A classification of Indiana plant communities. Proceedings of the Indiana Academy of Science 89:159-171.

Jenkins, R. 1988. Information management for the conservation of biodiversity. Pages 231-239 *in* E.O. Wilson, editor. Biodiversity. National Academy Press, Washington, D.C.

Jenkins, R. 1996. Natural Heritage Data Center Network: Managing information for managing biodiversity. Pages 176-192 i*n* R.C. Szaro and D.W. Johnston, editors. Biodiversity in manged landscapes: Theory and practice. Oxford University Press, New York, NY.

Jennings, M. 1993. Natural terrestrial cover classification; assumptions and definitions. GAP Analysis Technical Bulletin 2. U.S. Fish and Wildlife Service, Idaho Cooperative Fish and Wildlife Research Unit, University of Idaho, Moscow.

Kartesz, J. T. 1999. A synonymized checklist and atlas with biological attributes for the vascular flora of the United States, Canada, and Greenland. First edition. *In* J. T. Kartesz and C. A. Meacham. Synthesis of the North American Flora, Version 1.0. North Carolina Botanical Garden, Chapel Hill.

Kotar, J., J. A. Kovach, and C. T. Locey. 1988. Field guide to forest habitat types of northern Wisconsin. Department of Forestry, University of Wisconsin–Madison and Wisconsin Department of Natural Resources, Madison.

Keys, J.E., Jr., J. C. Carpenter, S. Hooks, F. Koenig, W.H. McNab, W.E. Russell, and M.L. Smith. 1995. Ecological units of the eastern United States - first approximation (map and booklet of map unit tables. U.S. Forest Service, Atlanta, GA. [Presentation scale 1:3,500,000, colored.]

Küchler, A. W. 1964. Manual to accompany the map: Potential natural vegetation of the conterminous United States. Special Publication 36, American Geographical Society, New York, NY. [With separate map at 1:3,168,000.]

Küchler, A. W. 1974. A new vegetation map of Kansas. Ecology 55:586-604 (with map supplement).

Lauver, C. L., K. Kindscher, D. Faber-Langendoen, and R. Schneider. 1999. A classification of the natural vegetation of Kansas. Southwestern Naturalist 44:421-443

Leach, M. K. and L. Ross. 1995. Midwest oak ecosystems recovery plan: A call to action. U.S. Environmental Protection Agency, Great Lakes National Program Office, and The Nature Conservancy, Chicago, IL.

Lee, H. T., W. D. Bakowsky, J. Riley, J. Bowles, M. Puddister, P. Uhlig and S. McMurray. 1998. Ecological land classification for Southern Ontario: First approximation and its application. SCSS Field Guide FG-02. Ontario Ministry of Natural Resources, Southcentral Science Section, Science Development and Technology Branch, Northbay, ON.

Lincoln, R. J., G. A. Boxshall, and P. F. Clark. 1982. A dictionary of ecology, evolution, and systematics. Cambridge University Press, New York, NY.

Loucks, O. 1996. 100 years after Cowles: A national classification for vegetation. Bulletin of the Ecological Society of America 77:75-76.

McNab, W. H. and P. E. Avers. 1994. Ecological subregions of the United States: Section descriptions. U.S. Forest Service Administrative Publications WO-WSA-5. U.S. Forest Service, Washington, D.C.

Marriott, H. J., D. Faber-Langendoen, A. McAdams, D. Stutzman, and B. Burkhart. 1999. The Black Hills community inventory: Final report. The Nature Conservancy, Midwest Conservation Science Center, Minneapolis, MN.

Marriott, H. J. and D. Faber-Langendoen. 2000. The Black Hills community inventory. Volume 2: Plant community descriptions. The Nature Conservancy, Midwest Conservation Science Center and Association for Biodiversity Information, Minneapolis, MN.

Maybury, K., editor. 1999. Seeing the forest *and* the trees: Ecological classification for conservation. The Nature Conservancy, Arlington, VA.

Minnesota Natural Heritage Program. 1993. Minnesota's native vegetation: A key to natural communities. Version 1.5. Minnesota Department of Natural Resources Biological Report No. 20. Minnesota Department of Natural Resources, St. Paul.

Mucina, L. 2001. Ecosystems of Europe. Pages 635-647 *in* S.A. Levin, editor. Encyclopedia of Biodiversity. Volume 2. Academic Press, New York, NY.

Mueller-Dombois, D. and H. Ellenberg. 1974. Aims and methods of vegetation ecology. John Wiley and Sons, New York, NY.

National Wetlands Working Group. 1988. Wetlands of Canada. Ecological Land Classification Series No. 24. Sustainable Development Branch, Environment Canada, Ottawa, ON, and Polyscience Publications, Inc., Montreal, QU.

Nelson, P. 1985. The terrestrial natural communities of Missouri. Missouri Natural Areas Committee, Jefferson City. (Reprinted in 1987).

Nelson, D. C. and R. C. Anderson. 1983. Factors related to the distribution of prairie plants along a moisture gradient. The American Midland Naturalist 109:367-375.

Nuzzo, V. 1986. Extent and status of Midwest oak savanna: Presettlement and 1985. Natural Areas Journal 6:6-36.

Peet, R. B., M. Walker, M. Jennings, and D. Grossman. 2000. An information infrastructure for vegetation science. National Science Foundation/National Center for Ecological Analysis and Synthesis. University of California, Santa Barbara. Web address: http//www2.nceas.ucsb.edu.

Pell, W. F. and R. N. Mack. 1977. The *Fagus grandifolia - Acer saccharum - Podophyllum peltatum* association in northeastern Ohio. Botanical Gazette 138:64-70.

Ponomarenko, S., R. Alvo, K. Baldwin, D. Faber-Langendoen, D. Grossman, O. Hendrickson, K. Maybury, N. Loupoukhine, and D. Welch. 2000. Developing a Canadian National Vegetation Classification. Parks Canada, Ottawa, ON.

Redmann, R. E. 1972. Plant communities and soils of an eastern North Dakota prairie. Bulletin of the Torrey Botanical Club 99:65-76.

Reid, M. S., K. A. Schulz, P. J. Comer, M. H. Schindel, D. R. Culver, D. A. Starr, and M. C. Damm. 1999. An alliance level classification of vegetation of the coterminous western United States. The Nature Conservancy, Western Conservation Science Department, Boulder, CO.

Reschke, C. 1990. Ecological communities of New York State. New York Natural Heritage Program, Latham.

Reschke, C., R. Reid, J. Jones, T. Feeney and H. Potter. 1999. Conserving Great Lakes alvars. The Nature Conservancy, Great Lakes Program, Chicago, IL.

Robertson, K. R., R. C. Anderson, and M. W. Schwartz. 1997. The tallgrass prairie mosaic. Pages 55-87 *in* M. W. Schwartz, editor. Conservation in highly fragmented landscapes. Chapman and Hall, NewYork, NY.

Rodwell, J. S., editor. 1991. British plant communities. Volume 1. Woodlands and scrub. Cambridge University Press, New York, NY.

Rodwell, J. S., editor. 2000. British plant communities. Volume 5. Maritime communities and vegetation of open habitats. Cambridge University Press, New York, NY.

Sims, P. L. and P. G. Risser. 2000. Grasslands. Pages 323-356 *in* M. G. Barbour and W. D. Billings, editors. North American terrestrial vegetation. Second edition. Cambridge University Press, Cambridge, UK.

Sneddon, L., M. Anderson, and K. Metzler. 1996. Community alliances and elements of the Eastern Region. Second draft. The Nature Conservancy, Eastern Conservation Science Department, Boston, MA.

Stein, B. A. and F. W. Davis. 2000. Discovering life in America: Tools and techniques of biodiversity inventory. Pages 19-53 *in* B. A. Stein, L. W. Kutner, and J. S. Adams. Precious Heritage: The status of biodiversity in the United States. Oxford University Press, New York, NY.

Steinauer, G. and S. Rolfsmeier. 2000. Terrestrial natural communities of Nebraska. Nebraska Game and Parks Commission, Lincoln, NE. Unpublished report.

Takhtajan, A. 1986. Floristic regions of the world. University of California Press, Los Angeles.

TNC [The Nature Conservancy]. 1995. A classification and description of plant communities in southern Illinois. Report by the Southern Illinois Field Office, Ullin, IL, and the Midwest Regional Office, Minneapolis, MN.

TNC [The Nature Conservancy, Northern Tallgrass Prairie Ecoregional Planning Team]. 1998. Ecoregional Planning in the Northern Tallgrass Prairie Ecoregion. The Nature Conservancy, Midwest Regional Office, Minneapolis, MN.

Tolstead, W. L. 1942. Vegetation of the northern part of Cherry County, Nebraska. Ecological Monographs 12:257-292.

Umbanhowar, C. E., Jr. 1990. A guide to the Wisconsin Plant Ecology Laboratory data. Available from the author on request.

Umbanhowar, C. E., Jr. 1992. Reanalysis of the Wisconsin prairie continuum. The American Midland Naturalist 127:268-275.

UNESCO. 1973. International classification and mapping of vegetation. Series 6, Ecology and Conservation. United Nations Education, Scientific, and Cultural Organization, Paris, France.

Voigt, J. W. and R. H. Mohlenbrock. 1964. Plant communities of southern Illinois. Southern Illinois University Press, Carbondale.

Von Loh, J., D. Cogan, D. Faber-Langendoen, D. Crawford, and M.J. Pucherelli. 1999. Badlands National Park, South Dakota. USGS-NPS Vegetation Mapping Program, U.S. Department of the Interior, Bureau of Reclamation's Remote Sensing and GIS Group, Denver Federal Center, Denver.

Weakley, A. S., K. D. Patterson, S. Landaal, M. Pyne, M. Gallyoun. 1997. An alliance level classification of the vegetation of the southeastern United States. A report to the University of Idaho Cooperative Fish and Wildlife Research Unit and National Gap Analysis Program. The Nature Conservancy, Southeast Regional Office, Southern Conservation Science Department, Community Ecology Group, Chapel Hill, NC.

Weaver, J. E. 1965. Native vegetation of Nebraska. University of Nebraska Press, Lincoln.

White, J. A. and D. C. Glenn-Lewin. 1984. Regional and local variation in tallgrass prairie remnants of Iowa and eastern Nebraska. Vegetatio 57:65-78.

White, J. and M. Madany. 1978. Classification of natural communities in Illinois. Pages 311-405 *in* Natural Areas Inventory technical report. Volume I. Survey methods and results. Illinois Natural Areas Inventory, Urbana.

Whittaker, R. H. 1957. Recent evolution of ecological concepts in relation to eastern forests of North America. American Journal of Botany 44:197-206.

APPENDIX: PLANT COMMUNITY (ASSOCIATION) DESCRIPTIONS

This appendix is provided on CD in Adobe Acrobat format (see the inside back cover of this document). The CD also contains individual state subsets for midwestern states. State subsets have the name of the state "stamped" on the title page, and do not include a cover, addendums, or bibliography (although the latter 2 items are available separately). Pagination on state subsets mirrors that of the complete appendix; thus, page numbers are not sequential.

The files are also available to download from http://www.abi.org/publications/midwest/. Bound volumes of the entire 705-page appendix are available at cost; send requests to the Association for Biodiversity Information.

PLANT COMMUNITIES OF THE MIDWEST
CLASSIFICATION IN AN ECOLOGICAL CONTEXT

Editor:
Don Faber-Langendoen, Association for Biodiversity Information

APPENDIX CD: INDEX TO FILES

Click on a filename to view that file.

Document	**filename**
APPENDIX	(Plant Communities of the Midwest--Appendix.pdf)
MAIN REPORT	(Plant Communities of the Midwest--Main Report.pdf)
MAIN REPORT WITHOUT PLATES	(Plant Communities of the Midwest--Main Report, no plates.pdf)
STATE SUBSETS OF THE APPENDIX	**(in the "State subsets" subdirectory)**
ILLINOIS	(Illinois subset.pdf)
INDIANA	(Indiana subset.pdf)
IOWA	(Iowa subset.pdf)
KANSAS	(Kansas subset.pdf)
MICHIGAN	(Michigan subset.pdf)
MINNESOTA	(Minnesota subset.pdf)
MISSOURI	(Missouri subset.pdf)
NEBRASKA	(Nebraska subset.pdf)
NORTH DAKOTA	(North Dakota subset.pdf)
OHIO	(Ohio subset.pdf)
SOUTH DAKOTA	(South Dakota subset.pdf)
WISCONSIN	(Wisconsin subset.pdf)

State subsets do not include the Appendix Addendums or Bibliography, but they are included as separate files in the "State subsets" subdirectory:

APPENDIX ADDENDUM I	(Addendum I.pdf)
APPENDIX ADDENDUM II	(Addendum II.pdf)
APPENDIX BIBLIOGRAPHY	(Bibliography.pdf)

© 2001 Association for Biodiversity Information

ISBN 0-9711053-0-8

PLANT COMMUNITIES OF THE MIDWEST

CLASSIFICATION IN AN ECOLOGICAL CONTEXT

APPENDIX: PLANT COMMUNITY (ASSOCIATION) DESCRIPTIONS

Don Faber-Langendoen, Editor

A contribution to the
U.S. National Vegetation Classification and
International Classification of Ecological Communities

The Nature Conservancy®
Saving the Last Great Places

ASSOCIATION FOR BIODIVERSITY INFORMATION

PLANT COMMUNITIES OF THE MIDWEST
CLASSIFICATION IN AN ECOLOGICAL CONTEXT

APPENDIX: PLANT COMMUNITY (ASSOCIATION) DESCRIPTIONS

Editor:

Don Faber-Langendoen Association for Biodiversity Information

Contributors:

Norman Aaseng	Minnesota County Biological Survey
Dennis Albert	Michigan Natural Features Inventory
Pat Comer[1]	Michigan Natural Features Inventory
Robert Dana	Minnesota Natural Heritage and Nongame Research
Jim Drake	Association for Biodiversity Information
Hannah Dunevitz	Minnesota Natural Heritage and Nongame Research
Eric Epstein	Wisconsin Natural Heritage Program
Mike Homoya	Indiana Natural Heritage Program
Max Hutchison	The Nature Conservancy, Illinois Field Office
Kelly Kindscher	Kansas Natural Heritage Inventory
Chris Lauver	Kansas Natural Heritage Inventory
Mike Leahy	Missouri Department of Conservation
Darla Lenz [2]	North Dakota Natural Heritage Inventory
Bill McClain	Illinois Natural Heritage Division
Shannon Menard	Association for Biodiversity Information
Tim Nigh	Missouri Department of Conservation
Dave Ode	South Dakota Natural Heritage Database
John Pearson	Iowa Natural Areas Inventory
Kurt Rusterholz	Minnesota Natural Heritage and Nongame Research
Greg Schneider	Ohio Department of Natural Resources
Rick Schneider	Nebraska Natural Heritage Program
Kristin Snow	Association for Biodiversity Information
Gerry Steinauer	Nebraska Natural Heritage Program

[1]Currently with The Nature Conservancy, Western Conservation Science Center
[2]Currently with the USDA Forest Service, Region 1, Dakota National Grasslands

A contribution to the
U.S. NATIONAL VEGETATION CLASSIFICATION and
INTERNATIONAL CLASSIFICATION OF ECOLOGICAL COMMUNITIES

Association for Biodiversity Information
in cooperation with **The Nature Conservancy**

ISBN 0-9711053-0-8

©2001 Association for Biodiversity Information

Cover Photos: The larger inset photo shows a summer view of **Central Mesic Tallgrass Prairie** grading into **Central Bur Oak Openings**. The site is along a railroad right-of-way at Carlinville Prairie in Macoupin County, Illinois. The smaller inset photo is of a winter burn of the same prairie type at Sac Prairie, Cuivre River State Park, Lincoln County, Missouri. The background photo shows greater prairie chickens (*Tympanuchus cupido pinnatus*) mating in early spring at the Bluestem Prairie Preserve of The Nature Conservancy, western Minnesota. All photos by D. Faber-Langendoen.

Citation:

Faber-Langendoen, D., editor. 2001. Plant communities of the Midwest: Classification in an ecological context. Association for Biodiversity Information, Arlington, VA. 61 pp. + appendix (705 pp.).

Plant Communities of the Midwest: Classification in an Ecological Context consists of a main report and this 705-page appendix. The appendix is available both as an Adobe Acrobat file and as a bound volume. The Adobe Acrobat file is provided on a CD insert on the back cover of the main report and on the internet at http://www.abi.org/publications/midwest/. The bound volume is available at cost; send requests to Heritage Data Services, Database Project Specialist, Association for Biodiversity Information, 1101 Wilson Blvd, 15th floor, Arlington, VA 22209.

The CD and website also contain individual state subsets of the appendix and a copy of the main report. State subsets have the name of the state "stamped" on the title page, and do not include a cover, addendums, or bibliography (although the latter 2 items are available separately). Pagination on state subsets mirrors that of the complete appendix; thus, page numbers are not sequential.

CONTENTS

APPENDIX: PLANT COMMUNITY (ASSOCIATION) DESCRIPTIONS

APPENDIX: PLANT COMMUNITY (ASSOCIATION) DESCRIPTIONS

OVERVIEW

This appendix includes all natural and semi-natural associations currently described for the Midwest.[1] The concepts and development of the classification are described in the main report. The 588 associations (including 21 of uncertain status described in Addendum I) and 7 complexes are organized by ecological groups. Ecological groups are defined based on habitat, ecological processes, vegetation, and biogeography (see Chapter IV in the main report for a detailed description). The list of all associations by ecological group on page 7 provides an organizational overview, as well as page numbers for individual association descriptions. In addition, the sections for each of the 15 "Level 2" ecological groups (e.g., Acid Peatlands, Wet Prairies and Wet Meadows, Forests and Woodlands, Prairies/Grasslands) begin with a list of all the associations encompassed within them, along with page numbers for the association descriptions. Each association is then presented with its own description.

The format for each description is as follows (see Box 1 for a summary of the fields):

- The **ecological group name** is given on the top right corner of the page, in the form **Level 2**:Level 4. (See Chapter IV in the main report for a description of ecological groups.)
- Within and directly below the lines, the various **names of the association** are given: first, the ***global scientific name***; second, the ***translated scientific name***; and third, a ***common name***. To the right of the common name is the ***database code*** used to track the type (see Addendum II).
- The **Description** field provides information on the vegetation characteristics of the association, followed by a paragraph on its environmental setting. Where available, information is also provided on the dynamic features of the association, including natural disturbance regimes. Vascular plant nomenclature follows the nationally standardized list of Kartesz (1999).
- The **Comments** field first gives the ***level of confidence*** in the association, ranked from 1 (highest confidence) to 3 (lowest). The definition for each level is as follows:

  1 = STRONG. Classification based on recent field data. Information is based on Element Occurrences or other data based on occurrences that can be relocated. Classification considers information collected across the entire range or potential range of the Element. Classification may be based on quantitative or qualitative data.

  2 = MODERATE. Classification is based on data that is of questionable quality, limited numbers of sample points, or data from a limited range.

  3 = WEAK. Classification is based on secondary or anecdotal information or a new type for which data has only been collected at a very small number of sites.

  The confidence level is followed by the code for the ***region that has responsibility for the association record*** *in the database:*

  MCS = Midwest
  ECS = East
  SCS = Southeast
  WCS = West

  These are the four regional centers responsible for maintaining the classification of the association and the associated database records (see Figure 3 in the main report). Thus, some associations found in the

[1] State-specific subsets are also available in electronic format. See the copyright page for more information.

Midwest are actually the responsibility of an adjacent region. (As a result, there are occasional stylistic and other differences in the descriptions.)

Following the region code is a discussion of the ***classification issues*** related to the association. In many cases, other similar or related associations are referred to in this field; these are referenced by global name or a common name followed by the global code (elcode). Addendum II can be used to locate these associations in this appendix.

- The **Conservation Rank** field gives the global ***conservation status rank*** of the association. The global rank is a numerical assessment of the rarity and imperilment of the association across its entire range of distribution. Ranks are primarily based on the number of occurrences, state conservation status rank(s), the geographic range of the type, and its long-term decline in abundance (e.g., pre-European settlement abundance versus current abundance). Other factors include permanence, intrinsic fragility and vulnerability, threats, and the number of occurrences that are protected (see Appendix D in Grossman et al. 1998). The regional ecologists, working with the Natural Heritage Network of ecologists, assign these ranks. The ranks are defined as follows:

  GH PRESUMED ELIMINATED (HISTORIC) throughout its range, with no or virtually no likelihood that it will be rediscovered, but with the potential for restoration (e.g., *Castanea dentata* Forest).

  G1 CRITICALLY IMPERILED. Generally 5 or fewer occurrences and/or very few remaining acres or very vulnerable to elimination throughout its range due to other factor(s).

  G2 IMPERILED. Generally 6-20 occurrences and/or few remaining acres or very vulnerable to elimination throughout its range due to other factor(s).

  G3 VULNERABLE. Generally 21-100 occurrences. Either very rare and local throughout its range or found locally, even abundantly, within a restricted range or vulnerable to elimination throughout its range due to specific factors.

  G4 APPARENTLY SECURE. Uncommon, but not rare (although it may be quite rare in parts of its range, especially at the periphery). Apparently not vulnerable in most of its range.

  G5 SECURE. Common, widespread, and abundant (though it may be quite rare in parts of its range, especially at the periphery). Not vulnerable in most of its range.

  GU UNRANKABLE. Status cannot be determined at this time.

  G? UNRANKED. Status has not yet been assessed.

  Modifiers and Rank Ranges

  ? A question mark added to a rank expresses an uncertainty about the rank in the range of 1 either way on the 1-5 scale. For example, a G2? rank indicates that the rank is thought to be a G2, but could be a G1 or a G3.

  G#G# Greater uncertainty about a rank is expressed by indicating the full range of ranks which may be appropriate. For example, a G1G3 rank indicates the rank could be a G1, G2, or a G3.

  Q A "Q" added to a rank denotes questionable taxonomy. It modifies the degree of imperilment and is only used in cases where the type would have a less imperiled rank if it were not recognized as a valid type (i.e., if it were combined with a more common type). A GUQ rank often indicates that the type is unrankable because of daunting taxonomic/definitional questions.

  The ***reasons for the rank*** assignment follow the actual rank. This information is available primarily for highly ranked communities, i.e., G1-G3.

- The **Distribution** fields present a variety of information on distribution:

  – A ***general statement*** is provided ***on the global distribution*** of the type.

- The **USFS** (U.S. Forest Service) Ecoregions field gives information on the presumed pre-European settlement distribution of the type using the ***province, section, and subsection levels of the U.S. Forest Service ECOMAP*** (Bailey et al. 1994, Keys et al. 1995). A map showing the province and section level units is provided in Plate 11 of the main report.
- The **Conservation Regions** field provides the presumed pre-European settlement distribution using codes for the ecoregional units used by The Nature Conservancy's ecoregional conservation planning teams (TNC 1997). These units are based on the U.S. Forest Service map but are grouped to facilitate conservation planning across the country. A map showing the Conservancy's ecoregions and codes is provided in Plate 12 of the main report.

  In the above two fields, each ecoregion is followed by a colon and a confidence level code. Confidence levels are as follows:

  C = Confident: > 95% certain that the type occurs in the specified ecoregion.
  P = Probable: 80-95% certain that the type occurs in the specified ecoregion.
  ? = Questionable: 10-80% certain that the type occurs in the specified ecoregion.
  X = Extirpated/presumed extirpated from the specified ecoregion.

  For example, 47:C in the Conservation Regions field means that the association confidently occurs in the Conservancy's ecoregion 47. For USFS Ecoregions, the first character after the colon goes with the Forest Service province, the second with the Forest Service section within that province, and the third with the subsection within that section. Thus, "212He:CC?" means that the association confidently occurs in province 212, confidently occurs in section 212H, and questionably occurs in subsection 212He.
- The **States** and **Provinces** fields give information on the ***distribution of the association in the United States and Canada***. The standard U.S. Postal Code abbreviation is given for each state or province. Uncertainty about the occurrence of a type in a state or province is shown as a question mark after the abbreviation.

- The **Midwest Heritage Synonymy** field provides the ***cross-walk*** between the U.S. National Vegetation Classification (USNVC) association and the Midwest state name used by a state Natural Heritage program ***only for states with a classification that differs from the USNVC***. Currently Illinois, Indiana, Michigan, Minnesota, Missouri, Nebraska, Ohio, and Wisconsin have such independent state-level classifications, and their types are reported in this field. Iowa, Kansas, North Dakota, and South Dakota use the USNVC associations as their state types, so their type names are identical to the USNVC name and there is no need to report them here. This field, then, illustrates how, for those states retaining an independent state-level classification, the state types are linked to the USNVC through the cross-walk. Uncertainty about the occurrence of a type in a state or province is shown as a question mark after the state abbreviation. The following codes are used to show the relationship of the state type to the USNVC type:

  + the type is more broadly defined than the USNVC type
  - the type is more finely or narrowly defined than the USNVC type
  = the type is equivalent or identical to the USNVC type
  I the types intersect, but the relationship is not simple

A reference for each state classification used by the Natural Heritage programs is given in Box 2. It should be noted that some states are actively revising their classifications, and the names used here may be more current than those listed in the referenced classifications. It is possible to generate reports using a state or provincial classification as the starting point, and to show the relation of the state or provincial types to the USNVC associations. Such reports are available upon request from ABI or individual programs.

- The **Other Synonymy** field provides names and references from the literature that were used to help describe the association. These are typically references describing a type that is quite similar to the USNVC association. Codes are used to show the relationship of each synonym to the USNVC type:
  - **B** the type is more broadly defined than the USNVC type
  - **F** the type is more finely or narrowly defined than the USNVC type
  - **=** the type is equivalent or identical to the USNVC type
  - **I** the types intersect, but the relationship is not simple
- Finally, the **USNVC Hierarchy** field provides the ***alliance name*** and the ***alliance code*** for the level above the association in the USNVC hierarchy.

Box 1. Summary of information used in the association descriptions.

Ecological Group Level 2: Ecological Group Level 4

Global Community Name (scientific): scientific name for a community

Global Community Name (translated) : common species names

Global Common Name: A commonly used, more colloquial, name for a type. Code (CEGL00xxxx) for the USNVC

DESCRIPTION: This is a summary of three key components of the community type description (each in its own paragraph): a vegetation summary, an environmental summary, and, where available, a summary of the dynamics and natural disturbances of the community.

COMMENTS: *#, ABI Region Code*. Classification Comments.

The number gives the classification confidence, on a scale of 1 (strong confidence) to 3 (weak confidence). The ABI Region code is the regional team that has responsibility for maintaining the classification of the type. The classification comments discuss issues relating to the classification of the type.

CONSERVATION RANK: *Global Rank*: Reasons.

The global rank assesses the relative rarity of the association across its entire range on a scale of 1 to 5: G1 (critically imperiled); G2 (imperiled); G3 (vulnerable); G4 (apparently secure); G5 (secure). G? and GU indicate that the association is not yet ranked or is considered unrankable, respectively. A "?" indicates the rank is somewhat uncertain and a range rank (e.g., G2G3) indicates an even higher degree of uncertainty. A "Q" indicates that the taxonomy of the type is in question, and, if resolved, may result in a less imperiled rank.

DISTRIBUTION: Distribution of the type is briefly summarized across its entire range.

USFS ECOREGIONS: Distribution of the type across its entire range is summarized using the U.S. Forest Service ECOMAP Ecological Land Classification, giving province, section, and subsection codes, and the confidence of assignment to that region (C = 95% confidence, P = 80-95% confident, ? = 10-80% confident). (See Plate 11.) *Example*: 212He:CP? indicates that the type is confidently believed to occur in province 212, probably occurs in section 212H , and might occur in subsection 212He.

CONSERVATION REGIONS: Distribution of the type across its entire range is given for The Nature Conservancy ecoregional planning units, which are numbered from 1-64, followed by a confidence code (see details above under *USFS Ecoregions*). (See Plate 12.)

STATES, PROVINCES: Distribution of each type is given for states and provinces in the United States and Canada.

MIDWEST HERITAGE SYNONYMY: The name used by the state classification is provided for the eight states in the Midwest using an independent state classification (Illinois, Indiana, Michigan, Minnesota, Missouri, Nebraska, Ohio, and Wisconsin). A symbol (+, -, =, I) indicates whether the state type is broader than, finer than, equivalent to, or intersects in a complex manner, respectively.

OTHER SYNONYMY: A selected cross-walk to names used in other classifications that have helped described this type.

USNVC HIERARCHY: The ***alliance name*** and the ***alliance code*** are provided for the level above the association in the USNVC hierarchy.

Box 2. State Natural Heritage program classifications in the Midwest

The citations listed below are the primary sources of information for the individual state classifications in the Midwest. For those states that maintain an independent state classification, the state community names are reported in the Midwest Heritage Synonymy field in the association description.

ILLINOIS: White, J. and M. Madany. 1978. Classification of natural communities in Illinois. Pages 311-405 *in:* Natural areas inventory technical report. Volume I. Survey methods and results. Illinois Natural Areas Inventory, Urbana. [Some revisions have been made to this classification, and those changes are reported here.]

INDIANA: Homoya, M. A., J. Aldrich, J. Bacone, L. Casebere, and T. Post. 1988. Indiana natural community classification. Indiana Natural Heritage Program, Indianapolis. Unpublished manuscript. [This classification is in draft form. The names used in our association descriptions are sometimes based on possible or proposed changes still under review by the Natural Heritage program.]

IOWA: [No published version of the Iowa state classification exists, but the state Natural Heritage Program is using the USNVC classification directly.]

KANSAS: Lauver, C.L., K. Kindscher, D. Faber-Langendoen, and R. Schneider. 1999. A classification of the natural vegetation of Kansas. Southwestern Naturalist 44:421-443. [This state classification is directly compatible with the USNVC, using the same hierarchy and association units.]

MICHIGAN: Chapman, K. A., D. A. Albert, and G. A. Reese. 1989. Draft descriptions of Michigan's natural community types. Michigan Department of Natural Resources, Lansing. [The state classification is under review. Some types have been added or changed based on a 1997 draft by Pat Comer and Dennis Albert, and the changes are reflected in our association descriptions. Further revisions are under review.]

MINNESOTA: Minnesota Natural Heritage Program. 1993. Minnesota's native vegetation: A key to natural communities. Version 1.5. Minnesota Department of Natural Resources Biological Report No. 20. Minnesota Department of Natural Resources, St. Paul. [The names reported in our association descriptions are taken directly from this publication, with only a few proposed modifications that are still under review. The state expects to complete a major revision of the state classification in 2001.]

MISSOURI: Nelson, P. 1985. The terrestrial natural communities of Missouri. Missouri Natural Areas Committee, Jefferson City. (Reprinted in 1987). [The names used in our association description are taken directly from this publication, with only a few modifications.]

NEBRASKA: Steinauer, G. and S. Rolfsmeier. 2000. Terrestrial natural communities of Nebraska. Unpublished Report of the Nebraska Game and Parks Commission, Lincoln. [This draft is still undergoing revision, but all natural community types are linked to USNVC associations. In almost all cases the natural community type and the association unit are directly equivalent. The state is using its own hierarchy to organize the types.]

NORTH DAKOTA: [At this time the North Dakota Natural Heritage Program is using the USNVC directly. Once a review has been completed, state-specific revisions will be made.]

OHIO: Anderson, D.M. 1982. Plant communities of Ohio: A preliminary classification and description. Ohio Natural Heritage Program, Ohio Department of Natural Resources, Columbus. Unpublished manuscript. [Substantial revisions to this classification have been made by both Anderson and by G. Schneider of the Ohio Department of Natural Resources, and these are partly reflected in the names reported here.]

SOUTH DAKOTA: [At this time the South Dakota Natural Heritage Program is using the USNVC directly. Once a review has been completed, state specific revisions will be made.]

WISCONSIN: Curtis, J.T. 1959. The vegetation of Wisconsin: An ordination of plant communities. University of Wisconsin Press, Madison. [Substantial revisions to this classification have been made by Eric Epstein of the Wisconsin Natural Heritage Program, and these are partly reflected in the names reported here.]

ASSOCIATION NOMENCLATURE

The names of dominant and diagnostic species are the foundation of the association names. Species occurring in the same stratum are separated by a hyphen (-), and those occurring in different strata are separated by a slash (/). Species occurring in the uppermost strata are listed first, followed successively by those in lower strata. Within the same stratum, the order of species names generally reflects decreasing levels of dominance or characteristic value. In physiognomic types where there is a dominant herbaceous layer with a scattered woody layer, association names can be based on species found in the herbaceous layer and/or the woody layer, whichever is more diagnostic of the type.

Species less consistently found in all occurrences of the association are placed in parentheses. In cases where a particular genus is dominant or diagnostic, but individual species of the genus may vary among occurrences, only the specific epithets are placed in parentheses. The lowest possible number of species is used in an association name. The use of up to six species is permitted to define types with very diverse vegetation, relatively even dominance, and variable total composition. Association names also include the class in which they are classified (e.g., Forest, Shrubland). Over time, and with better descriptions and keys, it would be desirable to shorten the names to a few key species.

Nomenclature for vascular plant species follows the nationally standardized list of Kartesz (1999), with very few exceptions. Nomenclature for the various nonvascular plant groups follows Anderson (1990), Anderson et al. (1990), Egan (1987, 1989, 1990), Esslinger and Egan (1995), and Stotler and Crandall-Stotler (1977).

In cases where diagnostic species are unknown or in question, a more general term is currently allowed as a "placeholder," e.g., *Pinus banksiana* - (*Quercus ellipsoidalis*) / *Schizachyrium scoparium* - **Prairie Forbs** Wooded Herbaceous Vegetation. An environmental, geographical, or other term describing the association can also be included in the association name when such a term is necessary to adequately characterize the association. For reasons of standardization and brevity, however, this is kept to a minimum. Examples are: *Quercus alba / Carex pensylvanica - Carex ouachitana* **Dwarf** Forest, *Cephalanthus occidentalis / Carex* spp. **Northern** Shrubland.

When confidence in the circumscription of the association is low, especially in cases where the association represents a large, heterogeneous group of stands that is unlikely to remain a single association following analysis of additional data, the association name is followed by the term "[Placeholder]".

Examples of association names:

Pinus banksiana / Vaccinium spp. / Pleurozium schreberi Forest
Quercus stellata - Quercus marilandica / Schizachyrium scoparium Woodland
Alnus incana Swamp Shrubland
Quercus macrocarpa - (*Quercus alba, Quercus velutina*) / *Andropogon gerardii* Wooded Herbaceous Vegetation
Andropogon gerardii - Hesperostipa spartea - Sporobolus heterolepis Herbaceous Vegetation

Inevitably, names only partially describe the vegetation of a type. Some stands that fit a type may not contain all of the species listed in the name. Others may have species that are more dominant than any of the species in the name. Over time, the descriptions will better reflect these kinds of variations. Vegetation keys will also help provide a more structured means to place stands into a type.

INDEX TO ASSOCIATIONS BY ECOLOGICAL GROUP

1. WETLANDS – NON TIDAL

1.1. Acid Peatlands

Larix laricina / Photinia melanocarpa / Sphagnum spp. Forest

Tamarack / Black Chokeberry / Peatmoss Species Forest

Central Tamarack Poor Swamp CEGL002472

DESCRIPTION: The tree canopy is variable, with stands containing 25-100% cover. *Larix laricina* is either the sole dominant, or often mixed with *Acer rubrum, Betula alleghaniensis, Pinus strobus, Fraxinus nigra*, and occasional *Picea mariana* in the west and *Nyssa sylvatica* in the east. The shrub layer may contain *Betula pumila, Chamaedaphne calyculata*, as well as other more minerotrophic species, such as *Alnus incana, Photinia melanocarpa (= Aronia melanocarpa), Ilex verticillata, Toxicodendron vernix*, and, in the eastern part of its range, *Vaccinium corymbosum*. The dwarf-shrub *Vaccinium macrocarpon* may also be present. The herbaceous layer contains a diverse mix of species, including *Carex lasiocarpa, Caltha palustris, Coptis trifolia (= Coptis groenlandica), Drosera rotundifolia, Impatiens capensis, Osmunda cinnamomea*, and *Sarracenia purpurea*. A nearly complete *Sphagnum* spp. mat covers the ground (Brewer 1966, Catana 1967, Anderson 1982, MNNHP 1993).

Stands contain shallow peats in sites along poorly drained river systems and in shallow kettle lake basins, and may form a zone in a larger peatland site.

Windthrows can be common because of the shallow-rooted trees (Anderson 1982).

COMMENTS: *2, MCS*. This type occurs south of the tension zone in the Great Lake states and Ontario, and has a few, isolated stands in Ohio. This more southern tamarack contains little or no *Picea* mariana, which may be one way to separate it from the more northern *Larix laricina* types. *Toxicodendron vernix (= Rhus vernix)* may be typical, but it may not be very constant. Note also that the canopy can have a woodland character. Stands of this type are sometimes referred to as conifer bog "relicts," being south of the main distribution of conifer bogs following the most recent glaciation, but their origin may actually be more recent.

CONSERVATION RANK: *G4?.*

DISTRIBUTION: This community is found in the upper midwestern United States and adjacent Canada, ranging from south-central Minnesota east to Ohio and southern Ontario.

USFS ECOREGIONS: 212Hb:???, 212Ht:???, 212Kb:???, 212Nc:???, 221Fa:CCC, 221Fc:CCC, 222Jb:CC?, 222Jc:CC?, 222Jd:CC?, 222Jg:CCC, 222Ji:CCC, 222Ka:CC?, 222Kb:CCC, 222Kd:CCC, 222Ke:CCC, 222Kf:CCC, 222Ma:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Na:CC?
CONSERVATION REGIONS: 35:C, 45:C, 46:C, 47:C, 48:C, 49:C
STATES: IL IN MI MN OH WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	forested bog =
IN	acid bog +
MI	southern relict conifer swamp (tamarack) +
MN	tamarack swamp sphagnum subtype =
OH	tamarack fen; tamarack-hardwood bog I
WI	tamarack swamp (southern) =

OTHER SYNONYMY: Tamarack Forest (Brewer 1966), Stand 7 (Catana 1967)

USNVC HIERARCHY: LARIX LARICINA SATURATED FOREST ALLIANCE (I.B.2.N.g)

Picea mariana - (Larix laricina) / Ledum groenlandicum / Sphagnum spp. Forest

Black Spruce - (Tamarack) / Labrador-tea / Peatmoss Species Forest

Black Spruce - (Tamarack) / Labrador Tea Poor Swamp CEGL005271

DESCRIPTION: The overstory of this community is dominated by conifers. The tree canopy is closed to broken to closed with a moderately well-developed low-shrub layer, sparse herbaceous layer, and a carpet of mosses (Kurmis et al. 1986). The canopy is often pure *Picea mariana*. *Abies balsamea* can be present as a codominant. The only other trees that are occasionally found with it are *Larix laricina* and *Pinus banksiana* (Sims et al. 1989). The shrubs are primarily ericaceous and include *Chamaedaphne calyculata, Gaultheria hispidula, Kalmia polifolia, Ledum groenlandicum*, and *Vaccinium* spp., as well as *Cornus canadensis*. In the Northeast, shrubs may include *Kalmia angustifolia, Nemopanthus mucronatus, Viburnum nudum var. cassinoides*, or *Rhododendron canadense*. The few herbaceous species that live in this community include *Carex lasiocarpa, Carex trisperma, Clintonia borealis, Coptis trifolia*, and *Maianthemum trifolium*. *Dicranum polysetum, Sphagnum* spp., and *Pleurozium schreberi* are the major species constituting the abundant moss layer (Damman and French 1987, Sims et al. 1989, Harris et al. 1996). Localized minerotrophic areas may contain a more diverse herbaceous layer, including species such as *Osmunda cinnamomea*.

This community is found on level, wet sites with organic soils (Zoladeski et al. 1995). These sites are poorly to very poorly drained and acidic, allowing a moderate to thick layer of peat to accumulate. Nutrient levels are very low (Kurmis et al. 1986).

COMMENTS: *2, MCS*. This type represents poor black spruce swamps in closed peatland basins. Conceptually, it overlaps with black spruce bog forests, *Picea mariana / Ledum groenlandicum / Carex trisperma / Sphagnum* spp. Forest (CEGL002485), which are more typically found in open peatland complexes. This type is found in smaller basins, where a weakly minerotrophic influence is more likely. In the Northern Appalachian/Boreal ecoregion, *Abies balsamea* differentiates this type from bogs of lower elevations and latitudes. Stands in northeast U.S. and Canada may also contain a suite of shrub species, such as *Kalmia angustifolia, Nemopanthus mucronata, Viburnum nudum var. cassinoides*, or *Rhododendron canadense*. These species differ from those in the midwestern U.S. and central Canada, but their constancy in this type needs further evaluation.

CONSERVATION RANK: *G5.*

DISTRIBUTION: This community is found in the northern Great Lakes region and Northern Appalachian/Boreal region of the United States and Canada and elsewhere in the boreal regions of central Canada. It ranges from northern Michigan to northern Minnesota, and northward to parts of Manitoba, Ontario, Quebec, and the Atlantic Provinces.

USFS ECOREGIONS: 212Aa:CCC, 212Ab:CCC, 212Ba:CCC, 212Bb:CCC, 212Ca:CCC, 212Cb:CCC, 212Da:CCC, 212Dc:CCC, 212Ha:CCP, 212Hb:CCP, 212He:CCP, 212Hh:CCP, 212Hi:CCP, 212Hj:CCC, 212Hk:CCP, 212Hp:CCP, 212Hq:CCC, 212Hr:CCP, 212Hs:CCP, 212Hv:CCP, 212Hw:CCC, 212Ib:CCC, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Je:CPP, 212Jf:CPP, 212Jj:CPP, 212Jk:CPP, 212Jl:CPP, 212Jm:CPP, 212Jn:CPP, 212Jo:CPP, 212Jr:CPP, 212Ka:CCP, 212Kb:CCC, 212La:CCC, 212Lb:CCC, 212Lc:CCC, 212Ld:CCC, 212Ma:CCC, 212Mb:CCC, 212Na:CCC, 212Nb:CCC, 212Nc:CCC, 221Ag:CCC, 221Ah:CCC, 221Ai:CCC, 221Ak:CCC, 221Al:CCC, M212Aa:CCC, M212Ab:CCC, M212Ac:CCC, M212Ad:CCC, M212Ae:CCC, M212Af:CCC, M212Ag:CCC, M212Ba:CCC, M212Ca:CCC, M212Cd:CCC, M212Da:CCC, M212Db:CCC, M212Dc:CCC, M212Dd:CCP

CONSERVATION REGIONS: 47:C, 48:C, 63:C

STATES: ME MI MN NH NY VT WI **PROVINCES:** MB NB ON

MIDWEST HERITAGE SYNONYMY:
MI poor conifer swamp - black spruce (tamarack) swamp =
MN black spruce swamp +
WI northern wet forest (black spruce poor swamp subtype) =

OTHER SYNONYMY: *Habenario - Picetum* Association (Janssen 1967) =, Black Spruce - *Kalmia* Type (Kurmis et al. 1986) =, Black Spruce / Bunchberry / Sphagnum (Feathermoss) (V36) (Sims et al. 1989) F, Black Spruce / Ericaceous Shrub / Sphagnum (V37) (Sims et al. 1989) F, Black Spruce / Herb Poor / Sphagnum (Feathermoss) (Zoladeski et al. 1995) =, Black Spruce / Labrador Tea / Feathermoss (Sphagnum) (V34) (Sims et al. 1989) F, Poor conifer swamp: black spruce / Labrador Tea / Sphagnum (W27) (Harris et al. 1996) F, Poor conifer swamp: black spruce / Labrador Tea / bluejoint grass (W28) (Harris et al. 1996) F, Spring-fen forest (Glaser 1992b) =, *Carex trisperma* - Black spruce forest (Damman and French 1987) =

USNVC HIERARCHY: PICEA MARIANA SATURATED FOREST ALLIANCE (I.A.8.N.g)

Picea mariana / Alnus incana / Sphagnum spp. Forest

Black Spruce / Speckled Alder / Peatmoss Species Forest

Black Spruce / Alder Swamp CEGL002452

DESCRIPTION: The overstory is composed almost exclusively of conifers. *Picea mariana* is the most abundant tree and may occur in pure stands. *Abies balsamea, Larix laricina*, and *Thuja occidentalis* vary from minor to codominant. There is a moderately well-developed tall-shrub/sapling layer, consisting of *Alnus incana* and saplings of the canopy trees. Several shrubs, many of them ericaceous, make up a low-shrub layer. These include *Andromeda polifolia, Chamaedaphne calyculata, Gaultheria hispidula, Ledum groenlandicum, Linnaea borealis, Rubus pubescens*, and *Vaccinium angustifolium*. The herbaceous layer is frequently species-rich, containing species such as *Calamagrostis canadensis* (in Manitoba), *Carex leptalea, Carex trisperma, Clintonia borealis, Coptis trifolia, Cornus canadensis, Dryopteris cristata, Eriophorum* spp., *Mitella nuda*, and *Trientalis borealis*. Mosses include *Dicranum flagellare, Dicranum polysetum, Pleurozium schreberi, Ptilium crista-castrensis, Sphagnum girgensohnii, Sphagnum magellanicum*, and *Sphagnum capillifolium (= Sphagnum nemoreum)* (Sims et al. 1989, Harris et al. 1996, Chambers et al. 1997).

This community occurs on level, wet, poorly drained organic soils (Zoladeski 1995). The peat on which this community is usually found may be shallow to deep, and nutrient levels are moderate to high for typical *Picea mariana* swamps.

COMMENTS: *1, MCS*. Conceptually, this type is a rich black spruce swamp. Small pockets of standing water may occur. The understory ranges from herb- and shrub-rich to poor. *Ledum groenlandicum* may be prominent in some stands, while *Equisetum sylvaticum* and various *Carex* spp. may be abundant in the herb layer. In Wisconsin, there may be small patches resembling this type, sometimes in more extensive stands of cedar or tamarack (E. Epstein pers. comm. 1999).

CONSERVATION RANK: *G5.*

DISTRIBUTION: This black spruce conifer poor swamp type is found in the southern boreal forest of the Great Lakes of the United States and adjacent Canada and ranges from northern Minnesota, northern Ontario and Manitoba, and probably more widely in central and eastern Canada.

USFS ECOREGIONS: 212Ib:CCC, 212JI:C??, 212Kb:CCC, 212La:CCC, 212Lb:CCC, 212Lc:CCC, 212Mb:CCC, 212Na:CCC, 212Nb:CCP, 212Nc:CCP, 222Na:CCC
CONSERVATION REGIONS: 35:C, 47:C, 48:C
STATES: MI? MN WI? **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY: MI? rich conifer swamp
MN black spruce swamp +
WI? northern wet forest (black spruce rich swamp subtype?) ?

OTHER SYNONYMY: *Dryopterideto cristate - Picetum* Association (Janssen 1967) =, Black Spruce - *Alnus* type (Kurmis et al. 1986) =, Black Spruce / Speckled Alder / Sphagnum (V35) (Sims et al. 1989) =, Black Spruce / Herb Rich / Sphagnum Forest (Zoladeski et al. 1995) =, Black Spruce / Tall Shrub / Labrador Tea (W29) (Harris et al. 1996) F, Conifer / Tall Shrub / Herb-rich (W30) (Harris et al. 1996) F, Intermediate conifer swamp: black spruce / tall shrub / Labrador tea (V29) (Harris et al. 1996) F, Black Spruce-White Cedar-Balsam Fir-Northern Wild Raisin-Sphagnum (V36) (Chambers et al. 1997) I, Tree islands (Glaser 1992b) =. ?

USNVC HIERARCHY: PICEA MARIANA SATURATED FOREST ALLIANCE (I.A.8.N.g)

Picea mariana / Ledum groenlandicum / Carex trisperma / Sphagnum spp. Forest

Black Spruce / Labrador-tea / Three-seed Sedge / Peatmoss Species Forest

Black Spruce Bog CEGL002485

DESCRIPTION: Trees cover at least 25% of the canopy (and may be very dense), varying in height from 3 m to over 10 m. *Picea mariana* is often the sole species in the canopy. *Larix laricina* may occasionally occur. The dwarf-shrub layer is dominated by *Ledum groenlandicum* and other ericaceous shrubs, such as *Chamaedaphne calyculata, Vaccinium myrtilloides, Vaccinium oxycoccos, Kalmia polifolia, Gaultheria hispidula*, and *Andromeda polifolia*. *Picea mariana* may also be found in scrub form in this layer. Ground cover consists of a species-poor herb layer, with *Carex trisperma, Eriophorum vaginatum*, and *Maianthemum trifolium* most prevalent. Moss cover is a *Sphagnum* carpet with patches of feathermoss (especially *Pleurozium schreberi*) and conifer litter beneath the trees. Dominant *Sphagnum* species include *Sphagnum magellanicum, Sphagnum fuscum*, and *Sphagnum angustifolium*, and less commonly, *Sphagnum capillifolium (= Sphagnum nemoreum*) and *Sphagnum girgensohnii*. Minerotrophic indicators, such as *Betula pumila, Carex stricta*, and *Carex aquatilis*, are absent (Sims et al. 1989, MNNHP 1993, McCarthy et al. 1994, Harris et al. 1996).

Stands are typically on the crests of raised bog landforms in large peatland complexes, as well as in basin bogs. Sites are poorly drained, with wet organic substrates (Sims et al. 1989, MNNHP 1993, McCarthy et al. 1994, Harris et al. 1996).

COMMENTS: *2, MCS*. This type is conceptually a raised bog in a large peatland complex, with a more open-treed canopy. It includes both raised and intermediate bogs as described by the MNNHP (1993); however, Minnesota's intermediate bog may also overlap in part with *Picea mariana - (Larix laricina) / Ledum groenlandicum / Sphagnum* spp. Forest (CEGL005271), a black spruce poor swamp type). Based on work at Voyageurs National Park, Minnesota, and work in Ontario, closed stands of black spruce bog may key here or to CEGL005271, a black spruce poor swamp type more typically found in basins. It may be that, apart from peatland setting (i.e., open peatland complex vs. closed basin), these two types are vegetationally indistinguishable. This type is not expected in Wisconsin (E. Epstein pers. comm. 1999).

CONSERVATION RANK: *G5.*

DISTRIBUTION: This black spruce-dominated bog community type is found in the sub-boreal to boreal regions of the Great Lakes and elsewhere in the boreal region of central Canada, ranging from inland areas of Maine to northern Minnesota and northward into central Canada, including Manitoba, Ontario and Quebec.

USFS ECOREGIONS: 212Hb:CPP, 212Hh:CPP, 212Hi:CPP, 212Hj:CPP, 212Hp:CPP, 212Hq:CPP, 212Hr:CPP, 212Hs:CPP, 212Hw:CPP, 212Hy:CPP, 212Ja:CCP, 212Jb:CCP, 212Jc:CCC, 212Je:CCC, 212Jf:CCP, 212Jj:CCP, 212Jl:CCP, 212Jm:CCP, 212Jn:CCP, 212Ka:CCP, 212Kb:CCC, 212La:CCC, 212Lb:CCC, 212Lc:CCP, 212Ma:CCP, 212Mb:CCC, 212Na:CCC, 212Nb:CCP, 212Nc:CCC, 212Nd:CCP, 222Ke:CCC, 222Na:CCC

CONSERVATION REGIONS: 35:C, 46:C, 47:C, 48:C

STATES: ME MI? MN WI **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY:
MI? bog
MN black spruce bog raised subtype; black spruce bog, intermediate subtype -
WI northern wet forest (black spruce bog subtype) =

OTHER SYNONYMY: Black Spruce / Ericaceous Shrub / Sphagnum (V37) (Sims et al. 1989) =, Black Spruce / Labrador-tea - Sphagnum (V25) (McCarthy et al. 1994) =, Treed Bog: black spruce / ericaceous shrub / Sphagnum (V26) (Harris et al. 1996) =, Radiating bog forest (Glaser 1992b) =

USNVC HIERARCHY: PICEA MARIANA SATURATED FOREST ALLIANCE (I.A.8.N.g)

Pinus banksiana - (Picea mariana) - Mixed Hardwoods / Sphagnum spp. Forest

Jack Pine - (Black Spruce) - Mixed Hardwoods / Peatmoss Species Forest

Jack Pine Swamp CEGL005166

DESCRIPTION: The canopy is dominated by *Pinus banksiana* with varying amounts of *Picea mariana*. The shrub layer is dominated by ericaceous shrubs, including *Chamaedaphne calyculata, Gaultheria hispidula, Ledum groenlandicum, Vaccinium angustifolium*, and *Vaccinium myrtilloides*. *Abies balsamea* and *Picea mariana* may also occur in scrub form in this layer. Herbaceous species include *Clintonia borealis, Coptis trifolia, Cornus canadensis, Maianthemum canadense, Maianthemum trifolium*, and others. The moss layer contains a variety of *Sphagnum* spp. and feathermosses (Sims et al. 1989).

Stands are found on poorly drained lowland sites, including those on sand plains.

This type appears to originate following a catastrophic burn in a *Picea mariana* swamp (P Comer, E. Epstein pers. comm. 1999).

COMMENTS: *3, MCS*. This type is being proposed by Michigan NFI (meeting January 11-12, 1996). It is found in Michigan on poorly drained sand plains in the northern Lower Peninsula. *Pinus resinosa* may also dominate some stands. Stands resembling this type were also reported in Wisconsin, by Curtis (1959, pages 223-224) and by E. Epstein (central sand plains of Jackson County and scattered localities in Bayfield County) and in Ontario by Sims et al. (1989, V36, footnote). Apart from the canopy, this type may essentially resemble a poor black spruce swamp (e.g., *Picea mariana - (Larix laricina) / Ledum groenlandicum / Sphagnum* spp. Forest (CEGL005271)).

CONSERVATION RANK: *G?Q.*

DISTRIBUTION: This jack pine swamp community is found in the upper Great Lakes region of the United States and Canada.

USFS ECOREGIONS: 212Hh:CCC, 212Hi:CCP, 212Hl:CC?, 212Hr:CCP, 212Hw:CCC, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jl:CPP, 212Jm:CPP, 212Jn:CPP, 212Jo:CPP, 212Ka:CPP
CONSERVATION REGIONS: 47:P, 48:C
STATES: MI WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI poor conifer swamp - jack pine swamp =
WI northern wet forest (jack pine-black spruce swamp subtype) =

OTHER SYNONYMY: Black Spruce / Bunchberry / Spaghnum (Feathermoss) (V36) (Sims et al. 1989) B. This type may contain jack pine dominated stands (see footnote).

USNVC HIERARCHY: PICEA MARIANA SATURATED FOREST ALLIANCE (I.A.8.N.g)

Carex lasiocarpa - Carex oligosperma - (Lysimachia terrestris) / Sphagnum spp. / Spiraea tomentosa Herbaceous Vegetation

Wiregrass Sedge - Few-seed Sedge - (Swamp-candles) / Peatmoss Species / Hardhack Herbaceous Vegetation

Midwestern Graminoid Poor Fen CEGL005279

DESCRIPTION: The vegetation is dominated by graminoids, with up to 25% shrub cover, and scattered trees. The dominant graminoid is typically *Carex lasiocarpa*, and common associates or codominants include *Carex oligosperma, Carex utriculata, Carex haydenii, Eriophorum virginicum*, and *Scheuchzeria palustris*. Forbs include *Maianthemum trifolium* and *Sarracenia purpurea*. In central Wisconsin, characteristic forbs include *Lysimachia terrestris* and *Hypericum kalmianum*. The moss layer is virtually continuous, and is dominated by *Sphagnum* spp. (including *Sphagnum recurvum*). The low-shrub layer varies from open to more dense, and may contain *Andromeda polifolia, Chamaedaphne calyculata, Kalmia polifolia, Vaccinium macrocarpon*, and *Vaccinium oxycoccos*. Taller shrubs or small trees are scattered and may include *Betula pumila, Larix laricina, Salix pedicellaris* and *Spiraea tomentosa* (White and Madany 1978, Wovcha et al. 1995, E. Epstein pers. comm. 1999).

Stands occur in ice block or kettle-hole depressions on sandplains and till plains. They almost always occur in basins that have small watersheds, which minimizes runoff from surrounding uplands. They can also occur in areas with sandy, nutrient poor soils. The water surface is mildly acidic with moderately low available nutrient concentrations. The surface mat is generally flat (Wovcha et al. 1995).

COMMENTS: *2, MCS*. This graminoid poor fen type may overlap into shrubby poor fens, such as the Leatherleaf kettle bog [see *Chamaedaphne calyculata / Carex oligosperma - Eriophorum virginicum* Dwarf-shrubland (CEGL005092)]. In parts of its range, the type may be thought of as a counterpart to, and is often associated with, the central tamarack poor swamps, *Larix laricina / Photinia melanocarpa / Sphagnum* spp. Forest (CEGL002472).

CONSERVATION RANK: *G3G4*. Stands of this type have always been localized, and not very abundant, but remaining stands are threatened by agricultural runoff and enrichment, draining, and development.

DISTRIBUTION: This graminoid poor fen community is found in localized areas of the central/upper midwestern region of the United States. The type ranges from central Minnesota east across to southern Michigan, and locally from northern Iowa to northern Illinois.

USFS ECOREGIONS: 222K:CC, 222M:CC, 251C:??
CONSERVATION REGIONS: 35:?, 36:?, 46:C, 48:C
STATES: IL MI MN WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	graminoid bog =
MI	poor fen +
MN	poor fen =
WI	poor fen (central subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: CAREX OLIGOSPERMA - CAREX LASIOCARPA SATURATED HERBACEOUS ALLIANCE (V.A.5.N.m)

Carex lasiocarpa - Carex oligosperma / Sphagnum spp. Herbaceous Vegetation

Wiregrass Sedge - Few-seed Sedge / Peatmoss Species Herbaceous Vegetation

Northern Sedge Poor Fen CEGL002265

DESCRIPTION: The vegetation is dominated by graminoids, with up to 25% shrub cover, and scattered trees. The dominant graminoid is *Carex lasiocarpa*, and typical associates include *Carex chordorrhiza, Carex limosa, Carex oligosperma, Rhynchospora alba, Trichophorum caespitosum (= Scirpus cespitosus)*, and *Scheuchzeria palustris*. Forbs include *Sarracenia purpurea*. The low-shrub layer contains *Andromeda polifolia, Betula pumila, Chamaedaphne calyculata, Larix laricina, Salix discolor, Salix pedicellaris*, and *Vaccinium oxycoccos*. The moss layer is virtually continuous and is dominated by *Sphagnum capillifolium, Sphagnum fuscum*, and *Sphagnum magellanicum* (Chapman et al. 1989, MNNHP 1993, Harris et al. 1996).

Stands are found in peatlands with low exposure to mineral-rich groundwater, including basin fens, shores above the level of seasonal flooding and larger peatlands. Water hydrology is saturated (Harris et al. 1996). The surface water is slightly acidic (pH 4.1-5.9) and nutrient-poor (calcium <13 mg/l) (MNNHP 1993).

COMMENTS: *2, MCS*. Isolated stands can occur in central/southern Minnesota, Wisconsin, Michigan, and even northern Iowa and Illinois. The description may not adequately characterize these stands. These graminoid poor fens may overlap into shrubby poor fens, such as a *Chamaedaphne* dwarf-shrub poor fen (undescribed, but see *Chamaedaphne calyculata / Carex oligosperma / Sphagnum* spp. Poor Fen Dwarf-shrubland (CEGL005277) and *Chamaedaphne calyculata - Ledum groenlandicum - Kalmia polifolia* Bog Dwarf-shrubland (CEGL005278)), and they should perhaps be treated as one type, with a variable shrub cover (see Harris et al. 1996). In addition, a poor fen type or subtype dominated by *Carex oligosperma* and *Carex rostrata (= Carex utriculata)* may exist in the central sandplains of Minnesota and Wisconsin; other characteristic species include *Spiraea tomentosa, Lysimachia terrestris, Sphagnum* spp., and *Hypericum kalmianum*. They usually have low ericad cover (*Chamaedaphne calyculata, Vaccinium oxycoccos*) (Eric Epstein pers. comm. 1999). The type may be thought of as a counterpart to the central tamarack poor swamps. Finally, this type may overlap with the prairie transition rich fen *Carex lasiocarpa - Calamagrostis spp. - (Eleocharis rostellata)* Herbaceous Vegetation (CEGL002383).

CONSERVATION RANK: *G3G4.* The type has a moderately wide distribution, but is not common anywhere in its range within the United States. It is ranked between S1 and S3 by individual state Heritage programs. The global rank remains somewhat uncertain because the distribution and conservation status of the type in Canada is not known.

DISTRIBUTION: This graminoid poor fen community is found in the Great Lakes region of the United States and Canada, as well as elsewhere in central Canada, ranging from Ontario to Manitoba, south to Iowa, and east to Illinois.

USFS ECOREGIONS: 212Hh:CCP, 212Hi:CCP, 212Hj:CCP, 212Hp:CCC, 212Hq:CCC, 212Hu:CCP, 212Hv:CCP, 212Hy:CCC, 212Ja:CCP, 212Jc:CCC, 212Jd:CCC, 212Jf:CCP, 212Jg:CCC, 212Jj:CCC, 212Jl:CCC, 212Jm:CCC, 212Ka:CCC, 212Kb:CCC, 212La:CCC, 212Lc:CCP, 212Ma:CPP, 212Mb:CPP, 212Na:CCC, 212Nb:CCC, 212Nc:CCC, 212Nd:CCP, 222Ka:CCC, 222Kd:CCC, 222Kf:CCC, 222Ma:CCC, 222Mc:CCC, 222Me:CCC, 251Be:CCC, 251Cf:CCC
CONSERVATION REGIONS: 34:C, 35:C, 36:C, 46:C, 47:C, 48:C
STATES: IA IL? MI MN ND WI **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY:

IL?	graminoid bog ?
MI	poor fen +
MN	poor fen sedge subtype +
WI	poor fen (sedge subtype) =

OTHER SYNONYMY: poor fen: ericaceous shrub / wire sedge / *Sphagnum* (W20) (Harris et al. 1996) B. Description may include both the shrub poor fen (but see W18) and the graminoid poor fen., Sphagnum lawn poor fen, flark? (Glaser 1992b)

USNVC HIERARCHY: CAREX OLIGOSPERMA - CAREX LASIOCARPA SATURATED HERBACEOUS ALLIANCE (V.A.5.N.m)

Carex lasiocarpa - Rhynchospora alba - Scheuchzeria palustris Herbaceous Vegetation

Wiregrass Sedge - Northern White Beaksedge - Rannoch-rush Herbaceous Vegetation

Open Schlenke Bog CEGL002501

DESCRIPTION: This community is dominated by sedges, cotton grasses, and *Sphagnum* spp. Scattered and stunted trees may be found in this community but their canopy never covers more than 30%. The most abundant species are *Carex lasiocarpa, Carex limosa*, and *Scheuchzeria palustris*. The presence of *Rhynchospora alba* and *Sphagnum cuspidatum* and the maritime species *Utricularia cornuta* characterize this community.

This bog community occurs only in areas that are genuinely ombrotrophic, that is, receiving minerals only from precipitation and having a pH less than 4.3. This is a raised bog in which pool formations have developed near bog crests. Species in these bog pools are typically absent from typical habitats in raised bogs, where the water table may drop as much as 70-100 cm below the surface for a period of time (Glaser 1992b - see also Plates 10b, 10c).

COMMENTS: *3, MCS*. Concept of the type is taken from the Minnesota state type - schlenke bog (MNNHP 1993), as developed by concepts from Paul Glaser (1983, 1992b). These raised bog pools are more typical of maritime raised bog on the east coast. *Sphagnum manus* may also be typical. Size of these raised bog pools ranges from 40-100 acres. Only three sites are known in Minnesota. Further work is needed to clarify the classification of this type.

According to N. Aaseng (pers. comm. 2000) Glaser argues that bog development eventually results in a change from a dome to a flatter surface that will pond water. This is what happens in the Maritimes where bog development has been going on faster and for longer periods of time. It is these wetter sites that have species such as *Scheuchzeria palustris* and *Rhynchospora alba*, which Glaser argues are not minerotrophic indicators but simply do not occur in other continental bogs because conditions do not get that wet. Glaser also cites the water chemistry of schlenke bogs, which is compatible with the ombrotrophic concept of bog. By contrast, E. Gorham argues that it is not just the low concentration of Ca+ and Mg+ ions that are important but the rate they are delivered to the plants. Typically in a bog there is not much water movement so these concentration tells the whole story. However, if there is a lot of water movement across a peatland (perhaps like in the case of a schlenke bog) then the plants will have more ions available to them and perceive the environment as somewhat richer (poor fen-like).

CONSERVATION RANK: *G2?*. Few examples are known in Minnesota, where it is currently known from only three sites, at North Black River, Myrtle Lake, and Sturgeon River. The type may be common in eastern Canada and northeastern United States, but occurrences in Maritime bogs would be expected to be a different type.

DISTRIBUTION: This graminoid bog crest community type is found in northern Minnesota and adjacent Canada. In Minnesota it is known from only three sites, at North Black River, Myrtle Lake, and Sturgeon River, where they range in size from 15-40 ha (40-100 acres). The type may never have been more extensive than in those three sites.

USFS ECOREGIONS: 212La:CPP, 212Mb:CPP
CONSERVATION REGIONS: 47:P, 48:C
STATES: MN **PROVINCES:** MB ON?

MIDWEST HERITAGE SYNONYMY: MN open sphagnum bog schlenke subtype =

OTHER SYNONYMY: Schlenke (Glaser 1992b) =

USNVC HIERARCHY: CAREX OLIGOSPERMA - CAREX LASIOCARPA SATURATED HERBACEOUS ALLIANCE (V.A.5.N.m)

Carex oligosperma - Carex pauciflora - Eriophorum vaginatum / Sphagnum spp. Herbaceous Vegetation

Few-seed Sedge - Few-flower Sedge - Tussock Cottongrass / Peatmoss Species Herbaceous Vegetation

Open Graminoid / Sphagnum Bog CEGL005256

DESCRIPTION: The vegetation is either dominated by sedges, especially *Carex oligosperma*, or by *Sphagnum* spp. (sphagnum lawns). Shrub cover is less than 25%, and tree cover is less than 10%. Microtopography in more northern stands is high hummocks and weakly developed hollows, but some stands can be flat. The ground cover is a continuous layer of *Sphagnum* spp., including *Sphagnum angustifolium, Sphagnum fuscum*, and *Sphagnum magellanicum*. Graminoid-dominated examples contain *Carex oligosperma* and *Carex pauciflora*, as well as *Eriophorum vaginatum* and *Eriophorum virginicum*. Herbs include *Sarracenia purpurea* and *Scheuchzeria palustris*. Scattered low shrubs may occur, such as *Andromeda polifolia, Chamaedaphne calyculata, Kalmia polifolia, Ledum groenlandicum*, and *Vaccinium oxycoccos*. Minerotrophic indicators may be present at low cover when rooted in minerotrophic peat beneath the mat. Species include *Betula pumila, Carex aquatilis*, and *Carex stricta*. (MNNHP 1993, Harris et al. 1996)

Stands occur in drainageways at margins of raised bogs in large peatland complexes, or occasionally on shores, but they are isolated from groundwater influence. The substrate is a saturated, fibric peat (Harris et al. 1996).

COMMENTS: *2, MCS*. Type may occur as small patches within low-shrub bog types, *Chamaedaphne calyculata / Carex oligosperma - Eriophorum virginicum* Dwarf-shrubland (CEGL005092), *Chamaedaphne calyculata / Carex oligosperma / Sphagnum* spp. Poor Fen Dwarf-shrubland (CEGL005277), and *Chamaedaphne calyculata - Ledum groenlandicum - Kalmia polifolia* Bog Dwarf-shrubland (CEGL005278). Tracking occurrences of these sphagnum mats in Ontario and Michigan should be checked.

CONSERVATION RANK: *G4G5.* This type is expected to be fairly common and widespread in peatlands in Canada.

DISTRIBUTION: This open sedge/sphagnum bog type is found widely in the boreal/sub-boreal regions of the Great Lakes, and more widely in Canada. It ranges from Minnesota to possibly Maine, and northward in Canada from Quebec to Manitoba and possibly elsewhere.

USFS ECOREGIONS: 212A:C?, 212La:CCC, 212Mb:CCC, M212A:C?
CONSERVATION REGIONS: 47:C, 48:?, 63:?
STATES: ME? MI? MN WI? **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY:

MI?	bog
MN	open sphagnum bog =
WI?	open bog (graminoid subtype?) ?

OTHER SYNONYMY: open graminoid bog: sedge / Sphagnum (W23) = (Harris et al. 1996), Nonforested bog (Glaser 1992b) B

USNVC HIERARCHY: CAREX OLIGOSPERMA - CAREX LASIOCARPA SATURATED HERBACEOUS ALLIANCE (V.A.5.N.m)

Chamaedaphne calyculata - Ledum groenlandicum - Kalmia polifolia Bog Dwarf-shrubland

Leatherleaf - Labrador-tea - Bog Laurel Bog Dwarf-shrubland

Leatherleaf Bog CEGL005278

DESCRIPTION: The vegetation is dominated by an open dwarf-shrub/scrub conifer layer with very scattered trees (<10% cover). Microtopography is high hummocks with weakly developed hollows. Ericaceous dwarf-shrubs are dominant, including *Chamaedaphne calyculata, Kalmia polifolia*, and *Ledum groenlandicum*, and the creeping dwarf-shrubs *Andromeda polifolia* and *Vaccinium oxycoccos*. Scrub conifers include *Larix laricina* and *Picea mariana*. They also occur as scattered trees (>3 m). The herb layer is species poor, containing *Carex oligosperma, Carex pauciflora, Eriophorum vaginatum*, and *Sarracenia purpurea*. The moss layer forms a continuous hummocky mat dominated by *Sphagnum angustifolium, Sphagnum fuscum*, and *Sphagnum magellanicum* (MNNHP 1993, Harris et al. 1996). Diagnostic features of this type include the dominance of a dwarf-shrub ericaceous layer, absence of a tree layer (<10%), species-poor herbaceous layer, and almost complete lack of minerotrophic indicators, such as *Betula pumila, Carex aquatilis*, and *Carex stricta*. A possible subtype may occur in which pools form near the bogs crests, and contain maritime species such as *Scheuchzeria palustris, Rhynchospora alba, Sphagnum cuspidatum*, and *Utricularia cornuta*.

Sites are found on raised bog landforms in large peatland complexes, basin bogs, and occasionally on shores (but still isolated from groundwater influence). Stands have a saturated hydrology with a fibric *Sphagnum* spp. peat soil and a pH usually <4.3 (Harris et al. 1996, MNNHP 1993).

COMMENTS: *2, MCS*. This type represents the "hard-core" shrub bog, with little or no minerotrophic influence, and typically in larger raised bog peatlands. Stands with sparse black spruce - tamarack layer (<10% tree cover) are part of this type. Stands with 10-25% black spruce and tamarack cover are placed in black spruce / leatherleaf semi-treed bog, *Picea mariana / Chamaedaphne calyculata / Sphagnum* spp. Dwarf-shrubland (CEGL005218). Minerotrophic indicators, especially *Betula pumila, Carex stricta* or *Carex aquatilis*, can be present at very low cover when rooted in minerotrophic peat beneath the bog (Harris et al. 1996), but stands with sufficient minerotrophic indicators are placed in the wetter type, *Chamaedaphne calyculata / Carex oligosperma / Sphagnum* spp. Poor Fen Shrubland, a much more widespread type in the midwestern and northeastern United States peatlands.

CONSERVATION RANK: *G5.*

DISTRIBUTION: This dwarf-shrub bog community is found in the northern Great Lakes region and extreme northeastern United States, and across much of central Canada, ranging from Maine to northern Minnesota, and northward from Quebec to Manitoba and other parts of Canada.

USFS ECOREGIONS: 212A:CC, 212La:CCC, M212A:CC, M212B:CC
CONSERVATION REGIONS: 47:C, 63:C
STATES: ME? MN NH? NY? VT? **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY: MN open sphagnum bog raised subtype +

OTHER SYNONYMY: Open low shrub bog: ericaceous shrub / Sphagnum (W24) (Harris et al. 1996) =, Nonforested bog (Glaser 1992b) B

USNVC HIERARCHY: CHAMAEDAPHNE CALYCULATA SATURATED DWARF-SHRUBLAND ALLIANCE (IV.A.1.N.g)

Chamaedaphne calyculata / Carex oligosperma - Eriophorum virginicum Dwarf-shrubland

Leatherleaf / Few-seed Sedge - Tawny Cottongrass Dwarf-shrubland

Leatherleaf Kettle Bog CEGL005092

DESCRIPTION: The vegetation is dominated by low shrubs, at least 25% cover, and a continuous covering of sphagnum moss. Herbaceous cover is variable, and tree cover is less than 10%. The dominant shrub is *Chamaedaphne calyculata*, with associates of *Andromeda polifolia, Betula pumila, Gaylussacia baccata, Nemopanthus mucronatus, Vaccinium oxycoccos*, and *Vaccinium macrocarpon*. Characteristic herbaceous species include *Calopogon tuberosus (= Calopogon pulchellus), Carex oligosperma, Drosera intermedia, Drosera rotundifolia, Eriophorum virginicum, Pogonia ophioglossoides, Rhynchospora alba, Sarracenia purpurea*, and *Woodwardia virginica*. In stands in Ohio, *Carex atlantica, Carex canescens, Carex echinata, Dulichium arundinaceum, Juncus canadensis*, and *Triadenum virginicum* may be found. Scattered trees may be present, including *Larix laricina* and *Picea mariana* (Curtis 1959, White and Madany 1978, Homoya et al. 1985, Chapman et al. 1989, Anderson 1996, Bakowsky and Lee 1996).

Stands are found in kettle lakes associated with kettle-kame-end moraine topography. In Michigan it is also reported on pitted outwash (Chapman et al. 1989). Soils are saturated peat, with acidity somewhat reduced by slightly alkaline lakewater and groundwater influences, suggestive of a "poor fen" hydrology (Curtis 1959, White and Madany 1978, Homoya et al. 1985, Chapman et al. 1989, Anderson 1996).

COMMENTS: *2, MCS*. Type may be very similar to the more northern leatherleaf poor fen type *Chamaedaphne calyculata / Carex oligosperma / Sphagnum* spp. Poor Fen Dwarf-shrubland (CEGL005277). In Ontario this type represents glaciated kettle bogs in extreme southern Ontario. Schneider and Cochrane (1997) summarize current stand conditions in Ohio. Examples of the "Sphagnum bog" type in Ohio are very small (<30 cm to 3 m wide according to Anderson (1996): thus they are probably best combined with the adjacent low-shrub zone dominated by *Chamaedaphne calyculata*. Historically, these sphagnum mats with or without leatherleaf, may have been far more common in Ohio, often referred to as "cranberry marshes" (Anderson 1996). The open graminoid version of this type is tracked as the Midwestern Graminoid Poor Fen, *Carex lasiocarpa - Carex oligosperma - (Lysimachia terrestris) / Sphagnum spp. / Spiraea tomentosa* Herbaceous Vegetation (CEGL005279).

CONSERVATION RANK: *G3G4.*

DISTRIBUTION: This low-shrub bog or poor fen type is found in kettle lake in the midwestern United States, ranging from southern parts of Wisconsin, Michigan, and Ontario to northern parts of Illinois, Indiana, and Ohio.

USFS ECOREGIONS: 221Fa:CCC, 221Fb:CCC, 221Fc:CCC, 222Jb:CCC, 222Jh:CCC, 222Ji:CCC, 222Ke:CCC, 222Kf:CCC
CONSERVATION REGIONS: 45:C, 46:C, 48:C, 49:C
STATES: IL IN MI OH WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	low shrub bog =
IN	acid bog +
MI	bog
OH	leatherleaf bog; sphagnum bog -
WI	open bog (relict subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: CHAMAEDAPHNE CALYCULATA SATURATED DWARF-SHRUBLAND ALLIANCE (IV.A.1.N.g)

Chamaedaphne calyculata / Carex oligosperma / Sphagnum spp. Dwarf-shrubland

Leatherleaf / Few-seed Sedge / Peatmoss Species Dwarf-shrubland

Great Lakes Leatherleaf Intermittent Wetland CEGL005091

DESCRIPTION: This wetland is dominated by herbs or by herbs and shrubs. *Chamaedaphne calyculata* is a short shrub which is present in this community. Herbaceous species present include *Carex oligosperma* and *Juncus* spp., and in some places, *Calamagrostis canadensis, Calamagrostis stricta, Eleocharis olivacea, Eleocharis robbinsii*, and *Phalaris arundinacea*. The nonvascular layer contains some *Sphagnum* spp. (Chapman et al. 1989).

This community is located along lakeshores or in depressions. It occurs on sandy glacial lakeplains and outwash plains. Soils range from loamy sand and peaty sand to peaty muck and are strongly acid to very strongly acid. The water level fluctuates seasonally and from year to year.

Sites may occur where bogs have been "burned out" (Chapman et al. 1989).

COMMENTS: *3, MCS*. This type is taken from the Michigan state classification - Intermittent Wetland, Boggy Seepage Wetland (Chapman et al. 1989). There it occurs on poorly drained portions of outwash, seepage with water table fluctuations. Rangewide characteristics of this type are not clear, but similar stands in "burned out" bogs in Wisconsin have been observed. It is possible that this type may be equivalent to the Leatherleaf Poor Fen type, *Chamaedaphne calyculata / Carex oligosperma / Sphagnum* spp. Poor Fen Dwarf-shrubland (CEGL005277).

CONSERVATION RANK: *G3Q.* There are probably fewer than 100 occurrences of this community rangewide in the Great Lakes basin. Currently 18 occurrences are documented from Michigan (where it is ranked S2?); this community also occurs in Wisconsin, Ontario, and New York. There are probably fewer than 10,000 acres rangewide. Currently there are 1151 acres documented from 18 occurrences in Michigan.

DISTRIBUTION: This community is found in Michigan, Wisconsin, Ontario, and New York in the Great Lakes basin.

USFS ECOREGIONS: 212Ha:CCC, 212Hb:CC?, 212He:CCC, 212Hh:CC?, 212Hi:CCP, 212Hj:CCC, 212Hk:CC?, 212Hl:CCC, 212Hp:CCP, 212Hq:CCC, 212Hr:CCP, 212Hs:CCP, 212Ht:CCP, 212Hv:CCC, 212Hw:CCP, 212Hx:CCP, 212Hy:CCC, 212Ib:CCC, 212Ja:CPP, 222Jc:CCC, 222Jh:CCC
CONSERVATION REGIONS: 48:C
STATES: MI WI **PROVINCES:** ON?

MIDWEST HERITAGE SYNONYMY: MI intermittent wetland =
WI boggy intermittent wetland (great lakes subtype?) ?

OTHER SYNONYMY:

USNVC HIERARCHY: CHAMAEDAPHNE CALYCULATA - (KALMIA ANGUSTIFOLIA) SEASONALLY FLOODED DWARF-SHRUBLAND ALLIANCE (IV.A.1.N.f)

Chamaedaphne calyculata / Carex oligosperma / Sphagnum spp. Poor Fen Dwarf-shrubland

Leatherleaf / Few-seed Sedge / Peatmoss Species Poor Fen Dwarf-shrubland

Leatherleaf Poor Fen CEGL005277

DESCRIPTION: The vegetation is dominated by an open dwarf-shrub/scrub conifer layer with very scattered trees (<10% cover). Microtopography is high to intermediate hummocks with hollows or a flat lawn of *Sphagnum* spp. Ericaceous dwarf-shrubs are dominant, including *Chamaedaphne calyculata, Kalmia polifolia*, and *Ledum groenlandicum*, and the creeping dwarf-shrubs *Andromeda polifolia* and *Vaccinium oxycoccos*. *Betula pumila* has low cover but is fairly constant. Scrub conifers include *Larix laricina* and *Picea mariana*. They also occur as scattered trees (>3 m). The herb layer is species-poor, containing *Carex oligosperma, Carex limosa, Equisetum fluviatile, Menyanthes trifoliata, Sarracenia purpurea*, and *Scheuchzeria palustris*. Minerotrophic indicators include *Carex aquatilis, Carex rostrata*, and *Carex stricta*. The moss layer forms a continuous hummocky mat dominated by *Sphagnum angustifolium, Sphagnum fuscum*, and *Sphagnum magellanicum* (Harris et al. 1996).

Sites are found on peatlands with low exposure to mineral-rich groundwater, including basin fens, shores above the level of seasonal flooding, and margins of larger peatlands. Stands have a saturated hydrology with a fibric *Sphagnum* spp. peat soil and a pH usually <4.5. (Harris et al. 1996).

COMMENTS: *2, MCS*. It is difficult to distinguish this leatherleaf poor fen from leatherleaf bogs in the field, but conceptually this type has somewhat more minerotrophic influence and a corresponding set of minerotrophic indicators. When minerotrophic indicators are absent or "very low", the type is placed in *Chamaedaphne calyculata - Ledum groenlandicum - Kalmia polifolia* Bog Dwarf-shrubland (CEGL005278) (Harris et al. 1996). Stands with sparse black spruce-tamarack layer (<10% tree cover) are part of this type. Stands with 10-25% black spruce and tamarack cover are placed in black spruce/leatherleaf semi-treed bog, *Picea mariana / Chamaedaphne calyculata / Sphagnum spp*. Dwarf-shrubland (CEGL005218). This type also overlaps closely with a "scrubby poor fen type" *Larix laricina / Chamaedaphne calyculata / Carex lasiocarpa* Shrubland (CEGL005226). There are intermediates between this poor fen and sedge meadows, such as when *Sphagnum* spp. and *Chamaedaphne calyculata* have invaded a *Carex rostrata* meadow and the *Carex rostrata* is hanging on because it still has deep rooting in the underlying minerotrophic peat or mineral soil (N. Aaseng pers. comm. 2000).

CONSERVATION RANK: *G5.*

DISTRIBUTION: This dwarf-shrub poor fen community is found in the northern Great Lakes region and northeastern United States and across much of central Canada, ranging from probably Maine and New Hampshire west to Minnesota, and northward from Quebec to Manitoba and other parts of Canada.

USFS ECOREGIONS: 212H:CC, 212I:CC, 212J:CC, 212K:CC, 212L:CC, 212M:CP, 212N:CP, 212O:CC, 212P:CC, 222J:C?, 222K:C?
CONSERVATION REGIONS: 46:?, 47:C, 48:C, 63:C
STATES: ME? MI MN NH? NY? VT? WI **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY:
MI bog +
MN open sphagnum bog intermediate subtype =
WI open bog (leatherleaf subtype) =

OTHER SYNONYMY: Poor fen: ericaceous shrub / Sphagnum (W21) (Harris et al. 1996) F, Poor fen: black spruce - tamarack / ericaceous shrub / Sphagnum (W22) (Harris et al. 1996) F

USNVC HIERARCHY: CHAMAEDAPHNE CALYCULATA SATURATED DWARF-SHRUBLAND ALLIANCE (IV.A.1.N.g)

Larix laricina / Chamaedaphne calyculata / Carex lasiocarpa Shrubland

Tamarack / Leatherleaf / Wiregrass Sedge Shrubland

Tamarack Scrub Poor Fen CEGL005226

DESCRIPTION: The vegetation is an open fen dominated by ericaceous shrubs, sedges, and *Sphagnum*. The scattered tree layer of *Larix laricina* and *Picea mariana* >2 m is less than 10%. The low-shrub layer is dominated by *Betula pumila, Chamaedaphne calyculata, Larix laricina, Salix discolor*, and *Salix pedicellaris*. The herb layer is somewhat low in diversity, with graminoids including the dominant *Carex lasiocarpa*, as well as *Carex chordorrhiza* and *Carex limosa*. *Carex oligosperma* may also occur. Forbs include *Sarracenia purpurea, Maianthemum trifolium*, and *Menyanthes trifoliata*. Mosses include *Sphagnum capillifolium, Sphagnum fuscum* and *Sphagnum magellanicum*. Diagnostic features include the ericaceous and tree scrub cover, the somewhat lower species diversity compared to richer fen, and *Carex lasiocarpa* more common than *Carex oligosperma* (Harris et al. 1996).

Stands occur on peatlands with low exposure to minerotrophic groundwater including basin fens, shores above the level of the seasonal flooding, and larger peatlands. The water regime is saturated, and the substrate is fibric to mesic peat. The microtopography is low to intermediate hummocks with hollows (Harris et al. 1996).

COMMENTS: *2, MCS*. Type concept is that of a scrub poor fen, where tree height does not exceed 2 m, as defined by the MNNHP type - poor fen, scrub tamarack subtype (MNNHP 1993), and the poor fen type (W20) in Harris et al. (1996) (with perhaps some elements of W22). Rangewide review is still needed. The type is similar to the Bog Birch - Leatherleaf Rich Fen, *Betula pumila / Chamaedaphne calyculata / Carex lasiocarpa* Shrubland (CEGL002494), but is less rich, and contains substantially more minerotrophic indicators when compared to the Leatherleaf Poor Fen, *Chamaedaphne calyculata - Ledum groenlandicum - Kalmia polifolia* Bog Dwarf-shrubland (CEGL005278).

CONSERVATION RANK: *G4G5.* Type is expected to be common in Canada.

DISTRIBUTION: This tamarack and ericaceous scrub poor fen is found in the northern Great Lakes region of the United States and into central Canada, ranging from Minnesota into Ontario and elsewhere in Canada.

USFS ECOREGIONS: 212La:CCC
CONSERVATION REGIONS: 47:C
STATES: MI? MN WI? **PROVINCES:** MB? ON

MIDWEST HERITAGE SYNONYMY: MI? poor fen
MN poor fen scrub tamarack subtype =
WI? muskeg? (poor fen scrub subtype?) ?

OTHER SYNONYMY: poor fen: ericaceous shrub / wire sedge / *Sphagnum* (W20) (Harris et al. 1996) =. Cover of tamarack scrub < 2-3 m tall is somewhat difficult to agree on from aerial photos vs ground perspective.

USNVC HIERARCHY: BETULA PUMILA - (SALIX SPP.) SATURATED SHRUBLAND ALLIANCE (III.B.2.N.g)

Picea mariana / Chamaedaphne calyculata / Sphagnum spp. Dwarf-shrubland

Black Spruce / Leatherleaf / Peatmoss Species Dwarf-shrubland

Black Spruce/Leatherleaf Semi-treed Bog CEGL005218

DESCRIPTION: Vegetation structure is complex with a dominant layer of dwarf-shrubs, stunted trees and hummock-hollow microtopography, sometimes referred to as muskeg. Ericaceous dwarf-shrubs dominate the stand, with over 40% cover. Dominant species include *Andromeda polifolia var. glaucophylla, Chamaedaphne calyculata, Kalmia polifolia*, and *Ledum groenlandicum*. Creeping dwarf-shrubs include *Gaultheria hispidula* and *Vaccinium oxycoccos*. Trees average about 10-25% cover, may be stunted (3 m tall), and are often clumped on higher hummocks with intervening, weakly developed hollows. Typical species include *Picea mariana* and *Larix laricina*. The herbaceous layer contains graminoids such as *Carex oligosperma, Carex pauciflora*, and *Eriophorum vaginatum*, and forbs such as *Maianthemum stellatum* and *Sarracenia purpurea*. The nonvascular layer contains a carpet of *Sphagnum* (including *Sphagnum fuscum* and *Sphagnum magellanicum*), with patches of *Pleurozium schreberi* (Sims et al. 1989, Harris et al. 1996).

Sites are on the crests of raised bogs in large peatland complexes, in basin bogs, and occasionally on shores isolated from groundwater influence (Sims et al. 1989, Harris et al. 1996).

COMMENTS: *2, MCS*. This type is intermediate in tree cover between treed bogs with >25% tree cover, *Picea mariana / Ledum groenlandicum / Carex trisperma / Sphagnum* spp. Forest (CEGL002485), and low-shrub bogs with less than 10% tree cover *Chamaedaphne calyculata - Ledum groenlandicum - Kalmia polifolia* Bog Dwarf-shrubland (CEGL005278). Minerotrophic indicators, especially *Betula pumila, Carex stricta*, or *Carex aquatilis*, are occasionally present at low cover when rooted in minerotrophic peat beneath the bog. It is reported in MI and WI as their "muskeg" types, but those stands may not be true ombrotrophic bogs - rather they may belong to the tamarack scrub poor fen, *Larix laricina / Chamaedaphne calyculata / Carex lasiocarpa* Shrubland (CEGL005226), which contains a tamarack and black spruce scrub layer.

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This muskeg community is found in the sub-boreal regions of the Great Lakes in the United States and is widespread in central Canada.

USFS ECOREGIONS: 212He:CCC, 212Hh:CCC, 212Hi:CCC, 212Hj:CCC, 212Hl:CCC, 212Hq:CCC, 212Hs:CCC, 212Hu:CCC, 212Ia:CCC, 212Ja:CCC, 212Jn:CCC, 212Kb:CCC, 212La:CCC, 212Lb:CCC, 212Lc:CCC, 212Ld:CCC, 212Ma:CCC, 212Mb:CCC, 212Na:CCC

CONSERVATION REGIONS: 47:C, 48:C

STATES: MI MN WI **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY:

MI	muskeg =
MN	open sphagnum bog raised subtype +
WI	muskeg (black spruce semi-treed bog subtype) =

OTHER SYNONYMY: Black Spruce / Leatherleaf / Sphagnum (V38) (Sims et al. 1989) =, Semi-treed bog: black spruce / ericaceous shrub / Sphagnum (W25) (Harris et al. 1996) =

USNVC HIERARCHY: CHAMAEDAPHNE CALYCULATA SATURATED DWARF-SHRUBLAND ALLIANCE (IV.A.1.N.g)

Vaccinium corymbosum - Gaylussacia baccata - Photinia melanocarpa / Calla palustris Shrubland

Highbush Blueberry - Black Huckleberry - Black Chokeberry / Water Arum Shrubland

Highbush Blueberry Poor Fen CEGL005085

DESCRIPTION: The dominant shrub is usually *Vaccinium corymbosum*. Other associated shrubs include *Photinia melanocarpa (= Aronia melanocarpa), Gaylussacia baccata, Ilex verticillata*, and *Nemopanthus mucronatus*. Characteristic herbs include *Calla palustris, Carex trisperma, Osmunda cinnamomea, Sarracenia purpurea*, and *Maianthemum trifolium (= Smilacina trifolia)*. Characteristic peat mosses include *Sphagnum centrale, Sphagnum fimbriatum, Sphagnum magellanicum*, and *Sphagnum capillifolium (= Sphagnum nemoreum)*. Stunted trees, including *Acer rubrum*, may be present at a low density and less than 25% cover. (Reschke 1990, Anderson 1996).

In Ohio, this community forms open stands in zones or patches in fens and bogs, or sometimes cover the entire area. The water is usually nutrient poor and acidic (Reschke 1990).

COMMENTS: *3, MCS*. This type is considered a poor fen/bog in Ohio. Characteristics in Michigan and Ontario need to be determined. As of August 1998, all New York EOs are tracked as *Vaccinium corymbosum / Sphagnum spp*. Shrubland (CEGL006190), but it probably makes sense to only include southeastern New York (including Catskills?) and Lower New England with CEGL006190, where *Rhododendron viscosum* can be a codominant and *Rhododendron canadense* is sometimes present. This association (CEGL005085) then can be extended to western (and northern?) New York and adjacent Ontario and Quebec.

CONSERVATION RANK: *G2G3.* Status is dependent on how the community is defined. If this community is restricted to the eastern parts of the Great Lakes basin, then it has fewer than 50 occurrences in Indiana, Ohio, Ontario, Pennsylvania, New York, and possibly Michigan. If this is the same community as in the ECS classification (*Vaccinium corymbosum / Sphagnum* spp. shrubland), then it is more widespread and there are probably over 100 occurrences.

DISTRIBUTION: This highbush blueberry community is a weakly minerotrophic peatland found in the midwestern and northeastern United States and adjacent Canada, ranging from Indiana east through Ohio and Ontario, perhaps to western New York.

USFS ECOREGIONS: 221Fa:CCC, 221Fc:CCC, 222Ie:CCC, 222Jc:CCC, 222Jh:CCC, 222Ji:CCC, M221:?
CONSERVATION REGIONS: 45:C, 48:C, 49:C
STATES: IN MI? NY OH **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IN	circumneutral bog +
MI?	no state equivalent
OH	tall shrub bog =

OTHER SYNONYMY:

USNVC HIERARCHY: VACCINIUM CORYMBOSUM SATURATED SHRUBLAND ALLIANCE (III.B.2.N.g)

* Nonstandard type (needs review)

Northern Patterned Poor Fen Complex*

Northern Patterned Poor Fen Complex

Northern Patterned Poor Fen Complex CECX002006

DESCRIPTION: Structure of the vegetation is reflected in the microtopography of the peatland. There are high to intermediate hummocks (strings) with hollows or flats (flarks) comprised of a sphagnum lawn. Substrate is a fibric peat. The hollows generally contain a lawn of *Sphagnum* spp. (including *Sphagnum angustifolium*) and *Carex oligosperma, Equisetum fluviatile, Menyanthes trifoliata*, and *Scheuchzeria palustris*. *Carex chordorrhiza* can also be present. The strings (or hummocks) are shrub-dominated and contain *Betula pumila, Chamaedaphne calyculata*, and *Andromeda polifolia*. Scattered short stems (<2 m) of *Picea mariana* and *Larix laricina* cover less than 10% of the area. The herbaceous layer on the hummocks contains *Carex oligosperma, Carex limosa, Drosera rotundifolia, Maianthemum trifolium*, and *Sarracenia purpurea*. Mosses include *Sphagnum angustifolium, Sphagnum fuscum*, and *Sphagnum magellanicum*. Patterning is diagnostic of the type, as is the presence of a few minerotrophic indicators, such as *Betula pumila*. This type is somewhat wet, and *Carex oligosperma* is more common than *Carex lasiocarpa* (Harris et al. 1996).

Substrate is a fibric peat. These peatlands are exposed to low levels of mineral-rich groundwater, and are typically found in the margins of larger peatlands (Harris et al. 1996). Glaser (1992a) summarizes the various explanations given to the formation of the string-flark, or hummock-hollow microtopography that comprise this complex.

COMMENTS: *2, MCS*. This type appears to represent a complex of Northern Graminoid Poor Fen, *Carex lasiocarpa - Carex oligosperma / Sphagnum* spp. Herbaceous Vegetation (CEGL002265) and, typically, *Larix laricina / Chamaedaphne calyculata / Carex lasiocarpa* Shrubland (CEGL005226), though some Bog Birch/Leatherleaf Rich Fen, *Betula pumila / Chamaedaphne calyculata / Carex lasiocarpa* Shrubland (CEGL002494) may also occur. This type can be compared and contrasted with the Northern Patterned Rich Fen Complex (CECX002007).

CONSERVATION RANK: *G4.*

DISTRIBUTION: This patterned poor fen represents a complex of strings and flarks in peatlands in the boreal regions of the Great Lakes and central Canada, ranging from Michigan to Minnesota, and northward into parts of central Canada, from Quebec to Manitoba, and possibly elsewhere.

USFS ECOREGIONS: 212Hh:CCC, 212Hi:CCP, 212Hj:CCP, 212Hl:CCC, 212Jm:CCC, 212La:CCC, 212Lb:CCC, 212Lc:CCP, 212Mb:CPP, 212Na:CCP, 212Nb:CCP, 212Nc:CCP, 212Nd:CCC
CONSERVATION REGIONS: 47:C, 48:C
STATES: MI **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY: MI patterned fen +

OTHER SYNONYMY:

USNVC HIERARCHY: N/A

* Nonstandard type (needs review)

Northern Patterned Rich Fen Complex*

Northern Patterned Rich Fen Complex

Northern Patterned Rich Fen Complex CECX002007

DESCRIPTION: Shrubs and stunted trees dominate the physiognomy. This scrub layer contains *Betula pumila, Chamaedaphne calyculata, Larix laricina, Ledum groenlandicum, Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda), Rhamnus alnifolia, Salix pedicellaris*, and *Thuja occidentalis*. The dwarf-shrub layer contains *Andromeda polifolia, Juniperus horizontalis, Lonicera villosa*, and *Vaccinium oxycoccos*. The herb-rich layer contains graminoids such as *Carex interior, Carex lasiocarpa, Carex limosa, Carex livida, Muhlenbergia glomerata, Trichophorum caespitosum (= Scirpus cespitosus)*, and *Trichophorum alpinum (= Scirpus hudsonianus)*. Common forbs include *Equisetum fluviatile, Galium labradoricum, Maianthemum trifolium, Menyanthes trifoliata, Sarracenia purpurea, Solidago uliginosa, Triantha glutinosa (= Tofieldia glutinosa)*, and *Triglochin maritima*. Occasionally, locally abundant species include *Carex exilis* and *Cladium mariscoides*. The moss layer contains brown mosses, such as *Campylium stellatum, Drepanocladus revolvens, Scorpidium scorpioides* (eastern part of the range), and *Tomentypnum nitens*, with patches of *Sphagnum* spp. Submergent aquatics, such as *Utricularia intermedia* and *Utricularia minor*, may be found in the flarks (Harris et al. 1996).

Stands are typically found in water tracks of large peatlands, perpendicular to the water flow, where strings (hummocks) and flarks (hollows) form (Harris et al 1996). This patterning usually occurs nearer to the main flow through the peatland. Flarks may have muddy bottoms, with decomposing peat. Glaser (1992a) summarizes the various explanations given to the formation of the string-flark, or hummock-hollow microtopography that comprise this complex.

COMMENTS: *2, MCS*. Description is taken largely from northern Ontario studies by Harris et al. (1996). The associations that occur in this type include the rich shrub fen type, *Betula pumila / Chamaedaphne calyculata / Carex lasiocarpa* Shrubland (CEGL002494), and the rich graminoid fen type *Carex lasiocarpa - Carex buxbaumii - Scirpus cespitosus* Boreal Herbaceous Vegetation (CEGL002500). Some examples may also contain the extremely rich shrub fen type, *Betula pumila - Pentaphylloides floribunda / Carex lasiocarpa - Eriophorum alpinum* Shrubland (CEGL002495). Compare with the Northern Patterned Poor Fen Complex (CECX002006), which can occur in the same peatland as this type.

CONSERVATION RANK: *G3G4.*

DISTRIBUTION: This patterned rich fen community is found in peatlands in the Upper Great Lakes region of the United States and Canada, and in the northeastern United States and central Canada, ranging from Minnesota to Michigan, and into central Canada, from Manitoba to Quebec.

USFS ECOREGIONS: 212Hh:CCC, 212Hi:CCC, 212Hj:CCC, 212Hl:CCC, 212Hq:CCP, 212Hr:CCP, 212Hs:CCP, 212Ht:CCP, 212Hv:CCP, 212Hw:CCP, 212Hx:CCP, 212Jj:CPP, 212Jm:CPP
CONSERVATION REGIONS: 47:P, 48:C
STATES: ME? MI **PROVINCES:** MB? ON?

MIDWEST HERITAGE SYNONYMY: MI patterned fen +

OTHER SYNONYMY:

USNVC HIERARCHY: N/A

1.2. Rich Peat Fens

Betula pumila - Dasiphora fruticosa ssp. floribunda / Carex lasiocarpa - Trichophorum alpinum Shrubland

Bog Birch - Shrubby-cinquefoil / Wiregrass Sedge - Alpine Cottongrass Shrubland

Bog Birch - Shrubby-cinquefoil Rich Boreal Fen CEGL002495

DESCRIPTION: Shrubs dominate the stand, covering at least 25% of the area. Dominants include *Betula pumila, Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda), Salix* spp. (including *Salix pedicellaris*). Scrubby forms of the tree species *Thuja occidentalis* and *Larix laricina* often occur with the shrubs on the hummocks. Other shrubs and dwarf-shrubs include *Andromeda polifolia, Chamaedaphne calyculata, Vaccinium oxycoccos* and others. The herbaceous layer is dominated by *Carex lasiocarpa, Carex buxbaumii, Carex livida*, and *Calamagrostis stricta*. Other graminoids include *Trichophorum alpinum (= Scirpus hudsonianus), Carex interior* and *Carex limosa* (MNNHP 1993, Harris et al. 1996).

Stands occur in water tracks of large peatlands, that have a nutrient-rich groundwater. Water pH is slightly acid to circumneutral (5.8-7.8) (MNNHP 1993, Harris et al. 1996).

COMMENTS: *2, MCS*. *Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda)* may be a useful addition or replacement for *Salix* spp. in the alliance name. Localized areas of somewhat calcium-rich groundwater are placed into *Carex lasiocarpa - Trichophorum caespitosum - Rhynchospora capillacea / Andromeda polifolia* Herbaceous Vegetation (CEGL002496). The Northern Patterned Rich Fen Complex (CECX002007) includes both this rich shrub fen and the boreal rich graminoid fen, *Carex lasiocarpa - Carex buxbaumii - Trichophorum caespitosum* Boreal Herbaceous Vegetation (CEGL002500), in a string (hummock) and flark (hollow) pattern (see Harris et al. 1996). This type may occur in Michigan, but further verification is needed before listing it (D. Albert, P. Comer pers. comm.). In fact, in Michigan, it may be very similar to the Great Lakes Shrubby-cinquefoil-Sweet Gale Rich Shore Fen type, *Dasiphora fruticosa ssp. floribunda - Myrica gale* Rich Shore Fen Shrubland (CEGL005275).

CONSERVATION RANK: *G3G5.* This type is uncommon in the United States, but its status in Canada should be determined before refining the rank.

DISTRIBUTION: This extremely rich boreal shrub fen community is found in the northern Great Lakes region of the United States and Canada, and probably elsewhere in central Canada, ranging from Minnesota and possibly Maine, northward to Manitoba, Ontario, and possibly Quebec.

USFS ECOREGIONS: 212He:CC?, 212Hh:CCP, 212Hj:CCP, 212Hl:CCC, 212Kb:CCC, 212La:CCC, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP
CONSERVATION REGIONS: 47:C, 48:C
STATES: ME? MI MN **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY: MI northern rich fen +
MN rich fen (boreal section) shrub subtype +

OTHER SYNONYMY: Extremely rich fen: ericaceous shrub / sedge / brown moss (W17) (Harris et al. 1996). This is a patterned rich fen that may describe both this type and rich graminoid fen (CEGL002500). It may also include the boreal calcareous seepage fen (CEGL002496)., Strings (Glaser 1992b) =

USNVC HIERARCHY: BETULA PUMILA - (SALIX SPP.) SATURATED SHRUBLAND ALLIANCE (III.B.2.N.g)

Betula pumila / Chamaedaphne calyculata / Carex lasiocarpa Shrubland

Bog Birch / Leatherleaf / Wiregrass Sedge Shrubland

Bog Birch – Leatherleaf Rich Fen CEGL002494

DESCRIPTION: The shrub cover is at least 25%, dominated by a combination of *Betula pumila* and ericaceous shrubs, including *Andromeda polifolia, Chamaedaphne calyculata, Ledum groenlandicum*, and *Vaccinium oxycoccos*. Other minerotrophic shrubs include *Lonicera villosa, Rhamnus alnifolia, Rubus arcticus ssp. acaulis (= Rubus acaulis), Rubus pubescens*, and *Salix pedicellaris*. Scattered, small (2-10 m) tree stems of *Larix laricina, Picea mariana*, and *Thuja occidentalis* are present at low cover. There is a diverse forb, graminoid, and moss cover, at least in the richer examples of this type. The graminoids include *Carex chordorrhiza, Carex lasiocarpa, Carex leptalea*, and *Eriophorum viridicarinatum*. Forbs include *Drosera rotundifolia, Equisetum fluviatile, Maianthemum trifolium, Menyanthes trifoliata, Comarum palustre (= Potentilla palustris), Sarracenia purpurea*, and *Solidago uliginosa*. The moss layer contains *Aulacomnium palustre, Pleurozium schreberi, Sphagnum angustifolium*, and *Sphagnum capillifolium*. Less frequent are *Campylium stellatum, Sphagnum fuscum*, and *Tomentypnum nitens* (Harris et al. 1996).

Stands are found on the margins of water tracks of large peatlands, or in the interior of small basins that are relatively isolated from run-off (Harris et al. 1996).

COMMENTS: *2, MCS*. This "moderately rich" to somewhat poor (or medium) fen is intermediate between the rich bog birch - shrubby-cinquefoil fen, *Betula pumila - Dasiphora fruticosa ssp. floribunda / Carex lasiocarpa - Trichophorum alpinum* Shrubland (CEGL002495) and both the Tamarack Scrub Poor Fen, *Larix laricina / Chamaedaphne calyculata / Carex lasiocarpa* Shrubland (CEGL005226), and the Leatherleaf Shrub Poor Fen, *Chamaedaphne calyculata / Carex oligosperma / Sphagnum* spp. Poor Fen Dwarf-Shrubland (CEGL005277). This parallels the work in northern Ontario (Harris et al. 1996), but field-based survey is needed to assist in establishing the practicality of these splits. In Wisconsin, this type is known from extensive areas in the Bad River - Kakogan Sloughs along Lake Superior. Otherwise, it is usually a minimal zone or inclusion. Note that some Heritage program names refer to this type as a poor fen.

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This bog birch - leatherleaf shrub fen is found in the northern Great Lakes region of the United States and Canada, and probably elsewhere, ranging from Minnesota east to possibly Maine, and northward into Canada in Manitoba eastward to possibly Quebec.

USFS ECOREGIONS: 212Hb:CC?, 212Hh:CCP, 212Hj:CCC, 212Hp:CCP, 212Hq:CCP, 212Ja:CCP, 212Jc:CCP, 212Jh:CCC, 212Jj:CCP, 212Jl:CCP, 212Jm:CCC, 212Ka:CC?, 212Kb:CCC, 212La:CCC, 212Ma:CCP, 212Mb:CCC, 212Na:CCC, 212Nb:CCP, 212Nc:CCC, 222Ka:CCC, 222Kf:CCC, 222Mc:CCC, 222Md:CCC, 222Na:CCC

CONSERVATION REGIONS: 35:C, 46:C, 47:C, 48:C

STATES: ME? MI MN WI **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY:
MI northern rich fen +
MN poor fen shrub subtype =
WI rich fen (bog birch-leatherleaf subtype) =

OTHER SYNONYMY: Moderately rich fen: tamarack-black spruce / ericaceous shrub (W18) (Harris et al. 1996) =

USNVC HIERARCHY: BETULA PUMILA - (SALIX SPP.) SATURATED SHRUBLAND ALLIANCE (III.B.2.N.g)

Carex lasiocarpa - Carex buxbaumii - Trichophorum caespitosum Boreal Herbaceous Vegetation

Wiregrass Sedge - Brown Bog Sedge - Deerhair Bulrush Boreal Herbaceous Vegetation

Boreal Sedge Rich Fen CEGL002500

DESCRIPTION: Vegetation is typically dominated by graminoids and *Sphagnum* spp. with low cover of ericaceous shrubs on the hummocks and a very scattered tree layer of *Picea mariana, Larix laricina*, and occasional *Thuja occidentalis*. Microtopography can consist of wet hollows with scattered low to intermediate hummocks. The graminoid layer is dominated by *Carex lasiocarpa, Carex limosa, Carex livida, Rhynchospora alba*, and *Trichophorum caespitosum (= Scirpus cespitosus)*. Other associated graminoids may include *Carex exilis* and *Trichophorum alpinum (= Scirpus hudsonianus)*. Typical herbs include *Drosera rotundifolia, Drosera intermedia, Equisetum fluviatile, Menyanthes trifoliata, Sarracenia purpurea*, and *Scheuchzeria palustris*. Mosses include the brown mosses, such as *Campylium stellatum*. The ericaceous shrubs include *Andromeda polifolia, Betula pumila, Chamaedaphne calyculata*, and *Vaccinium oxycoccos* (MNNHP 1993, Harris et al. 1996).

Stands are found in peatlands with moderate exposure to mineral-rich groundwater including wet, floating mats of basin fens, shores above the level of seasonal flooding, and larger peatlands. Substrate is saturated fibric to mesic peat (MNNHP 1993, Harris et al. 1996).

COMMENTS: *2, MCS*.

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This rich graminoid fen type is found in the northern Great Lakes region of the United States and Canada, ranging from Minnesota east to Michigan and northward into Ontario and probably other parts of central Canada .

USFS ECOREGIONS: 212He:CCC, 212Hj:CCC, 212Hl:CCC, 212Hm:CCC, 212Hq:CCC, 212Hr:CCC, 212Hy:CCC, 212Jm:CCC, 212Kb:CCC, 212La:CCC, 212Ma:CPP, 212Mb:CPP, 212Na:CCC, 212Nb:CCP, 212Nc:CCC, 212Nd:CCP, 222Na:CCC
CONSERVATION REGIONS: 35:C, 47:C, 48:C
STATES: MI MN WI **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY: MI northern rich fen +
MN rich fen (boreal section) floating mat subtype; rich fen (boreal section) sedge subtype -
WI calcareous fen (boreal subtype) =

OTHER SYNONYMY: Moderately rich fen: graminoid (W19) (Harris et al. 1996) =, Flarks (Glaser 1992b) ?, Featureless water tracks (Glaser 1992b) F

USNVC HIERARCHY: CAREX LASIOCARPA SATURATED HERBACEOUS ALLIANCE (V.A.5.N.m)

Carex lasiocarpa - Trichophorum caespitosum - Rhynchospora capillacea / Andromeda polifolia Herbaceous Vegetation

Wiregrass Sedge - Deerhair Bulrush - Limestone Beaksedge / Bog Rosemary Herbaceous Vegetation

Boreal Extremely Rich Seepage Fen CEGL002496

DESCRIPTION: The vegetation is dominated by open sedge and rush species. The dominant species include *Carex lasiocarpa, Muhlenbergia glomerata, Rhynchospora capillacea*, and *Trichophorum caespitosum (= Scirpus cespitosus)*. Other associates include the dwarf-shrubs *Andromeda polifolia* and *Vaccinium oxycoccos*, and the herbs *Sarracenia purpurea* (MNNHP 1993).

Stands occur on shallow or deep peaty soils in areas of calcareous discharge. The surface water may be circumneutral (pH 6.8-8.0), with high concentrations of dissolved salts (typically calcium, but also magnesium) that often form a marl precipitate. The discharge water is low in oxygen, which is likely important in inhibiting dense vegetation growth and favoring heliophytic vascular and moss species (MNNHP 1993, Harris et al. 1996).

COMMENTS: *2, MCS*. A related Great Lakes rich shore fen type *Calamagrostis canadensis - Carex viridula - Cladium mariscoides - Lobelia kalmii* Herbaceous Vegetation (CEGL005115) may overlap with this type. A related type that is quite nutrient-rich but not found on discharge areas is the Boreal Sedge Rich Fen, *Carex lasiocarpa - Carex buxbaumii - Trichophorum caespitosum* Boreal Herbaceous Vegetation (CEGL002500). The species in the type name should perhaps be changed from *Trichophorum caespitosum* to *Scirpus hudsonianus*, which now equals *Trichophorum alpinum* (Kartesz 1999).

CONSERVATION RANK: *G2Q.* There are probably fewer than 100 occurrences, and there may be fewer than 20 occurrences of this community rangewide. Currently there are two occurrences documented from Minnesota. This community is reported from Minnesota (where it is ranked S2), Manitoba (S?), and Ontario (S?). It is reported from two ecoregion subsections: the Lake Agassiz Lowlands subsection, and the Border Lakes subsection.

DISTRIBUTION: This calcareous seepage fen is found in northern Minnesota and adjacent boreal regions in Canada, and possibly elsewhere in the northern Great Lakes region, ranging from Minnesota to Ontario and Manitoba, and probably adjacent areas.

USFS ECOREGIONS: 212La:CCC, 212Ma:CCP, 212Mb:CCC
CONSERVATION REGIONS: 47:C, 48:C
STATES: MN **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY: MN calcareous seepage fen boreal subtype =

OTHER SYNONYMY: Extremely rich fen: ericaceous shrub / sedge / brown moss (W17) (Harris et al. 1996). This is a patterned rich fen that may describe this type, as well as aspects of rich graminoid fen (CEGL002500), the rich shrub fen or their combination in a patterned peatland (CEGL005117)., Spring-fen channels (Glaser 1992b) =

USNVC HIERARCHY: CAREX LASIOCARPA SATURATED HERBACEOUS ALLIANCE (V.A.5.N.m)

Myrica gale Fen Shrubland

Sweet Gale Fen Shrubland

Sweet Gale Shrub Fen CEGL005141

DESCRIPTION: This shrub fen has not been well-described by any authors. Stands are dominated by *Myrica gale*, and may be codominated by *Chamaedaphne calyculata* in more nutrient-poor examples, and by *Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda)* in richer examples. Further work is needed to determine the characteristics of this type.

COMMENTS: *3, MCS*. This type may overlap in concept with other shrub fens, e.g., the leatherleaf-sweet gale shore fen, *Chamaedaphne calyculata - Myrica gale / Carex lasiocarpa* Dwarf-shrubland (CEGL005228), and may not warrant its own type. Ontario (Lee et al. 1998) list a sweet gale shore fen type. In Minnesota, *Myrica gale* is found in the poor fen, shrub subtype or perhaps an open bog, intermediate subtype. See also types in the open shrub/herb fen category, as used in the Eastern Region (formation V.A.7.N.p), e.g., *Myrica gale / Carex lasiocarpa - Lobelia kalmii - Trichophorum alpinum* Shrub Herbaceous Vegetation (CEGL006160).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This sweet gale shrub fen is found in the northern Great Lakes region of the United States and Canada.

USFS ECOREGIONS: 212Hw:???
CONSERVATION REGIONS: 48:C
STATES: MI? MN? **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI? no state equivalent
MN? rich fen (boreal section) shrub subtype ?

OTHER SYNONYMY: Low shrub shore fen: leatherleaf - sweet gale / graminoid (W15) (Harris et al. 1996) ?. Myrica gale dominated stands may occur elsewhere than in shore fens.

USNVC HIERARCHY: DASIPHORA FRUTICOSA SSP. FLORIBUNDA - MYRICA GALE - (CAREX LASIOCARPA) SATURATED SHRUBLAND ALLIANCE (III.B.2.N.g)

Thuja occidentalis - (Myrica gale) / Trichophorum alpinum / Drepanocladus spp. Shrubland

Northern White-cedar - (Sweet Gale) / Alpine Cottongrass / Brown Moss Species Shrubland

White-cedar - Sweet Gale Scrub Fen CEGL005193

DESCRIPTION: The vegetation contain a scrub layer between 1 and 2 m tall dominated by *Thuja occidentalis*, with occasional *Myrica gale*. The ground layer contains a rich diversity of herbs and mosses, including *Trichophorum alpinum (= Scirpus hudsonianus)* and *Drepanocladus* spp.

Stands contain at least 40 cm or more of brown moss or sedge peat. Stands are rarely flooded, primarily saturated, and the pH is slightly alkaline to mildly acidic.

COMMENTS: *3, MCS*. Type concept is taken from the southern Ontario list of vegetation types by Lee et al. (1998) and needs rangewide review. Type may closely resemble a *Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda)* shrub fen type, *Dasiphora fruticosa ssp. floribunda / Carex interior - Carex flava - Sarracenia purpurea* Shrub Herbaceous Vegetation (CEGL005140). *Trichophorum alpinum* is the Kartesz (1999) name for *Scirpus hudsonianus*. See also *Betula pumila - Dasiphora fruticosa ssp. floribunda / Carex lasiocarpa - Trichophorum alpinum* Shrubland (CEGL002495) for a similar, but more boreal, rich fen.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This white cedar scrub fen type is found in southern Ontario, Canada, and possibly in adjacent northern areas of the Great Lakes states in the United States.

USFS ECOREGIONS: 212Ib:CCC, 212J:CC, 212La:CCC
CONSERVATION REGIONS:
STATES: MN? **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MN? rich fen (boreal section) shrub subtype ?

OTHER SYNONYMY: Extremely rich fen: ericaceous shrub / sedge / brown moss (W17) (Harris et al. 1996) ?

USNVC HIERARCHY: DASIPHORA FRUTICOSA SSP. FLORIBUNDA - MYRICA GALE - (CAREX LASIOCARPA) SATURATED SHRUBLAND ALLIANCE (III.B.2.N.g)

Alnus incana - Salix spp. - Betula pumila / Chamaedaphne calyculata Shrubland

Speckled Alder - Willow Species - Bog Birch / Leatherleaf Shrubland

Bog Birch-willow Shore Fen CEGL005227

DESCRIPTION: The shrub layer of this type is dominated by *Betula pumila var. glandulifera (= Betula glandulifera)*, with *Alnus incana* and *Salix* spp. as codominants (including *Salix pyrifolia, Salix planifolia, Salix pedicellaris*, and *Salix petiolaris*). Other less constant tall shrubs include *Cornus sericea (= Cornus stolonifera)* and *Rhamnus alnifolia*. Shrubs are typically 1.5-3 m tall and coverage ranges from 30-80%. *Chamaedaphne calyculata* dominates the dwarf-shrub layer, with lesser amounts of *Ledum groenlandicum, Andromeda polifolia var. glaucophylla (= Andromeda glaucophylla), Kalmia polifolia, Rubus arcticus ssp. acaulis (= Rubus acaulis), Rubus idaeus*, and *Rubus pubescens*. Cover of these dwarf-shrubs is typically 60-90%. Often being shaded out by this dense dwarf-shrub layer, the cover of herbaceous plants is variable (20-60%). The most abundant species are *Carex lacustris, Carex leptalea, Carex rostrata, Carex trisperma, Maianthemum trifolium*, and *Comarum palustre (= Potentilla palustris)*. *Calamagrostis canadensis, Carex chordorrhiza, Carex lasiocarpa, Eriophorum vaginatum var. spissum (= Eriophorum spissum)*, and *Viola* spp. are also common at low density. The nonvascular stratum in northern Minnesota is dominated by *Sphagnum magellanicum, Sphagnum angustifolium, Sphagnum centrale, Sphagnum girgensohnii*, and *Sphagnum fallax*. These species typically comprise 90-100% cover (Harris et al. 1996, M. Smith pers. comm. 1999).

This type is most commonly found along the minerotrophic margins of confined basin peatlands, associated with peatland lakeshore complexes or on "lagg" zones at edges of peatlands where periodic exposure to flooding occurs from groundwater runoff. The substrate is deep fibric to mesic peat. The water regime is saturated to seasonally flooded. Hummock and hollow microtopography is well-developed (Harris et al. 1996).

COMMENTS: *2, MCS*. Type concept is that of a tall-shrub shore fen, as described by W16 of Harris et al. (1996). Rangewide review is needed.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This shrub shore fen is found in the northern Great Lakes region of the United States and Canada.

USFS ECOREGIONS: 212J:CC, 212La:CCC
CONSERVATION REGIONS:
STATES: MI? MN WI? **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:
MI? northern rich fen
MN rich fen (boreal section) +
WI? shore fen (tall shrub subtype?) ?

OTHER SYNONYMY: Tall shrub shore fen: speckled alder-willow / dwarf birch / ericaeous shrub (W16) (Harris et al. 1996) =

USNVC HIERARCHY: BETULA PUMILA - (SALIX SPP.) SATURATED SHRUBLAND ALLIANCE (III.B.2.N.g)

Calamagrostis canadensis - Carex viridula - Cladium mariscoides - Lobelia kalmii Herbaceous Vegetation

Bluejoint - Hairy Sedge - Twig-rush - Ontario Lobelia Herbaceous Vegetation

Great Lakes Sedge Rich Shore Fen CEGL005115

DESCRIPTION: These 'marly flats' contain a rich assemblage of calciphilic plants. Herbaceous species dominate parts of these areas. The dominant graminoid is *Calamagrostis canadensis*, but *Carex viridula* and *Lobelia kalmii* are key diagnostics of this type. Other diagnostic species include *Cladium mariscoides, Hypericum kalmianum, Dichanthelium acuminatum var. lindheimeri (= Panicum lindheimeri), Argentina anserina (= Potentilla anserina)*, and *Triglochin maritima*. Scattered shrubs, such as *Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda)* or *Myrica gale*, may be present, but shrub cover is less than 25% (Minc and Albert 1998). In Wisconsin, in coastal estuaries of Lake Superior, common associates include *Cladium mariscoides, Carex livida*, and *Triglochin maritima*. *Carex exilis* is codominant at several sites (E. Epstein pers. comm. 1999). On Isle Royale, a stand occurs in saturated peat on a wet depression of a lakeplain at Hidden Lake. Sedges dominate the vegetation. *Cladium mariscoides* is most abundant; other common herbs include *Carex lacustris, Rhynchospora alba*, and *Utricularia intermedia*. *Myrica gale* is the most abundant shrub. *Sphagnum* spp. form an incomplete cover (C. Reschke pers. comm. 1999).

This community is typically found on marly coastal sites in northern Lake Michigan, Lake Huron, and Lake Superior in the United States. These sites occupy embayments of open, sandy shorelines where limestone bedrock or cobble is at or near the surface. These sites have calcareous soils (with a pH as high as 8.2), resulting either from calcareous substrates, water flow off adjacent limestone bedrock or limestone-rich till, or algal precipitation of calcium carbonate in the relatively warm, carbonate saturated waters (Minc and Albert 1998). On Isle Royale, a stand occurs in saturated peat on a wet depression of a lakeplain at Hidden Lake (C. Reschke pers. comm. 1999).

COMMENTS: *3, MCS*. This type typically occurs as part of a Great Lakes Coastal Wetlands Complex (CECX002002). It is wetter and more herbaceous than the shrub-rich shore fen, *Dasiphora fruticosa ssp. floribunda - Myrica gale* Rich Shore Fen Shrubland (CEGL005275). Perhaps the shrub and graminoid type can be combined, depending on their spatial extent. Type concept was originally taken from the southern Ontario list of vegetation types by Lee et al. (1998), but it may, in fact, have been deleted by them and combined into their Graminoid Coastal Meadow Marsh type, which is tracked globally as the interdunal wetland type, *Dasiphora fruticosa ssp. floribunda / Cladium mariscoides - Juncus balticus - (Rhynchospora capillacea)* Herbaceous Vegetation (CEGL005105). That type is a more southern Great Lakes region type that may occur either on the Great Lakes shoreline or on inland lakes. This type may be very similar to an inland extremely rich graminoid fen, *Carex lasiocarpa - Trichophorum caespitosum - Rhynchospora capillacea / Andromeda polifolia* Herbaceous Vegetation (CEGL002496).

CONSERVATION RANK: *G1G2.* Eleven sites totaling 1100 ha were identified by Minc and Albert (1998) as part of their Northern Rich Fen Complex, but it is not known if all sites contained this type and what its specific area is. Ten of the sites were ranked A or B quality. Ten of the eleven sites are in Michigan and one is in Wisconsin.

DISTRIBUTION: This community is typically found on marly coastal sites in northern Lake Michigan, Lake Huron, and Lake Superior in the United States, in both northern Michigan and northern Wisconsin, and possibly in Ontario, Canada.

USFS ECOREGIONS: 212H:CC
CONSERVATION REGIONS: 48:C
STATES: MI WI? **PROVINCES:** ON?

MIDWEST HERITAGE SYNONYMY: MI northern rich fen +
WI? rich fen (Great Lakes shoreline subtype?) ?

OTHER SYNONYMY:

USNVC HIERARCHY: CALAMAGROSTIS CANADENSIS - CAREX VIRIDULA - CLADIUM MARISCOIDES - LOBELIA KALMII SATURATED HERBACEOUS ALLIANCE (V.A.5.N.m)

Carex lasiocarpa - (Carex rostrata) - Equisetum fluviatile Herbaceous Vegetation

Wiregrass Sedge - (Swollen-beak Sedge) - Water Horsetail Herbaceous Vegetation

Wiregrass Sedge Shore Fen CEGL005229

DESCRIPTION: Graminoids dominate the stand, with shrub cover typically much less than 25%. *Myrica gale* can be among the more common shrubs. The graminoid *Carex lasiocarpa* can form extensive 'lawns.' Other herbaceous species present include *Carex rostrata, Eleocharis elliptica, Equisetum fluviatile, Comarum palustre (= Potentilla palustris), Rhynchospora alba, Triadenum fraseri, Utricularia intermedia*, and *Utricularia minor*. *Menyanthes trifoliata* can occur at high cover, especially at the outer edge of the floating mat (Harris et al. 1996).

This community is found typically on floating (or occasionally grounded) mats on the edges of lakes and streams. Lakes and streams have low wave and current energy and seasonally flood the mat. Permanent surface pools and small hummocks with *Sphagnum* spp. and ericaceous shrubs may be present. The substrate is a mat of fibric to mesic peat held together by roots and rhizomes.

COMMENTS: *2, MCS*. This type is wetter than low shrub shore fen, *Chamaedaphne calyculata - Myrica gale / Carex lasiocarpa* Dwarf-shrubland (CEGL005228), and has structural similarities to bluejoint meadows, but the mat tends to float and the surface is less frequently flooded (Harris et al. 1996). Shore fens may also resemble Narrow-leaf Sedge Organic meadow marshes in Ontario and the concept of shore fen has not been standardized across the province yet (W. Bakowsky pers. comm. 1999). In the Great Lakes shore fens, a more nutrient-rich type has been described separately, *Calamagrostis canadensis - Carex viridula - Cladium mariscoides - Lobelia kalmii* Herbaceous Vegetation (CEGL005115).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This community is found typically on floating (or occasionally grounded) mats on the edges of lakes and streams in the Great Lakes region of the United States and Canada. It ranges from northern Minnesota and adjacent Ontario eastward to localized areas of Michigan and New York. In New York, one site (Deer Creek) is known along the shores of eastern Lake Ontario.

USFS ECOREGIONS: 212La:CCC, 222Ie:CCC
CONSERVATION REGIONS: 47:C, 48:C
STATES: MI? MN NY WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:
MI? northern rich fen
MN rich fen (boreal section) +
WI shore fen (graminoid subtype) =

OTHER SYNONYMY: Open graminoid shore fen: wire sedge (W14) (Harris et al. 1996) =

USNVC HIERARCHY: CAREX LASIOCARPA SATURATED HERBACEOUS ALLIANCE (V.A.5.N.m)

Chamaedaphne calyculata - Myrica gale / Carex lasiocarpa Dwarf-shrubland

Leatherleaf - Sweet Gale / Wiregrass Sedge Dwarf-shrubland

Leatherleaf - Sweetgale Shore Fen CEGL005228

DESCRIPTION: Hummocks with *Sphagnum* spp. and ericaceous shrubs are often present, but small in area. Shallow surface pools of water may persist throughout the growing season. Low shrubs dominate the stands, generally over 60%. Dominant species include *Chamaedaphne calyculata* and *Myrica gale*. *Salix pedicellaris* is often present. The herbaceous layer is variable in cover and composition, sometimes shaded out by the heavy shrub cover. Species include *Calamagrostis canadensis, Carex aquatilis, Carex lasiocarpa, Carex rostrata*, and *Comarum palustre (= Potentilla palustris)*. Diagnostic features of the type are high cover of *Chamaedaphne calyculata* with one or more of the following minerotrophic species present: *Myrica gale, Betula pumila, Salix* spp., *Carex lacustris, Carex lasiocarpa, Typha latifolia, Calamagrostis canadensis*, and *Iris versicolor* (Harris et al. 1996).

This community is typically found on floating mats on the edges of lakes and streams. Stands occur where there is low wave and current energy, and where seasonal flooding may be expected (Harris et al. 1996). Seasonal flooding apparently tends to produce somewhat intermediate nutrient conditions, but depending on degree of flooding and water chemistry, individual stands may vary from moderately poor to moderately rich.

COMMENTS: *2, MCS*. Diagnostic features of the type are high cover of *Chamaedaphne calyculata* with one or more of the following minerotrophic species present: *Myrica gale, Betula pumila var. glandulifera, Salix* spp., *Carex lacustris, Carex lasiocarpa, Typha latifolia, Calamagrostis canadensis*, and *Iris versicolor*. Depending on the site, nutrient conditions may vary; however, rich shore fens along the Great Lakes are treated as a separate type, *Dasiphora fruticosa ssp. floribunda - Myrica gale* Rich Shore Fen Shrubland (CEGL005275). This type differs from the Leatherleaf Bog, *Chamaedaphne calyculata - Ledum groenlandicum - Kalmia polifolia* Bog Dwarf-shrubland (CEGL005278), and the Leatherleaf Poor Fen, *Chamaedaphne calyculata / Carex oligosperma / Sphagnum* spp. Poor Fen Dwarf-shrubland (CEGL005277) in that it harbors more minerotrophic indicator species which the Leatherleaf types lack, and tends to have less acidic indicators, such as *Carex oligosperma*. When cover of *Betula pumila var. glandulifera* and *Salix* spp. increases, this community can grade into a Bog Birch - Willow Shore Fen, *Alnus incana - Salix spp. - Betula pumila / Chamaedaphne calyculata* Shrubland (CEGL005227), or a Dogwood - Pussy Willow swamp, *Cornus sericea - Salix spp. - (Rosa palustris)* Shrubland (CEGL002186). Greater than 25% cover of short (not dwarf) shrubs would warrant placing the stand into one of these other communities. This type is drier than graminoid shore fen, *Carex lasiocarpa - (Carex rostrata) - Equisetum fluviatile* Herbaceous Vegetation (CEGL005229), and is transitional to saturated rich and poor fens. Shore fens may also resemble organic shrub swamps in Ontario and the concept of shore fen has not been standardized across the province yet (W. Bakowsky pers. comm. 1999).

CONSERVATION RANK: *G4G5.* Type is expected to be fairly common in Canada.

DISTRIBUTION: This community is typically found on floating mats on the edges of lakes and streams in the Great Lakes region of the United States and Canada. It ranges from northern Minnesota and adjacent Ontario eastward to localized areas of Michigan and New York. In New York, one site (Deer Creek) is known along the shores of eastern Lake Ontario.

USFS ECOREGIONS: 212Ja:CCC, 212La:CCC, 222Ie:CCC
CONSERVATION REGIONS: 47:C, 48:C
STATES: MI? MN NY WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI? northern rich fen
MN rich fen (boreal section) +
WI shore fen (leatherleaf-sweetgale low shrub subtype) =

OTHER SYNONYMY: low shrub shore fen: leatherleaf-sweetgale / graminoid (W15) (Harris et al. 1996) =

USNVC HIERARCHY: CHAMAEDAPHNE CALYCULATA SATURATED DWARF-SHRUBLAND ALLIANCE (IV.A.1.N.g)

Dasiphora fruticosa ssp. floribunda - Myrica gale Rich Shore Fen Shrubland

Shrubby-cinquefoil - Sweet Gale Rich Shore Fen Shrubland

Shrubby-cinquefoil - Sweetgale Rich Shore Fen CEGL005275

DESCRIPTION: These 'marly flats' contain a rich assemblage of calciphilic plants. Short shrubs dominate parts of these areas. Typical dominants include *Myrica gale* and *Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda)*, generally over 60% (?). *Larix laricina* and *Salix pedicellaris* are often present. The herbaceous layer is variable in cover and composition, sometimes shaded out by the heavy shrub cover. Species include *Calamagrostis canadensis, Carex viridula, Carex lasiocarpa*, and *Cladium mariscoides* (Minc and Albert 1998).

These sites occupy embayments of open, sandy shorelines where limestone bedrock or cobble is at or near the surface. These sites have calcareous soils (with a pH as high as 8.2), resulting either from calcareous substrates, water flow off adjacent limestone bedrock or limestone-rich till, or algal precipitation of calcium carbonate in the relatively warm, carbonate saturated waters (Minc and Albert 1998).

COMMENTS: *3, MCS*. This type typically occurs as part of a Great Lakes Coastal Wetlands Complex (CECX002002). It is drier and more shrubby than the graminoid rich shore fen, *Calamagrostis canadensis - Carex viridula - Cladium mariscoides - Lobelia kalmii* Herbaceous Vegetation (CEGL005115). Perhaps the shrub and graminoid type can be combined, depending on their spatial extent.

CONSERVATION RANK: *G1G2.* Eleven sites were identified by Minc and Albert (1998) as part of their Northern Rich Fen Complex, totaling 1100 ha, but it is not known if all sites contained this type and what its specific area is. Ten of the sites were ranked A or B quality. Ten of the eleven sites are in Michigan and one is in Wisconsin.

DISTRIBUTION: This community is typically found on marly coastal sites in northern Lake Michigan and Lake Huron in the United States, in both northern Michigan and northern Wisconsin, and possibly in Ontario, Canada.

USFS ECOREGIONS: 212H:CC
CONSERVATION REGIONS: 48:C
STATES: MI WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI northern rich fen +
WI shore fen (Great Lakes subtype?) ?

OTHER SYNONYMY:

USNVC HIERARCHY: DASIPHORA FRUTICOSA SSP. FLORIBUNDA - MYRICA GALE - (CAREX LASIOCARPA) SATURATED SHRUBLAND ALLIANCE (III.B.2.N.g)

Cornus sericea - Cornus amomum - Photinia melanocarpa - Viburnum lentago Fen Shrubland

Red-osier Dogwood - Silky Dogwood - Black Chokeberry - Nannyberry Fen Shrubland

Western Allegheny Tall Shrub Rich Fen CEGL005088

DESCRIPTION: Stands of this type are dominated by shrubs, with over 50% cover, including both tall (>1 m) and short shrubs (<1 m). Tall shrubs include *Alnus incana, Photinia melanocarpa (= Aronia melanocarpa), Betula pumila, Cornus amomum, Cornus sericea, Salix candida, Salix serissima*, and *Viburnum lentago*. Low shrubs include *Lonicera oblongifolia, Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda), Rhamnus alnifolia*, and *Toxicodendron vernix*. More nutrient-poor stands may contain *Chamaedaphne calyculata, Gaylussacia baccata, Ilex verticillata*, and *Vaccinium corymbosum*. Trees, such as *Acer rubrum* or *Larix laricina*, may be present as saplings or stunted trees. Characteristic herbs include the graminoids *Carex aquatilis, Carex lacustris, Carex lasiocarpa*, and *Schoenoplectus acutus (= Scirpus acutus)*, and forbs and ferns, such as *Iris versicolor, Osmunda regalis, Sarracenia purpurea*, and *Thelypteris palustris*. Characteristic mosses include *Campylium stellatum* and *Sphagnum warnstorfii*, though *Sphagnum* cover varies from absent to patchy (Anderson 1996, Reschke 1990).

Stands of this type are found on moraines, especially where gravels permit calcareous seepage, and occur both in lake basins and stream valleys. Soils are organic, with strongly to weakly minerotrophic woody, saturated peat (Anderson 1996, Reschke 1990).

COMMENTS: *2, MCS*. This type appears to have a pH that varies from circumneutral to rich. Further work is needed to determine if this variability is too broad (see Ohio stands in particular). Characteristic ground layer species need to be determined. *Salix candida* and *Salix serissima* are associates, as well as *Toxicodendron vernix (= Rhus vernix)*. The more nutrient-poor (tall shrub bog) stands are probably best placed in the Highbush Blueberry Bog type, *Vaccinium corymbosum - Gaylussacia baccata - Photinia melanocarpa / Calla palustris* Shrubland (CEGL005085). This type is the tall-shrub fen equivalent of *Dasiphora fruticosa ssp. floribunda / Carex interior - Carex flava - Sarracenia purpurea* Shrub Herbaceous Vegetation (CEGL005140). Both of these types are derived from northeastern Ohio studies [see Anderson 1996], but are poorly understood rangewide. Ohio treats the short-shrub and tall-shrub components as zones within their northeastern (boreal transition) fens (Schneider and Cochrane 1997) .

CONSERVATION RANK: *G2Q*.

DISTRIBUTION: This tall-shrub fen community type is found in northeastern Ohio, particularly in the Allegheny region and probably elsewhere in the eastern Great Lakes area of the northeastern United States.

USFS ECOREGIONS: 212Ea:CCC, 212Ee:CCC, 222Ib:CCC, 222Ic:CCC, 222Ie:CCC, M221:P
CONSERVATION REGIONS: 48:C
STATES: NY OH **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: OH cinquefoil-sedge fen +

OTHER SYNONYMY:

USNVC HIERARCHY: CORNUS SERICEA - PHOTINIA MELANOCARPA - TOXICODENDRON VERNIX SATURATED SHRUBLAND ALLIANCE (III.B.2.N.g)

Dasiphora fruticosa ssp. floribunda / Carex interior - Carex flava - Sarracenia purpurea Shrub Herbaceous Vegetation

Shrubby-cinquefoil / Inland Sedge - Yellow Sedge - Purple Pitcherplant Shrub Herbaceous Vegetation

Western Allegheny Cinquefoil - Sedge Rich Fen CEGL005140

DESCRIPTION: Graminoids dominate, though forbs and dwarf-shrubs can be prominent. A tall-shrub layer swamp often surrounds the core fen area. Typical graminoids include the sedges *Carex aquatilis, Carex flava, Carex interior, Carex leptalea, Carex lacustris, Carex hystericina, Carex sterilis*, and *Carex stricta*, as well as *Cladium mariscoides, Eleocharis rostellata, Eriophorum viridicarinatum*. Other herbaceous species include *Symphyotrichum puniceum (= Aster puniceus), Doellingeria umbellata (= Aster umbellatus), Cypripedium reginae, Muhlenbergia glomerata, Oxypolis rigidior, Platanthera dilatata, Pycnanthemum virginianum, Solidago patula, Solidago uliginosa, Thalictrum dasycarpum*, and *Thelypteris palustris*. Shrubs most characteristic of this type include *Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda)* and *Rhamnus alnifolia*, but *Photinia melanocarpa (= Aronia melanocarpa), Alnus incana, Cornus amomum, Cornus foemina, Salix candida, Salix sericea*, and *Viburnum lentago* can also be found. A moss layer is commonly well-developed and may or may not contain species of *Sphagnum*. The open marl area is often sparsely vegetated, but can contain *Chara* spp., *Juncus brachycephalus, Lobelia kalmii, Parnassia glauca, Rhynchospora capillacea, Sarracenia purpurea, Triglochin maritima*, and *Triglochin palustris* (Anderson 1996, Reschke 1990).

Sites are minerotrophic and alkaline to circumneutral in character, with groundwater flowing throughout shallow peats and marls on glacial deposits. In New York, the sloping fens are fed by small springs of groundwater seepage; these are headwater wetlands with cold water constantly flowing through them (Reschke 1990). In Ohio, sites are found in seepage areas of minerotrophic springs associated with gravel deposits in terminal moraines and other glacial forms (Anderson 1996).

COMMENTS: *3, MCS*. This type allows for considerable variability in the shrub component, allowing for as much as 50% shrub cover. Compare with *Dasiphora fruticosa ssp. floribunda / Carex (sterilis, hystericina, flava)* Shrub Herbaceous Vegetation (CEGL006326), which may be the same type, but see also *Cornus racemosa / Carex (sterilis, hystericina, flava)* Shrub Herbaceous Vegetation (CEGL006123). Note that the tall-shrub rich fen equivalent is treated as *Cornus sericea - Cornus amomum - Photinia melanocarpa - Viburnum lentago* Fen Shrubland (CEGL005088), but some states, such as Ohio, simply treat these two types as zones within their fen (Schneider and Cochrane 1997). There, the type is restricted to the glaciated Allegheny Plateau in the northeast. In New York it is found in the glaciated Finger Lakes region. In Ontario, the shrubby-cinquefoil type is only reported from Site Region 6, suggesting that the type may not be the same.

CONSERVATION RANK: *G3G4.*

DISTRIBUTION: This shrubby-cinquefoil - sedge rich fen community type is found in the Allegheny region of northeastern Ohio and elsewhere in the eastern Great Lakes area of the northeastern United States, including central-western New York (glaciated Finger Lakes region) and possibly in southern Ontario.

USFS ECOREGIONS: 221Fa:CCC, 221Fc:CCC, 222Ib:CCC, 222Ic:CCC, 222Id:CCC, 222Oa:CCC, M221:P
CONSERVATION REGIONS: 45:C, 48:C, 49:C
STATES: NY OH **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: OH cinquefoil-sedge fen +

OTHER SYNONYMY:

USNVC HIERARCHY: DASIPHORA FRUTICOSA SSP. FLORIBUNDA / CAREX (FLAVA, INTERIOR, LASIOCARPA, STERILIS) SATURATED SHRUB HERBACEOUS ALLIANCE (V.A.7.N.p)

Betula pumila - Salix spp. Prairie Fen Shrubland

Bog Birch - Willow Species Prairie Fen Shrubland

Bog Birch - Willow Prairie Fen CEGL002189

DESCRIPTION: This community has a shrub layer with 25-70% cover, abundant herbaceous species, and sparse to abundant mosses. The most abundant shrub species are *Betula pumila, Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda)*, and *Salix* spp. Common herbaceous species include *Calamagrostis canadensis, Calamagrostis stricta, Carex aquatilis, Carex lasiocarpa, Eriophorum angustifolium, Euthamia graminifolia, Lobelia kalmii, Lycopus uniflorus*, and *Triadenum fraseri*. Where mosses are present they are dominated by species other than *Sphagnum* spp.

This community is found where surface waters are circumneutral to moderately alkaline, with moderate nutrient levels. It is typically found on relatively shallow peat, or, more rarely, on wet mineral soil (MNNHP 1993).

COMMENTS: *3, MCS*. *Carex sartwellii* may be an important "prairie fen" diagnostic compared to more boreal bog birch fen types (R. Dana pers. comm. 1999). It is possible that the North Dakota Poor Fen should go with *Betula pumila / Chamaedaphne calyculata / Carex lasiocarpa* Shrubland (CEGL002494). This requires further review, but there is no *Carex lasiocarpa* in North Dakota. In Michigan, this type may occur but further verification is needed before listing it (D. Albert, P. Comer pers. comm. 1998). Some stands in northeastern South Dakota (Prairie Coteau) have no shrubs, and *Betula pumila* is not found in eastern South Dakota. In Minnesota, the Shrub Swamp, seepage subtype may resemble Bog Birch Fen. Type should be compared with *Carex lasiocarpa - Calamagrostis spp. - (Eleocharis rostellata)* Herbaceous Vegetation (CEGL002383).

CONSERVATION RANK: *G3.*

DISTRIBUTION: This community type is found in the northern tallgrass prairie and adjacent prairie-forest border regions of the upper midwestern United States, where surface waters are circumneutral to somewhat alkaline. The type range extends from Michigan and Indiana west to Manitoba and south to Iowa.

USFS ECOREGIONS: 212Mb:CCC, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 222Ma:CCC, 222Md:CCC, 222Na:CCC, 251Aa:CCC, 251Ab:CCC

CONSERVATION REGIONS: 26:C, 34:C, 35:C, 46:C, 47:C, 48:C

STATES: IA IN MI? MN ND SD **PROVINCES:** MB

MIDWEST HERITAGE SYNONYMY:

IN	fen +
MI?	northern rich fen
MN	rich fen (transition section) shrub subtype =

OTHER SYNONYMY:

USNVC HIERARCHY: BETULA PUMILA - (SALIX SPP.) SATURATED SHRUBLAND ALLIANCE (III.B.2.N.g)

Carex lasiocarpa - Calamagrostis spp. - (Eleocharis rostellata) Herbaceous Vegetation

Wiregrass Sedge - Reedgrass Species - (Beaked Spikerush) Herbaceous Vegetation

Prairie Transition Rich Fen CEGL002383

DESCRIPTION: The graminoid layer is often dominated by *Carex lasiocarpa*, with associates of *Carex aquatilis, Carex buxbaumii, Carex interior, Carex livida, Carex pellita, Carex sartwellii, Carex stricta, Decodon verticillatus, Dulichium arundinaceum, Eleocharis elliptica, Eleocharis palustris (= Eleocharis smallii), Eriophorum angustifolium, Glyceria grandis, Schoenoplectus acutus (= Scirpus acutus)*, and *Schoenoplectus subterminalis (= Scirpus subterminalis)*. *Eleocharis rostellata* and *Cladium mariscoides* occur less frequently. Grasses include *Calamagrostis canadensis* and *Calamagrostis stricta*. Prairie and other herbs are present, such as *Cardamine pratensis, Comarum palustre (= Potentilla palustris), Euthamia graminifolia, Galium labradoricum, Impatiens capensis, Lobelia kalmii, Lycopus uniflorus, Lysimachia thyrsiflora, Menyanthes trifoliata, Pedicularis lanceolata*, and *Triadenum fraseri*. Brown mosses, at least in Indiana, may include *Leptodictyum riparium (= Amblystegium riparium), Calliergonella cuspidata, Campylium polygamum, Campylium stellatum*, and *Fissidens adianthoides* (Swinehart and Parker 2000). Shrub cover is variable and may exceed 25%. *Betula pumila, Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda), Salix candida, Salix pedicellaris*, and *Spiraea tomentosa* may be present. *Sphagnum* spp. are typically absent (White and Madany 1978, MNNHP 1993, Wovcha et al. 1995). In parts of the range of this type, such as western Ohio, some of the more boreal species are nearly or completely absent, e.g., *Carex aquatilis, Carex lasiocarpa, Carex livida, Eriophorum angustifolium*, and *Schoenoplectus subterminalis*. *Euthamia caroliniana (= Euthamia tenuifolia var. tenuifolia)* may occur on sites near Lake Erie. Ohio sites have *Carex stricta, Cladium mariscoides* and *Dasiphora fruticosa ssp. floribunda* as common dominants (G. Schneider pers. comm. 2000). A more marly beach subtype is found in Indiana, and contains a combination of prairie and alkaline fen indicators, such as *Agalinis paupercula, Calopogon tuberosus, Cladium mariscoides, Liatris spicata, Liparis loeselii, Rhynchospora capillacea, Selaginella eclipes, Scleria verticillata*, and *Sorghastrum nutans*.

Stands are found in calcareous, gravelly moraines and occur on wet, saturated soils with groundwater influence, or on the edges of lake margins and on grounded or floating mats. Water levels may be near the surface throughout the growing season. The peat is typically sedge peat and lacks sphagnum, and may be less than 0.5 m deep. Stands may also occur on shallow, highly decomposed peat, or, more rarely, on wet, mineral soil (White and Madany 1978, MNNHP 1993, Wovcha et al. 1995). The marly beach subtype in northeast Indiana occurs on firm muck, which in early spring may be flooded, but by mid-summer is moist but not saturated. Marl precipitation is evident (Homoya et al. 1988).

COMMENTS: *2, MCS*. This type differs from calcareous seepage prairie fens, *Dasiphora fruticosa ssp. floribunda / Carex sterilis - Andropogon gerardii - Arnoglossum plantagineum* Shrub Herbaceous Vegetation (CEGL005139), by its occurrence on alkaline lake margins or floating and grounded peat mats. Absent from this type are the more boreal dwarf-shrubs such as *Andromeda polifolia* or *Vaccinium oxycoccos*. This type may or may not occur in the Prairie Coteau. If so, *Carex lasiocarpa* does not occur in North or South Dakota, or far western Minnesota. *Carex pellita* is probably its equivalent (R. Dana pers. comm. 1999). Compare this type to *Betula pumila - Salix* spp. Prairie Fen Shrubland (CEGL002189) and to more northern fens. The marl beach subtype in Indiana may be an early stage of fen development from beach to floating mat to grounded mat (see also Swinehart and Parker 2000).

CONSERVATION RANK: *G3?.*

DISTRIBUTION: This rich prairie graminoid fen community type is found in the northern prairie and prairie-forest border region of the midwestern United States and Canada, ranging from Indiana and southern Ontario, and possibly Ohio, westward to southern Wisconsin, southern and western Minnesota, and possibly South Dakota.

USFS ECOREGIONS: 212Kb:CCC, 212Mb:CCC, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 222If:C??, 222Ji:CCC, 222K:CC, 222Lc:CCC, 222Ma:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 222Na:CCC, 251Aa:CCC, 251Ba:CCC, 251Bb:CCC, 251Bd:CCC
CONSERVATION REGIONS: 35:C, 46:C, 47:C
STATES: IA IL IN MN SD WI **PROVINCES:** ON?

MIDWEST HERITAGE SYNONYMY:
IL calcareous floating mat -
IN marl beach =
MN rich fen (transition section) sedge subtype; rich fen (transition section) floating-mat subtype -
WI rich fen (southern subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: CAREX LASIOCARPA SATURATED HERBACEOUS ALLIANCE (V.A.5.N.m)

Carex prairea - Schoenoplectus pungens - Rhynchospora capillacea Herbaceous Vegetation

Prairie Sedge - Threesquare - Limestone Beaksedge Herbaceous Vegetation

Northern Tallgrass Calcareous Fen CEGL002267

DESCRIPTION: The vegetation is dominated by graminoids, but may contain small shrubs. Many species are inhibited by the water conditions and thus the vegetation cover is moderate (MNNHP 1993). This allows the growth of many heliophytic species. Van der Valk (1975) found that the predominant vegetation was 25-35 cm tall, with *Schoenoplectus americanus (= Scirpus americanus)* growing to 75-85 cm tall. The most abundant species are *Calamagrostis stricta, Carex prairea, Carex sterilis, Eleocharis* spp., *Lobelia kalmii, Muhlenbergia glomerata, Muhlenbergia richardsonis, Parnassia glauca, Rhynchospora capillacea, Schoenoplectus pungens (= Scirpus pungens), Spartina pectinata*, and *Triglochin maritima* (Pearson and Leoschke 1992). Shrubs that occur with the herbaceous species include *Betula pumila, Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda)*, and *Salix* spp. (*Salix candida* is highly characteristic, others include *Salix X bebbii* and *Salix discolor*) (R. Dana pers. comm. 1999). Prairie herb associates include *Andropogon gerardii, Doellingeria umbellata (= Aster umbellatus), Cirsium muticum, Liatris ligulistylis, Lilium philadelphicum, Solidago nemoralis, Oligoneuron riddellii (= Solidago riddellii), Zigadenus elegans*, and *Zizia aurea* (R. Dana pers. comm. 1999).

This community is found where calcium-rich groundwater emerges as springs. These springs are commonly associated with porous bedrock or coarse-textured deposits such as beach or outwash (Richardson et al. 1987). The water is cold, anoxic, and circumneutral (MNNHP 1993). These conditions promote the accumulation of peat resulting in soils that are shallow to deep peats. There may be calcium carbonates precipitated in the soil.

COMMENTS: *2, MCS*. *Schoenoplectus pungens (= Scirpus pungens)* is apparently the right name for the *Scirpus* spp. found in this type (R. Dana pers. comm. 1999, Ownbey and Morley 1991). Type may not be found west of tallgrass prairie ecoregion. In Iowa, distinction between western rich fen, bog birch fen, and alkaline fen needs clarification (See Pearson and Leoschke 1992). In Minnesota, fens can have *Carex sterilis* and *Andropogon gerardii*. Unlike southeastern Minnesota calcareous prairie fens, western Minnesota calcareous prairie fens do not have some of the prairie forb associates such as *Valeriana edulis* and *Saxifraga pensylvanica*.

CONSERVATION RANK: *G2.* There are probably fewer than 100 occurrences rangewide. Currently there are 79 occurrences documented from Minnesota and South Dakota, where it is ranked S1 and S?, respectively. This fen is also reported from Iowa (ranked S1) and from North Dakota (ranked S?). There are probably less than 2500 acres rangewide. Currently there are over 1450 acres documented, and most EOs are less than 50 acres. Most occurrences are naturally small and patchy. Long-term decline is primarily in quality, with many occurrences degraded by alterations to hydrology (such as ditching, draining, or gravel mine operations nearby), by grazing and trampling, or by fire suppression. This community has fairly restricted environmental requirements, and occurs in a somewhat restricted range in western Minnesota, northern Iowa, and eastern North and South Dakota. About half the currently documented occurrences are in good condition.

DISTRIBUTION: This community type is found primarily in the northern tallgrass prairie region of western Minnesota, northwestern Iowa and eastern Dakotas, where calcium rich groundwater emerges as springs.

USFS ECOREGIONS: 212Na:CCC, 222Ma:CCC, 222Na:CCC, 251Aa:CCC, 251Ba:CCC, 251Bb:CCC, 251Bc:CCC, 251Bd:CCC, 251Be:CCC
CONSERVATION REGIONS: 26:C, 35:C, 46:C, 47:C
STATES: IA MN ND SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MN calcareous seepage fen (northwest section) prairie subtype; calcareous seepage fen (southwest section) prairie subtype -

OTHER SYNONYMY: Discharge zone (Van der Valk 1975) B, Sedge mat zone (Van der Valk 1975) B

USNVC HIERARCHY: CAREX SPP. SATURATED HERBACEOUS ALLIANCE (V.A.5.N.m)

Carex stricta - Valeriana edulis - Parnassia palustris Herbaceous Vegetation

Tussock Sedge - Tobacco-root - Arctic Grass-of-parnassus Herbaceous Vegetation

Tussock Sedge Fen CEGL005241

DESCRIPTION: The vegetation is dominated by *Carex stricta*, a tussock-forming sedge that creates a hummock-hollow microtopography, and *Eupatorium maculatum*. Other common associates include *Asclepias incarnata, Symphyotrichum puniceum (= Aster puniceus), Doellingeria umbellata (= Aster umbellatus), Calamagrostis canadensis, Carex* spp. (including *Carex interior* and *Carex prairea*), *Eupatorium perfoliatum, Helianthus grosseserratus, Helenium autumnale, Lobelia siphilitica, Pedicularis lanceolata, Pycnanthemum virginianum, Schoenoplectus acutus (= Scirpus acutus)*, and *Viola nephrophylla*. Common shrubs include *Salix X bebbii* and *Salix discolor* (Pearson and Leoschke 1992). Herbaceous species unique or more common to eastern Iowa fens as compared to western Iowa fens include (with constancy >20%) *Chelone glabra, Fragaria virginiana, Gentiana andrewsii, Geum aleppicum, Lythrum alatum, Onoclea sensibilis, Oxypolis rigidior, Phlox maculata, Saxifraga pensylvanica, Oligoneuron riddellii (= Solidago riddellii)*, and *Thelypteris palustris*. Shrubs include *Cornus amomum, Salix candida*, and *Spiraea alba*. Fen indicators, with variable constancy (and some rare), include *Eriophorum angustifolium, Liparis loeselii, Muhlenbergia glomerata, Parnassia glauca, Rhynchospora capillacea, Triglochin palustris*, and *Valeriana edulis*. Prairie species include, among others, *Triadenum fraseri* and *Veronicastrum virginicum*. Western Iowa fens tend to have more *Schoenoplectus pungens (= Scirpus pungens)* and *Lobelia kalmii* (Pearson and Leoschke 1992).

Stands are typically situated partially upslope, where groundwater seeps out of the hillside. Stands generally occur on accumulated peat. Soils are organic, and soil pH is typically neutral to slightly acidic (6.5-7.0) and never very alkaline. Stands typically do not have a sedge mat zone, suggesting that mineral substrates extend throughout the whole fen. This is a reflection of their small size (<2 ha) and perhaps a fluctuating water table (Pearson and Leoschke 1992).

Carex stricta may respond well to a fluctuating water table (Pearson and Leoschke 1992), unlike other fen species that are more dependent on saturated conditions. Selected grazing of palatable grasses and forbs tends to increase the relative abundance of *Carex stricta* and *Helianthus grosseserratus*. It may also increase *Aster umbellatus, Eupatorium maculatum* and *Eupatorium perfoliatum*. Trampling may also increase the hummocks, as the hollows get compacted.

COMMENTS: *3, MCS*. This type has been described for eastern Iowa. Stands in western Iowa (*Carex prairea - Schoenoplectus pungens - Rhynchospora capillacea* Herbaceous Vegetation (CEGL002267)) have an 80% overlap in floristics with eastern stands. The rangewide distribution of this type needs review, as Wisconsin generally treats these stands as part of the *Carex stricta* meadows, namely *Carex stricta - Carex spp*. Herbaceous Vegetation (CEGL002258) (Eric Epstein pers. comm. 1999). Species listed as indicators of eastern Iowa fens is still preliminary, and a wider analysis may alter these patterns (see Carpenter 1990, in Pearson and Leoschke 1992). The type is not as alkaline or diverse as prairie rich fens, such as *Dasiphora fruticosa ssp. floribunda / Carex sterilis - Andropogon gerardii - Arnoglossum plantagineum* Shrub Herbaceous Vegetation (CEGL005139).

CONSERVATION RANK: *G2G3.* A total of 156 stands were located in eastern Iowa, 90 of which were A or B ranked, but less than 5 are protected, and many are highly threatened. Grazing by cattle may eliminate many of the more minor forbs and graminoids. Cropland edges tend to increase weedy species such as *Ambrosia trifida, Asclepias syriaca, Lactuca canadensis, Oenothera biennis, Pastinaca sativa*, and *Urtica dioica*. Drainage by ditching lowers the water table, shrinking the fen, and can lead to woody species expansion by *Cornus amomum, Ulmus alata*, and taller willows such as *Salix bebbii* and *Salix discolor* (Pearson and Leoschke 1992).

DISTRIBUTION: This prairie tussock sedge fen is found in the prairie region of the central midwestern United States on seepage slopes, particularly in eastern Iowa, but possible in adjacent states, such as Wisconsin.

USFS ECOREGIONS: 222Ke:CCC, 222Kf:CCC, 222Me:CCC
CONSERVATION REGIONS:
STATES: IA WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: WI sedge meadow (fen subtype?) +

OTHER SYNONYMY:

USNVC HIERARCHY: CAREX SPP. SATURATED HERBACEOUS ALLIANCE (V.A.5.N.m)

Cornus amomum - Salix spp. - Toxicodendron vernix - Rhamnus lanceolata Fen Shrubland

Silky Dogwood - Willow Species - Poison-sumac - Lanceleaf Buckthorn Fen Shrubland

Dogwood - Willow - Poison Sumac Shrub Fen CEGL005087

DESCRIPTION: The vegetation is dominated by tall shrubs 1-3 m in height, with a mixture of herbaceous species in the ground layer. Tall shrubs include *Cornus amomum, Cornus sericea, Toxicodendron vernix, Salix discolor, Salix sericea*, and *Viburnum lentago*. *Vaccinium corymbosum* may also be present. Herbaceous species include *Cypripedium reginae, Filipendula rubra, Solidago patula*, and *Woodwardia virginica*. The prairie species component in this tall-shrub fen is a diagnostic characteristic (White and Madany 1978, Anderson 1982, Homoya et al. 1985, Eric Epstein pers. comm. 1999).

Stands are found on moraines, especially where gravels permit calcareous seepage, and occur both in lake basins and stream valleys. Soils are organic with calcareous seepage causing saturated conditions (White and Madany 1978, Anderson 1982, Homoya et al. 1985).

COMMENTS: *2, MCS*. This type is found in western Ohio prairie shrub fens, as well as northern Indiana and Illinois tall-shrub circumneutral fens. It is the tall-shrub counterpart to the low-shrub/herb prairie fen, *Dasiphora fruticosa ssp. floribunda / Carex sterilis - Andropogon gerardii - Arnoglossum plantagineum* Shrub Herbaceous Vegetation (CEGL005139). This type is very similar to the more circumneutral shrub fen/bog, *Cornus spp. - Salix spp. - Vaccinium corymbosum - Rhamnus alnifolia - Toxicodendron vernix* Shrubland (CEGL005083) and the two types could probably be combined. It is also similar to *Cornus sericea - Salix spp. - (Rosa palustris)* Shrubland (CEGL002186), but that type is a shrub swamp rather than fen. However, these tall shrub swamps are difficult to distinguish in terms of fen versus swamp. This type is found in southern Wisconsin and southern Michigan. However, although the type is fairly distinctive, it is often a relatively small zone on the edge of low shrub/graminoid fens, and is not always recognized or tracked.

CONSERVATION RANK: *G2G3.* There are probably fewer than 100 occurrences of this fen community rangewide. This community is reported from Indiana (where it is ranked S3), Ohio (S2), and Illinois (S1S2). Currently 15 occurrences have been documented from Indiana and Illinois. Individual occurrences are usually fairly small (under 20 acres); total acreage rangewide is probably less than 2000 acres. Historical acreage is unknown, but some acres of this community have probably been destroyed or degraded by alterations in wetland hydrology and agricultural development.

DISTRIBUTION: This tall-shrub fen community type is found in the central midwestern United States and probably adjacent Canada, ranging from western Ohio and probably southern Ontario to southern Wisconsin.

USFS ECOREGIONS: 222Ha:CCC, 222Hb:CCC, 222Jb:CCC, 222Jh:CCC, 222Ji:CCC, 222Kj:C??, 251Cf:CCC, 251Dd:C??
CONSERVATION REGIONS: 36:C, 45:C, 48:C
STATES: IL IN MI? OH WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	tall shrub fen =
IN	circumneutral bog +
MI?	prairie fen
OH	cinquefoil-sedge fen +
WI	tall shrub fen (not tracked) ?

OTHER SYNONYMY:

USNVC HIERARCHY: CORNUS SERICEA - PHOTINIA MELANOCARPA - TOXICODENDRON VERNIX SATURATED SHRUBLAND ALLIANCE (III.B.2.N.g)

Dasiphora fruticosa ssp. floribunda / Carex sterilis - Andropogon gerardii - Arnoglossum plantagineum Shrub Herbaceous Vegetation

Shrubby-cinquefoil / Sterile Sedge - Big Bluestem - Indian-plantain Shrub Herbaceous Vegetation

Cinquefoil - Sedge Prairie Fen CEGL005139

DESCRIPTION: Graminoids dominate, though forbs and dwarf-shrubs can be prominent. Shrub swamps or tall-shrub fens often surround the core fen area. Diagnostic species include the prairie grasses *Andropogon gerardii* and *Spartina pectinata*, prairie forbs such as *Arnoglossum plantagineum (= Cacalia plantaginea), Filipendula rubra, Liatris spicata, Silphium terebinthinaceum* (more eastern), *Oligoneuron ohioense (= Solidago ohioensis)*, and the sedges *Carex aquatilis, Carex haydenii, Carex hystericina, Carex leptalea, Carex sterilis*, and *Carex stricta*. Other characteristic species include *Doellingeria umbellata (= Aster umbellatus), Eupatorium maculatum, Gentianopsis virgata (= Gentianopsis procera), Lobelia kalmii, Lysimachia quadriflora, Muhlenbergia glomerata, Oxypolis rigidior, Pedicularis lanceolata, Pycnanthemum virginianum, Thalictrum dasycarpum*, and *Thelypteris palustris*. The most characteristic shrubs of this type are *Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda)* and *Salix candida*, but *Cornus foemina, Cornus sericea*, and *Salix discolor* can also be found. Open areas around spring discharges are often sparsely vegetated, and contain *Cladium mariscoides, Eleocharis elliptica, Eleocharis rostellata, Lobelia kalmii, Parnassia glauca, Rhynchospora capillacea, Schoenoplectus acutus (= Scirpus acutus)*, and *Triantha glutinosa (= Tofieldia glutinosa)*. (Anderson 1996, Chapman et al. 1989, MNNHP 1993, White and Madany 1978).

This community is found on muck (peaty muck), through which flows groundwater rich in calcium and magnesium carbonates. Soils are saturated mucks, with neutral to slightly alkaline pH. Sites typically lie next to lakes, less commonly along streams and rivers, all of which occur in glacial outwash, ice contact topography or coarse-textured end moraines (Chapman et al. 1989).

COMMENTS: *2, MCS*. In Minnesota this is a calcareous seepage fen. Classification of rich prairie fens in the Midwest has generally allowed for considerable variability in the shrub or dwarf-shrub component, allowing for as much as 50% or more of shrubs. White and Madany (1978) recognized a graminoid fen and a low-shrub fen type in Illinois. They noted that they were floristically identical, but the latter was probably more protected from fires. Note: In western Ohio, see Stuckey article, where type contains *Sorghastrum nutans, Andropogon gerardii, Oligoneuron riddellii (= Solidago riddellii), Oligoneuron ohioense (= Solidago ohioensis), Arnoglossum plantagineum (= Cacalia tuberosa), Silphium compositum var. reniforme (= Silphium terebinthinaceum), Carex suberecta*. In Ontario, there is one stand at Brantford.

CONSERVATION RANK: *G3G4.*

DISTRIBUTION: This prairie fen is found in the central midwestern United States, ranging from western Ohio west to southeastern Minnesota.

USFS ECOREGIONS: 212He:PPP, 212Jj:PPP, 222Ha:CCC, 222Hb:CCC, 222Hd:CCC, 222Hf:CCC, 222If:CCC, 222Jb:CCC, 222Jc:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kb:CCC, 222Kd:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Lc:CCC, 222Le:CCC, 222Lf:CCC, 222Mb:CCC, 222Md:CCC, 222Me:CCC, 251Ba:CCC, 251Dg:CCC, 251Dh:CCC
CONSERVATION REGIONS: 35:C, 36:C, 45:C, 46:C, 47:P, 48:C
STATES: IL IN MI MN OH WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	calcareous seep; graminoid fen; low shrub fen -
IN	fen +
MI	prairie fen =
MN	calcareous seepage fen (southeast section) prairie subtype =
OH	cinquefoil-sedge fen +
WI	calcareous fen (prairie subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: DASIPHORA FRUTICOSA SSP. FLORIBUNDA / CAREX (FLAVA, INTERIOR, LASIOCARPA, STERILIS) SATURATED SHRUB HERBACEOUS ALLIANCE (V.A.7.N.p)

(Carex interior, Carex lurida) - Carex leptalea - Parnassia grandifolia - Rhynchospora capillacea Herbaceous Vegetation

(Inland Sedge, Sallow Sedge) - Little Bog Sedge - Largeleaf Grass-of-parnassus - Limestone Beaksedge Herbaceous Vegetation

Ozark Fen CEGL002404

DESCRIPTION: Hydrophytic plants dominate this community. It is a mixed-grass or sedge fen that is composed of different types of vegetation. Type 1) saturated areas dominated by tussock sedges such as *Carex interior* and *Carex lurida*; Type 2) deep muck saturated areas, dominated by those sedges and by *Carex hystericina, Carex suberecta*, and the shrub *Alnus serrulata*; Type 3) marly ooze areas dominated by *Carex leptalea, Rhynchospora capillacea*, and *Scleria verticillata*; Type 4) drier areas or margins dominated by *Andropogon gerardii, Rudbeckia fulgida var. umbrosa*, and *Parnassia grandifolia*. Characteristic species include *Menyanthes trifoliata* and *Pogonia ophioglossoides*. Other species present in most examples include *Carex hystericina, Castilleja coccinea, Fuirena simplex, Helenium autumnale, Lobelia siphilitica, Schoenoplectus americanus (= Scirpus americanus), Scirpus atrovirens, Scirpus lineatus, Selaginella apoda, Packera aurea (= Senecio aureus)*, and *Oligoneuron rigidum var. rigidum (= Solidago rigida ssp. rigida)*. Deep muck fens may also contain *Thelypteris palustris var. pubescens, Lysimachia quadriflora, Selaginella eclipes, Rudbeckia fulgida var. umbrosa, Carex granularis, Oxypolis rigidior, Physocarpus opulifolius, Pedicularis lanceolata, Cardamine bulbosa*, and *Viola cucullata* (Nelson 1985, T. Nigh pers. comm. 1996).

This community occurs on the sideslopes or toeslopes of hills in narrow valleys, bases of bluffs, rock ledges, and terraces. It occurs on all aspects and on a slope of 5-45 degrees. The soil or substrate is saturated by groundwater seepage. The soil conditions are the result of the underlying substrate and vegetation. In this fen community, the soil moisture gradient ranges from moist to wet with seasonal fluctuations. The groundwater is calcareous. The soil is mucky peat or mineral, with pH above 6.5, and varies from very shallow (0-40 cm) to deep (>100 cm), depending on natural disturbance and slope. The parent material is a mixture of gravel and dolomite with fragments of deeply weathered bedrock present. The bedrock strata are exposed in more shallow soil examples, especially in hanging fens where the slope is greater than 35 degrees, or they may be undetectable in deeper muck examples (Nelson 1985).

The fluctuations in saturation, leading to dry periods, may stress some fen species (Nelson 1985).

COMMENTS: *2, MCS*. This community type is based largely on work by S. Orzell and others (1984, 1985a, 1985b). Although numerous sites of this community remain, many are threatened by overgrazing. This community may suffer permanent loss of water because of local hydrologic changes. In Arkansas, occurrences are 0.5- to 1-acre areas along streams with exposed cliffline and seepage (P. Hyatt pers. comm.). The composition of Arkansas occurrences may vary sufficiently from this description to warrant another association. *Carex interior* is very restricted in Arkansas.

CONSERVATION RANK: *G2G3*. Although numerous sites of this community remain, many are threatened by overgrazing. This community may suffer permanent loss of water because of local hydrologic changes. In Arkansas, occurrences are 0.5- to 1-acre areas along streams with exposed cliffline and seepage (P. Hyatt pers. comm.).

DISTRIBUTION: This fen community type is found in the Ozarks region of the United States, particularly in the central part of southern Missouri and Arkansas.

USFS ECOREGIONS: 222Aa:CCC, 222Ab:CCC, 222Ac:CCC, 222Ad:CCC, 222Ae:CCC, 222Af:CCC, 222Ag:CCC, 222Al:CCC, 222An:CCC
CONSERVATION REGIONS: 38:C
STATES: AR MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO fen; deep muck fen -

OTHER SYNONYMY: IIE1b. Calcareous Fen Complex, in part (Allard 1990), P5B2cI1a. *Parnassia grandifolia-Carex lurida* (Foti et al. 1994), Streamside Seep-fen (Orzell et al. 1985), Sedge-Shrub Fen (Orzell et al. 1985)

USNVC HIERARCHY: CAREX LURIDA - CAREX LEPTALEA - (CAREX ATLANTICA, CAREX INTERIOR, PARNASSIA GRANDIFOLIA) SATURATED HERBACEOUS ALLIANCE (V.A.5.N.m)

Carex interior - Carex lurida - Andropogon gerardii - Parnassia grandifolia Herbaceous Vegetation

Inland Sedge - Sallow Sedge - Big Bluestem - Largeleaf Grass-of-parnassus Herbaceous Vegetation

Ozark Prairie Fen CEGL002416

DESCRIPTION: A mix of tallgrass and herbaceous calciphiles dominate the vegetation. Scattered shrubs may occur. Dominant graminoids include *Andropogon gerardii, Sorghastrum nutans*, and *Spartina pectinata*. Other characteristic graminoids include *Carex interior, Carex lurida* and *Panicum virgatum*. Characteristic forbs include *Castilleja coccinea, Helianthus grosseserratus, Helianthus mollis, Lysimachia quadriflora, Lythrum alatum, Oxypolis rigidior, Pycnanthemum tenuifolium, Pycnanthemum virginianum, Rudbeckia fulgida var. umbrosa, Silphium integrifolium, Silphium terebinthinaceum*, and *Veronicastrum virginicum*. More rarely, *Platanthera leucophaea* may occur (Orzell and Kurz 1984, Nelson 1985).

Stands occur on the valley terraces of larger streams and rivers. Soils are moist to wet, and seasonally saturated by calcareous internal groundwater seepage. Soils are muck or mucky peat, alkaline (pH above 6.5), and shallow (40-100 cm), or, locally, very shallow with gravel at the surface. The parent material is a gravelly alluvium or colluvium over dolomite bedrock. The bedrock strata are detectable (Nelson 1985).

Fires are possible in some of the larger fens (Nelson 1985).

COMMENTS: *2, MCS*. Concept of this type is based on Missouri state classification - prairie fen (Nelson 1985). This community often has inclusions of *(Carex interior, Carex lurida) - Carex leptalea - Parnassia grandifolia - Rhynchospora capillacea* Herbaceous Vegetation (CEGL002404).

CONSERVATION RANK: *G1G2*. There are probably fewer than 20 occurrences rangewide. Currently 13 occurrences have been documented from Missouri, where it is ranked S1. There are probably fewer than 100 acres rangewide. Currently 37 acres have been documented for 12 occurrences, with sizes ranging from 1 to 13 acres. This community is reported from four ecoregion subsections in the Ozark Highlands section in southern Missouri. These fens usually have fairly restricted hydrological requirements, and this community may have always been rare.

DISTRIBUTION: This prairie fen community type is found in the Ozarks region of the United States, particularly in south-central Missouri.

USFS ECOREGIONS: 222Ab:CCC, 222Af:CCC, 222Ag:CCC, 222Al:CCC
CONSERVATION REGIONS: 38:C
STATES: MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO prairie fen =

OTHER SYNONYMY:

USNVC HIERARCHY: CAREX LURIDA - CAREX LEPTALEA - (CAREX ATLANTICA, CAREX INTERIOR, PARNASSIA GRANDIFOLIA) SATURATED HERBACEOUS ALLIANCE (V.A.5.N.m)

Carex interior - Eleocharis elliptica - Thelypteris palustris Herbaceous Vegetation

Inland Sedge - Elliptic Spikerush - Marsh Fern Herbaceous Vegetation

Sandhills Fen CEGL002390

DESCRIPTION: The vegetation consists mainly of hydrophytic herbaceous species. Stands are typically dominated by sedges, including *Carex interior, Carex lacustris, Carex nebrascensis, Carex prairea*, and *Carex sartwellii*. Other abundant species are *Calamagrostis canadensis, Eleocharis elliptica, Glyceria striata*, and *Thelypteris palustris*. In areas of well-preserved fibrous peat, *Carex pellita, Carex interior*, and *Carex prairea* dominate. Where the peat is more degraded and mucky, *Carex lacustris* and *Carex nebrascensis* often dominate, with *Carex aquatilis* common in some sites. Some parts of the fen may be dominated by taller graminoids, such as *Phragmites australis, Schoenoplectus acutus (= Scirpus acutus)*, and *Typha latifolia*, with a ground layer of *Onoclea sensibilis* and *Thelypteris palustris*. In other parts, shrub cover can be high. Shrub species include *Salix petiolaris, Cornus sericea (= Cornus stolonifera)*, and *Salix* spp. Many disjunct boreal species are commonly found in the fibrous peat, including *Symphyotrichum boreale (= Aster borealis), Doellingeria umbellata var. pubens (= Aster umbellatus var. pubens), Eriophorum angustifolium, Eriophorum gracile, Muhlenbergia glomerata*, and *Ophioglossum pusillum*. (Tolstead 1942, Steinauer et al. 1996, Steinauer and Rolfsmeier 2000).

This community is typically found at the headwaters of Sandhills stream valleys or at the upper ends of lakes and marshes. The water table is 15-30 cm below the surface (Tolstead 1942), and these sites remain saturated throughout the year but never become flooded. Soils are predominately Cutcomb mucky peat formed in decaying herbaceous vegetation, and show evidence of low oxygen availability during the growing season. Organic deposits range from 30 cm to 7+ m deep with sand layers interspersed among the organic deposits. The oldest deposits have been radiocarbon dated at 12,260 +/- 60 years B.P. Surface mounding is an important feature of Sandhills fens and raised peat mounds are frequently areas of groundwater discharge. Groundwater pH ranges from 6.0-6.9 (Tolstead 1942, Steinauer et al. 1996, Steinauer and Rolfsmeier 2000).

Fires spreading from surrounding prairie vegetation may have been common in this community before European settlement. Flooding due to the presence of beaver dams may have been important in fens bordering the prairie (Steinauer et al. 1996).

COMMENTS: *3, MCS*. Type needs rangewide review. Shrubby patches with greater than 25% cover may occur.

CONSERVATION RANK: *G1G2.* Many sites have been impacted by drainage modifications, and seeded to exotic grasses and legumes for use as hay meadows. Decomposition of peat may be a major concern in drained fens. Very few high-quality sites remain, and fewer are protected.

DISTRIBUTION: This community type is found in the Sandhills region of the central Great Plains on gently sloping to level valley bottoms bordering streams or lakes, particularly in northwestern Nebraska and adjacent southwestern South Dakota.

USFS ECOREGIONS: 331:?, 332:C
CONSERVATION REGIONS: 33:C
STATES: NE SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE sandhills fen =

OTHER SYNONYMY: Plants of Peat Soils (Tolstead 1942)

USNVC HIERARCHY: CAREX PELLITA - (CAREX NEBRASCENSIS) - SCHOENOPLECTUS SPP. SATURATED HERBACEOUS ALLIANCE (V.A.5.N.m)

Carex pellita - Carex spp. - Schoenoplectus tabernaemontani Fen Herbaceous Vegetation

Woolly Sedge - Sedge Species - Softstem Bulrush Fen Herbaceous Vegetation

Central Tallgrass Fen CEGL002041

DESCRIPTION: Vegetation consists mainly of hydrophytic graminoids and forbs between 0.5 and 1 m tall. Shrubs are occasionally present. *Carex pellita (= Carex lanuginosa), Juncus* spp., and *Schoenoplectus* spp. (= *Scirpus* spp.) dominate this community. Other herbaceous species include *Carex emoryi, Carex hystericina, Carex interior, Dulichium arundinaceum, Eupatorium perfoliatum, Onoclea sensibilis*, and *Thelypteris palustris* (Steinauer and Rolfsmeier 2000). In Missouri, species include *Asclepias incarnata, Carex hystericina, Carex lurida, Chelone glabra, Schoenoplectus tabernaemontani (= Scirpus tabernaemontani)*, and *Scirpus atrovirens* (Leahy, pers. comm. 1998).

Seepage fens occur near the bases of canyon and valley slopes and on floodplain terraces. They have soils that are classified as hydric or show evidence of low oxygen availability during the growing season. The soil is saturated to the surface or flooded at some point during the growing season. The soils are peat or muck, often mixed with sand. They are deep and continually saturated with moderately (pH 6.0-6.9) to possibly strongly (pH 7.0-8.4) minerotrophic groundwater. The peat often creates uplifted mounds. Subsurface recharge of fens may occur through localized artesian conditions.

COMMENTS: *2, MCS*. Missouri part of range needs review to see if it matches stands in Nebraska and Kansas, but currently includes stands found in northern (glaciated) Missouri that are not like their Ozark or prairie fens, e.g., *Carex lurida* is not present in northern Missouri fens. Distinctions between this fen type and the Great Plains Neutral Seep type, *Typha latifolia - Equisetum hyemale - Carex (hystericina, pellita)* Seep Herbaceous Vegetation (CEGL002033), should be reviewed.

CONSERVATION RANK: *G1*. Many sites are threatened by ditching, herbicide sprays, and grazing. Loss of artesian flow can occur from off-site development.

DISTRIBUTION: This community occurs in saturated areas on low slopes and floodplain terraces in the central-western tallgrass prairie region, extending from northern Missouri and possibly southern Iowa west to Nebraska and Kansas.

USFS ECOREGIONS: 251Cc:CCC, 251Cm:CCC, 251Cp:CCC, 251Cq:CC?, 251Ea:CP?, 332E:??
CONSERVATION REGIONS: 33:C, 36:C, 37:C
STATES: IA KS MO? NE **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO? fen ?
NE fen =

OTHER SYNONYMY:

USNVC HIERARCHY: CAREX PELLITA - (CAREX NEBRASCENSIS) - SCHOENOPLECTUS SPP. SATURATED HERBACEOUS ALLIANCE (V.A.5.N.m)

Carex spp. - Triglochin maritima - Eleocharis quinqueflora Marl Fen Herbaceous Vegetation

Sedge Species - Seaside Arrowgrass - Few-flower Spikerush Marl Fen Herbaceous Vegetation

Great Plains Marl Fen CEGL002268

DESCRIPTION: This community is characterized by fine-textured, short-statured vegetation such as *Eleocharis quinqueflora (= Eleocharis pauciflora), Rhynchospora capillacea, Lobelia kalmii*, and *Parnassia glauca* (Leoschke 1997). Algae such as *Chara* spp. and moss such as *Drepanocladus* spp may be associated with open marl ponds. There are also areas of taller vegetation such as *Carex prairea, Schoenoplectus pungens (= Scirpus pungens)*, and *Carex aquatilis* associated with this community (NDNHP 1997).

This community is found where mineral-rich groundwater flow emerges from porous, glacial till. In central North Dakota, these communities are often found on slopes bordering wetlands, and may be found along river valley slopes (Godfread 1976). These wetland areas remain saturated throughout the growing season, permitting the development of organic peat. These communities are marked by shallow, interconnected pools lined with marl, a mix of calcium carbonate, organic matter, and other minerals (Duxbury 1987).

COMMENTS: *3, MCS*. In South Dakota neither the *Carex* spp. nor *Triglochin maritimum* may be characteristic. Type concept is restricted to regions west of the tallgrass prairie ecoregion (Bailey's Province 251), in which *Carex prairea - Schoenoplectus pungens - Rhynchospora capillacea* Herbaceous Vegetation (CEGL002267) is used.

CONSERVATION RANK: *G1?.* There are probably fewer than 20 occurrences of this community rangewide. Currently six occurrences are documented from North Dakota and South Dakota, and the community is ranked S1 in both states. It is not reported from any other states. There are probably fewer than 500 acres rangewide. Currently a little over 100 acres have been documented, with occurrences ranging in size from 3 to 60 acres. This type of fen has very specific habitat requirements, and has probably always been rare, with limited acreage; however, historical acreage and trends are unknown. Half of the documented occurrences are in good condition. This type has not been well surveyed.

DISTRIBUTION: This community type is found in seepage areas in the mixedgrass prairie regions of the northeastern and north-central Great Plains, particularly in the western Dakotas.

USFS ECOREGIONS: 331:?, 332A:PP
CONSERVATION REGIONS: 26:C, 34:C
STATES: ND SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: Class VII-fen ponds (Stewart and Kantrud 1971) B. Stewart and Kantrud appear to include both rich fens and calcareous fens within their classification.

USNVC HIERARCHY: CAREX SPP. SATURATED HERBACEOUS ALLIANCE (V.A.5.N.m)

Salix candida / Carex rostrata Shrubland

Hoary Willow / Swollen-beak Sedge Shrubland

Sage Willow Fen CEGL001188

DESCRIPTION: Overall shrub cover is in the 25-60% range. Herbaceous cover is 60-100%. Stands consist of small patches of *Salix candida, Salix serissima, Salix exigua, Salix bebbiana*, and *Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda)*. Any of these shrubs may be locally dominant. Common herbaceous species include *Carex rostrata, Carex nebrascensis, Juncus balticus, Calamagrostis canadensis*, and wetland forbs (Marriott and Faber-Langendoen 2000).

In the Black Hills, the single stand at McIntosh Fen is on the eastern edge of the Limestone Plateau at 6000 feet elevation. It occurs in a broad drainage bottom underlain by metamorphic rocks and traversed by Castle Creek. Water issuing from springs in the limestone strata on the sides of the drainage contribute to the alkalinity of the wetland (Marriott and Faber-Langendoen 2000).

With persistent heavy browsing, sage willow is likely to be eliminated from stands of this type, leading to dominance by beaked sedge and other wetland graminoids (Hansen et al. 1995). The impact on other willows probably would be similar. In contrast, shrubby-cinquefoil often increases with heavy utilization.

COMMENTS: *2, WCS*.

CONSERVATION RANK: *G3.*

DISTRIBUTION: Sage Willow Fen is found in the northern Rocky Mountains of the United States, including the Black Hills.

USFS ECOREGIONS: M331A:CC, M332B:CC, M332C:CC, M332D:CC, M332E:CC, M333B:CC, M333C:CC, M334A:CC
CONSERVATION REGIONS: 25:C
STATES: ID MT SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: SALIX CANDIDA SEASONALLY FLOODED SHRUBLAND ALLIANCE (III.B.2.N.e)

1.3. Seeps

Clay Seeps Sparse Vegetation

Clay Seeps Sparse Vegetation

Clay Seeps CEGL005163

DESCRIPTION: Stands are often shaded (up to 90% cover) by adjacent forest types, including *Tsuga canadensis* and *Acer saccharum* dominated stands. Trees rarely occur in the seepage zone itself, which can be as much as 30 m wide. Characteristic plants include *Equisetum scirpoides* (often dominant) and *Impatiens pallida*. Other species in northern Wisconsin include *Cypripedium reginae, Cypripedium parviflorum, Equisetum arvense*, and, rarely, *Parnassia palustris* and *Parnassia glauca*. In southeastern Wisconsin, common species include *Gentianopsis virgata (= Gentianopsis procera), Oligoneuron ohioense (= Solidago ohioensis)* and *Triantha glutinosa (= Tofieldia glutinosa)*. Other fen plants may also occur. *Epipactis helleborine* is a common exotic orchid (E. Epstein pers. comm. 1999).

Stands occur on toeslopes, where constant seepage creates saturated, semi-stable clay soil bluffs. Substrate is neither mucky nor peaty. Stands are often shaded (up to 90% cover) by adjacent forest types (E. Epstein pers. comm. 1999).

COMMENTS: *3, MCS*. Description is based on input at Great Lakes Planning meeting workshop in Escanaba, Michigan, Dec 14-15, 1998, and further review by Eric Epstein (pers. comm. 1999) from Wisconsin and Michigan. Type may actually fit better under a forb formation (V.B.2.N.f.- Saturated perennial forb vegetation). Stands occur on the Apostle Islands, the St. Louis River and tributaries in northwest Wisconsin, along Lake Michigan in Milwaukee County, and possibly in Door, Kewaunee, and Manitowoc counties. Unstable bluffs generally support a more "weedy" flora, resembling that of the surrounding forest.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This type is found in the northern regions of the Great Lakes in the United States, and is currently only reported from Wisconsin and Michigan.

USFS ECOREGIONS: 212Ja:CPP
CONSERVATION REGIONS: 48:C
STATES: MI? WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MI? northern wet meadow ?
WI clay seeps =

OTHER SYNONYMY:

USNVC HIERARCHY: CLAY SLOPES SPARSE VEGETATION ALLIANCE (VII.C.3.N.b)

Symplocarpus foetidus Herbaceous Vegetation

Skunk-cabbage Herbaceous Vegetation

Skunk Cabbage Seepage Meadow CEGL002385

DESCRIPTION: This is an herbaceous-dominated community. Tree and shrub cover may vary, particularly from overhanging upland trees, but trees and shrubs rooted in the stand are less than 25% cover. Forbs dominate the community. *Symplocarpus foetidus* and *Angelica atropurpurea* are the leading dominant and indicator species. Other forbs and ferns present include *Caltha palustris, Chelone glabra, Epilobium coloratum, Impatiens capensis (= Impatiens biflora), Impatiens capensis, Pedicularis lanceolata, Pilea pumila, Saxifraga pensylvanica, Solidago patula*, and *Thelypteris palustris*. Graminoid cover is generally low, less than 25%, and may include *Carex bromoides, Carex comosa, Carex lacustris, Carex stricta*, and *Carex trichocarpa* (MNNHP 1993, White and Madany 1978).

This community develops around spring heads and in broader areas of groundwater discharge, where water flows to the surface in a diffuse rather than concentrated flow. Peat may be present in some areas, and perhaps locally can be as deep as 1 m, but it is typically less than 0.4 m deep. Stands can occur along the lower slopes of glacial moraines, ravines and in deep glacial meltwater-cut river valleys at the bases of slopes separating stream terraces. Soils are seasonally to more-or-less permanently saturated (MNNHP 1993).

COMMENTS: *2, MCS*. This community is defined as an herbaceous community, thereby excluding many closed canopy seepage meadows with trees or shrubs rooted in the stand. However, some herbaceous seepage meadows could be quite shaded because of surrounding upland forests. This type is not always separated out by state heritage programs, since it can be a zone in other wetland types. *Carex lacustris* may occur in this type. The presence of coarse-leaved sedges may be a structural difference as compared to fens, which typically have fine-leaved sedges (MNNHP 1993).

CONSERVATION RANK: *G4?.*

DISTRIBUTION: This community is found throughout the upper midwestern region of the United States and adjacent Canada, where it develops around spring heads and in broader areas of groundwater discharge. The type extends from Indiana and possibly Ontario and Ohio, west to Minnesota and Iowa.

USFS ECOREGIONS: 212He:CPP, 212Hl:CP?, 212Hm:CPP, 212Hq:CPP, 212Hr:CPP, 212Ht:CPP, 212Hu:CPP, 212Hv:CP?, 212Hw:CP?, 212Hx:CP?, 212Kb:CCC, 221Ec:CCC, 222Em:CPP, 222Ff:CCC, 222Gc:CCC, 222Ge:CCC, 222Ha:CCC, 222Hb:CCC, 222Hf:CCC, 222I:CP, 222Jb:CCC, 222Kg:CCC, 222Kh:CCC, 222Lc:CCC, 222Lf:CCC, 222Md:CCC, 251Cf:CCC, 251Dd:CCC, M221:?

CONSERVATION REGIONS: 36:C, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C

STATES: IA? IL IN MI MN OH? **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	seep =
IN	circumneutral seep +
MI	southern swamp +
MN	seepage meadow =
OH?	no state equivalent

OTHER SYNONYMY:

USNVC HIERARCHY: SYMPLOCARPUS FOETIDUS - CALTHA PALUSTRIS SATURATED HERBACEOUS ALLIANCE (V.B.2.N.f)

Carex crinita - Osmunda spp. / Physocarpus opulifolius Seep Herbaceous Vegetation

Fringed Sedge - Royal Fern Species / Eastern Ninebark Seep Herbaceous Vegetation

Midwest Sand Seep CEGL002392

DESCRIPTION: This community is typically dominated by herbaceous species but is sometimes semi-forested. Abundant species in the northern parts of the range include *Athyrium filix-femina, Carex crinita, Dryopteris carthusiana (= Dryopteris spinulosa), Glyceria striata, Osmunda cinnamomea, Osmunda regalis, Physocarpus opulifolius*, and *Symplocarpus foetidus* (White and Madany 1978). More southern stands contain *Photinia melanocarpa (= Aronia melanocarpa), Bartonia paniculata, Cyperus polystachyos var. texensis, Ilex opaca, Oldenlandia uniflora, Platanthera ciliaris, Platanthera clavellata, Sphenopholis pensylvanica (= Trisetum pensylvanicum), Woodwardia areolata*, and the moss *Campylopodiella stenocarpa (= Atractylocarpus costaricensis)* (Nelson 1985).

Stands occupy margins of basins and edges of outwash plains where groundwater continuously flows from surface or, rarely, deep aquifers. Although the flow is generally diffuse, localized concentrated flows can occur and result in spring runs. The soils are saturated year-round. Water is always near the surface in normal years, and it is not uncommon for temporary flooding to cover the ground. There is slight nutrient input from the cold, oxygen-poor, weakly minerotrophic groundwater. Soil pH ranges from 4.5-5.9. Some muck deposits can accumulate. This community is usually less than 0.04 ha and, consequently, is often shaded by surrounding trees (White and Madany 1978, Nelson 1985).

COMMENTS: *3, MCS*. This type has a somewhat bifurcated distribution, either located in the sand outwash in north-central Illinois, or in the sands in the Crowley's Ridge area of Missouri. Though there are scattered occurrences elsewhere in Missouri, these may not fit well with this type concept. The Crowley's Ridge stands are floristically distinct, and there may be other sand seeps in the Interior Highlands with which they are aligned. The sand ridges of the Missouri portion of Crowley's Ridge may possibly extend into the northern section of Crowley's Ridge in Arkansas, north of Joneboro where there is more sand and less loess (D. Zollner pers. comm. 2000).

CONSERVATION RANK: *G2.* There are probably fewer than 25 occurrences rangewide; it is reported from Missouri (where it is ranked S2) and Illinois (S1), and it may also occur in Indiana. Currently there are three occurrences documented from Missouri. Occurrences tend to be very small (usually less than 0.1 acre), so total acreage is likely much less than 100 acres. In Arkansas, a few sand seeps are known to occur in the sandy areas at the northern end of Crowley's ridge (T. Foti pers. comm. 2000). The community has very specific habitat requirements; these habitats may have always been rare.

DISTRIBUTION: This sand seep sedge community is found in the central midwestern United States, particularly in the Kankakee Sands area of northern Illinois and in Crowley's Ridge of southeastern Missouri and northeast Arkansas, but also in scattered areas elsewhere in the state of Missouri.

USFS ECOREGIONS: 222Aa:CCC, 222Ab:CCC, 234Ab:CCC, 251Eb:CCC
CONSERVATION REGIONS: 37:C, 38:C, 42:C
STATES: AR? IL IN? MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	sand seep =
IN?	acid seep ?
MO	acid seep +

OTHER SYNONYMY:

USNVC HIERARCHY: CAREX CRINITA - OSMUNDA SPP. / SPHAGNUM SPP. SATURATED HERBACEOUS ALLIANCE (V.A.5.N.m)

Carex crinita - Osmunda spp. / Sphagnum spp. Herbaceous Vegetation

Fringed Sedge - Royal Fern Species / Peatmoss Species Herbaceous Vegetation

Midwest Acid Seep CEGL002263

DESCRIPTION: This element is best understood in terms of its herbaceous flora. The principal dominant plants are *Carex crinita, Impatiens capensis, Osmunda regalis*, and *Osmunda cinnamomea*. Dominant overstory trees include *Acer rubrum, Liriodendron tulipifera, Quercus alba, Liquidambar styraciflua, Platanus occidentalis*, and *Betula nigra*. It is interesting to note that high-quality examples of this community often have occurrences of both northern (*Osmunda claytoniana*) and southern (*Ilex decidua*) relict plants (TNC 1995a). In Indiana, additional species may also include *Carex lurida, Carex bromoides, Platanthera clavellata, Photinia melanocarpa (= Aronia melanocarpa), Ilex verticillata, Polygonum arifolium, Dryopteris cristata*, and *Sphagnum* spp. (Homoya et al. 1985).

These seeps occupy bases of slopes in valleys and canyons, the margins of basins, and the edges of outwash plains where groundwater flows continuously from surface or, sometimes, deep aquifers. The soils are organic and saturated throughout the year, with water always close to the surface in normal years. There is weak nutrient input from the groundwater. Soil pH ranges from 4.5-5.9. The soils are shallow to deep (40 cm to more than 100 cm) with deposits of muck or peat. Parent material is sandstone, colluvium, or igneous (Schwegman 1969, White and Madany 1978, Nelson 1985).

Sustained droughts, fire (15-20 year cycles?), windthrow, ice storms, and insect-borne diseases are thought to be the primary natural disturbance regimes.

COMMENTS: *2, MCS*. Type is not restricted to gravel seeps. However, circumneutral seeps, e.g., *Symplocarpus foetidus* Herbaceous Vegetation (CEGL002385), if they occur within the range of this type, should be investigated to determine how their floristic composition relates to this acid seep type. Related forested seeps of Kentucky and Tennessee are found in I.B.2.N.g *Acer rubrum - Nyssa sylvatica* Saturated Forest Alliance (A.348).

CONSERVATION RANK: *G2G3.* This community has a moderately restricted geographical range, there are probably fewer than 100 occurrences, and most occurrences are less than 1.0 ha. in size. Sites are often impacted by grazing or ditching.

DISTRIBUTION: This graminoid acid seep community is found primarily in the Interior Highlands of the midwestern United States, ranging from southern Indiana south to Tennessee and west to southeastern Missouri and northeastern Arkansas.

USFS ECOREGIONS: 222Aa:CCC, 222Ab:CCC, 222Aq:CC?, 222Ca:CCC, 222Db:CC?, 222Dc:CCC, 222De:CCC, 222Dh:CCC, 222Em:CPP, 222Ff:CCC, 222Gc:CCC, 234A:PP
CONSERVATION REGIONS: 38:C, 39:?, 43:C, 44:C, 48:C
STATES: AR IL IN KY? MO OH? TN? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	acid gravel seep =
IN	acid seep =
MO	acid seep; forested acid seep I
OH?	seep? ?

OTHER SYNONYMY:

USNVC HIERARCHY: CAREX CRINITA - OSMUNDA SPP. / SPHAGNUM SPP. SATURATED HERBACEOUS ALLIANCE (V.A.5.N.m)

Typha latifolia - Equisetum hyemale - Carex (hystericina, pellita) Seep Herbaceous Vegetation

Broadleaf Cattail - Common Scouringrush - (Porcupine Sedge, Woolly Sedge) Seep Herbaceous Vegetation

Great Plains Neutral Seep CEGL002033

DESCRIPTION: The dominant vegetation in this community consists of hydrophytic macrophytes, typically 1-2 m tall. *Typha latifolia* is by far the most common of the taller species. Among the shorter plants, which rarely exceed 1 m, *Carex* spp. (including *Carex pellita, Carex hystericina*) and *Equisetum hyemale* predominate. Other wetland species, such as *Epilobium* spp., *Eupatorium perfoliatum, Glyceria striata, Impatiens* spp., *Marchantia polymorpha* (a liverwort), *Pilea fontana, Schoenoplectus acutus (= Scirpus acutus), Schoenoplectus pungens (= Scirpus pungens), Schoenoplectus tabernaemontani (= Scirpus tabernaemontani)*, and *Sparganium eurycarpum* are frequent. Small trees, such as *Populus deltoides* and *Salix* spp., are rarely present. Flowing cold-water springs and streams associated with them are often dominated by partly emergent hydrophytic forbs, which may form partly floating mats on the waters surface and include *Berula erecta, Mimulus glabratus, Rorippa nasturtium-aquaticum*, and *Veronica americana*. Submersed hydrophytes including *Elodea canadensis, Potamogeton foliosus*, and *Ranunculus longirostris* may also be present, but rarely flower in flowing water (Steinauer and Rolfsmeier 2000).

This community occurs on the slopes of hills, in valleys, and at the bases of bluffs. Seeps form when rainwater permeates loess, sand, glacial till, limestone, or siltstone and contains an impervious layer of shales, clay or siltstone. The soils in this community can be sand, muck, or gravel. They can be shallow to deep, depending on the degree of slope. The parent material is glacial till, loess, eolian sand, colluvium, or bedrock. A shallow (<30 cm) layer of sedge peat may accumulate at some sites. Moderately minerotrophic groundwater (pH 6.0-6.9) continually saturates at least part of this community (Steinauer and Rolfsmeier 2000).

COMMENTS: *2, MCS*. The distinctions between this community and *Carex pellita - Carex spp. - Schoenoplectus tabernaemontani* Fen Herbaceous Vegetation (CEGL002041) need to be clarified. In the South Dakota Prairie Coteau region, this type may be found under a forest canopy (M. Leoschke pers. comm.).

CONSERVATION RANK: *G3.* Though many sites are intact in some areas such as the Nebraska Sandhills, many more have been degraded through overgrazing. Pollution from agricultural runoff and livestock waste may eliminate some aquatic species that are very sensitive to water quality.

DISTRIBUTION: This cattail-mixed graminoid seep is found in the central Great Plains and central-western tallgrass prairie region, extending from western Missouri and Iowa west to South Dakota and south to Kansas.

USFS ECOREGIONS: 222Ak:???, 251Ba:CCC, 251Cd:CC?, 251Cm:CCC, 332A:C?, 332B:C?, 332C:CC, 332D:C?, 332E:C?
CONSERVATION REGIONS: 27:C, 33:C, 35:C, 36:C
STATES: IA KS MO NE SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO seep =
NE spring seep/stream =

OTHER SYNONYMY: Streamside marsh association (Pool 1914) B

USNVC HIERARCHY: CAREX SPP. - TYPHA SPP. SATURATED HERBACEOUS ALLIANCE (V.A.5.N.m)

Typha spp. - Carex spp. Acid Seep Herbaceous Vegetation

Cattail Species - Sedge Species Acid Seep Herbaceous Vegetation

Great Plains Acid Seep CEGL002235

DESCRIPTION: The vegetation is dominated by herbaceous species, with scattered shrubs. Prominent herbs include *Typha latifolia* or *Typha angustifolia* and a variety of Carices. There may be *Sphagnum* spp. present in some stands. Shrubs include *Lindera benzoin, Sassafras albidum*, and *Vaccinium arboreum* (Lauver et al. 1999).

Stands occur at the bases of gently to moderately steep slopes in river valleys and canyons. Soils are shallow to deep with deposits of peat or muck, formed in sandstone or alluvium. Soils are constantly saturated by acidic groundwater that flows from gravelly or sandy substrates (Lauver et al. 1999).

COMMENTS: *3, MCS*. Concept of the type is taken from the Kansas state classification - acid seep (Lauver et al. 1999) and needs rangewide review, particularly in Missouri. Identification of the Carices that are found in this type is particularly important.

CONSERVATION RANK: *G1G2.*

DISTRIBUTION: This type is currently reported from the western tallgrass prairie region in southeastern Kansas.

USFS ECOREGIONS: 222Am:???, 251Ea:CCC, 255Aa:???, 332:?
CONSERVATION REGIONS: 37:C
STATES: KS MO? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO? acid seep ?

OTHER SYNONYMY:

USNVC HIERARCHY: CAREX SPP. - TYPHA SPP. SATURATED HERBACEOUS ALLIANCE (V.A.5.N.m)

1.4. Open and Emergent Marshes

Nelumbo lutea Herbaceous Vegetation

American Lotus Herbaceous Vegetation

American Lotus Aquatic Wetland CEGL004323

DESCRIPTION: Stands are essentially monospecific *Nelumbo lutea* communities. This association may be divided as more information becomes available. In the Central Appalachian region, mixed or monospecific *Nelumbo lutea* communities of natural wetlands or artificial impoundments sometimes contain scattered *Cephalanthus occidentalis*. Other floating-leaved aquatic plant species, such as *Nuphar lutea* and *Nymphaea odorata*, may be present, as may emergent species such as *Schoenoplectus tabernaemontani (= Scirpus tabernaemontani), Pontederia cordata, Juncus effusus, Typha latifolia, Eichhornia crassipes* (alien), *Hydrocotyle* spp., and floating aquatics, such as *Salvinia minima, Spirodela* spp., *Lemna* spp., and *Azolla caroliniana* (Central Appalachian Ecoregional Planning Team pers. comm. 1998).

Stands are found in natural wetlands or artificial impoundments. The hydrology of this association in the Central Appalachian region is highly variable; thus, the hydrologic placement is debatable (Central Appalachian Ecoregional Planning Team pers. comm. 1998).

COMMENTS: *1, SCS*. It is unclear whether natural stands (ponds) can be separated from semi-natural stands (cultural impoundments that are invaded by *Nelumbo lutea*), complicating the classification and the assessment of the rarity of this type.

CONSERVATION RANK: *G3G4.* Although natural stands may be relatively rare, this type may also occur in cultural impoundments.

DISTRIBUTION: This type is found locally across many parts of the eastern/southeastern United States, from Kentucky and Virginia northeast to Ontario and Michigan, south to Texas, and east to Georgia.

USFS ECOREGIONS: 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222An:CCC, 222Ch:CCC, 222Db:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232:C, 234An:CCC, 251Df:CCC, M221Ad:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC

CONSERVATION REGIONS: 31:C, 32:P, 36:C, 37:P, 38:C, 39:C, 40:P, 41:C, 42:C, 43:C, 44:C, 48:C, 51:?, 52:P, 53:C, 56:P, 57:P, 58:?, 59:C

STATES: AL AR GA IA IL? IN KY LA MI MO? MS NC OK SC TN TX VA **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL?	pond (N) ?
IN	pond +
MI	inland emergent marsh +
MO?	freshwater marsh +

OTHER SYNONYMY: IID6a. Natural Impoundment Pond (Allard 1990), Water lily emergent vegetation (CAP)

USNVC HIERARCHY: NELUMBO LUTEA PERMANENTLY FLOODED TEMPERATE HERBACEOUS ALLIANCE (V.C.2.N.a)

Nuphar lutea ssp. advena - Nymphaea odorata Herbaceous Vegetation

Broadleaf Pondlily - White Waterlily Herbaceous Vegetation

Water Lily Aquatic Wetland CEGL002386

DESCRIPTION: This community is dominated by rooted, floating-leaved aquatic species, with both submergent and emergent aquatics also present. *Nuphar lutea ssp. advena* and *Nymphaea odorata* are dominants. Other species present include *Brasenia schreberi*, various *Potamogeton* spp., *Polygonum amphibium*, and *Polygonum amphibium var. emersum (= Polygonum coccineum)* (Anderson 1982). Submerged aquatic species more common in the southern part of the range include *Cabomba caroliniana, Ceratophyllum demersum*, and *Heteranthera dubia*.

This community occupies shallow water depressions, oxbow ponds, and backwater sloughs of river floodplains, ponds, and small lakes.

COMMENTS: *3, MCS*. Occurs in borrow pits on Kisatchie National Forest. On the Conecuh National Forest (Alabama), vegetation of this alliance occurs in Gum Pond and Open Pond as a mix of *Nymphaea odorata* and *Nuphar lutea ssp. advena*.

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This rooted aquatic community occupies shallow, quiet waters throughout the central and eastern United States, extending from Maine to Ontario and Minnesota, south to Oklahoma and east to Georgia.

USFS ECOREGIONS: 212Cb:CCC, 212Hb:CPP, 212Ja:CCP, 212Jb:CCP, 212Jc:CCP, 212Je:CCP, 212Jf:CCP, 212Jj:CCP, 212Jl:CCP, 212Jm:CCC, 212Ka:CPP, 221Ea:CCC, 221Ed:CC?, 221Ef:CCC, 221He:CCC, 222Ch:CCC, 222Db:CCC, 222Gc:C??, 222Ha:CCC, 222Ja:CCC, 222Jb:CCC, 222Ji:CCC, 222Jj:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Kj:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 234Ac:CC?, 234An:CCC, 251Cf:CCC, 251Dd:CCC, 251Dg:CCC, 251Eb:CCC, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCC, M221Ba:CCC, M221Bb:CCC, M221Bc:CCC, M221Bd:CCC, M221Be:CCC, M221Bf:CCC, M221Da:CCC

CONSERVATION REGIONS: 31:C, 32:P, 36:C, 37:C, 39:C, 40:P, 41:C, 42:C, 43:C, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C, 50:C, 51:?, 52:C, 53:C, 55:P, 56:C, 57:C, 58:C, 59:C, 60:?, 61:C, 62:C, 63:C

STATES: AL AR CT DE GA IA IL IN KY LA MA MD ME MI MN MO MS NC NH NJ NY OH OK PA RI SC TN TX VA VT WI WV

PROVINCES: ON

MIDWEST HERITAGE SYNONYMY:

IL	pond (N); marsh (N) I
IN	lake +
MI	inland emergent marsh +
MN	lake bed -
MO	freshwater marsh +
OH	floating-leaved marsh; floating-leaved riverine community I
WI	submerged aquatic (water lily subtype (not tracked)) ?

OTHER SYNONYMY: L5D2aI1a. *Nuphar lutea* (Foti et al. 1994), Cowlily Aquatic Bed, Open water marsh with floating-leaved plants (NAP)

USNVC HIERARCHY: NYMPHAEA ODORATA - NUPHAR SPP. PERMANENTLY FLOODED TEMPERATE HERBACEOUS ALLIANCE (V.C.2.N.a)

Nymphaea odorata - Nuphar lutea (ssp. pumila, ssp. variegata) Herbaceous Vegetation

White Waterlily - Yellow Waterlily Herbaceous Vegetation

Northern Water Lily Aquatic Wetland CEGL002562

DESCRIPTION: Emergent vegetation cover is less than 25% and floating-leaved aquatics cover at least 25% of the surface. Typical dominants vary from stand to stand, but include *Nymphaea odorata, Nuphar lutea ssp. pumila*, and *Nuphar lutea ssp. variegata*. Other dominants may include *Brasenia schreberi* and *Potamogeton amplifolius*. A variety of emergent species can occur with this type (Harris et al. 1996).

Stands occur in open, slow-moving water on lakes and streams, often less than 0.5 m deep. The substrate is variable, from muck to sedimentary peat (Harris et al. 1996)

COMMENTS: *3, MCS*. This type is not well characterized across its range. Further review is needed in the United States. Depending on spatial scale, it conceptually overlaps both submergent and emergent aquatic types.

CONSERVATION RANK: *G5.*

DISTRIBUTION: This water lily aquatic wetland type occurs throughout the upper midwestern region of the United States and adjacent Canada.

USFS ECOREGIONS: 212Hl:CPP, 212Hm:CPP, 212Hn:CPP, 212Ho:CPP, 212Hp:CPP, 212Hq:CPP, 212Hr:CPP, 212Hs:CPP, 212Ht:CPP, 212Hv:CPP, 212Hw:CPP, 212Hx:CPP, 212Hy:CPP, 212Ib:CPP, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jl:CPP, 212Jn:CPP, 212Jo:CPP, 212La:CPP, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 221B:CC, 222Jb:CCC, 222Je:CCC, M212:C
CONSERVATION REGIONS: 47:P, 48:C
STATES: MI MN NY WI **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY:
MI inland emergent marsh +
MN lake bed -
WI submerged aquatic (northern water lily subtype (not tracked)) ?

OTHER SYNONYMY: Open water marsh: floating-leaved plants (W4) (Harris et al. 1996) =

USNVC HIERARCHY: NYMPHAEA ODORATA - NUPHAR SPP. PERMANENTLY FLOODED TEMPERATE HERBACEOUS ALLIANCE (V.C.2.N.a)

Nymphaea tetragona - Nuphar lutea (ssp. pumila, ssp. variegata) Herbaceous Vegetation

Northern Waterlily - Yellow Waterlily Herbaceous Vegetation

Boreal Water Lily Aquatic Wetland CEGL002563

DESCRIPTION: The vegetation is dominated by rooted aquatics, with at least 25% cover. Dominants include *Nymphaea tetragona, Nuphar lutea ssp. pumila* and *Nuphar lutea ssp. variegata* (J. Greenall pers. comm. 1994).

Stands occur on the margins of lakes, or in ponds and slow-moving rivers.

COMMENTS: *3, MCS*. This type was proposed by the Manitoba CDC (meeting Nov 3, 1994). A new species *Nymphaea leibergii* may be segregated from *Nymphaea tetragona* (Flora of North America, Vol. III), but both have a boreal distribution. Type may occur north of the range of *Nymphaea odorata*, and thus may not be expected in the United States.

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This northern waterlily aquatic type is found in the northern regions of the upper midwestern United States and in central Canada.

USFS ECOREGIONS: 212Lb:CCC, 212Ld:CCC, 212Mb:C??, 212Na:C??, 212Nb:C??, 212Nc:C??
CONSERVATION REGIONS: 47:P, 48:C
STATES: MN **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY: MN lake bed -

OTHER SYNONYMY:

USNVC HIERARCHY: NYMPHAEA ODORATA - NUPHAR SPP. PERMANENTLY FLOODED TEMPERATE HERBACEOUS ALLIANCE (V.C.2.N.a)

Potamogeton spp. - Ceratophyllum spp. Midwest Herbaceous Vegetation

Pondweed Species - Coontail Species Midwest Herbaceous Vegetation

Midwest Pondweed Submerged Aquatic Wetland CEGL002282

DESCRIPTION: Based on information in the northern parts of the Midwest, several vegetation subgroups can be recognized that may be separate associations. Subgroup A is a shallow (<50 cm), sparsely vegetated, open-water marsh found on sand, or organic and mineral material trapped in rocky bottoms. Stands are often exposed to wave action and found in oligotrophic lakes. Dominant plants often have basal rosettes that are resistant to wave action. Typical species include *Elatine minima, Eriocaulon aquaticum, Gratiola aurea, Isoetes tenella (= Isoetes echinospora), Isoetes lacustris (= Isoetes macrospora), Juncus pelocarpus*, and *Lobelia dortmanna* (Curtis 1959, Harris et al. 1996). Subgroup B is a shallow (<50 cm), open-water marsh with emergent cover <25% and floating-leaved aquatics >25%. Substrate is a mineral soil (often sand), boulders, or a mixture of sedimentary peat and fine mineral soil. Stands can be exposed to waves or are in stream channels. Stands may often be dominated by a single species. Typical dominants include *Eleocharis acicularis, Myriophyllum* spp., *Potamogeton amplifolius, Potamogeton gramineus, Potamogeton praelongus, Potamogeton robbinsii, Sparganium fluctuans*, and *Utricularia macrorhiza (= Utricularia vulgaris)*. Subgroup C includes open-water marsh with emergent cover <25% and floating-leaved aquatics >25%. Substrate is sedimentary peat, and stands are often found in sheltered bays of lakes and streams that do not have high wave energy. Stands may often be dominated by a single species. Typical dominants include *Ceratophyllum demersum, Lemna* spp., *Myriophyllum sibiricum, Myriophyllum verticillatum, Potamogeton natans, Stuckenia pectinata (= Potamogeton pectinatus), Potamogeton richardsonii, Potamogeton zosteriformis, Ranunculus aquatilis, Utricularia macrorhiza (= Utricularia vulgaris)*, and *Vallisneria americana* (Curtis 1959, Harris et al. 1996).

Curtis (1959, see also Swindale and Curtis 1955) noted that the major environmental controls on submerged aquatic vegetation are water depth (as it relates to light intensity), water chemistry, water movement, and nature of the substrate. Various combinations of these factors can interact in a variety of ways to influence the local composition of the community. As a result, a single lake may contain a number of relatively homogeneous stands, each with a different species makeup, which depends on depth, nature of adjoining shoreline, degree of protection from waves, etc. Water chemistry may be one of the few constants. Assessment of water conductivity and alkalinity are two measured parameters that can provide some understanding of the influence of water chemistry on species composition.

COMMENTS: *3, MCS*. This type is based on information in the more northern parts of the range. However, it may need to be split into a boreal/sub-boreal type (subgroup A above) and a Midwestern type (subgroups B and C), and even within the Midwest there may be substantial differences between western and eastern stands (Robert Dana pers. comm. 1999). In Wisconsin, Subgroup A is considered distinctive, and could be ranked an S3 type. It is locally common there in deep, hard-bottomed seepage lakes of the Northern Highlands Pitted Outwash subsection (212Jm of Keys et al. 1995) (E. Epstein pers. comm. 1999).

CONSERVATION RANK: *G5.*

DISTRIBUTION: This pondweed submerged aquatic type is found widely throughout the midwestern United States and adjacent Canada, ranging from Ohio and Ontario west to North Dakota and south to Iowa.

USFS ECOREGIONS: 212Hb:CCP, 212Hs:CCC, 212Hv:CCC, 212Hw:CCC, 212Ib:CPP, 212Ja:CCP, 212Jb:CCP, 212Jc:CCP, 212Je:CCP, 212Jf:CCP, 212Jj:CCP, 212Jl:CCP, 212Jm:CCC, 212Ka:CPP, 212La:CPP, 212Mb:C??, 221Ef:CCC, 221Fc:CCC, 221He:CCC, 222Ao:CPP, 222Ch:CPP, 222Gc:CPP, 222Ha:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Kf:CCC, 251Aa:???, 251Ba:???

CONSERVATION REGIONS: 35:C, 36:C, 45:C, 46:C, 47:C, 48:C, 49:C, 50:C

STATES: IA IL IN MI MN ND OH SD WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	pond (N) +
IN	lake +
MI	submergent marsh +
MN	river bed; lake bed -
OH	submerged marsh; submerged riverine community I
WI	submerged aquatic (northern pondweed & pondweed subtypes) -

OTHER SYNONYMY: Open water marsh: floating-leaved plants (W4) (Harris et al. 1996) I

USNVC HIERARCHY: POTAMOGETON SPP. - CERATOPHYLLUM SPP. - ELODEA SPP. PERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.C.2.N.a)

Vallisneria americana Herbaceous Vegetation

American Eelgrass Herbaceous Vegetation

Tape Grass Submerged Aquatic Wetland CEGL002284

DESCRIPTION: The vegetation is dominated by *Vallisneria americana*. Little is known about possible associates.

Stands may be expected on sandy soil bottoms in shallow quiet waters, including lakes, streams, and ponds. Some sites where *Vallisneria americana* persists may be as much as 7 m deep (Voss 1972).

COMMENTS: *3, MCS*. Type is a dominance-based submerged aquatic type that was developed by the Iowa Natural Heritage Program (J. Pearson pers. comm. 1997). Little information is available on associated species or its rangewide distribution as a dominant. The species has a very broad range, extending from Nova Scotia to Minnesota and South Dakota south to Texas and east to Florida.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This aquatic wetland or open marsh type is reported from the midwestern United States.

USFS ECOREGIONS: 251:P
CONSERVATION REGIONS: 48:C
STATES: IA **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: VALLISNERIA AMERICANA PERMANENTLY FLOODED TEMPERATE HERBACEOUS ALLIANCE (V.C.2.N.a)

Equisetum fluviatile - (Eleocharis palustris) Herbaceous Vegetation

Water Horsetail - (Marsh Spikerush) Herbaceous Vegetation

Water Horsetail - Spikerush Marsh CEGL005258

DESCRIPTION: Emergent cover is greater than 25%, and floating-leaved and submergent cover is low. Emergent graminoids <1 m dominate the stands, including *Equisetum fluviatile* and/or *Eleocharis palustris (= Eleocharis smallii)*. Associated species of low constancy include *Glyceria borealis, Isoetes echinospora, Potamogeton gramineus*, and *Utricularia macrorhiza (= Utricularia vulgaris)* (Harris et al. 1996).

Stands occur in wave-washed shores, sandbars, and stream channels. Substrate is mineral soil (often sand), sometimes held together by root mats. The water regime is permanently flooded to intermittently exposed, and water depth is generally less than 1 m (Harris et al. 1996).

COMMENTS: *2, MCS*. This type can occur as reed swamp communities. It can grade into bulrush-dominated communities, or occur in conjunction with wild rice marshes. The range limit westward for this type (CEGL005258) and eastward for *Equisetum fluviatile* Herbaceous Vegetation (CEGL001960) remains to be worked out. The Northern Great Lakes Emergent Marsh type, *Schoenoplectus acutus - Schoenoplectus subterminalis - Eleocharis palustris - (Scirpus americanus)* Northern Great Lakes Shore Herbaceous Vegetation (CEGL005274), may resemble this type to some degree.

CONSERVATION RANK: *G4.*

DISTRIBUTION: This low graminoid marsh community is found in the boreal regions of the Great Lakes and perhaps more widely in Canada.

USFS ECOREGIONS: 212La:CCC, 212Lc:CCC
CONSERVATION REGIONS: 47:C
STATES: MN **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY: MN mixed emergent marsh (forest section) +

OTHER SYNONYMY: Marsh: spikerush-water horsetail: mineral substrate (W6) (Harris et al. 1996) =

USNVC HIERARCHY: EQUISETUM FLUVIATILE SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.B.2.N.e)

Polygonum spp. - Mixed Forbs Herbaceous Vegetation

Smartweed Species - Mixed Forbs Herbaceous Vegetation

Midwest Ephemeral Pond CEGL002430

DESCRIPTION: A wide variety of forbs and graminoids may colonize the exposed substrate. Repeated flooding may eliminate perennial species and favor annuals. Species include *Bidens* spp., *Cyperus* spp., *Echinochloa crus-galli*, and *Polygonum* spp. (Eggers and Reed 1987). In Missouri *Polygonum hydropiperoides* is common. In sand ponds in central Illinois, annuals were the most common species (43 of 72 species present), including some of the major dominants, such as *Schoenoplectus hallii (= Scirpus hallii), Ammannia coccinea*, and various *Polygonum* spp. (including *Polygonum hydropiperoides, Polygonum lapathifolium, Polygonum pensylvanicum*, and *Polygonum persicaria*). Dominant perennials include *Typha latifolia, Typha angustifolia, Schoenoplectus tabernaemontani (= Scirpus tabernaemontani)*, and *Polygonum amphibium*. Other notable species include the annuals *Cyperus* spp. (including *Cyperus acuminatus, Cyperus erythrorhizos, Cyperus esculentus, Cyperus odoratus (= Cyperus ferruginescens), Cyperus strigosus), Bidens cernua*, and *Bidens frondosa*. Rare species found in these sand ponds include *Boltonia decurrens* and *Schoenoplectus hallii* (Ebinger et al. 1997).

Stands occur in shallow depressions that may flood briefly in the spring, but typically draw down by early summer. These basins may be kettles in glacial deposits, low spots in outwash plains, or depressions in floodplains (Eggers and Reed 1987). Areas on glacial sand deposits occur in central Illinois. These deep sands produce an open groundwater aquifer that floods surface depressions during wet years (McClain et al. 1997).

Repeated flooding may eliminate perennial species and favor annuals (Eggers and Reed 1987). This is particularly documented in sand ponds in central Illinois, where 43 of 72 species recorded were annuals (McClain et al. 1997). Seed banks are an important source of redevelopment. Seeds can remain viable 20-40 years after being drained or drying out.

COMMENTS: *3, MCS*. This type is in need of further characterization. Type should be compared to Lake Mud Flats Sparse Vegetation (CEGL002313), which may be conceptually similar. However, in Illinois this type is found in sandy areas. Type is placed in a low forb category, but graminoids can dominate. Much work is needed to better describe this type.

CONSERVATION RANK: *G4G5.* This type is a widespread early successional type. However, during dry years, many stands may be plowed and farmed. Sand ponds in Illinois may be a more rare subtype, as they are typically farmed during dry years, and native vegetation only develops during wet years, when ponds retain water.

DISTRIBUTION: This temporary pond community type occurs in the central midwestern region of the United States, extending from Indiana to Wisconsin, Iowa, and Missouri.

USFS ECOREGIONS: 212Ja:PPP, 212Jb:PPP, 212Jc:PPP, 212Je:PPP, 212Jf:PPP, 212Jj:PPP, 212Jl:PPP, 212Jm:PPP, 222Ab:CCC, 222Ag:CCC, 222Aj:CCC, 222Ak:CC?, 222Am:CCC, 222Gc:CCC, 222Jb:CCC, 222Ji:CCC, 222Jj:CCC, 222Kf:CCC, 251Cc:CCC, 251Cd:CC?, 251Cf:CCC, 251Cg:CCC, 251Ck:CCC, 251Eb:CCC

CONSERVATION REGIONS: 36:C, 37:C, 38:C, 39:?, 44:P, 45:C, 46:C, 47:P, 48:C

STATES: IA IL IN MO WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	pond (N) +
IN	pond +
MO	freshwater marsh +
WI	ephemeral pond =

OTHER SYNONYMY: Seasonally flooded basins (Eggers and Reed 1987) =

USNVC HIERARCHY: POLYGONUM SPP. (SECTION PERSICARIA) SEASONALLY FLOODED HERBACEOUS ALLIANCE (V.B.2.N.h)

Rhynchospora capitellata - Rhexia virginica - Rhynchospora scirpoides - Schoenoplectus hallii Herbaceous Vegetation

Northern Beaksedge - Virginia Meadow-beauty - Longbeak Beaksedge - Hall's Bulrush Herbaceous Vegetation

Inland Coastal Plain Marsh CEGL005108

DESCRIPTION: Graminoids and forbs dominate the main part of this wetland community. This plant community typically forms a distinct zonation in concentric bands: open water (when present); shallow water to recently emerged shore dominated by annual plant species and emergents; moist meadow typically dominated by *Calamagrostis canadensis* and sometimes *Cladium mariscoides, Rhynchospora capitellata, Carex scoparia*, etc.; and shrub tree margin (when present), often with *Acer rubrum, Nyssa sylvatica, Quercus palustris, Photinia melanocarpa (= Aronia melanocarpa), Vaccinium corymbosum, Cornus* spp., and *Cephalanthus occidentalis*. Common indicator species such as *Symphyotrichum dumosum (= Aster dumosus), Eleocharis melanocarpa, Fuirena squarrosa, Lycopodiella appressa (= Lycopodium appressum), Dichanthelium spretum (= Panicum spretum), Polygala cruciata, Rhynchospora scirpoides (= Psilocarya scirpoides), Rhynchospora macrostachya, Rotala ramosior, Euthamia caroliniana (= Solidago remota), Scleria reticularis, Stachys hyssopifolia*, and *Triadenum virginicum* are found on the northern Atlantic Coastal Plain, either disjunct or ranging west into the Lower Great Lakes region. About 48 species including 11 indicators, are common components of this community; species include *Eriocaulon aquaticum (= Eriocaulon septangulare), Fimbristylis autumnalis, Lipocarpha micrantha (= Hemicarpha micrantha), Dichanthelium meridionale (= Panicum meridionale), Rhexia virginica, Schoenoplectus smithii (= Scirpus smithii), Viola lanceolata*, and *Xyris difformis*. Many of the characteristic species of this community are annuals. They are favored by and persist because of periodic drawdowns of pond or lake levels that expose bare substrate for germination.

This community occurs on sandy pitted outwash plains and sandy glacial lakeplains, where it is found on shores of softwater seepage lakes, ponds, or depressions. The level topography of these plains produces gently sloping, shallow basins with no outlets and sometimes no inlets. The water table fluctuates seasonally and yearly. It is highest in late winter and spring, and during years of high precipitation. Four zones of flooding regimes may be recognized, Zone 1 is open water (when present), Zone 2 is intermittently exposed (usually inundated), Zone 3 is either seasonally flooded (inundated for part of the growing season) or saturated due to season, and Zone 4 is temporarily flooded (rarely inundated except during periods of high precipitation). Complete drawdown is possible during drought, exposing the bottoms of the basins.

The soils in this community are derived mainly from sand. The sand is poor in nutrients and is acidic to circumneutral, with pH ranging from 4.4-7.0. Lake water that is circumneutral tends to raise the pH of soils nearest the lake. The acidic, nutrient-poor conditions inhibit microbial decomposition and considerable organic material accumulates as peat. The peat mixes with sand or forms more-or-less pure deposits. Basin shorelines typically have stretches of pure sand in areas where wave action is greatest, pure peat in protected areas, and a mixture of the two substrates in other areas. In some basins, an impermeable layer of clay develops 2-5 m below the surface. This layer may hold the local water table above the regional water table for long periods.

The natural dynamics of this type are affected by annual and seasonal variations in precipitation. Longer term climatic effects and migration patterns are discussed by Reznicek (1994) and Jackson and Singer (1997). In particular Jackson and Singer (1987) report that coastal plain disjuncts in northwestern Indiana probably arrived about 5700 years BP, during the mid-Holocene warming, but some species, such as *Fuirena pumila* and *Eleocharis equisetoides* have since gone extinct, probably prior to human occupation of the basin.

COMMENTS: *2, MCS*. Hydrology is typically seasonally flooded, but parts of stand may vary from temporarily flooded to saturated.

CONSERVATION RANK: *G2?*. This type has a restricted natural distribution. A variety of urban and rural developments have affected the hydrology of these systems.

DISTRIBUTION: This inland coastal plain marsh community is found in the Great Lakes region of the midwestern United States and Canada. Ninety percent of the occurrences of this community are within 160 km of the southeastern shore of Lake Michigan in southwestern Lower Michigan and northeastern Indiana. This community also is found in the central Wisconsin sandplain and the outwash of northwestern Wisconsin. There is a concentration of sites on the till plains of Georgian Bay, Ontario. Smaller concentrations occur on outwash and lakeplains in northern Lower Michigan and eastern Upper Michigan.

USFS ECOREGIONS: 212Hu:CCC, 212Hv:CCP, 212Hx:CCC, 212Ka:C??, 222Ge:CCC, 222Ja:CCC, 222Jb:CCC, 222Jc:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ka:CCC, 222Kb:CCC
CONSERVATION REGIONS: 44:C, 45:C, 46:C, 47:?, 48:C
STATES: IN MI WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IN	muck flat; sand flat I
MI	coastal plain marsh =
WI	coastal plain marsh =

OTHER SYNONYMY:

USNVC HIERARCHY: RHYNCHOSPORA SPP. - PANICUM (RIGIDULUM, VERRUCOSUM) - RHEXIA VIRGINICA SEASONALLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.k)

Sagittaria latifolia - (Sagittaria rigida) Herbaceous Vegetation

Broadleaf Arrowhead - (Sessile-fruit Arrowhead) Herbaceous Vegetation

Arrowhead Marsh CEGL005240

DESCRIPTION: Stands are dominated by *Sagittaria latifolia*, often with other emergent aquatic species. Little is known about the dynamics, naturalness, or composition of this association.

Stands occur in semipermanently flooded wetlands.

COMMENTS: *3, MCS*. Type is newly listed for Iowa and needs rangewide review. Little is known about the dynamics, naturalness, or composition of this association. It may be a subtype of a more broadly defined shallow marsh type, the *Schoenoplectus tabernaemontani - Typha spp. - (Sparganium spp., Juncus spp.)* Herbaceous Vegetation (CEGL002026).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This type is found in the midwestern United States, but is poorly described, so its range is not well understood.

USFS ECOREGIONS: 251B:PP, 251C:PP, 331E:??
CONSERVATION REGIONS: 26:C, 36:P
STATES: IA **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: SAGITTARIA LATIFOLIA SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.B.2.N.e)

Schoenoplectus acutus - (Schoenoplectus fluviatilis) Freshwater Herbaceous Vegetation

Hardstem Bulrush - (River Bulrush) Freshwater Herbaceous Vegetation

Freshwater Bulrush Marsh CEGL002225

DESCRIPTION: Tall hydrophytic graminoids, particularly *Schoenoplectus acutus (= Scirpus acutus)* and, less frequently, *Schoenoplectus fluviatilis (= Scirpus fluviatilis)*, dominate the vegetation. These two species may grow taller that 2 m (Weaver 1960) and sometimes nearly exclude other species. Other species that can be present include *Carex atherodes* (especially in the shallower parts of the community), *Lemna* spp., *Schoenoplectus tabernaemontani (= Scirpus tabernaemontani), Typha latifolia*, and *Utricularia macrorhiza*. *Schoenoplectus tabernaemontani* can be a codominant in places. Floating-leaved and submergent plants have low cover (Harris et al. 1996). This community often occurs as dense stands with interspersed channels or pools of open water.

This community is found on wetland sites that are flooded for most or all of the growing season. Weaver (1960) found abundant *Schoenoplectus acutus (= Scirpus acutus)* in water 0.3-1.6 m deep. Soils are mostly mineral but can contain significant organic matter (Harris et al. 1996). Dix and Smeins (1967) found the soils to be humic gleys and mucks in North Dakota, while in northwestern Ontario this community is favored on sandy substrates (Harris et al. 1996).

COMMENTS: *2, MCS*. Separation of pure bulrush marsh types from mixed emergent marsh types may be difficult. Iowa shallow marsh may better fit with *Schoenoplectus tabernaemontani - Typha spp. - (Sparganium spp., Juncus spp.)* Herbaceous Vegetation (CEGL002026). In many places, including at Voyageurs National Park, Minnesota, *Schoenoplectus tabernaemontani* is dominant.

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This hardstem bulrush - mixed bulrush community type is found mainly in the northeastern Great Plains and northern tallgrass prairie region of the United States and Canada, from Minnesota and Ontario west to Manitoba and south to Iowa.

USFS ECOREGIONS: 212La:CPP, 222Lc:CCC, 251Aa:CCC, 251Bb:CCC, 251Be:CCC
CONSERVATION REGIONS: 26:C, 34:C, 35:C, 46:C, 47:P
STATES: IA MN ND SD **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY: MN mixed emergent marsh (prairie section) +

OTHER SYNONYMY: Swamps (Weaver 1960) B, Marshes (Dix and Smeins 1967) B, Sedge zone, pothole and drainage community (Brotherson 1969) =. uncertain if equivalent, Semipermanent ponds and lakes, slightly brackish, central deep-marsh zone (Stewart and Kantrud 1971) B, Bulrush marsh =., Marsh: Bulrush: Mineral substrate (W7) (Harris et al. 1996) =

USNVC HIERARCHY: SCHOENOPLECTUS ACUTUS - (SCHOENOPLECTUS TABERNAEMONTANI) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.I)

Schoenoplectus fluviatilis - Schoenoplectus spp. Herbaceous Vegetation

River Bulrush - Bulrush Species Herbaceous Vegetation

River Bulrush Marsh CEGL002221

DESCRIPTION: The diagnostic dominant is *Schoenoplectus fluviatilis (= Scirpus fluviatilis)*, which often forms almost mono-dominant patches. Other marsh associates include *Typha angustifolia, Typha latifolia, Schoenoplectus tabernaemontani (= Scirpus tabernaemontani)*, and *Sparganium eurycarpum*.

Sites are subject to seasonal flooding that typically draws down by late summer.

COMMENTS: *3, MCS*. This type is weakly defined, often being treated as part of a mixed emergent marsh type. Further work is needed to characterize its extent and composition. But its potentially extensive nature along major rivers and dependence on flooding may make it a good indicator of natural flooding regimes. In the northern tallgrass prairie and Mississippi River floodplains these marshes can be heavily degraded due to heavy siltation, nutrient enrichment, and plowed floodplains (R. Dana, E. Epstein pers. comm. 1999).

CONSERVATION RANK: *G3G4.* In the northern tallgrass prairie these marshes can be heavily degraded due to heavy siltation, nutrient enrichment, and plowed floodplains (R. Dana pers. comm. 1999). In the Mississippi River floodplains, extensive stands once occurred, but they are now subject to very altered hydrologic regimes (since the 1930s) (Eric Epstein pers. comm. 1999).

DISTRIBUTION: This community is found throughout the central and upper midwestern United States where it is found along large rivers and lakeshores, ranging from Ohio west to Manitoba and south to Iowa.

USFS ECOREGIONS: 212Ja:PPP, 222Ab:C??, 222Ak:C??, 222Gc:CCC, 222Kg:CCC, 222Md:CCC, 251Aa:C??, 251Cd:CC?, 251Cf:CCC, 251Ck:CCC
CONSERVATION REGIONS: 35:C, 36:C, 37:P, 44:P, 46:C, 48:C
STATES: IA IL IN MN MO OH WI **PROVINCES:** MB

MIDWEST HERITAGE SYNONYMY:

IL	marsh (S); marsh (N) I
IN	marsh +
MN	mixed emergent marsh (prairie section) +
MO	freshwater marsh +
OH	mixed emergent marsh +
WI	deep marsh (river bulrush subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: SCHOENOPLECTUS FLUVIATILIS SEASONALLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.k)

Schoenoplectus maritimus - Atriplex patula - Eleocharis parvula Herbaceous Vegetation

Saltmarsh Clubrush - Halberd-leaf Orach - Dwarf Spikerush Herbaceous Vegetation

Inland Saline Marsh CEGL005111

DESCRIPTION: This community is a wetland dominated by tall graminoid plants. The vegetation may be sparse with areas of bare mud. Salt-tolerant species are common in the community.

Because occurrences are small and widely scattered, each site tends to have a distinct composition. Dominant species vary from marsh to marsh, and eastern sites are richer in halophytic species than western sites. Species that are found across the range of the community are *Atriplex patula, Eleocharis parvula, Hibiscus moscheutos*, and *Schoenoplectus maritimus (= Scirpus maritimus)*. In Illinois, *Spartina pectinata* can be dominant. In Michigan, *Symphyotrichum lanceolatum var. lanceolatum (= Aster lanceolatus var. lanceolatus), Schoenoplectus americanus (= Scirpus americanus)*, and *Typha latifolia* tend to be dominants. In New York, other characteristic plants include *Agrostis stolonifera, Leptochloa fusca ssp. fascicularis (= Diplachne maritima)*, and *Spergularia salina (= Spergularia marina)* (White and Madany 1978, Faust and Roberts 1983, Chapman et al. 1989, Reschke 1990).

This community occurs on peat, muck, or mineral soils saturated by sodium- or chlorine-rich groundwater seeping from saline aquifers. These sites are most common along streams or rivers where glacial drift is thin enough to permit brine from deep saline aquifers to remain concentrated and emerge at discrete points (White and Madany 1978, Chapman et al. 1985, Chapman et al. 1989, Reschke 1990).

These sites may be seasonally flooded (Reschke 1990).

COMMENTS: *2, MCS*. This type puts together several very discrete and isolated saline stands. Floristic similarity needs to be reviewed.

CONSERVATION RANK: *G1*. This is a naturally rare community in the Midwest, occurring where saline water emerges at the surface only rarely. Stands can be affected by alterations to hydrology. They may also be invaded by *Phragmites communis*, which can be fairly salt-tolerant. Many sites in New York have been destroyed or degraded by salt extraction operations, filling, and development (Reschke 1990).

DISTRIBUTION: This inland salt marsh community type is found in scattered locations in the upper midwestern United States in the Great Lakes region, including Illinois, Michigan, and western New York.

USFS ECOREGIONS: 221Ea:CCC, 222Ic:CCC, 222Jc:CCC, 251Dd:CCC
CONSERVATION REGIONS: 36:C, 45:, 48:C, 49:C
STATES: IL MI NY **PROVINCES:** ON?

MIDWEST HERITAGE SYNONYMY: IL brackish marsh =
MI inland salt marsh =

OTHER SYNONYMY:

USNVC HIERARCHY: SCHOENOPLECTUS MARITIMUS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.I)

Schoenoplectus tabernaemontani - Typha spp. - (Sparganium spp., Juncus spp.) Herbaceous Vegetation

Softstem Bulrush - Cattail Species - (Bur-reed Species, Rush Species) Herbaceous Vegetation

Bulrush - Cattail - Burreed Shallow Marsh CEGL002026

DESCRIPTION: Vegetation varies from zones dominated by tall emergents 1-2 m tall to those with hydrophytic annual and perennial forbs <1 m tall. In the tall emergent zone, *Schoenoplectus tabernaemontani (= Scirpus tabernaemontani), Schoenoplectus fluviatilis (= Scirpus fluviatilis), Schoenoplectus acutus (= Scirpus acutus), Typha angustifolia*, and *Typha latifolia* may dominate, mixed with a variety of other herbaceous species, such as *Leersia oryzoides, Eleocharis palustris, Juncus* spp., and *Sparganium* spp. The hydrophytic annual and perennial forb zone is dominated by *Alisma subcordatum, Alisma plantago-aquatica, Pontederia cordata, Sagittaria latifolia*, and *Sparganium eurycarpum*, along with *Bacopa rotundifolia* and *Heteranthera limosa*. Other species that may dominate locally include *Polygonum pensylvanicum (= Polygonum bicorne), Polygonum amphibium var. emersum (= Polygonum coccineum)*, and *Polygonum lapathifolium*. Occasional floating-leaved aquatics are sometimes present, including *Azolla caroliniana, Lemna* spp., *Spirodela polyrrhiza*, and *Utricularia macrorhiza* (Eggers and Reed 1987, Steinauer and Rolfsmeier 2000).

This community ranges broadly over the Midwestern United States. It is found in basin-like depressions, backwater areas of floodplains and shallow margins of lakes or ponds. Soils are shallow to deep, very poorly drained, consisting of peats, mucks, or mineral materials, often found in alluvium (Lauver et al. 1999).

COMMENTS: *3, MCS*. This is a very broadly defined type that intergrades between wet meadows and deep marshes. Shaw and Fredine (in Eggers and Reed 1987) define shallow marsh as "soils that are saturated to inundated by standing water up to 15 cm in depth, throughout most of the growing season." Depending on the local topographic context, the type may or may not be extensive. Any number of types could be separated within this coarsely defined type, but it is not yet clear how best to make such distinctions (e.g., the forb-dominated portions, such as *Pontederia cordata* or *Sagittaria latifolia*). [See e.g., *Sagittaria latifolia - (Sagittaria rigida)* Herbaceous Vegetation (CEGL005240).] See also Lee et al. (1998), who separate out a *Sparganium eurycarpum* type. Taxonomically, *Schoenoplectus tabernaemontani* is equivalent to former *Scirpus validus* (Kartesz 1999). In Minnesota, *Schoenoplectus acutus (= Scirpus acutus)* may be the more common bulrush (R. Dana pers. comm. 1999). *Eleocharis* spp. can also be typical of this type. Dominant and characteristic plants should always be described from stands to allow for adequate characterization. In Nebraska, the pond marsh extends to south-central Nebraska (Steinauer and Rolfsmeier 2000).

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This shallow marsh mixed emergent community ranges broadly over the midwestern United States and adjacent Canada, from Ohio and Ontario west to Manitoba, south to Oklahoma, and east to Indiana.

USFS ECOREGIONS: 212Hb:CC?, 212Hm:CCC, 212Hs:CCC, 212Hv:CCC, 212Ib:C??, 212Ja:CCP, 212Jb:CC?, 212Jc:CCP, 212Jd:CCC, 212Je:CC?, 212Jf:CC?, 212Jj:CC?, 212Jk:CC?, 212Jl:CC?, 212Jm:CC?, 212Ka:CP?, 212Kb:CPP, 212La:CPP, 212Lb:CPP, 212Lc:CPP, 212Ld:CPP, 212Ma:CPP, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 212Nd:CPP, 221Ea:CCC, 221Ec:CCC, 221Ed:CCP, 221Ef:CCC, 221Fa:CCC, 221He:CCC, 222Ak:CP?, 222Ao:CPP, 222Db:CCC, 222Ga:CCC, 222Gb:CCC, 222Ha:CCC, 222Hc:CCC, 222Hf:CCC, 222Ji:CCC, 222Jj:CCC, 222Kf:CCC, 222Kg:CCC, 222Md:CCC, 222Na:CPP, 251Aa:CP?, 251Cc:CCC, 251Cd:CC?, 251Cf:CCC, 251Cj:CCC, 251Co:CCC, 251Dg:CCC, 332E:PP
CONSERVATION REGIONS: 26:C, 33:C, 34:C, 35:C, 36:C, 37:C, 42:?, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C, 50:C
STATES: IA IL IN KS MI MN MO ND NE OH OK SD WI **PROVINCES:** MB ON SK

MIDWEST HERITAGE SYNONYMY:

IL	marsh (N); marsh (S) I
IN	marsh +
MI	inland emergent marsh +
MN	mixed emergent marsh (forest section) +
MO	freshwater marsh +
NE	pond marsh =
OH	mixed emergent marsh +
WI	shallow marsh =

OTHER SYNONYMY:

USNVC HIERARCHY: TYPHA SPP. - (SCHOENOPLECTUS SPP., JUNCUS SPP.) SEASONALLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.k)

Typha spp. - Schoenoplectus acutus - Mixed Herbs Midwest Herbaceous Vegetation

Cattail Species - Hardstem Bulrush - Mixed Herbs Midwest Herbaceous Vegetation

Midwest Mixed Emergent Deep Marsh CEGL002229

DESCRIPTION: This deepwater emergent marsh community is dominated by perennial herbaceous vegetation with graminoid leaves. A typical example of this marsh contains a mosaic of emergents, submergents, and floating-leaved plants interspersed with areas of open water (Harris et al. 1996). Various kinds of emergents may dominate a marsh depending on the water depth. Quite often the vegetation arranges itself in belts (wetland zonation), with a particular species or range of species occupying specific depths from the shoreline to deep open water. Marshes may display areas of open water, but vegetation dominates (>30% cover). *Typha latifolia, Typha angustifolia*, and *Schoenoplectus acutus (= Scirpus acutus)* dominate this dynamic ecosystem. Sedges are also common (e.g. *Carex lupuliformis* and *Carex hyalinolepis* in the eastern part of the range). A diverse assemblage of grasses, floating-leaved aquatics, and submerged aquatics are present (TNC 1995a).

These highly productive wetlands are found in glacial potholes, river valleys, ponds, and on lakeplains. They are characterized by continuous inundation and are considered a deep marsh. Water depth averages 0.3-0.6 m, ranging from several centimeters to more than one meter for a significant part of the growing season. Seasonal flooding during winter and spring or flooding during heavy rains help maintain these marshes by causing water exchange which replenishes freshwater and circulates nutrients and organic debris. Soils can be mineral or organic but are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part. Vegetative diversity and density are highly variable in response to water depth, water chemistry, and natural forces.

Seasonal flooding and heavy rains influence vegetative growth, aquatic animals, and nutrient cycling in marsh ecosystems.

COMMENTS: *2, MCS*. This community type is very broadly defined. It can be highly dynamic from one season to the next, and species composition and density are very dependent on water regime and sometimes the mineral content of water and soil (Niering 1985). Deep marsh is defined as having water depths of 15 cm to over 1 m throughout all or most of the growing season (Shaw and Fredine 1971, in Eggers and Reed 1987). The concept and distribution of this community in the Southeast needs reassessment; it should be compared to *Typha latifolia* Southern Herbaceous Vegetation (CEGL004150), particularly in the Mississippi alluvial plain of Missouri (M. Leahy pers. comm. 1999). Many of the presettlement occurrences of this community have been drained and converted to cropland or destroyed by siltation, which greatly accelerates the natural successional process from shallow inundation to moist soil. *Lythrum salicaria* is an aggressive exotic species that threatens this community in Canada, the Northeast, and more recently in the Midwest. Stands in Province 212 may deserve to be recognized as a separate northern type, but further data are needed.

CONSERVATION RANK: *G4?*. This type is subject to many forms of human impact, particularly draining for farmland.

DISTRIBUTION: This community is found in glacial potholes, river valleys, ponds, and on lake plains throughout the midwestern and parts of the eastern United States, ranging from Ohio and Ontario west to North Dakota, south to Nebraska and east to Alabama.

USFS ECOREGIONS: 212He:CCC, 212Hj:CCP, 212Ho:CCC, 212Hq:CCP, 212Ht:CCC, 212Hv:CCC, 212Ib:C??, 212Ja:CPP, 212Jb:CP?, 212Jc:CP?, 212Jf:CPP, 212Jj:CPP, 212Jl:CPP, 212Jm:CPP, 212Jn:CP?, 212Jo:CP?, 212Ka:CPP, 212Mb:CPP, 212Na:CCP, 212Nb:CCP, 212Nc:CCC, 212Nd:CC?, 222A:CP, 222Cg:CCP, 222D:CP, 222E:CP, 222G:CP, 222Ha:CCC, 222Hb:CCC, 222Ia:CCC, 222Jc:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kd:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Kj:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 222Na:CCC, 234A:PP, 251Aa:CCC, 251Ab:CCC, 251Bb:CCC, 251Bd:CCC, 251Be:CCC, 251Cb:CCC, 251Cf:CCC, 251Cg:CCC, 251Ch:CCC, 251Cm:CCC, 251Cp:CCC, 251Dg:CCC, 251Eb:CCC

CONSERVATION REGIONS: 35:C, 36:C, 37:P, 43:C, 44:P, 46:C, 47:C, 48:C, 50:?

STATES: AL IA IL IN KY MI MN MO ND NE OH SD TN WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	marsh (S); marsh (N) I
IN	marsh +
MI	inland emergent marsh +
MN	mixed emergent marsh (prairie section); mixed emergent marsh (forest section) I
MO	freshwater marsh +
NE	freshwater marsh +
OH	mixed emergent marsh; mixed emergent riverine community I
WI	deep marsh (mixed emergent subtype) =

OTHER SYNONYMY: Marsh: Mixed: Mineral Substrate (W5) (Harris et al. 1996) B, Marsh: Mixed: Organic Substrate (W10) (Harris et al. 1996) B

USNVC HIERARCHY: TYPHA (ANGUSTIFOLIA, LATIFOLIA) - (SCHOENOPLECTUS SPP.) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.I)

Typha spp. Midwest Herbaceous Vegetation

Cattail Species Midwest Herbaceous Vegetation

Midwest Cattail Deep Marsh CEGL002233

DESCRIPTION: This deepwater emergent marsh community is dominated by perennial, coarse-leaved graminoid vegetation. Stands may vary from a mosaic of emergents, submergents, and floating-leaved plants interspersed with areas of open water to dense stands of emergents (Harris et al. 1996). They may display substantial areas of open water, but vegetation covers at least 30% of the surface. The vegetation is dominated by relatively pure stands of *Typha* spp., either *Typha latifolia* or *Typha angustifolia* or both. Many associates could occur.

These wetlands are found in glacial potholes, river valleys, ponds, and on lakeplains. They are characterized by continuous inundation and are considered a deep marsh. Water depth averages 0.3-0.6 m, ranging from several centimeters to more than one meter for a significant part of the growing season.

COMMENTS: *2, MCS*. It is unclear whether a separate *Typha*-dominated type is needed in addition to the mixed *Typha - Scirpus* type (e.g., *Typha spp. - Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation (CEGL002229)), as well as separate *Scirpus*-dominated types (e.g., *Schoenoplectus acutus - (Schoenoplectus fluviatilis)* Freshwater Herbaceous Vegetation (CEGL002225)). Pure *Typha* stands, depending on site conditions, are also perceived as degraded examples of the mixed type. In western Minnesota, where *Typha* spp. form pure stands, the species may be *Typha angustifolia* or *Typha X glauca* in culturally disturbed marshes, and *Typha latifolia* (mixed with other species, especially Carices) in more undisturbed marshes (R. Dana pers. comm. 1999). Elsewhere, *Typha angustifolia* is thought to be more typical of undisturbed marshes.

CONSERVATION RANK: *G5.*

DISTRIBUTION: This community type is found in deep marshes throughout the midwestern United States, from Ohio and Ontario west to North Dakota, south to Kansas, and east to Indiana.

USFS ECOREGIONS: 212Ha:CPP, 212Hb:CPP, 212He:CPP, 212Hh:CPP, 212Hi:CPP, 212Hj:CPP, 212Hk:CPP, 212Hl:CPP, 212Hm:CPP, 212Hn:CPP, 212Ho:CPP, 212Hp:CPP, 212Hq:CPP, 212Hr:CPP, 212Hs:CPP, 212Ht:CPP, 212Hv:CPP, 212Hw:CPP, 212Hx:CPP, 212Hy:CPP, 212Ib:C??, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jf:CPP, 212Jj:CPP, 212Jk:CPP, 212Jl:CPP, 212Jm:CPP, 212Jn:CPP, 212Jo:CPP, 212Jr:CPP, 212Ka:CCP, 212Kb:CCC, 212La:CPP, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 221Ec:CCC, 221Eg:CCC, 222Am:CCC, 222Ge:CCC, 222Ha:CCC, 222Jc:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kf:CCC, 222Kg:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 251Aa:CCC, 251Ba:CCC, 251Bb:CCC, 251Bd:CCC, 251Be:CCC, 251Cc:CCC, 251Cf:CCC, 251Cg:CCC, 251Dc:CCC, 251Dg:CCC, 251Ea:CCC, 251Ed:CCC, 255Aa:CCC

CONSERVATION REGIONS: 32:C, 35:C, 36:C, 37:C, 38:C, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C

STATES: IA IL IN KS MI MN MO ND NE OH SD WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	marsh (N); marsh (S) I
IN	marsh +
MI	inland emergent marsh +
MN	cattail marsh =
MO	freshwater marsh +
NE	freshwater marsh +
OH	cattail marsh =
WI	deep marsh (cattail subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: TYPHA (ANGUSTIFOLIA, LATIFOLIA) - (SCHOENOPLECTUS SPP.) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.I)

Zizania (aquatica, palustris) Herbaceous Vegetation

(Indian Wild Rice, Northern Wild Rice) Herbaceous Vegetation

Wild Rice Marsh CEGL002382

DESCRIPTION: This marsh is dominated almost entirely by the tall emergent graminoids *Zizania aquatica* or *Zizania palustris*. Floating-leaved and submerged aquatic cover can be high, but species composition is variable. Species include *Ceratophyllum demersum, Nuphar lutea ssp. variegata (= Nuphar variegata), Potamogeton natans, Potamogeton zosteriformis, Spirodela polyrrhiza, Utricularia macrorhiza (= Utricularia vulgaris)*, and others (Harris et al. 1996).

Stands are found in deeper, sheltered waters of slow-moving streams, protected bays, and flowage lakes, particularly at stream mouths. Water depths generally exceed 0.5 m. Substrate is rich sedimentary peat, or mucky, silty soils. A thick mat of rice stalks often covers the bottom (Harris et al. 1996, Voss 1972).

COMMENTS: *3, MCS*. Taxonomy of wild rice is somewhat indeterminate. *Zizania aquatica* may be more common in southern stands and *Zizania palustris* in more northern stands. Stands of this type may have cultural origins, as wild rice was an important food source for Native Americans (Voss 1972). In northeastern Minnesota and Wisconsin, commercial operators and agency wildlife managers may establish stands by seeding directly into natural open water marsh systems (Chel Anderson pers. comm. 1998, E. Epstein pers. comm. 1999). These *Zizania* species are actually annual grasses, so technically they should be placed in a "Permanently flooded temperate annual grassland" formation (V.D.2.N.x), but they are left with their other perennial associates for clarity.

CONSERVATION RANK: *G3G4.* In southern Wisconsin, this type has been greatly reduced by drainage of wetlands. Augmentation of the type through planting makes it difficult to distinguish natural stands from cultural stands.

DISTRIBUTION: This wild rice marsh community is found in the upper midwestern and northeastern United States and adjacent Canada, ranging from Vermont and New York to Minnesota and Manitoba, south to Iowa and Indiana.

USFS ECOREGIONS: 212Hq:CPP, 212Ja:CCC, 212Jb:CC?, 212Jc:CC?, 212JI:CCP, 212Jm:CCC, 212Jn:CC?, 212Jo:CC?, 212La:CPP, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 222Ji:PPP
CONSERVATION REGIONS: 47:C, 48:C, 63:C
STATES: IA IN MI MN NY VT WI **PROVINCES:** MB? ON

MIDWEST HERITAGE SYNONYMY:

IN	marsh +
MI	inland emergent marsh +
MN	mixed emergent marsh (forest section) +
WI	deep marsh (wild rice subtype) =

OTHER SYNONYMY: Marsh: wild rice: organic substrate (W9) (Harris et al. 1996) =

USNVC HIERARCHY: ZIZANIA (AQUATICA, PALUSTRIS) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.I)

* Nonstandard type (needs review)

Great Lakes Coastal Wetlands Complex*

Great Lakes Coastal Wetlands Complex

Great Lakes Coastal Wetlands Complex CECX002002

DESCRIPTION: This Great Lakes Coastal Wetlands Complex is found throughout the Great Lakes Basin and upper St. Lawrence Valley in the United States and Canada. These coastal wetlands have recently been characterized in detail by a series of studies summarized by Minc and Albert (1998). The following summary has largely been abstracted from their work.

The Great Lakes coastal wetlands occur along the Great Lakes shoreline proper and in portions of tributary rivers and streams that are directly affected by Great Lakes water regimes. Species distributions and community patterns are determined by multiple abiotic factors, including the type of aquatic system (whether lacustrine, connecting major river channels, smaller tributary rivers, or estuarine), Great Lakes water-level fluctuations, surficial bedrock, glacial landform, climate, and land use. Great Lakes water level fluctuate over at least three temporal time scales: first, short-term fluctuations caused by winds or barometric pressures; second, seasonal fluctuations reflecting the annual hydrologic cycle in the basin; and third, interannual fluctuations in lake level as a result of variable precipitation and evaporation within the drainage basin. Interannual fluctuations can be as much as 1.3-2.5 m, with apparently little or no periodicity. These fluctuations, which also alter turbidity, nutrient availability, ice scour zones, etc., cause locational shifts in vegetation zones, but also in the composition of these zones, as species have individual tolerance limits.

The major bedrock distinction in the Great Lakes Basin is between igneous and metamorphic bedrock of the Precambrian period and younger (Paleozoic) sedimentary bedrock. The igneous and metamorphic bedrock form the rugged north shore of Lake Superior and Georgian Bay, and line much of the St. Lawrence River; they are locally present on the south shore of western Lake Superior. They lack the shallow protected waters and fine-textured substrates that support broad coastal wetlands. Where such bedrock is at or near the surface, it forms soils that are nutrient-poor and acidic. The rest of the basin is dominated by softer, sedimentary bedrock, which, with its broad, horizontal depositions, favors broad zones of shallow waters. The sedimentary rocks are typically more alkaline (calcareous), forming soils that are nutrient- and moisture-rich loams and clays.

Bedrock patterns are overlaid by glacial landforms that, in combination with recent long-shore transport processes, create the prevalent physiographic features of the shorelines. In the lakes themselves, sand lakeplains, clay lakeplains, and moraines are shaped by currents, and the long-shore transportation of sediments has created sand-spit embayments and swales, dune-swale complexes, and tombolos. Channels and rivers contain channel-side wetlands, embayments, and deltas, and estuaries form as either open or barred river mouths. It is this diversity of landforms that has given rise to a diverse set of vegetation types.

Finally, regional patterns of climate affect the basin. The strong latitudinal gradient from southern Lake Erie to northern Lake Superior creates marked differences in length of growing season and solar radiation. Although wetland species are generally widely distributed, those of more boreal and subarctic regions are found in the northern parts of the basin, whereas those of more temperate and prairie regions are found in the southern parts.

Vegetation types found across this diverse set of abiotic factors vary in any number of ways, but they can be placed into a number of zones, though not all are present at a given site. The first four zones are typically inundated directly by lake waters: (a) submergent marsh - containing submergent and/or floating vegetation; (b) emergent marsh - characterized by shallow water or semipermanently flooded soils, and typically dominated by bulrushes, cattails, and other emergent species, but also containing submergent and/or floating vegetation; (c) shore fen - saturated vegetation mats characterized by groundwater influence from shoreline habitats but affected by lake level fluctuations, and dominated by herbaceous or shrubby species; (d) shoreline or strand - a narrow zone at or just above the water level where seasonal water-level fluctuations and waves cause erosion, and which is dominated by annual or pioneer herbaceous species. The next set of zones are inland from the water's edge and include: (e) herbaceous and shrubby wet meadows - characterized by saturated or seasonally flooded soils, and typically dominated by sedges, grasses, and other herbs, but occasionally dominated by shrubs; and (f) shrub or wooded swamps - characterized by seasonal flooding and dominated by woody species. Species assemblages in these zones change depending on the interaction of factors across the Great Lakes Basin. The data gathered by Minc and Albert (1998) indicate that it is possible to divide the zones into a number of different vegetation types, or associations. The submergent and emergent marsh zones can each be divided into two types: Northern Great Lakes Submergent Marsh, *Potamogeton gramineus - Potamogeton natans* Northern Great Lakes Shore Herbaceous Vegetation (CEGL005273); Southern Great Lakes Submergent Marsh, *Potamogeton zosteriformis - Ceratophyllum demersum - Elodea canadensis* Southern Great Lakes Shore Herbaceous Vegetation (CEGL005152); Northern Great Lakes Emergent Marsh, *Schoenoplectus acutus - Schoenoplectus subterminalis - Eleocharis palustris -*

(Schoenoplectus americanus) Northern Great Lakes Shore Herbaceous Vegetation (CEGL005274); and Southern Great Lakes Emergent Marsh, *Typha spp. - Schoenoplectus tabernaemontani* - Mixed Herbs Southern Great Lakes Shore Herbaceous Vegetation (CEGL005112). All four are only found in the Great Lakes coastal wetlands. Two other herbaceous marsh types are tentatively listed for the Great Lakes, the Central Water Lily Open Marsh, *Nuphar lutea ssp. advena - Nymphaea odorata* Herbaceous Vegetation (CEGL002386), and the American Lotus Marsh, *Nelumbo lutea* Herbaceous Vegetation (CEGL004323), but these may simply be treated as part of the submergent marsh types. The fens can be divided into four types as well. Two rich shoreline fen types are also currently only known from the Great Lakes shores, the Shrubby-cinquefoil-Sweetgale Rich Shore Fen, *Dasiphora fruticosa ssp. floribunda - Myrica gale* Rich Shore Fen Shrubland (CEGL005275), and the Graminoid Rich Shore Fen, *Calamagrostis canadensis - Carex viridula - Cladium mariscoides - Lobelia kalmii* Herbaceous Vegetation (CEGL005115). Two other shoreline poor fens, four wet meadows types, two shrub swamps, and a mud flat type are widely distributed both along the Great Lakes shoreline and elsewhere [see list below]. Thus a total of 17 community types are identified for Great Lakes coastal wetlands.

Because of both the spatially intricate and temporally dynamic nature of the coastal wetlands, they are treated both as associations and as complexes. Furthermore, because the associations vary across the basin, such that some types only occur in some parts of the basin, and others elsewhere, they can be grouped into a number of different kinds of Great Lakes Coastal Wetland complexes. These are as follows: (1) Lake Superior Poor Fen (2) Northern Rich Fen; (3) Northern Great Lakes Marsh; (4) Green Bay Disturbed Marsh; (5) Lake Michigan Lacustrine Estuary; (6) Saginaw Bay Lakeplain Marsh; (7) Lake Erie-St. Clair Lakeplain Marsh; (8) Lake Ontario Lagoon Marsh; (9) St Lawrence River Estuary. The distribution of types across these complexes is illustrated in the attached table.

COMMENTS: *1, MCS*.

CONSERVATION RANK: *G3G4*. A total of 105 Great Lakes Coastal Wetland complexes in the United States were characterized by Minc and Albert (1998). Of these 73 were ranked as either A or B in quality. It is not known how many sites may occur in Ontario, but there could easily be 75 or more sites there. Individual complex types may be much rarer, e.g. the Northern Rich Fen Complex, the Green Bay Disturbed Marsh, the Saginaw Bay Lakeplain Marsh, and the Lake Ontario Lagoon Marsh Complex all have 11 or less occurrences. Individual vegetation types may also be quite rare, with the rarest, the two rich shore fens types, both ranked as G1G2.

DISTRIBUTION: This marsh complex is found throughout the Great Lakes Basin in the United States and Canada.

USFS ECOREGIONS: 212:C, 222:C
CONSERVATION REGIONS: 48:C, 64:C
STATES: IL IN MI MN? NY OH PA WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	marsh (N) +
IN	marsh +
MI	great lakes marsh complex =
MN?	mixed emergent marsh (forest section) +
OH	mixed emergent marsh ?
WI	deep marsh (Great Lakes marsh complex) ?

OTHER SYNONYMY:

USNVC HIERARCHY: N/A

Potamogeton gramineus - Potamogeton natans Northern Great Lakes Shore Herbaceous Vegetation

Grassy Pondweed - Floating Pondweed Northern Great Lakes Shore Herbaceous Vegetation

Various-leaved Pondweed - Common Floating Pondweed Northern Great Lakes Shore Herbaceous Vegetation CEGL005273

DESCRIPTION: The submergent vegetation typically contains *Potamogeton gramineus* and *Potamogeton natans*, as well as floating aquatics such as *Brasenia schreberi, Megalodonta beckii*, and *Nuphar lutea ssp. variegata (= Nuphar variegata)*. *Chara* spp. may be very common in alkaline areas (Minc and Albert 1998).

Stands occur in a variety of shoreline contexts, including clay lakeplains, sand lakeplains, and sandy ground moraines. They typically occur in open water and stream margins within estuarine sites, often within a much larger poor fen. Stands in Lake Huron and Lake Michigan are found in relatively protected coastal embayments. Stands along the St. Mary's River occur in channel-side wetlands and embayments (Minc and Albert 1998).

Storms, seiches, and water level cycles contribute to a dynamic vegetation structure and composition. Substrate is mineral soil. Water depth generally exceeds 0.3 m. Stands appear to be correlated with greater site protection from wave action and storms (Minc 1996).

COMMENTS: *2, MCS*. This type typically occurs as part of a Great Lakes Coastal Wetlands Complex (CECX002002). See also the Southern Great Lakes Submergent Marsh type, *Potamogeton zosteriformis - Ceratophyllum demersum - Elodea canadensis* Southern Great Lakes Shore Herbaceous Vegetation (CEGL005152).

CONSERVATION RANK: *G3?.* Twenty-nine sites were identified by Minc and Albert (1998) as part of their Northern Great Lakes Marsh type, but it is not known if all sites contained this type and what its specific area is. The type may also occur as small examples in the Lake Superior Poor Fen and Northern Rich Fen complexes. Twenty-four of the 29 sites were ranked A or B quality. One site is found in Minnesota, 22 are in Michigan and 6 are in Wisconsin. Sites may also occur in Ontario.

DISTRIBUTION: This submergent marsh type is found along northern Great Lakes shorelines in Lake Huron, Lake Michigan, Lake Superior and along the St. Clair River in the United States and Canada.

USFS ECOREGIONS: 212H:CP, 212I:CP, 212J:CC, 212O:CC, 212P:CC
CONSERVATION REGIONS: 48:C
STATES: MI MN WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

MI	great lakes marsh complex +
MN	lake bed -
WI	submerged aquatic (northern great lakes subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: POTAMOGETON SPP. - CERATOPHYLLUM SPP. - ELODEA SPP. PERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.C.2.N.a)

Potamogeton zosteriformis - Ceratophyllum demersum - Elodea canadensis Southern Great Lakes Shore Herbaceous Vegetation

Flat-stem Pondweed - Coontail - Canadian Waterweed Southern Great Lakes Shore Herbaceous Vegetation

Southern Great Lakes Submergent Marsh CEGL005152

DESCRIPTION: Dominant submerged aquatics include *Ceratophyllum demersum, Chara* spp., *Elodea canadensis, Heteranthera dubia, Myriophyllum spicatum, Najas flexilis, Potamogeton* spp. (including *Potamogeton amplifolius, Potamogeton friesii, Potamogeton gramineus, Stuckenia pectinata (= Potamogeton pectinatus), Potamogeton zosteriformis*), and *Vallisneria americana*. Floating aquatics include *Lemna minor, Lemna trisulca*, and *Spirodela polyrrhiza*. Other rooted aquatics include *Nymphaea odorata, Nuphar lutea ssp. advena, Nelumbo lutea, Peltandra virginica*, and *Sagittaria latifolia*. The exotic *Hydrocharis morsus-ranae* is increasingly common in the St. Lawrence, Lake Ontario, and Lake Erie marshes (Minc and Albert 1998).

Remaining stands in the area are primarily found in lacustrine estuaries, barrier-beach lagoons, or sand-spit swales. In the Great Lakes, the estuaries are often formed at the mouths of rivers drowned by the post-glacial rise in lake level, whereas in the St. Lawrence these are formed from small streams or rivers that occupy apparent pre-glacial valleys that have been partly filled in by outwash and alluvial deposits to form fairly broad , flat basins. Storms, seiches, and water level cycles create a very dynamic pattern of species composition and structure in the vegetation. Water depth generally exceeds 0.3 m.

Stands appear to be correlated with greater site protection from wave action and storms (Minc 1996). The southern Great Lakes emergent marshes may have an increased level of dominance in *Typha spp.* because of a reduction in the amplitude of natural water-level fluctuations (Wilcox et al. 1993, in Minc and Albert 1998). It is thought that the natural fluctuations favor more diverse vegetation because they permit a wider range of habitat, exclude species that cannot tolerate water-depth changes or favor species requiring periodic exposures of fertile substrates.

COMMENTS: *2, MCS*. This type may often be tracked as part of the Great Lakes Wetlands Complex (CECX002002).

CONSERVATION RANK: *G3G4.* This type is found in at least 24 sites in the southern Great Lakes, as part of a number of different Great Lakes Wetland Complexes, but many are disturbed. Only 12 sites were ranked A or B quality. Marshes along Lake Erie and Lake Ontario are often subject to high levels of agricultural disturbances characteristic of the fertile, flat lakeplain soils, along with heavy manipulation of the shoreline through diking and rip-rap.

DISTRIBUTION: This deep emergent marsh community typically occurs in the southern Great Lakes region of the United States and Canada, including southern Lake Michigan, Lake St. Clair, Lake Erie, Lake Ontario, and into the St. Lawrence River, and possibly Lake Champlain.

USFS ECOREGIONS: 212He:CPP, 212Hi:CPP, 212Hj:CPP, 212Hl:CPP, 212Hm:CPP, 212Ho:CPP, 212Hp:CP?, 212Hr:CP?, 212Hs:CP?, 212Ht:CP?, 212Hv:CP?, 212Hw:CPP, 212Hx:CPP, 212Hy:CPP, 212Ib:CPP, 212Ja:CCC, 212Jb:CC?, 212Jk:CCP, 212Jn:CC?, 222:P
CONSERVATION REGIONS: 47:P, 48:C
STATES: MI NY OH PA VT WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:
MI Great Lakes marsh complex +
OH submerged marsh I
WI submerged aquatic (southern great lakes subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: POTAMOGETON SPP. - CERATOPHYLLUM SPP. - ELODEA SPP. PERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.C.2.N.a)

Schoenoplectus acutus - Schoenoplectus subterminalis - Eleocharis palustris - (Schoenoplectus americanus) Northern Great Lakes Shore Herbaceous Vegetation

Hardstem Bulrush - Water Bulrush - Marsh Spikerush - (Chairmaker's Bulrush) Northern Great Lakes Shore Herbaceous Vegetation

Northern Great Lakes Emergent Marsh CEGL005274

DESCRIPTION: The emergent vegetation is open, sometimes sparse. Species typically include *Schoenoplectus acutus (= Scirpus acutus)* and *Eleocharis palustris (= Eleocharis smallii)*, along with *Equisetum fluviatile, Najas flexilis, Schoenoplectus subterminalis (= Scirpus subterminalis)*, and *Sparganium eurycarpum*. *Schoenoplectus americanus (= Scirpus americanus)* can be common in some sites, e.g., open stretches of some bays may contain a narrow, but dense fringe, apparently due to its greater tolerance of extreme wave action. Some sites may contain species more typical of southern Great Lakes marshes, such as *Najas flexilis, Schoenoplectus tabernaemontani (= Scirpus tabernaemontani)* and *Typha angustifolia*. Sites in calcium-rich areas may also contain *Eleocharis rostellata* and *Chara* spp. Submergents within this zone include *Potamogeton gramineus* and *Potamogeton natans* (Minc and Albert 1998).

Stands occur in a variety of shoreline contexts, including clay lakeplains, sand lakeplains, and sandy ground moraines. They typically occur in open water and stream margins within estuarine sites, often within a much larger poor fen. Stands in Lake Huron and Lake Michigan are found in relatively protected coastal embayments. Stands along the St. Mary's River occur in channel-side wetlands and embayments. Substrate is mineral soil. Water depth generally exceeds 0.3 m (Minc 1996).

Storms, seiches, and water level cycles create a very dynamic pattern of vegetation (Minc 1996).

COMMENTS: *2, MCS*. This type typically occurs as part of a Great Lakes Coastal Wetlands Complex (CECX002002), where it occurs in zones associated with the northern Great Lakes submergent marsh type *Potamogeton gramineus - Potamogeton natans* Northern Great Lakes Shore Herbaceous Vegetation (CEGL005273). It is unclear whether stands in Green Bay area go with this emergent type or with the Southern Great Lakes Emergent Marsh type, *Typha spp. - Schoenoplectus tabernaemontani* - Mixed Herbs Southern Great Lakes Shore Herbaceous Vegetation (CEGL005112).

CONSERVATION RANK: *G3?.* Twenty-nine sites were identified by Minc and Albert (1998) as part of their Northern Great Lakes Marsh type, but it is not known if all sites contained this type and what its specific area is. The type may also occur as small examples in the Lake Superior Poor Fen and Northern Rich Fen complexes. Twenty-four of the 29 sites were ranked A or B quality. One site is found in Minnesota, 22 are in Michigan and 6 are in Wisconsin. Sites may also occur in Ontario.

DISTRIBUTION: This emergent marsh type is found along northern Great Lakes shorelines in Lake Huron, Lake Michigan, Lake Superior and along the St. Clair River in the United States and Canada.

USFS ECOREGIONS: 212H:CC, 212I:CC, 212J:CC, 212O:CC, 212P:CC
CONSERVATION REGIONS: 48:C
STATES: MI MN WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

MI	great lakes marsh complex +
MN	mixed emergent marsh (forest section) +
WI	deep marsh (northern great lakes subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: TYPHA (ANGUSTIFOLIA, LATIFOLIA) - (SCHOENOPLECTUS SPP.) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.I)

Typha spp. - Schoenoplectus tabernaemontani - Mixed Herbs Southern Great Lakes Shore Herbaceous Vegetation

Cattail Species - Softstem Bulrush - Mixed Herbs Southern Great Lakes Shore Herbaceous Vegetation

Southern Great Lakes Shore Emergent Marsh CEGL005112

DESCRIPTION: Typical dominants include the emergents *Schoenoplectus tabernaemontani (= Scirpus tabernaemontani)* and *Typha* spp. (*Typha angustifolia, Typha X glauca, Typha latifolia*). Stands in Lake Erie and Lake Ontario may contain more pure *Typha angustifolia* stands, or mixes of that species with *Calamagrostis canadensis*. *Thelypteris palustris* is a common fern. *Impatiens capensis* may be common in open parts of the marsh. Floating and rooted aquatics include *Ceratophyllum demersum, Lemna minor, Nuphar lutea ssp. advena (= Nuphar advena), Nymphaea odorata, Potamogeton gramineus, Sagittaria latifolia*, and *Spirodela polyrrhiza* (Minc and Albert 1998).

Remaining stands in the area are primarily found in lacustrine estuaries, barrier-beach lagoons, or sand-spit swales. In the Great Lakes the estuaries are often formed at the mouths of rivers drowned by the post-glacial rise in lake level, whereas in the St. Lawrence River the estuaries are formed from small streams or rivers that occupy apparent pre-glacial valleys that have been partly filled in by outwash and alluvial deposits to form fairly broad, flat basins. Storms, seiches, and water level cycles create a very dynamic pattern of species composition and structure in the vegetation. Water depth generally exceeds 0.3 m.

Storms, seiches, and water level cycles create a very dynamic pattern of vegetation (Minc 1996).

COMMENTS: *2, MCS*. This type typically occurs as part of a Great Lakes Coastal Wetlands Complex (CECX002002). It is unclear whether stands in Green Bay area go with this type or with the Northern Great Lakes Emergent Marsh type, *Schoenoplectus acutus - Schoenoplectus subterminalis - Eleocharis palustris - (Scirpus americanus)* Northern Great Lakes Shore Herbaceous Vegetation (CEGL005274). In Wisconsin no stands are reported along the southwest shore of Lake Michigan, so perhaps no "southern Great Lakes" type is needed there.

CONSERVATION RANK: *G3G4*. This type is found in at least 24 sites in the southern Great Lakes, as part of a number of different Great Lakes Wetland Complexes, but many are disturbed. Only 12 sites were ranked A or B quality. Marshes along Lake Erie and Lake Ontario are often subject to high levels of agricultural disturbances characteristic of the fertile, flat lakeplain soils, along with heavy manipulation of the shoreline through diking and rip-rap. As a result exotics or invasive species such as *Lythrum salicaria, Phalaris arundinacea*, and *Phragmites australis* can be common.

DISTRIBUTION: This deep emergent marsh community typically occurs in the southern Great Lakes region of the United States and Canada, including southern Lake Michigan, Lake St. Clair, Lake Erie, Lake Ontario, and into the St. Lawrence River, and possibly Lake Champlain.

USFS ECOREGIONS: 212Ea:CCC, 212Ec:CCP, 212Ee:CCP, 212Pa:C??, 222Ia:CCC, 222Ib:CCP, 222Ie:CCP, 222If:CCC, 222J:CC, 222Q:CC
CONSERVATION REGIONS: 48:C, 64:C
STATES: MI NY OH PA VT WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:
MI Great Lakes marsh complex +
OH mixed emergent marsh +
WI deep marsh (southern great lakes subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: TYPHA (ANGUSTIFOLIA, LATIFOLIA) - (SCHOENOPLECTUS SPP.) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.I)

Carex comosa - Carex decomposita - Dulichium arundinaceum - Lycopus rubellus Herbaceous Vegetation

Comosa Sedge - Decomposite Sedge - Threeway Sedge - Stalked Water-horehound Herbaceous Vegetation

Sinkhole Pond Marsh CEGL002413

DESCRIPTION: The vegetation is variable, depending on water fluctuations, with zones of tall emergents, submerged aquatics, or vegetative mats. Dominant emergents include *Typha latifolia, Schoenoplectus tabernaemontani (= Scirpus tabernaemontani)* and *Nelumbo lutea*. In Missouri, other characteristic plants include *Carex comosa, Glyceria acutiflora, Potamogeton diversifolius, Alopecurus aequalis, Galium tinctorium, Sagittaria rigida, Dulichium arundinaceum, Hottonia inflata, Ceratophyllum echinatum, Viola lanceolata, Wolffia brasiliensis (= Wolffia papulifera), Isoetes engelmannii*. Sand ponds are characterized by *Iris fulva, Carex crus-corvi, Rhynchospora corniculata, Juncus nodatus, Saururus cernuus*, and *Hydrolea uniflora*. Indiana ponds may contain *Sparganium androcladum, Nuphar lutea ssp. advena (= Nuphar advena), Cephalanthus occidentalis, Decodon verticillatus, Utricularia gibba*, and *Carex comosa* (Homoya et al. 1985, Nelson 1985).

Stands occur in sinkholes and depressions of terraces and broad level uplands, including those in karst topography. Soils are very poorly drained, with surface water present for extended periods of the year, sometimes up to 1 m in depth. Soils are deep (>100 cm) consisting of peat, muck, or mineral. The parent material may be sand, rock or loess, where depressions occur on hardpans (Nelson 1985).

Droughts may cause these sinkholes to dry out completely (Nelson 1985).

COMMENTS: *2, MCS*. Concept of the type is taken from Indiana state classification - sinkhole pond (Homoya et al. 1985) and Missouri state classification - pond marsh (Nelson 1985). Nelson provides lists of additional species in Missouri that are restricted to, but potentially not consistently found in, this type. See also thesis work by Haefner (1993), a survey of sinkhole ponds in karst plain topography. This type ought to be in Kentucky and Tennessee, e.g., Kentucky Broadhead Swamp. Other sinkhole pond types, *Decodon verticillatus* Seasonally Flooded Shrubland (CEGL003905) and *Cephalanthus occidentalis / Hibiscus moscheutos ssp. moscheutos* Shrubland (CEGL004742) may overlap floristically with this type.

CONSERVATION RANK: *G3G4*. The SRANK for Missouri will be revisited (M. Leahy pers. comm. 1999).

DISTRIBUTION: This sinkhole pond marsh type is found in the Interior Highlands region of the United States, ranging from southern Indiana and southeastern Missouri to possibly Kentucky and Tennessee.

USFS ECOREGIONS: 222Ab:CCC, 222Af:CCC, 222Ag:CCC, 222Am:CCC, 222Ek:CCC, 234:P, 251Ce:CCC
CONSERVATION REGIONS: 36:C, 38:C, 44:C
STATES: IN KY? MO TN? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IN sinkhole pond +
MO pond marsh =

OTHER SYNONYMY:

USNVC HIERARCHY: CAREX COMOSA - (CAREX DECOMPOSITA) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.I)

Potamogeton spp. - Ceratophyllum demersum Great Plains Herbaceous Vegetation

Pondweed Species - Coontail Great Plains Herbaceous Vegetation

Great Plains Pondweed Submerged Aquatic Wetland CEGL002044

DESCRIPTION: Vegetation varies from sparse to dense, with submersed rooted and free-floating macrophytes. Species composition varies with a number of environmental factors, such as substrate, water depth, and water chemistry, but these are poorly understood. Dominant species in Nebraska include narrow-leaved pondweeds (*Potamogeton foliosus, Stuckenia pectinata (= Potamogeton pectinatus), Potamogeton pusillus*), *Najas guadalupensis*, and *Zannichellia palustris*. *Ceratophyllum demersum* and *Utricularia macrorhiza* can be locally abundant. In quiet bays, *Potamogeton nodosus* and *Lemna* spp. are common. In clear water with sandy bottoms *Chara* spp. may also be common. *Azolla caroliniana* and the liverworts *Riccia fluitans* and *Ricciocarpus natans* may also be common. Uncommon species present in this community include *Nuphar lutea, Nymphaea odorata*, and *Potamogeton amplifolius* (Steinauer and Rolfsmeier 2000). Other species can include *Schoenoplectus* spp. (= *Scirpus* spp.) and *Typha* spp.

This community type is found in the Great Plains of the United States in shallow to relatively deep (1 m) freshwater basins or bands in marshes or bays that remain flooded in all but the driest years. Species composition varies with substrate, water depth, water chemistry, turbidity, water temperatures and other factors, but these are poorly understood.

COMMENTS: *3, MCS*. This type is geographically restricted to the interior Great Plains (Province 331 and 332 of Bailey et al. 1994) until a better understanding of its floristic composition and relation to Midwest pondweed types can be determined. However, it may be absent from western Kansas (sections 331B, 331C). In Nebraska, both the pondweed wetland (deep marsh) and the Sandhills deep marsh are treated together here until further investigation can resolve the distinctiveness of the sandhills type. Steinauer and Rolfsmeier (2000) suggest that the Sandhills deep marsh differs in that it contains a more organic substrate and is dominated by broad-leaved pondweeds (*Potamogeton pusillus, Potamogeton richardsonii, Potamogeton zosteriformis*); otherwise species composition is similar.

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This community type is found in the northern and central Great Plains of the United States in shallow to relatively deep (1 m) freshwater basins, extending from Manitoba south to Kansas.

USFS ECOREGIONS: 251:?, 331E:CP, 331F:CP, 332A:CP, 332B:CP, 332C:CP, 332D:CP, 332E:CP
CONSERVATION REGIONS: 26:P
STATES: KS ND NE SD **PROVINCES:** MB

MIDWEST HERITAGE SYNONYMY: NE pondweed open water marsh; sandhills open water marsh -

OTHER SYNONYMY:

USNVC HIERARCHY: POTAMOGETON SPP. - CERATOPHYLLUM SPP. - ELODEA SPP. PERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.C.2.N.a)

Stuckenia pectinata - Myriophyllum spicatum Herbaceous Vegetation

Sago Pondweed - Eurasian Water-milfoil Herbaceous Vegetation

Sago Pondweed - Water-milfoil Submerged Wetland CEGL002003

DESCRIPTION: These communities are characteristically poor in species, and canopy cover is low (<50%). Submerged aquatic macrophytes dominate the vegetation. *Stuckenia pectinata (= Potamogeton pectinatus)* was present in all stands sampled; *Myriophyllum spicatum* can be locally dominant and was present in about 50% of stands. *Ranunculus aquatilis, Utricularia macrorhiza (= Utricularia vulgaris)*, and *Potamogeton richardsonii* were occasionally present. *Chara* spp., a calciphile macroalgae, was often present (Lesica 1989, 1994; Lesica pers obs.).

This community occurs in the permanently inundated, "deep water" zone of glacial ponds of the western Great Plains in gentle, rolling, glacial terrain. Water is usually 15-100 cm deep. The type can occur in fresh to brackish water (270-44,000 ohms/cm), but is characteristic of mildly brackish water (median of 2500 ohms/cm) (Lesica 1989). These ponds occur at an elevation of 1300-1500 m (4300-5000 feet). Underlying parent material is mixed sedimentary (partly calcareous) glacial till. Pond bottoms are composed of mud or mud mixed with gravel and stones.

These communities probably experience little natural disturbance except inter- and intra-annual water level fluctuations.

COMMENTS: *3, WCS*. This type should be reviewed throughout the Great Plains prairie potholes region. There is disagreement over the taxonomy of *Myriophyllum*. Some authorities consider the native North American plants to be *Myriophyllum spicatum var. exalbescens*, while others consider them to be a distinct species, *Myriophyllum exalbescens*. Synonymous communities may have *Myriophyllum exalbescens* rather than *Myriophyllum spicatum* in the name.

Stewart and Kantrud (1972) report that both *Myriophyllum exalbescens (= Myriophyllum spicatum)* and *Stuckenia pectinata (= Potamogeton pectinatus)* are common in slightly or moderately brackish water of potholes in North Dakota. They describe the open-water community of moderately brackish ponds as dominated by *Zannichellia palustris* and *Stuckenia pectinata* with *Myriophyllum exalbescens* a secondary species (Stewart and Kantrud 1971). Lesica (1989, 1992) considered communities dominated by *Zannichellia palustris* distinct from those dominated by *Stuckenia pectinata*. Walker and Coupland (1970) report that lightly saline aquatic communities of southern Saskatchewan are dominated by a number of species including *Myriophyllum exalbescens*; *Stuckenia pectinata* is of secondary importance. In Saskatchewan as in North Dakota *Myriophyllum exalbescens* is dominant while *Stuckenia pectinata* is less abundant, opposite to what was found in Montana. *Myriophyllum spicatum* and *Stuckenia pectinata* are among the characteristic plants of ponds in southern California (Ferren et al. 1996). This community as described in Montana has lower species richness compared to those from other, more humid areas. Montana communities may be depauperate representations of a more widespread aquatic association of slightly to moderately saline water.

Similar communities are associated with glacial ponds in western Montana but were called the *Potamogeton pectinatus* or the *Myriophyllum spicatum* community types (Lesica 1994).

CONSERVATION RANK: *G3G4.* More than 18 occurrences of this community type have been documented in Montana, ranging from the glacial potholes of the Ovando Valley (west-central portion) to those of Missouri Coteau Subsection (northeastern most Montana) and including the area most intensively sampled, the prairie potholes of the Blackfeet Indian Reservation (just east of the Continental Divide, Lesica 1989); related or identical communities (supporting same dominant species) have been documented from Saskatchewan, North Dakota, and California. This is a common aquatic type of open-water portions of prairie ponds (sloughs in Canadian parlance) with slightly brackish to saline water and a variety of bottom conditions.

DISTRIBUTION: This sago pondweed - water milfoil pond community is found in glacial ponds in the northwestern Great Plains of the United States and Canada, but may range more broadly.

USFS ECOREGIONS: 331D:CC, M332C:C?
CONSERVATION REGIONS: 26:C
STATES: CA? MT ND SD **PROVINCES:** MB ON? SK

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Potamogeton pectinatus* community type (Lesica 1994) F, *Myriophyllum spicatum* community type (Lesica 1994) F, *Ruppia maritima-Potamogeton pectinatus* (Lesica 1989). is similar and occurs in the same area, but in more saline water. *Ruppia maritima* is codominant with *P. pectinatus*.

USNVC HIERARCHY: STUCKENIA PECTINATA PERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.C.2.N.a)

Stuckenia pectinata - Ruppia maritima Herbaceous Vegetation

Sago Pondweed - Beaked Ditch-grass Herbaceous Vegetation

Sago Pondweed Submerged Wetland CEGL002004

DESCRIPTION: *Stuckenia pectinata (= Potamogeton pectinatus)* and *Ruppia maritima* frequently form dense beds of floating and submerged vegetation. Other species may include *Zannichellia palustris, Stuckenia vaginata (= Potamogeton vaginatus)*, and *Chara* spp. (Stewart and Kantrud 1971). Within wetlands with extremely high salinity, *Ruppia maritima* may be the only species found.

This community includes brackish, subsaline, or saline shallow water wetlands that may alternate with exposed alkali saltflats. These wetlands maintain surface water for a period of a few weeks or more during the growing season (Stewart and Kantrud 1971). These wetlands are commonly found in glacial outwash sediments in low elevations on the landscape, and serve as discharge wetlands, with no effective means for removal of accumulated salts (Dodd and Coupland 1966). Salts are principally sulfates and chlorides of sodium and magnesium (Stewart and Kantrud 1972). The high salinity of these wetlands excludes most aquatic and emergent plant species (Swanson and Springer 1972).

COMMENTS: *2, WCS*. Pools of *Ruppia maritima* and *Stuckenia pectinata (= Potamogeton pectinatus)* have been reported in *Distichlis spicata - Schoenoplectus maritimus - Salicornia rubra* Herbaceous Vegetation (CEGL002043), by Steinauer and Rolfsmeier (2000). These associations may occur in very similar habitats. Stands dominated solely by *Ruppia maritima* have been treated as a separate type, but are now considered part of this type.

CONSERVATION RANK: *G2?.* There are probably fewer than 100 occurrences of this community rangewide. This community is reported from Iowa (SU), Montana (S2Q), North Dakota (S3), and South Dakota (S?). Currently there are 28 occurrences documented in North Dakota. This community is restricted to brackish, subsaline, or saline shallow water wetlands in the northern Great Plains. These wetlands may alternate with exposed alkali saltflats. Historical acreage and trends are unknown, but this community was probably always uncommon.

DISTRIBUTION: This community is found in the northern Great Plains and northern tallgrass prairie regions in brackish to saline shallow water wetlands or exposed alkali saltflats, extending from Iowa west to the Dakotas and Montana.

USFS ECOREGIONS: 222Ic:CCC, 251Aa:CCC, 331D:CC, M332C:C?
CONSERVATION REGIONS: 26:C, 34:C, 35:C
STATES: IA MT ND SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: Class VI-alkali ponds and lakes (Stewart and Kantrud 1971) =

USNVC HIERARCHY: STUCKENIA PECTINATA PERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.C.2.N.a)

Stuckenia pectinata - Zannichellia palustris Herbaceous Vegetation

Sago Pondweed - Horned Pondweed Herbaceous Vegetation

Sago Pondweed - Horned Pondweed Submerged Wetland CEGL002005

DESCRIPTION: This community is characteristically poor in species. Stands are dominated by aquatic macrophytes. In Montana, *Zannichellia palustris* is dominant in all stands; *Stuckenia pectinata (= Potamogeton pectinatus)* is present in some stands. The macroalgae *Chara* sp. may also be present (Lesica 1989). In North Dakota, *Zannichellia palustris, Stuckenia pectinata* and *Chara* share dominance; *Ranunculus aquatilis* and *Myriophyllum sibiricum (= Myriophyllum exalbescens)* are secondary species.

This community occurs in the permanently inundated, "deep water" zone of glacial ponds of the Great Plains in gentle, rolling, glacial terrain. In the Montana occurrences, water is usually 15-100 cm deep. In Montana, the type is found in mildly brackish to brackish water (945-15,710 ohms/cm), but is characteristic of brackish water (median of 3745 ohms/cm) (Lesica 1989). In North Dakota, the type is characteristic of waters with a conductivity of 2000-15,000 ohms/cm (Stewart and Kantrud 1971). Ionic concentrations are probably determined by a complex interaction of groundwater hydrology and underlying parent materials. Described Montana occurrences are at an elevation of 1200-1300 m (4000-4300 feet) (Lesica 1989); North Dakota occurrences are lower, probably 200-600 m (500-2000 feet). Underlying parent material is glacial till. Pond bottoms are composed of mud in Montana.

These communities probably experience little natural disturbance except inter- and, in less saline waters, intra-annual water level fluctuations (Stewart and Kantrud 1971).

COMMENTS: *3, WCS*. Stewart and Kantrud (1972) report that both *Stuckenia pectinata (= Potamogeton pectinatus)* and *Zannichellia palustris* are characteristic of glacial potholes with moderately brackish to brackish water in North Dakota. Their open water communities of moderately brackish and brackish ponds are dominated by *Stuckenia pectinata* and *Zannichellia palustris*. *Ranunculus aquatilis* and *Myriophyllum exalbescens (= Myriophyllum spicatum)* are of secondary importance in moderately brackish waters (Stewart and Kantrud 1971).

Communities dominated by *Stuckenia pectinata* and *Zannichellia palustris* are common in sloughs (ponds) with moderately saline water in the Canadian Prairie Provinces (Looman 1986).

CONSERVATION RANK: *G3G4.* More than 6 occurrences of this community type have been documented in Montana, ranging from the glacial potholes of the Ovando Valley (west-central portion, Lesica 1994) to those of Missouri Coteau Subsection (northeastern most Montana) and including the area most intensively sampled, the prairie potholes of the Blackfeet Indian Reservation (just east of the Continental Divide, Lesica 1989); related or identical communities (supporting same dominant species) have been documented from Saskatchewan (Looman 1986) and North Dakota (Stewart and Kantrud 1971). This is a common aquatic type of open water portions of prairie ponds with slightly brackish to moderately saline water and a variety of bottom conditions. This habitat is not unique and the dominant (indicator) species for the community type are broadly distributed, so this type can be expected to occur from at least Manitoba and Minnesota westward and south to California and Arizona. This association was initially rated as rare because investigators had not previously differentiated aquatic species assemblages at the community type level.

DISTRIBUTION: This pondweed wetland community is found in the glacial ponds of the Northern Great Plains of the United States and Canada, including the Dakotas, Montana, Manitoba, and Saskatchewan.

USFS ECOREGIONS: 331D:CC, M332C:C?
CONSERVATION REGIONS: 11:C, 26:C
STATES: MT ND SD **PROVINCES:** MB SK

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: Open water phase of moderately brackish ponds and lakes (Stewart and Kantrud 1971) I, Open water phase of brackish ponds and lakes (Stewart and Kantrud 1971) I, *Zannichellia palustris* community type (Lesica 1989) =, Association *Potamo-Zannichellietum* (Looman 1986) =, Ponds with open water communities dominated by *P. pectinatus* and *Z. palustris* (Ferren et al. 1996). reported for southern California; similalr, but *Ruppia maritima (= R. cirrhosa)* is also present in the California communities.

USNVC HIERARCHY: STUCKENIA PECTINATA PERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.C.2.N.a)

Schoenoplectus acutus - Typha latifolia - (Schoenoplectus tabernaemontani) Sandhills Herbaceous Vegetation

Hardstem Bulrush - Broadleaf Cattail - (Softstem Bulrush) Sandhills Herbaceous Vegetation

Sandhills Bulrush Marsh CEGL002030

DESCRIPTION: The vegetational composition of this community varies in response to water depth and other factors. This community is dominated by tall, emergent, hydrophytic graminoids. In areas flooded most of the season *Schoenoplectus acutus (= Scirpus acutus)* is usually dominant, with *Typha latifolia* increasingly common in areas of deeper water. Scattered patches of *Phragmites australis* may be present, but are seldom common. *Sagittaria latifolia* frequently forms a sparse understory layer, but is often dense in openings in the overstory and in deeper water with *Typha latifolia* at the margin of the permanent water line. Other species found in openings include *Carex lacustris, Polygonum amphibium var. emersum (= Polygonum coccineum)*, and *Sparganium eurycarpum*. In areas which experience a more frequent fluctuation in the water level, *Phragmites australis* dominates, and may spread extensively during extended periods of low water. Scattered *Carex lacustris, Polygonum amphibium var. emersum (= Polygonum coccineum)*, and *Schoenoplectus acutus* are found with *Phragmites australis* in these sites. Species diversity is low (Steinauer and Rolfsmeier 2000).

This community occurs where the regionally high water table of the Sandhills intersects the land surface in interdunal valleys, and is commonly associated with lakes, though it may occur in smaller depressions as well. Soils are deep, very poorly drained, and contain much organic matter (peat or muck) and are formed in eolian sand or alluvium. Soils are flooded or waterlogged through much of the season. The water is usually slightly alkaline, and surface water levels fluctuate seasonally with groundwater levels (Steinauer and Rolfsmeier 2000).

COMMENTS: *2, MCS*. This type is a Sandhills version of the more broadly defined mixed emergent type, *Typha spp. - Scirpus spp*. - Mixed Herbs Great Plains Herbaceous Vegetation (CEGL002228). Recent work by the Colorado NHP (Kittel et al. 1998) may broaden the concept of this type into other sandhills regions in the central-western Great Plains.

CONSERVATION RANK: *G4.* Many unmodified marshes remain, though many more have been drained, particularly in the eastern portion of the range of this community. These sites are vulnerable to invasion by *Lythrum salicaria*.

DISTRIBUTION: This community is found in floodplains and interdunal valleys of the sandhills regions of the central Great Plains in the United States.

USFS ECOREGIONS: 332C:CC
CONSERVATION REGIONS: 10:C, 19:C, 20:C, 33:C, 34:C
STATES: NE **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE sandhills freshwater marsh =

OTHER SYNONYMY: Bulrush - Reed Grass Association (Pool 1914) =

USNVC HIERARCHY: TYPHA (ANGUSTIFOLIA, LATIFOLIA) - (SCHOENOPLECTUS SPP.) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.I)

Typha (angustifolia, domingensis, latifolia) - Schoenoplectus americanus Herbaceous Vegetation

(Narrowleaf Cattail, Southern Cattail, Broadleaf Cattail) - Chairmaker's Bulrush Herbaceous Vegetation

Southern Great Plains Cattail - Bulrush Marsh CEGL002032

DESCRIPTION: The vegetation is dominated by tall emergents 1-2 m tall. Dominant species include various combinations of *Typha angustifolia, Typha domingensis, Typha latifolia*, and *Schoenoplectus americanus (= Scirpus americanus)*. Other species include *Carex hyalinolepis, Eleocharis* sp., *Lemna minor*, and *Sagittaria latifolia*. In Kansas *Schoenoplectus americanus* is very uncommon in this type (Lauver et al. 1999).

Stands occur in oxbows and low areas along creeks and streams. Soils are poorly drained clays and silty loams (Lauver et al. 1999).

COMMENTS: *2, MCS*. This association includes vegetation dominated by various combinations of *Typha* spp. with *Scirpus americanus* in regions to the west of the Ozarks, Ouachitas, and Upper West Gulf Coastal Plain. It should be compared to related vegetation to the east, e.g., *Typha latifolia* Southern Herbaceous Vegetation (CEGL004150), which is also attributed to Oklahoma and Texas. The relative distribution, composition, and relationship of these two associations in these states need to be properly defined.

CONSERVATION RANK: *G3G4.*

DISTRIBUTION: This community type is found in the southeastern Great Plains region of the United States, extending from Kansas down to possibly Texas.

USFS ECOREGIONS: 251:?, 255:P, 311A:PP, 332:?
CONSERVATION REGIONS: 27:C, 32:P, 33:P, 37:C
STATES: KS OK TX? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: TYPHA (ANGUSTIFOLIA, LATIFOLIA) - (SCHOENOPLECTUS SPP.) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.I)

Schoenoplectus maritimus - Schoenoplectus acutus - (Triglochin maritima) Herbaceous Vegetation

Saltmarsh Clubrush - Hardstem Bulrush - (Seaside Arrow-grass) Herbaceous Vegetation

Northern Plains Bulrush Brackish Marsh CEGL002227

DESCRIPTION: This is an emergent wetland consisting predominantly of medium-tall graminoids. Shrubs are very rare and forbs are not abundant. The canopy of vegetation is often dense, but may be only moderate on more saline sites. *Schoenoplectus acutus (= Scirpus acutus)* and *Schoenoplectus maritimus (= Scirpus maritimus)* are typically the most abundant species, either individually or together, in this community. *Schoenoplectus maritimus* is typically more abundant on stands with higher salinities and may form virtually monotypic stands (Ungar 1970), while *Schoenoplectus acutus* tends to dominate on moderately saline sites (Walker and Coupland 1970, Stewart and Kantrud 1971). Other species commonly found in moderately saline stands include *Juncus balticus, Scolochloa festucacea, Schoenoplectus americanus (= Scirpus americanus), Schoenoplectus tabernaemontani (= Scirpus tabernaemontani), Triglochin maritima*, and *Typha latifolia*. *Triglochin maritima* can also grow on the drier edges of the more saline stands.

This community is found on sites that are flooded for much of the growing season. These sites are usually in rounded depressions (e.g., prairie potholes) or along the margins of lakes or streams. The soils are typically medium- to fine-textured and moderately saline to saline (Greenall 1995). Salinities of 0.7-4.6% were measured by Ungar (1970) in South Dakota.

COMMENTS: *2, MCS*. This type has not been well described in Minnesota, where *Schoenoplectus maritimus (= Scirpus maritimus)* is fairly localized (R. Dana pers. comm. 1999).

CONSERVATION RANK: *G3G5.* This type is localized in saline areas of the Great Plains, but may be widely distributed in saline prairie potholes. However, many of these potholes are subject to a wide variety of agriculturally-related disturbances, making it's conservation status unclear.

DISTRIBUTION: This community type is found in the northeastern Great Plains of the United States and Canada, on saline, flooded sites. It ranges from western Minnesota west to Saskatchewan and the Dakotas.

USFS ECOREGIONS: 251Be:PPP, 331:?, 332:?
CONSERVATION REGIONS: 26:C, 34:C, 35:C
STATES: MN ND SD **PROVINCES:** MB SK

MIDWEST HERITAGE SYNONYMY: MN mixed emergent marsh (prairie section) +

OTHER SYNONYMY: *Scirpus paludosus* Community (Ungar 1970) =. uncertain if equivalent, Deep marsh, moderate saline (Walker and Coupland 1970) =, Semipermanent ponds and lakes, brackish, normal emergent phase (Stewart and Kantrud 1971) I, Semipermanent ponds and lakes, subsaline, normal emergent phase (Stewart and Kantrud 1971) I

USNVC HIERARCHY: SCHOENOPLECTUS MARITIMUS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.I)

Schoenoplectus pungens - Suaeda calceoliformis Alkaline Herbaceous Vegetation

Threesquare - Sea-blite Alkaline Herbaceous Vegetation

Western Great Plains Alkaline Marsh CEGL002040

DESCRIPTION: The vegetation of this community is dominated by medium-height hydrophytic graminoids which can tolerate strongly alkaline conditions. *Schoenoplectus pungens (= Scirpus pungens)* is the dominant species, though in some sites, *Scirpus nevadensis* is abundant. In Nebraska, occasional patches of *Schoenoplectus acutus (= Scirpus acutus)* or *Schoenoplectus maritimus (= Scirpus maritimus)* may also be present, but are never common. In deeper portions of the marsh, *Chara* spp. and *Stuckenia pectinata (= Potamogeton pectinatus)* are commonly present, with *Ruppia maritima* additionally present at some sites. Along the periphery of this community, a band of mesophytic graminoids forms a transition to the adjoining grassland communities. *Hordeum jubatum* and *Puccinellia nuttalliana* frequently dominate this zone, with *Puccinellia distans* additionally present in many sites. Species diversity is low (Steinauer and Rolfsmeier 2000). In Kansas, *Coreopsis tinctoria, Polygonum pensylvanicum (= Polygonum bicorne), Sagittaria longiloba, Schoenoplectus acutus, Schoenoplectus tabernaemontani (= Scirpus tabernaemontani)*, and *Typha latifolia* may also be present in these different zones (Lauver et al. 1999).

This community occupies depressions on the bottomlands of rivers and streams, and the margins of moderately to strongly alkaline lakes in interdunal basins and valleys with no surface inflow or outflow and poor subsurface drainage, usually caused by a layer of impermeable or slightly permeable silt, clay, or siltstone beneath the bottom of the wetland. Soils are poorly drained, very strongly alkaline silty loams or sandy loams with a silty clay subsoil, and are formed in siltstone, calcareous alluvium, or eolian sand. These sites remain inundated through most of the season. Salts commonly accumulate as evaporites on shorelines, vegetation, and at times as a thin film on the water surface. The most abundant salts are sodium and potassium carbonates, with calcium and magnesium carbonates common, but not abundant. Alkalinity is >5000 mg/l (Bleed and Ginsberg 1990, Mathern 1994).

COMMENTS: *2, MCS*. This type should be compared with other *Schoenoplectus pungens (= Scirpus pungens)* associations in the western Great Plains. This community is known in western Nebraska in the "closed basin" region of the Sandhills and in the North Platte River valley.

CONSERVATION RANK: *G3G4.* This community has a limited range, but many sites in the Sandhills are not heavily impacted by artificial drainage, grazing, nor invasion by exotic species. Some sites have been eliminated due to the lowering of the water table by excessive irrigation.

DISTRIBUTION: This alkaline bulrush community type is found in the central-western Great Plains of the United States.

USFS ECOREGIONS: 331C:CP, 331F:C?, 332C:CC, 332E:CP
CONSERVATION REGIONS: 26:?, 27:C
STATES: KS NE **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE western alkaline marsh =

OTHER SYNONYMY: Permanent saline wetland (Rolfsmeier 1993b) F, Wet saline meadow (Rolfsmeier 1993b) F

USNVC HIERARCHY: SCHOENOPLECTUS PUNGENS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.I)

Schoenoplectus pungens Herbaceous Vegetation

Threesquare Herbaceous Vegetation

Bulrush Wet Meadow CEGL001587

DESCRIPTION: *Schoenoplectus pungens (= Scirpus pungens)* dominates the herbaceous vegetation layer, which is 0.3-0.6 m tall. Other species that often are present include *Schoenoplectus pungens, Spartina gracilis, Hordeum jubatum, Pascopyrum smithii*, and *Eleocharis palustris*. Stands of this association contain no tree or shrub layer, but a few scattered trees and shrubs may be present; *Populus deltoides, Salix amygdaloides, Salix exigua*, or *Symphoricarpos occidentalis* are the most common species. In Kansas, species present include *Schoenoplectus maritimus (= Scirpus maritimus), Lemna minor, Sagittaria latifolia*, and *Typha* spp. (Lauver et al. 1999).

Stands of this association are found along low-gradient, meandering, usually perennial streams and around the margins of ponds and marshes (Hansen et al. 1995, Jones and Walford 1995, Walford 1996).

Stands of this association are flooded in the spring (Larson 1993).

COMMENTS: *2, WCS*.

CONSERVATION RANK: *G3G4*.

DISTRIBUTION: This community is found in the western United States in the inter-mountain basins, as well as in western parts of the Great Plains, from Montana south to Colorado, and west into Nevada, Utah, and Wyoming.

USFS ECOREGIONS: 331:C, 341B:CP, 342G:CC, M331H:CC
CONSERVATION REGIONS: 10:C, 11:C, 19:C, 20:C, 26:C, 27:C
STATES: CO KS MT ND NV SD UT WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Scirpus pungens* habitat type (Hansen et al. 1995) B. includes vegetation dominated by all combinations of *Scirpus pungens* and *S. americanus*., *Scirpus pungens* series (Montana Natural Heritage Program 1998) B. apparently includes a wider range of vegetation types than does this association., *Scirpus pungens* Community (Jones and Walford 1995) =. described from eastern Wyoming; synonymous, *Scirpus pungens* community (Walford 1996) =. described from Wyoming's Bighorn Basin; synonymous

USNVC HIERARCHY: SCHOENOPLECTUS PUNGENS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.I)

Typha spp. - Schoenoplectus spp. - Mixed Herbs Great Plains Herbaceous Vegetation

Cattail Species - Bulrush Species - Mixed Herbs Great Plains Herbaceous Vegetation

Northern Great Plains Cattail - Bulrush Marsh CEGL002228

DESCRIPTION: Vegetation varies from zones dominated by tall emergents 1-2 m tall to those with floating-leaved or submerged aquatics in the deeper margins and perennial forbs <1 m tall in the shallower margins. In the tall emergent zone, *Schoenoplectus tabernaemontani (= Scirpus tabernaemontani), Schoenoplectus fluviatilis (= Scirpus fluviatilis), Schoenoplectus acutus (= Scirpus acutus), Typha angustifolia*, and *Typha latifolia* may dominate, mixed with a variety of other herbaceous species, such as *Leersia oryzoides, Eleocharis palustris, Juncus* spp., and *Sparganium* spp. Floating-leaved and submerged aquatics are sometimes present, including *Azolla caroliniana, Lemna* spp., *Spirodela polyrrhiza*, and *Potamogeton* spp. (Steinauer and Rolfsmeier 2000).

Stands occur in basin-like depressions, backwater areas of floodplains and shallow margins of lakes or ponds. Hydrology varies from seasonally flooded to semipermanently flooded.

COMMENTS: *2, MCS*. This is a very broadly defined type that can be difficult to separate from pure cattail marshes, *Typha* spp. Great Plains Herbaceous Vegetation (CEGL002389). Sandhills mixed emergent marshes are treated in *Schoenoplectus acutus - Typha latifolia - (Schoenoplectus tabernaemontani)* Sandhills Herbaceous Vegetation (CEGL002030). Pure bulrush marshes would also be placed in this type, at least at present (but see Montana and Wyoming). There is no shallow marsh equivalent in the northern Great Plains, comparable to the shallow marshes of the Midwest (*Schoenoplectus tabernaemontani - Typha spp. - (Sparganium spp., Juncus spp.)* Herbaceous Vegetation (CEGL002026), as the range of marsh depths is probably not as important as farther east (or west?). Shaw and Fredine (in Eggers and Reed 1987) define deep marsh as having water depths ranging from 15 cm to greater than 1 m over most or all of the growing season, and shallow marshes as having less than 15 cm with seasonal drawdowns to at or near the surface. Both may apply to this Great Plains type. Dominant and characteristic plants should always be described from stands to allow for adequate characterization. In Nebraska, the state type "pond marsh" may be a distinct type. Distribution of this type in Montana and Wyoming needs review.

CONSERVATION RANK: *G4G5.* Although occurring in very small patches in the Great Plains, this relatively simple floristic association may be very widespread.

DISTRIBUTION: This community ranges broadly over the northern Great Plains of the United States, and into adjacent Canada, from Nebraska to Manitoba.

USFS ECOREGIONS: 331C:CC, 332C:CC, 332E:CC, M334A:CC
CONSERVATION REGIONS: 25:C, 26:C, 34:C
STATES: ND NE SD **PROVINCES:** MB

MIDWEST HERITAGE SYNONYMY: NE freshwater marsh +

OTHER SYNONYMY:

USNVC HIERARCHY: TYPHA (ANGUSTIFOLIA, LATIFOLIA) - (SCHOENOPLECTUS SPP.) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.I)

Typha spp. Great Plains Herbaceous Vegetation

Cattail Species Great Plains Herbaceous Vegetation

Northern Great Plains Cattail Marsh CEGL002389

DESCRIPTION: The vegetation is dominated by relatively pure stands of *Typha* spp., either *Typha latifolia* or *Typha angustifolia* or both. Many associates can occur, including *Eleocharis* spp. and *Sagittaria latifolia*. This type may simply be a less diverse variation of *Typha spp - Scirpus spp*. - Mixed Herbs Great Plains Herbaceous Vegetation (CEGL002228).

Stands occur in shallow (<0.5 m) or deep depressions, ponds, and seepy drainages. Stands may originate from human-related disturbance, including heavy grazing of wetlands or creation of wetlands for watering cattle (stock ponds).

COMMENTS: *2, MCS*. Where this type extends into western states, see *Typha latifolia* Western Herbaceous Vegetation (CEGL002010); where type extends into Southeast, see *Typha latifolia* Southern Herbaceous Vegetation (CEGL004150), and where type extends into the Midwest see *Typha* spp. Midwest Herbaceous Vegetation (CEGL002233). Bailey's province lines (Bailey et al. 1994) influence these association definitions. It is unclear whether a separate *Typha*-dominated type is needed in addition to the mixed *Typha - Scirpus* types, namely *Typha spp. - Scirpus spp*. - Mixed Herbs Great Plains Herbaceous Vegetation (CEGL002228) and *Schoenoplectus acutus - Typha latifolia - (Schoenoplectus tabernaemontani)* Sandhills Herbaceous Vegetation (CEGL002030). Pure *Typha* stands, depending on site conditions, are often perceived as degraded examples of the mixed type.

CONSERVATION RANK: *G4G5.* Type is widespread throughout the plains, but most examples show evidence of disturbance. It is possible that the type originates primarily from human-related disturbances in which case the type could be treated as a semi-natural, weedy, type with a rank of GW.

DISTRIBUTION: This cattail community type is found throughout the Northern Great Plains and adjacent Canada, ranging from Kansas to Manitoba.

USFS ECOREGIONS: 251Aa:CCC, 331C:PP, 331F:PP, 331H:P?, 332A:PP, 332B:P?, 332D:PP, M334A:CC
CONSERVATION REGIONS: 25:C, 26:C, 27:C, 34:C
STATES: KS ND NE SD **PROVINCES:** MB

MIDWEST HERITAGE SYNONYMY: NE freshwater marsh +

OTHER SYNONYMY:

USNVC HIERARCHY: TYPHA (ANGUSTIFOLIA, LATIFOLIA) - (SCHOENOPLECTUS SPP.) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.I)

1.5. Wet Prairies and Wet Meadows

Calamagrostis canadensis - Phalaris arundinacea Herbaceous Vegetation

Bluejoint - Reed Canary Grass Herbaceous Vegetation

Bluejoint Wet Meadow CEGL005174

DESCRIPTION: Graminoid cover is typically dense, and can form hummocky microtopography. *Calamagrostis canadensis* dominates, often in almost pure stands or with tall sedges, such as *Carex aquatilis, Carex lacustris, Carex rostrata*, and *Carex stricta*. In fen transitions, *Carex lasiocarpa* can be present. *Agrostis gigantea (= Agrostis alba), Glyceria grandis, Poa palustris, Scirpus cyperinus*, and *Typha latifolia* are sometimes abundant. Forbs include *Campanula aparinoides, Epilobium leptophyllum, Eupatorium maculatum, Iris versicolor, Polygonum amphibium*, and *Comarum palustre (= Potentilla palustris)*. Scattered shrubs, such as *Viburnum nudum, Viburnum dentatum, Spiraea alba, Alnus incana*, or *Alnus serrulata,* may be present.

Stands occur on the floodplains of small streams, in poorly drained depressions, beaver meadows, and lakeshores. Soils are typically mineral soil or well-decomposed peat, with a thick root mat. Water regime varies between temporarily and seasonally flooded.

COMMENTS: *3, ECS*. This type can grade into sedge meadows. A guideline of perhaps <50% sedges may be suggested as a criteria for the definition of this type compared to sedge meadow types. Harris et al. (1996) suggest that the bluejoint meadow type is drier than sedge meadows and less peaty than shore fens.

CONSERVATION RANK: *G4G5*. This type is widespread throughout the northeastern and upper midwestern United States and central/southern Canada.

DISTRIBUTION: This wet meadow vegetation is widely distributed in the northeastern and midwestern United States and south-central and southeastern Canada. It ranges from Maine south to West Virginia and possibly Virginia and west to Minnesota.

USFS ECOREGIONS: 212Hj:CCC, 212Hs:CCC, 212Hx:CCC, 212Ib:CCC, 212La:CPP, 212Na:CPP, 221:C, 222Jg:CCC, 222Na:CCC, 251Aa:CCC, M212:C, M221Db:???, M221Dc:???, M221Dd:???
CONSERVATION REGIONS: 35:C, 45:C, 47:P, 48:C, 51:C, 59:C, 61:C, 63:C
STATES: CT DE MA MD ME MI MN NH NJ NY PA RI VA? VT WI WV **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:
MI northern wet meadow +
MN wet meadow +
WI bluejoint meadow =

OTHER SYNONYMY: Meadow marsh: bluejoint grass (W13) (Harris et al. 1996) =, Boreal alluvial tall meadow (NAP), Canada bluejoint-tussock sedge meadow (CAP)

USNVC HIERARCHY: CALAMAGROSTIS CANADENSIS SEASONALLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.k)

Carex rostrata - Carex lacustris - (Carex vesicaria) Herbaceous Vegetation

Swollen-beak Sedge - Lake Sedge - (Inflated Sedge) Herbaceous Vegetation

Northern Sedge Wet Meadow CEGL002257

DESCRIPTION: Tall coarse-leaved sedges dominate the vegetation layer, often creating a tussocky hummock microtopography. Shrubs can cover up to 25% of the area. Pools with submergents may also be present. Dominant graminoids include a number of Carices, including *Carex aquatilis, Carex lacustris, Carex lasiocarpa, Carex rostrata, Carex vesicaria*, and locally *Carex stricta*. Other graminoids include *Calamagrostis canadensis, Scirpus atrovirens, Scirpus cyperinus*, and in wetter areas, *Eleocharis palustris (= Eleocharis smallii)* and *Equisetum fluviatile*. Forbs include *Acorus calamus, Symphyotrichum lanceolatum var. lanceolatum (= Aster simplex), Campanula aparinoides, Eupatorium maculatum, Iris virginica var. shrevei (= Iris shrevei), Lycopus uniflorus, Poa palustris, Polygonum amphibium, Comarum palustre (= Potentilla palustris)*, and others (Curtis 1959, Harris et al. 1996).

Sites are found on floodplains, shallow bays of lakes and streams, beaver meadows, ditches, and occasionally in isolated basins, or on semi-floating mats. Hydrology is seasonally to semipermanently flooded. Substrate is mineral soil or well-decomposed peat (Curtis 1959, Harris et al. 1996).

Stands often have a fluctuating hydrology, leading in some years to fairly deep (> 1 m) flooding and in other years to little or no flooding. Beavers can also increase flooding in these stands.

COMMENTS: *2, MCS*. Taxonomy and distribution of *Carex utriculata* vs. *Carex rostrata* needs to be resolved. In Gleason and Cronquist (1991), *Carex rostrata* is circumboreal and only occurs in northern Michigan and northern Minnesota, whereas *Carex utriculata* is boreal but extends south to Delaware, Indiana, Nebraska, New Mexico and California. (*Carex vesicaria* has a similar distribution to *Carex utriculata*.) *Carex rostrata* has also been reported from extreme northern Wisconsin, e.g., on the Apostle Islands (E. Judziewicz pers. comm. 1999). However, all of the atlases and floras in the Midwest (Voss 1972, Mohlenbrock and Ladd 1978, Ownbey and Morley 1991) do not make such a distinction, so the species are essentially treated as synonymous in this type. Curtis (1959) suggested that differential species for northern sedge meadows in Wisconsin may be *Symphyotrichum puniceum (= Aster puniceus), Campanula aparinoides, Glyceria canadensis, Scirpus atrovirens*, and *Solidago uliginosa*, among others, but this list needs further study.

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This northern tall sedge community is found in the mixed conifer - hardwood zone of the Great Lakes and northeastern region of the United States and north into Canada, extending from Maine to Manitoba, south to Michigan and Iowa.

USFS ECOREGIONS: 212Ha:CCP, 212Hb:CCP, 212He:CCP, 212Hh:CCP, 212Hi:CCP, 212Hj:CCC, 212Hk:CCP, 212Hn:CCP, 212Ho:CCP, 212Hq:CCP, 212Hr:CCP, 212Hs:CCP, 212Ht:CCP, 212Hv:CCC, 212Hw:CCP, 212Hx:CCP, 212Hy:CCP, 212Ib:CPP, 212Ja:CCP, 212Jb:CCP, 212Jc:CCP, 212Jd:CCC, 212Je:CC?, 212Jf:CCP, 212Jj:CCP, 212Jk:CCP, 212Jl:CCP, 212Jm:CCP, 212Jn:CCP, 212Jo:CCP, 212Jr:CCP, 212Ka:CCC, 212La:CPP, 212Lb:CPP, 212Lc:CPP, 212Ld:CPP, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 222Lb:CCC, 251Ab:CCC, 251B:CC, 332:?

CONSERVATION REGIONS: 26:C, 34:C, 35:C, 46:C, 47:C, 48:C

STATES: IA ME MI MN ND SD WI **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY:

	MI	northern wet meadow +
	MN	wet meadow +
	WI	sedge meadow (northern subtype) =

OTHER SYNONYMY: Northern Sedge Meadow (Curtis 1959) =, meadow mash: tall sedge (W12) (Harris et al. 1996) =

USNVC HIERARCHY: CAREX (ROSTRATA, UTRICULATA) SEASONALLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.k)

Dasiphora fruticosa ssp. floribunda / Cladium mariscoides - Juncus balticus - (Rhynchospora capillacea) Herbaceous Vegetation

Shrubby-cinquefoil / Twig-rush - Baltic Rush - (Limestone Beaksedge) Herbaceous Vegetation

Interdunal Wetland CEGL005105

DESCRIPTION: Herbaceous vascular plants have <30% cover, trees and shrubs together have <30% cover, and trees alone have <5% cover. Several variants of this community occur, correlating with depth to the mean annual water table (centers of swales versus highest portions of swales) and distance inland from the lakeshore (exposed duneland versus sheltered inland/duneland). The species composition of the community resembles alkaline shrub/herb fens, especially in the zone of groundwater emergence. The physiognomy and floristics of the herb-dominated intermediate zone of the swale are emphasized in this description and include *Calamagrostis canadensis, Carex* spp., *Cladium mariscoides, Eleocharis quinqueflora, Equisetum variegatum, Juncus balticus, Dichanthelium acuminatum var. fasciculatum (= Panicum implicatum), Rhynchospora capillacea, Schoenoplectus acutus (= Scirpus acutus)*, and *Typha* spp. Apart from the dominants, characteristic species include *Carex viridula, Oligoneuron ohioense (= Solidago ohioensis), Hypericum kalmianum, Panicum flexile, Scleria verticillata, Lysimachia quadriflora, Packera paupercula (= Senecio pauperculus), Eleocharis* spp. (including *Eleocharis quinqueflora (= Eleocharis pauciflora)*). *Rhynchospora capillacea* is not in Ohio sites (White and Madany 1978, Homoya et al. 1985, Hiebert et al 1986, Chapman et al. 1989).

Interdunal wetlands are found on the sandy soils of wet depressions in wind-deposited dune systems of the Great Lakes. The depressions often form a sequence, with the youngest near the lake and older ones inland. Ontario occurrences of this same vegetative community have been recorded from moist, sandy substrates well inland. The substrate is 75-100% sand. Organics and silts occur in small amounts in depressions of exposed dunelands, and in larger amounts in sheltered, inland wet depressions. Occasionally, when located within active dune fields, these communities are buried by dune sand. Springs have been recorded to occur within interdunal wetland complexes, probably resulting from hydrological heads developed within adjacent dune ridges. These springs, when occurring on an occasional basis, set back succession within the wetland (Hiebert et al. 1986).

COMMENTS: *2, MCS*. This type may fit better under a *Dasiphora fruticosa ssp. floribunda* saturated alliance (P. Comer pers. comm. 1997), where the shrub component may vary from low to as high as 50%. This range of this type is currently limited to the southern Great Lakes, but in Michigan this type could occur in northern Michigan, where it may be found as part of the Great Lakes Wooded Dune and Swale Complex (CECX002000). A number of the dominant and indicator species (*Cladium mariscoides, Pentaphylloides fruticosa, Oligoneuron ohioense (= Solidago ohioensis)*) are common in both the southern and northern wetlands, but stands in the south are often found with oak savanna and tallgrass prairie species on adjacent ridges, and thus have some compositional differences reflected in the wetlands (P. Comer pers. comm. 2000). It is also possible that *Calamagrostis canadensis - Carex viridula - Cladium mariscoides - Lobelia kalmii* Herbaceous Vegetation (CEGL005115) is the northern interdunal wetland equivalent.

CONSERVATION RANK: *G3?*. The total number of occurrences is unknown. Thirty-six have been documented: 2 in Illinois (where the community is ranked S1), 6 in Indiana (S1), 23 in Michigan (S2), and 5 in Wisconsin (S1). No other occurrences have been documented, but the community also occurs in Ontario (S2,S1). It is found in 14 ecoregional subsections. Sizes of 29 occurrences range from 1 to 430 acres, totaling 1326.

DISTRIBUTION: This interdunal wetland herbaceous community is found in dune systems of the southern (and perhaps northern) Great Lakes in the United States and Canada, ranging from northern Illinois and Indiana, northward to Wisconsin, Michigan, and Ontario. Great Lakes shores include Lake Michigan, Lake Huron (not south of Saginaw Bay), Georgian Bay, and possibly Lake Erie.

USFS ECOREGIONS: 212Hd:CCC, 212Hj:CCC, 212Hl:CCC, 212Ho:CCC, 212Hr:CCC, 212Hw:CCC, 212Hx:CCC, 212Ia:CCC, 212Ja:CCP, 212Jb:CCC, 212Jn:CCC, 212Oa:CCC, 212Ob:CCC, 222Jj:CCC, 222Kg:CCC
CONSERVATION REGIONS: 48:C
STATES: IL IN MI OH WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	panne =
IN	panne =
MI	interdunal wetland =
OH	beach-dune community ?
WI	interdunal wetland =

OTHER SYNONYMY:

USNVC HIERARCHY: CLADIUM MARISCOIDES SEASONALLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.k)

Carex aquatilis - Carex spp. Herbaceous Vegetation

Aquatic Sedge - Sedge Species Herbaceous Vegetation

Water Sedge Wet Meadow CEGL002262

DESCRIPTION: The vegetation is dominated by graminoids approximately 0.4-0.7 m tall. *Carex* spp. predominate, especially *Carex aquatilis*, as well as *Carex rostrata, Carex lacustris*, and *Carex stricta*. *Eleocharis palustris, Polygonum amphibium, Schoenoplectus* spp. (= *Scirpus* spp.), and *Typha* spp. may all be found in this community. *Scolochloa festucacea* may be found in drier stands (Looman 1982). Woody species are rare. If present, they are often shrubs such as *Salix* spp.

This community is typically found in depressions or around ponds or lakes, although it may occur adjacent to streams or rivers. They are flooded for some time during the growing season in most years. Looman (1981a, 1982) found *Carex aquatilis*-dominated stands in the northern Great Plains on mostly mineral soils in fresh or slightly saline shallow marshes.

COMMENTS: *3, MCS*. This type and its alliance are not well defined.

CONSERVATION RANK: *G4?.*

DISTRIBUTION: This water sedge community type is found in the northern Great Plains and northern tallgrass prairie region of the United States and Canada, extending from Ontario to Manitoba, south to Michigan and the Dakotas.

USFS ECOREGIONS: 222Jf:CCC, 222Jh:CCC, 222Na:C??, 251Aa:CCP, 251Ab:CC?
CONSERVATION REGIONS: 26:C, 34:C, 35:C, 48:C
STATES: MI MN ND SD **PROVINCES:** MB? ON

MIDWEST HERITAGE SYNONYMY: MI northern wet meadow +
MN wet meadow +

OTHER SYNONYMY: *Caricetosum aquatilis* subassociation (Looman 1981a) F. Both of Looman's (1981a, 1982) *Carex aquatilis* types are assumed to be in this community based on dominant vegetation and what little environmental information is given., *Carex aquatilis* association (Looman 1982) F. Both of Looman's (1981a, 1982) *Carex aquatilis* types are assumed to be in this community based on dominant vegetation and what little environmental information is given, Water smartweed marsh (Harris et al. 1996) B

USNVC HIERARCHY: CAREX AQUATILIS SEASONALLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.k)

Carex atherodes Herbaceous Vegetation

Awned Sedge Herbaceous Vegetation

Awned Sedge Wet Meadow CEGL002220

DESCRIPTION: Vegetation cover is usually high but can vary in wet or dry years. Dominant species are herbaceous and typically between 0.5 and 1 m tall. Forb diversity is moderate to high (MNNHP 1993). *Carex atherodes* can form almost monotypic stands or it may be dominant. Common associated species are *Alisma triviale, Symphyotrichum lanceolatum (= Aster lanceolatus), Eleocharis palustris, Glyceria grandis* (in drier stands), *Mentha arvensis, Phalaris arundinacea, Polygonum amphibium, Scolochloa festucacea* (especially on mildly saline stands), *Sium suave*, and *Sparganium eurycarpum*. Shrubs, including *Salix* spp., can invade this community, especially in the eastern portions of its range. *Beckmannia syzigachne* often is an indicator of disturbance (Walker and Coupland 1970).

This community is found on lowland sites that have standing water for several weeks each year. These sites are typically in depressions or basins but can be along streams and rivers (MNNHP 1993). The water may be fresh or mildly saline. Soils can be mineral but mucks often form through the buildup of organic material (Looman 1982).

Fire may have been important to prevent the invasion of this community by woody species, especially in the eastern part of its range (MNNHP 1993).

COMMENTS: *2, MCS*. See Dix and Smeins (1967) for a discussion of the hydrology of this type, which borders on temporarily vs. seasonally flooded. See also Stewart and Kantrud (1972, including photos on pp. 34-35). Brotherson (1969) performed an ordination of pothole and drainage communities on a prairie in northwestern Iowa and found a community with 55% cover by *Carex atherodes*. The only other species with more than 4% cover was *Polygonum amphibium*, at 30%. *Schoenoplectus fluviatilis (= Scirpus fluviatilis), Calamagrostis canadensis, Carex lasiocarpa, Spartina pectinata*, and *Carex aquatilis* all had between 1 and 3% cover. This community occurred as a narrow band around potholes or sometimes in wide patches.

The relationship of this community and *Scolochloa festucacea* Herbaceous Vegetation needs to better defined. *Carex atherodes* tends to be on non-saline sites while *Scolochloa festucacea* tends to do better on mildly to moderately saline sites (Walker and Coupland 1970). However, the two can co-occur or codominate on mildly saline sites. *Carex atherodes* tends to occur on drier sites (Smith 1973).

CONSERVATION RANK: *G3G5.*

DISTRIBUTION: This awned sedge wet meadow occurs in the northern tallgrass prairie region of the United States and Canada, from Minnesota and Iowa, north and west into the Dakotas, Manitoba and perhaps other provinces.

USFS ECOREGIONS: 222Na:CCC, 251Aa:CCC, 251Ba:CCC, 251Bb:CCC
CONSERVATION REGIONS: 26:C, 34:C, 35:C
STATES: IA MN ND SD **PROVINCES:** MB

MIDWEST HERITAGE SYNONYMY: MN wet meadow +

OTHER SYNONYMY: Meadows (Dix and Smeins 1967) B, Groups 9, 10, 17, 25, and 26 (Walker and Coupland 1970) =, Seasonal ponds and lakes, fresh, central shallow marsh phase (Stewart and Kantrud 1971) I, Seasonal ponds and lakes, slightly brackish, central shallow marsh phase (Stewart and Kantrud 1971) I, *Carex atherodes* association (Looman 1982) =

USNVC HIERARCHY: CAREX ATHERODES SEASONALLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.k)

Carex lacustris Herbaceous Vegetation

Lake Sedge Herbaceous Vegetation

Lake Sedge Wet Meadow CEGL002256

DESCRIPTION: The vegetation is dominated by tall sedges. Shrubs may have up to 25% cover. *Carex lacustris* forms almost mono-dominant stands. Occasionally other emergents, such as *Typha latifolia* or *Sagittaria* spp., may codominate. In Wisconsin this type is common in the northwest, where it typically intermingles with tall shrubs, especially *Salix* spp. (e.g., *Salix petiolaris*). Common herbaceous associates include *Doellingeria umbellata (= Aster umbellatus), Calamagrostis canadensis, Carex stricta, Eupatorium maculatum*, and *Muhlenbergia glomerata* (E. Epstein pers. comm. 1999).

Stands occur on floodplains, shallow bays of lakes and streams, and upland depressions. Soils are mineral or well-decomposed peat. Flooding is variable, but typically is seasonal.

COMMENTS: *3, MCS*. Further characterization of this type is needed to determine whether it is a good type. It may represent a mono-dominant variant of a more broadly defined mixed broad-leaved sedge type (e.g., Bakowsky and Lee 1996). *Carex stricta*, by contrast, is a narrow-leaved sedge. Geographic distribution of this type versus *Carex rostrata - Carex lacustris - (Carex vesicaria)* Herbaceous Vegetation (CEGL002257) also needs to be clarified. In Ohio, stands can be very large, especially in northeastern Ohio. *Carex hyalinolepis* can also occur over large areas in Ohio (Greg Schneider pers. comm. 1996). Charles Umbanhowar should be consulted for examples of this type in southeastern Minnesota.

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This broad-leaved wet sedge meadow type occurs in the north-central region of the midwestern United States, extending from Ohio and Ontario to Iowa, the Dakotas, and Manitoba.

USFS ECOREGIONS: 212Hb:CPP, 212Ja:CPP, 212Jb:CP?, 212Jc:CP?, 212Je:CP?, 212Jf:CPP, 212Jj:CP?, 212Jk:CP?, 212Jl:CPP, 212Jm:CPP, 212Ka:CCP, 212Kb:CCC, 212Mb:CPP, 212Na:CCC, 212Nb:CCP, 212Nc:CCC, 222Jg:CCC, 222Ke:CCC, 222Kf:CCC, 222Lc:CCC, 222Lf:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 222Na:CCC, 251Aa:CCC
CONSERVATION REGIONS: 35:C, 46:C, 47:C, 48:C
STATES: IA IL IN MN OH WI **PROVINCES:** MB

MIDWEST HERITAGE SYNONYMY:

IL	marsh (N) +
IN	marsh +
MN	wet meadow +
OH	sedge-grass meadow +
WI	sedge meadow (lake sedge subtype (not tracked)) ?

OTHER SYNONYMY:

USNVC HIERARCHY: CAREX LACUSTRIS SEASONALLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.k)

Carex pellita - Calamagrostis stricta Herbaceous Vegetation

Woolly Sedge - Western Bluejoint Herbaceous Vegetation

Bluejoint - Woolly Sedge Wet Meadow CEGL002254

DESCRIPTION: The vegetation of this community provides approximately 100% cover, and the dominant vegetation is graminoids, typically 0.3-1.0 m tall. Forbs can be common; they had 25% relative cover in the stands studied by Nelson et al. (1981). Shrubs are rarely found in this type. The most abundant species are *Calamagrostis stricta, Carex pellita (= Carex lanuginosa), Carex sartwellii, Anemone canadensis, Apocynum cannabinum, Symphyotrichum lanceolatum (= Aster lanceolatus), Eleocharis compressa, Juncus balticus, Phalaris arundinacea, Polygonum amphibium*, and *Schoenoplectus americanus (= Scirpus americanus)*. *Carex buxbaumii* can be common, except in North Dakota.

This community occurs on level ground in shallow depressions and other lowlands on poorly drained sandy, loamy, or silty clay soils. Standing water can be present for a few to several weeks a year (Dix and Smeins 1967, Smeins and Olsen 1970). Soil pH is circumneutral to somewhat alkaline, and organic content can be moderately high.

COMMENTS: *3, MCS*. Type concept is a little unclear. Simple dominance by *Carex lanuginosa* (now *Carex pellita* in Kartesz 1994) may not be adequate. Hydrologic placement is difficult, ranging from seasonally flooded to temporarily flooded. This type may simply be a part of *Spartina pectinata - Calamagrostis stricta - Carex spp*. Herbaceous Vegetation (CEGL002027) (wet prairie), or vice versa. See also *Carex lanuginosa* Herbaceous Vegetation (CEGL001809).

CONSERVATION RANK: *G3G5.*

DISTRIBUTION: This sedge-bluejoint wet meadow is found in the northern tallgrass prairie region and in the northeastern Great Plains, ranging from northern Iowa, western Minnesota, and the Dakotas to parts of the Canadian prairie provinces.

USFS ECOREGIONS: 222:P, 251Aa:CCC, 251Ab:CCC
CONSERVATION REGIONS: 26:C, 34:C, 35:C
STATES: IA MN ND SD **PROVINCES:** MB SK

MIDWEST HERITAGE SYNONYMY: MN wet meadow +

OTHER SYNONYMY: *Carex lanuginosa* Community (Smeins and Olsen 1970) =, *Carex lanuginosa / Calamagrostis inexpansa* Habitat Type (Nelson et al. 1981) =

USNVC HIERARCHY: CAREX PELLITA SEASONALLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.k)

Carex spp. - (Carex pellita, Carex vulpinoidea) Herbaceous Vegetation

Sedge Species - (Woolly Sedge, Fox Sedge) Herbaceous Vegetation

Central Midwest Sedge Meadow CEGL005272

DESCRIPTION: The vegetation cover is quite dense, and may be patchy. The structure is dominated by graminoids 0.5-1.5 m tall. Typical species include *Carex cristatella, Carex molesta, Carex pellita (= Carex lanuginosa), Carex stipata, Carex tribuloides*, and *Carex vulpinoidea* (a dominant in southeast Nebraska meadows). Other frequent emergent graminoids include *Eleocharis* spp., *Juncus interior, Juncus torreyi, Scirpus atrovirens*, and *Scirpus pallidus*. *Leersia oryzoides* may be common where the stand borders a marsh. Forbs are common and may be conspicuous. Among the more common are *Apocynum cannabinum, Symphyotrichum lanceolatum (= Aster lanceolatus), Lycopus americanus, Lythrum alatum* and *Verbena hastata*. *Phalaris arundinacea* may invade this community to the point of excluding many of the native species (Steinauer and Rolfsmeier 2000).

Stands occur on nearly level floodplains, often in bands surrounding channels, or in basins. Soils are poorly drained silty and clay loams formed in alluvium. Stands are flooded for much of the growing season, but may dry out in late summer. Hydrology varies from seasonally to almost semipermanently flooded (Steinauer and Rolfsmeier 2000).

COMMENTS: *3, MCS*. In Nebraska, diagnostic species are suggested to be *Carex cristatella, Carex vulpinoidea, Scirpus atrovirens* and *Scirpus pallidus* (Steinauer and Rolfsmeier 2000), though many of these species are widespread across the eastern United States. In a Midwest context, the absence of *Carex stricta*, and perhaps *Calamagrostis canadensis*, may separate this type from those in the upper and more eastern parts of the Midwest. This type may also grade into freshwater marsh types, making separation difficult in the field (see "freshwater marsh" type in Nelson 1985). Further range-wide review is needed.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This sedge meadow type is found in the central midwestern United States, in the central tallgrass prairie region, ranging from eastern Nebraska to southern Iowa and northern Missouri.

USFS ECOREGIONS: 251C:CC
CONSERVATION REGIONS: 36:C
STATES: IA? MO NE **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO no state equivalent
NE eastern sedge wet meadow =

OTHER SYNONYMY:

USNVC HIERARCHY: CAREX PELLITA SEASONALLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.k)

Carex stricta - Carex spp. Herbaceous Vegetation

Tussock Sedge - Sedge Species Herbaceous Vegetation

Tussock Sedge Wet Meadow CEGL002258

DESCRIPTION: The vegetation is dominated by sedges and grasses, but the shrub component can be high as 25%. Dominant plants include *Calamagrostis canadensis* and *Carex stricta*. Associated graminoids include *Carex aquatilis, Carex pellita (= Carex lanuginosa), Carex bebbii, Carex lacustris, Eleocharis* spp., *Juncus* spp., *Phalaris arundinacea* (common in more degraded examples), and *Typha latifolia*. Typical forbs include *Anemone canadensis, Asclepias incarnata, Symphyotrichum lanceolatum var. lanceolatum (= Aster simplex), Equisetum arvense, Eupatorium maculatum, Eupatorium perfoliatum, Iris versicolor, Lycopus americanus*, and *Solidago canadensis* (Curtis 1959, Chapman et al. 1989, MNNHP 1993).

Sites occur in stream valleys, along lake margins, and in depressions and channels in glacial outwash. Soils include wet mineral soils, muck, or shallow peat (<0.5 m), with the water table below the surface for most of the growing season (Chapman et al. 1989, MNNHP 1993).

Wet meadows tend to succeed to shrub swamp communities in the absence of fire (MNNHP 1993). Lowering of the water table by ditching or drought may speed up succession to shrub swamp. Wet meadows on muck or peat recover very slowly, if at all, once altered by artificial flooding or ditching (MNNHP 1993).

COMMENTS: *2, MCS*. This type may have some fen characteristics, but stands dominated by *Carex stricta* with fen associates are better placed in *Carex stricta - Valeriana edulis - Parnassia palustris* Herbaceous Vegetation (CEGL005241), whose concept is strongly based on northeastern Iowa stands (Leoschke and Pearson 1987). The northern limits of this type are not clear with respect to *Carex rostrata - Carex lacustris - (Carex vesicaria)* Herbaceous Vegetation (CEGL002257). Wet meadow stands in the northern parts of Michigan, Wisconsin, and Minnesota are usually placed in CEGL002257, and, although they are more typically dominated by coarse sedges (*Carex rostrata, Carex lacustris, Carex vesicaria*), they can occasionally have dominance by *Carex stricta*) (Harris et al. 1996, W12). As a result ecoregion distribution of this type needs review. Ontario stands may have some *Carex lasiocarpa* in this type.

CONSERVATION RANK: *G4?.*

DISTRIBUTION: This wet sedge meadow community is found in the southern Great Lakes region of the United States and Canada, and parts of the central Midwest, ranging from Indiana and Ontario, west to Minnesota and Iowa.

USFS ECOREGIONS: 212Hb:CCC, 212Hl:CCC, 212Hm:CCP, 212Hn:CCP, 212Ho:CCP, 212Hp:CCP, 212Hq:CCP, 212Hr:CCP, 212Ht:CCP, 212Hv:CCC, 212Hw:CCP, 212Hx:CCP, 212Hy:CCC, 212Ib:CPP, 212Ja:CCP, 212Jb:CC?, 212Jc:CCP, 212Je:CCP, 212Jf:CCC, 212Jj:CCP, 212Jk:CCC, 212Jl:CCP, 212Jm:CCC, 212Ka:CPP, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 222Ha:CPP, 222Hb:CPP, 222Ja:CCP, 222Jb:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ka:CCC, 222Kb:CCC, 222Kd:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Ki:CCC, 222Kj:CCC, 222Lb:CCC, 222Lc:CCC, 222Le:CCC, 222Lf:CCC, 222Me:CCC, 251Aa:CCC, 251Ab:CCC, 251Bb:CCC, 251Bd:CCC, 251Ca:CCC, 251Cc:CCC, 251Cf:CCC, 251Ch:CCC, 251Dc:CCC, 251Dd:CCP, 251Dg:CCC, 251Dh:CCP

CONSERVATION REGIONS: 26:C, 35:C, 36:C, 45:C, 46:C, 47:C, 48:C

STATES: IA IL IN MI MN ND WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	sedge meadow =
IN	sedge meadow =
MI	southern wet meadow =
MN	wet meadow +
WI	sedge meadow (tussock sedge subtype?) +

OTHER SYNONYMY:

USNVC HIERARCHY: CAREX STRICTA SEASONALLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.k)

Cladium mariscoides - (Carex lasiocarpa, Hypericum kalmianum, Oligoneuron riddellii, Eleocharis elliptica) Herbaceous Vegetation

Twig-rush - (Wiregrass Sedge, Kalm's St. John's-wort, Riddell's Goldenrod, Elliptic Spikerush) Herbaceous Vegetation

Twigrush Wet Prairie CEGL005104

DESCRIPTION: The dominant species include *Carex lasiocarpa* and/or *Cladium mariscoides*. *Carex sartwellii* and occasionally *Calamagrostis canadensis, Calamagrostis stricta*, or *Carex stricta* may be locally dominant. Stand composition is quite variable, and other species include *Carex atherodes, Carex buxbaumii, Carex cryptolepis, Carex pellita, Coreopsis tripteris, Eleocharis elliptica, Euthamia caroliniana (= Euthamia remota), Gentiana andrewsii, Hypericum kalmianum, Liatris spicata, Lobelia kalmii, Lythrum alatum, Prenanthes racemosa, Sorghastrum nutans*, and *Oligoneuron riddellii (= Solidago riddellii)*. Scattered shrubs such as *Salix petiolaris* may occur. The wettest areas tend to favor *Sagittaria graminea, Proserpinaca palustris, Carex sartwellii, Iris versicolor*, and *Dulichium arundinaceum*. Shrubs including *Salix discolor, Salix petiolaris, Ilex verticillata, Physocarpus opulifolius, Cornus amomum*, and the non-native *Frangula alnus (= Rhamnus frangula)* may increase in drier areas (Schneider and Cochrane 1997).

Stands occur in low-lying, sandy areas where the groundwater is at or near the surface for much of the year. Soils are typically a muck over sand. Stands are seasonally flooded, and water depth may vary in spring from several centimeters to almost 0.5 m. (Schneider and Cochrane 1997).

Seasonal flooding coupled with fires during dry periods maintain the herbaceous dominance of these stands (Schneider and Cochrane 1997). In the absence of fire, these stands could succeed to shrub swamps or pin oak *Quercus palustris* woodlands.

COMMENTS: *3, MCS*. This type may grade into wet prairies, such as *Spartina pectinata - Carex spp. - Calamagrostis canadensis - Lythrum alatum - (Oxypolis rigidior)* Herbaceous Vegetation (CEGL002224). Great Lakes shoreline stands classified as interdunal wetlands, or *Dasiphora fruticosa ssp. floribunda / Cladium mariscoides - Juncus balticus - (Rhynchospora capillacea)* Herbaceous Vegetation (CEGL005105), may resemble this type. Lakeplain wet sand prairies, *Spartina pectinata - Carex spp. - Calamagrostis canadensis* Lakeplain Herbaceous Vegetation (CEGL005109), should also be compared (Comer et al. 1995b). This type may have occurred historically in southern Ontario on the Bothwell and Norfolk sandplains and at Dunwich Prairie, but they have been extirpated (W. Bakowsky pers. comm. 2000).

CONSERVATION RANK: *G2?.* There are probably fewer than 50 occurrences of this community rangewide. It is reported from Ohio (S1) where it is found only in the Oak Openings region in the northwest part of the states. A total of 4 A-ranked sites (combined acreage of 125 acres) and 5 B-ranked sites (combined acreage of 120 acres) have been documented (Schneider and Cochrane 1997). Many occurrences of this community have been disturbed and degraded by drainage for agriculture and development. Lack of fire may also lead to successional changes causing replacement by other community types.

DISTRIBUTION: This twig-rush wet prairie community is in the oak openings region of northwest Ohio, and may occur elsewhere in adjacent regions of the United States and Canada.

USFS ECOREGIONS: 222Ig:CCC
CONSERVATION REGIONS: 48:C
STATES: IN MI? OH **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

	IN	marl beach =
	MI?	no state equivalent
	OH	twigrush-wiregrass wet prairie =

OTHER SYNONYMY:

USNVC HIERARCHY: CLADIUM MARISCOIDES SEASONALLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.k)

Salix petiolaris - (Betula pumila) / Spartina pectinata - Carex pellita Shrubland

Meadow Willow - (Bog Birch) / Prairie Cordgrass - Woolly Sedge Shrubland

Willow Wet Brush Prairie CEGL002434

DESCRIPTION: The vegetation consists of clumps or thickets of low shrubs in a graminoid matrix of wet prairie vegetation. Some of the more important grasses include *Spartina pectinata, Calamagrostis stricta, Calamagrostis canadensis, Andropogon gerardii*, and *Muhlenbergia richardsonis*. Other grasses that may be present include *Elymus trachycaulus (= Agropyron trachycaulum), Deschampsia caespitosa, Panicum virgatum, Poa palustris*, and *Sporobolus heterolepis*. Common sedges include *Carex buxbaumii, Carex pellita (= Carex lanuginosa), Carex sartwellii*, and *Carex tetanica*. Forbs are moderately abundant, and are typical of wet prairie. Shrubs include *Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda), Salix discolor*, and *Salix petiolaris (= Salix gracilis)*. *Betula pumila* and *Spiraea alba* are common on some sites. These sites can also contain scattered saplings, or even groves, of *Populus tremuloides* and *Populus balsamifera* (MNNHP 1993).

Stands occur on level, poorly drained sites. Soils range in texture from loamy fine sand to sandy clay loam, and are often calcareous. Some stands contain seepage zones (MNNHP 1993).

This is a fire-dependent community. Without frequent fire this type will succeed to Aspen Woodland (CEGL005205) or wet aspen forests *Populus tremuloides - Populus balsamifera / Calamagrostis canadensis* Forest (CEGL002097). Infrequent fires may actually stimulate increased aspen cover, as heat from the fire stimulates aspen suckering. Lack of repeated fires allows the aspen stems to mature (MNNHP 1993).

COMMENTS: *2, MCS*. Type concept is taken from Minnesota NHP type - wet brush prairie. Rangewide review was completed with the Manitoba CDC in 1997. See *Spartina pectinata - Calamagrostis stricta - Carex spp*. Herbaceous Vegetation (CEGL002027) for species of the wet prairie type that are found in the herbaceous layer of this type.

CONSERVATION RANK: *G3.* This type has a limited range, and is susceptible to successional conversion to woodlands or wet aspen forests in the absence of fire. It has also been impacted by draining, which can lead to succession to somewhat drier aspen woodland types.

DISTRIBUTION: This wet brush prairie community type is found in the aspen parkland region of the upper midwestern United States and Canada, particularly in western Minnesota and southeastern Manitoba.

USFS ECOREGIONS: 222Na:CCC, 251Aa:CCC
CONSERVATION REGIONS: 35:C
STATES: MN **PROVINCES:** MB?

MIDWEST HERITAGE SYNONYMY: MN wet brush-prairie; wet brush-prairie seepage subtype -

OTHER SYNONYMY:

USNVC HIERARCHY: SALIX PETIOLARIS - SALIX SPP. TEMPORARILY FLOODED SHRUBLAND ALLIANCE (III.B.2.N.d)

Spartina pectinata - Calamagrostis stricta - Carex spp. Herbaceous Vegetation

Prairie Cordgrass - Western Bluejoint - Sedge Species Herbaceous Vegetation

Northern Cordgrass Wet Prairie CEGL002027

DESCRIPTION: The vegetation is dominated by fine textured grasses, low sedges, and rushes, with a mixture of forbs. *Spartina pectinata* may form near monocultures in places (Weaver 1960). The most common species are *Symphyotrichum lanceolatum var. lanceolatum (= Aster lanceolatus var. lanceolatus), Boltonia asteroides var. latisquama, Calamagrostis canadensis, Carex pellita (= Carex lanuginosa), Carex praegracilis, Carex sartwellii, Carex stricta, Poa palustris*, and *Spartina pectinata*. Other species that are often present are *Apocynum cannabinum, Juncus balticus, Liatris pycnostachya, Sonchus arvensis, Stachys palustris*, and *Teucrium canadense* (R. Dana pers. comm. 1999).

This community occurs in many shallow pond basins and in concentric bands peripheral to most temporary and seasonal ponds and lakes. It also occurs on floodplains and terraces of streams and rivers. The soils are deep, typically poorly drained, with clay or silty loam soils that have a characteristic gley layer. Less commonly, stands may occur on organic soils. The community is subject to seasonal inundation, but standing water typically does not persist for more than a few weeks. Tatina (1987) described the soils as poorly drained silt loams derived from glacial drift. Clay content is 20% and soil pH is 5.4. Soils are moist (soil moisture = 42%), and during wet years sites maintain standing water for at least part of the growing season. Barnes and Tieszen (1978) described the soils as moist loams and soil pH ranges from 7.5 to 7.7. The soils may be slightly saline (Redmann 1972).

COMMENTS: *2, MCS*. In general, this wet prairie type may be distinguished from other wet meadow types because of strong grass dominance (rather than sedge), high forb diversity, and typically mineral soils. Stands described by Brotherson (1969) in northwestern Iowa, although included in this type, appear to better fit the *Spartina pectinata - Carex spp. - Calamagrostis canadensis - Lythrum alatum - (Oxypolis rigidior)* Herbaceous Vegetation (CEGL002224) type. In North Dakota, the Turtle Mountains have more *Calamagrostis canadensis* than *Calamagrostis stricta. Eleocharis compressa* may be a component. This type may be a part of *Carex lanuginosa - Calamagrostis stricta* Herbaceous Vegetation (CEGL002254) (sedge meadow) or vice-versa.

CONSERVATION RANK: *G3?.* Many sites of this community have been drained and/or plowed and converted to cropland.

DISTRIBUTION: This prairie cordgrass wet prairie community occurs in the northern tallgrass prairie region of the United States and Canada, ranging from northern Nebraska to southern Manitoba.

USFS ECOREGIONS: 212Kb:CCC, 222Ma:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 222Na:CCC, 251Aa:CCC, 251Ab:CCC, 251Ba:CCC, 251Bb:CCC, 251Bd:CCC, 251Be:CCC, 332:P
CONSERVATION REGIONS: 26:C, 34:C, 35:C, 46:C, 47:C
STATES: IA MN ND NE SD **PROVINCES:** MB

MIDWEST HERITAGE SYNONYMY: MN wet prairie (northwest section) seepage subtype; wet prairie (northwest section); wet prairie (central section) seepage subtype; wet prairie (central section); wet prairie (southwest section) -
NE northern cordgrass wet prairie =

OTHER SYNONYMY: Coarse grasses of wet lands (Weaver 1960) B, Pothole and Drainage Communities, sections 4 and 5 (Brotherson 1969) =, *Spartina* Type (Redmann 1972) =

USNVC HIERARCHY: SPARTINA PECTINATA TEMPORARILY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.j)

Spartina pectinata - Carex spp. - Calamagrostis canadensis - Lythrum alatum - (Oxypolis rigidior) Herbaceous Vegetation

Prairie Cordgrass - Sedge Species - Bluejoint - Winged Loosestrife - (Common Water-dropwort) Herbaceous Vegetation

Central Cordgrass Wet Prairie CEGL002224

DESCRIPTION: A dense layer of graminoids dominates this community. Forbs and small trees or shrubs are also common. The vegetation is typically 1-2 m tall. *Calamagrostis canadensis* and *Spartina pectinata* are the two most abundant species. Several common *Carex* spp. found in this include *Carex lacustris, Carex aquatilis, Carex pellita (= Carex lanuginosa)*, and *Carex atherodes* (in the northwest of this community's range). Other species that are less frequent in this community include *Andropogon gerardii, Symphyotrichum novae-angliae (= Aster novae-angliae), Fragaria virginiana, Galium boreale, Helianthus grosseserratus, Iris versicolor, Liatris pycnostachya, Lythrum alatum, Muhlenbergia richardsonis, Oxypolis rigidior, Panicum virgatum, Pycnanthemum virginianum, Solidago gigantea, Thalictrum dasycarpum*, and *Veronicastrum virginicum* (Curtis 1959, White and Madany 1978, MNNHP 1993). In Missouri, composition may show more of a meadow character, with *Asclepias incarnata, Leersia oryzoides, Sium suave*, and *Stachys palustris* listed as characteristic plants (see Nelson 1985).

This community is found in lowland areas that are flooded in spring and saturated for much of the growing season (White and Madany 1978, Nelson 1985). The soils are typically deep, fine-textured, poorly drained, and have high organic content (Bliss and Cox 1964, Nelson 1985). On some sites there is an impermeable subsurface layer that impedes soil drainage (MNNHP 1993).

Periodic prolonged flooding and fire prevents woody vegetation from dominating this community (Curtis 1959, Nelson 1985).

COMMENTS: *1, MCS*. Distinctions between this type and wet sand prairie, *Spartina pectinata - Carex spp. - Calamagrostis canadensis* Sand Herbaceous Vegetation (CEGL005178), are not clear. Wet sand prairies may be more acidic and more likely to become dry in summer; however, floristic characteristics that reflect those factors are not known. This type is found in Ohio at Daumer Savanna. Stands described by Brotherson's (1969) Pothole and Drainage Communities, sections 4 and 5 are located in northwestern Iowa, beyond the main range of this type; however, they appear to fit better in this community than with the Northern Cordgrass Prairie, *Spartina pectinata - Calamagrostis stricta - Carex spp*. Herbaceous Vegetation (CEGL002027), where they are currently classified.

CONSERVATION RANK: *G3?.* There are probably fewer than 100 occurrences rangewide. Sixty have been documented: 20 in Missouri (where the community is ranked S1), 16 in Illinois (S1,S1), 8 in Michigan (S2), 4 in Ohio (S3), 4 in Wisconsin (S1), 3 in Minnesota (S1,S2,S1?), and 1 in Iowa (SU). It is also reported in Nebraska (S1). It is found in 26 ecoregional subsections and probably occupies less than 10,000 acres. The 60 occurrences range from 0 to 261 acres, totaling 2200.

DISTRIBUTION: This prairie cordgrass wet prairie community type is found in the central United States, ranging from Ohio west to Minnesota, south to Nebraska and Missouri, and east to Indiana.

USFS ECOREGIONS: 212Hu:CCC, 212Hv:CCC, 212Je:C??, 212Jf:C??, 222Ab:CCC, 222Ha:CCC, 222Hb:CCP, 222Jc:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCP, 222Jj:CCC, 222Kc:CCC, 222Kd:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Ki:CCC, 222Mb:CCC, 222Mc:CCC, 222Me:CCC, 251Ba:CCC, 251Cc:CCC, 251Cd:CC?, 251Cf:CCC, 251Cg:CCC, 251Dd:CCC, 251Dg:CCC, 251Dh:CCC, 251Eb:CCC

CONSERVATION REGIONS: 35:C, 36:C, 37:C, 38:C, 45:C, 46:C, 47:?, 48:C

STATES: IA IL IN MI MN MO NE OH WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:
IL wet prairie (N) -
IN wet prairie =
MI inland wet prairie =
MN wet prairie (central section) seepage subtype; wet prairie (central section); wet prairie (southeast section) -
MO wet prairie =
NE eastern cordgrass wet prairie =
OH slough grass-bluejoint prairie +
WI wet prairie =

OTHER SYNONYMY: Cordgrass (Bliss and Cox 1964) =

USNVC HIERARCHY: SPARTINA PECTINATA TEMPORARILY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.j)

Spartina pectinata - Carex spp. - Calamagrostis canadensis Lakeplain Herbaceous Vegetation

Prairie Cordgrass - Sedge Species - Bluejoint Lakeplain Herbaceous Vegetation

Lakeplain Wet Prairie CEGL005109

DESCRIPTION: Average vegetation height is 1-2 m with little bare ground exposed. The dominant species are graminoids, although forbs and small trees and shrubs are common. *Calamagrostis canadensis, Carex aquatilis, Carex pellita (= Carex lanuginosa)*, and *Spartina pectinata* are typical dominants. *Andropogon gerardii, Symphyotrichum ericoides (= Aster ericoides), Juncus balticus, Panicum virgatum, Oligoneuron ohioense (= Solidago ohioensis)*, and *Sorghastrum nutans* are all common components of this community. The shrubs *Cornus sericea* and *Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda)*, and small *Fraxinus pennsylvanica* and *Populus deltoides* trees may also be found (Faber-Langendoen and Maycock 1987, 1994, Comer et al. 1995b).

This community occurs on level, sandy glacial outwash, sandy glacial lakeplains, and deposits of dune sand in silty/clayer glacial lakeplains. Soils are sandy or sandy loam soil, rarely with clay or silt loam. There is often a clay layer below the surface thatimpedes drainage and prevents groundwater from moving to the surface (Comer et al. 1995b). These conditions result in temporary flooding in the winter and spring and drought in the summer and fall. The soil is neutral to somewhat alkaline (Chapman 1984). The subsurface clay was deposited on the beds of glacial lakes, whereas the sand was deposited on lake beaches or by alluvial processes (Comer et al. 1995b).

Wildfires may have played a role maintaining these systems in the past (Faber-Langendoen and Maycock 1987).

COMMENTS: *2, MCS*. Faber-Langendoen and Maycock (1994) found that wet lakeplain prairies were floristically distinct from other wet prairies in Michigan and Wisconsin, though no diagnostic species were provided. In Ohio, this type is found at Castalia Prairie. In Vermont this type is found in the Lake Champlain area.

CONSERVATION RANK: *G2G3*. There are probably fewer than 100 occurrences of this community rangewide. It is reported from Ohio (where it is ranked S3), Indiana (S2), Michigan (S2), Ontario (S?) and Vermont (S?). Currently 19 occurrences have been documented from Indiana and Michigan. There are probably less than 4000 acres rangewide. Currently over 370 acres have been documented; the average documented size is about 37 acres. Acreage of this community has probably been reduced by both residential and commercial development near the Great Lakes and Lake Champlain shores.

DISTRIBUTION: This lakeplain wet prairie grassland community occurs in the southern Great Lakes region of the midwestern United States, ranging from northern Indiana, northern Ohio, southern Michigan, and southern Ontario, eastward to possibly Vermont. In Michigan, lakeplain wet prairies are most commonly found close to the shoreline of Saginaw Bay and within the St. Clair River Delta.

USFS ECOREGIONS: 212E:CC, 222If:CCC, 222Jb:CCC, 222Jd:CCC, 222Je:CCC, 222Jj:CCC, 222Qb:CCC
CONSERVATION REGIONS: 48:C
STATES: IL IN MI OH VT **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	wet sand prairie +
IN	wet sand prairie +
MI	lakeplain wet prairie =
OH	slough grass-bluejoint prairie +

OTHER SYNONYMY: Wet loam prairie (Faber-Langendoen and Maycock 1987) =, Wet prairie (Faber-Langendoen and Maycock 1994) =, Lakeplain wet prairie (Comer et al. 1995b) =

USNVC HIERARCHY: SPARTINA PECTINATA TEMPORARILY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.j)

Spartina pectinata - Carex spp. - Calamagrostis canadensis Sand Herbaceous Vegetation

Prairie Cordgrass - Sedge Species - Bluejoint Sand Herbaceous Vegetation

Central Cordgrass Wet Sand Prairie CEGL005178

DESCRIPTION: The dominant vegetation of this community consists of dense graminoids 1-2 m tall. *Calamagrostis canadensis, Carex* spp., and *Spartina pectinata* are dominant. Other common species include *Arnoglossum plantagineum, Eupatorium perfoliatum, Iris virginica, Lythrum alatum*, and *Sium suave* (White and Madany 1978, Homoya et al. 1985).

This community is found on sandy soils that are flooded for a short time during the growing season (White and Madany 1978). These sites occur on outwash plains, lakeplains, and valley trains.

COMMENTS: *2, MCS*. Floristic distinctions between this type and either the wet loam prairie type, *Spartina pectinata - Carex spp. - Calamagrostis canadensis - Lythrum alatum - (Oxypolis rigidior)* Herbaceous Vegetation (CEGL002224) or the wet, Great Lakes lakeplain type, *Spartina pectinata - Carex spp. - Calamagrostis canadensis* Lakeplain Herbaceous Vegetation (CEGL005109) are not clear.

CONSERVATION RANK: *G3?.* The total number of occurrences is unknown. Five have been documented in Illinois, where the community is ranked S2, and 7 in Indiana (S2). The type is also ranked S1 in Wisconsin, where it may occur in their central sand plain region. However, hydrologic alterations are pervasive, and any occurrences will be small (less than 10 acres). The community may also occur in Ontario and Michigan. It is known from 9 ecoregional subsections. Sizes of 11 occurrences range from 0.1 to 543 acres, totaling 1064. Two of 9 ranked occurrences are A or B. This community is found on the sandy soils of outwash plains, lake plains, and valley trains that are flooded for a short time during the growing season.

DISTRIBUTION: This wet sand prairie is found in the central and upper midwestern region of the United States and possibly in parts of adjacent Canada, ranging from southern Wisconsin east to Indiana, Michigan, and possibly southern Ontario.

USFS ECOREGIONS: 212Hu:CCC, 222Ge:CPP, 222Jh:CCC, 222Jj:CCC, 222Kd:CCC, 222Kg:CCC, 251Cf:CCC, 251Dd:CCC, 251Dg:CCC, 251Dh:CCC
CONSERVATION REGIONS: 36:C, 46:C, 48:C
STATES: IL IN WI? **PROVINCES:** ON?

MIDWEST HERITAGE SYNONYMY:

IL	wet sand prairie +
IN	wet sand prairie +
WI?	sand meadow ?

OTHER SYNONYMY:

USNVC HIERARCHY: SPARTINA PECTINATA TEMPORARILY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.j)

Scirpus cyperinus - Panicum rigidulum var. elongatum - Rhynchospora corniculata - (Dulichium arundinaceum) Herbaceous Vegetation

Woolgrass Bulrush - Tall Flat Panicgrass - Short-bristle Horned Beaksedge - (Threeway Sedge) Herbaceous Vegetation

Highland Rim Pond (Woolgrass Bulrush - Threeway Sedge Subtype) CEGL004719

DESCRIPTION: The vegetation is typically dominated by patches or zones of *Scirpus cyperinus*, possibly with thick mats of *Dulichium*. In addition to these and the other nominal species, *Carex* spp., *Juncus* spp., *Osmunda regalis var. spectabilis*, and scattered *Itea virginica* and *Cephalanthus occidentalis* are often found. Floristics and gradient expression vary with context and management. Some examples may have additional small trees and shrubs, such as *Cephalanthus occidentalis, Hibiscus moscheutos, Itea virginica, Liquidambar styraciflua, Quercus phellos*, and *Rosa palustris* scattered within. On drier ground surrounding the pond center, *Scirpus cyperinus* may share dominance with *Panicum rigidulum var. elongatum* and *Rhynchospora corniculata*. In more open examples, some other species present may include *Xyris laxifolia var. iridifolia, Carex bullata, Carex gigantea, Calamagrostis coarctata, Leersia hexandra, Rhynchospora glomerata, Rhynchospora perplexa, Andropogon virginicus, Dichanthelium scoparium, Dichanthelium dichotomum var. ramulosum, Dichanthelium longiligulatum, Saccharum baldwinii, Proserpinaca pectinata*, and *Juncus effusus*. The vegetation may consist of monospecific clumps of the component species, which are present around the pond margin.

This association is a component of emergent zones in upland depression ponds of the Interior Low Plateau of Kentucky, Tennessee, and possibly Indiana. It has a pronounced seasonal fluctuation in water level becoming saturated to ponded in the winter and often completely drying in the summer.

This community provides important breeding habitat for amphibians. In a burned or mowed context, examples of this vegetation type may grade down into the V.A.5.N.k *Juncus repens - Eleocharis microcarpa* Seasonally Flooded Herbaceous Alliance (A.1376) or up into the V.A.5.N.k *Saccharum (baldwinii, giganteum) - Panicum (rigidulum, verrucosum)* Seasonally Flooded Herbaceous Alliance (A.1907). In a more forested context, it may grade into upland depression forests dominated by *Quercus phellos, Liquidambar styraciflua*, and *Acer rubrum* (e.g., wetter phases of *Quercus phellos - Quercus alba / Vaccinium fuscatum - (Viburnum nudum) / Carex (barrattii, intumescens)* Forest (CEGL007364)).

COMMENTS: *2, SCS*. This community provides important breeding habitat for amphibians. Originally described from the Eastern Highland Rim of Coffee and DeKalb counties, Tennessee. On Arnold Air Force Base, Coffee County, Tennessee, an example is known from a depression pond located on the former airfield. Mingo Pond, in Franklin County, Tennessee, is presumed to be an exemplary occurrence of this type. In Indiana see *Carex comosa - Carex decomposita - Dulichium arundinaceum - Lycopus rubellus* Herbaceous Vegetation (CEGL002413), a semipermanently flooded community of deeper sinkhole ponds; however, there is a pond that might fit the description of this type, though it has increased in woody cover somewhat in recent years, and would take some management to revert and fit the type, as it once did (M. Homoya pers. comm. 2000).

CONSERVATION RANK: *G2G3*. This seasonally flooded herbaceous association is found in the emergent zones of ponds in the Interior Low Plateau (Kentucky, Tennessee, and possibly Indiana). The total number of occurrences is not known. Many examples have been altered or destroyed, for example converted to farm ponds or affected by erosion from adjoining agricultural lands. Only a few extensive, high-quality examples remain. Remaining unprotected examples are vulnerable to damage from off-road vehicles, local hydrologic changes (ditching and draining), and land-use change (including housing development). Some examples are in areas of extensive human population growth, and the best hope for conservation is on public lands (e.g., natural areas, wildlife areas, military bases).

DISTRIBUTION: This herbaceous sinkhole pond type is found in the Interior Low Plateau region of the United States (Kentucky, Tennessee, and possibly Indiana).

USFS ECOREGIONS: 222Eb:CCC
CONSERVATION REGIONS: 43:?, 44:C
STATES: IN KY TN **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IN sinkhole pond +

OTHER SYNONYMY:

USNVC HIERARCHY: SCIRPUS CYPERINUS SEASONALLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.k)

Calamagrostis canadensis - Juncus spp. - Carex spp. Sandhills Herbaceous Vegetation

Bluejoint - Rush Species - Sedge Species Sandhills Herbaceous Vegetation

Sandhills Wet Prairie CEGL002028

DESCRIPTION: This community is densely vegetated, predominately by hydrophytic graminoids about 0.5-1.5 m tall with roots constantly in contact with the water table. *Calamagrostis canadensis* and *Spartina pectinata* are the most common native grasses, though frequently *Agrostis stolonifera, Phalaris arundinacea, Phleum pratense*, and *Poa pratensis* are introduced and abundant. Other graminoids are also plentiful; the most abundant are *Carex atherodes, Carex crawei, Carex pellita (= Carex lanuginosa), Carex nebrascensis, Carex sartwellii, Carex scoparia, Carex tetanica, Eleocharis atropurpurea, Eleocharis elliptica, Juncus balticus, Juncus nodosus, Juncus torreyi*, and *Panicum virgatum*. Scattered patches of shrubs, including *Amorpha fruticosa, Cornus sericea, Salix exigua*, and *Salix lutea*, are often found in slightly wetter areas, such as near streams. Forbs are scattered to locally common. Among the more prominent species are *Asclepias incarnata, Cicuta maculata, Hypoxis hirsuta, Mentha arvensis, Lycopus uniflorus*, and *Scutellaria galericulata*. *Trifolium* spp. has been seeded in many sites. Species diversity is moderate to relatively high.

This community occurs on nearly level ground along streams and rivers and in wet interdunal valleys, and often forms a zone bordering lakes, marshes, and fens. Soils are poorly drained sandy loams and sands with high organic content (muck or peat) and are formed in eolian sand or alluvium (Steinauer 1989). These sites are often saturated or temporarily flooded early in the season, and the water table is usually within one meter of the surface throughout the growing season.

COMMENTS: *3, MCS*. Concept of this type is taken from Nebraska and Kansas state types - sandhills wet meadow (Lauver et al. 1999, Steinauer and Rolfsmeier 2000). The alliance placement for this type needs review. The distribution of this type in North Dakota (Sheyenne National Grasslands) and South Dakota needs review.

CONSERVATION RANK: *G3G4.* The majority of these sites have been ditched and seeded to cool-season Eurasian grasses. Extensive center pivot irrigation in some areas may lower the water table enough to negatively impact the hydrophytic vegetation in these sites. Few high-quality sites remain.

DISTRIBUTION: This community is found in sand-dominated regions of the central and northern Great Plains, possibly extending into the eastern Dakotas.

USFS ECOREGIONS: 251Aa:CCC, 251Ab:CCC, 332C:CC
CONSERVATION REGIONS: 33:C
STATES: KS ND NE SD **PROVINCES:** SK?

MIDWEST HERITAGE SYNONYMY: NE northern sedge wet meadow =

OTHER SYNONYMY: Hydrophytic tall-grass area (Frolick and Keim 1933) =, Rush-sedge wet meadow (Pool 1914) F, Water hemlock association (Pool 1914) F, Hydrophytic grass and sedge zone (Tolstead 1942) =

USNVC HIERARCHY: SPARTINA PECTINATA TEMPORARILY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.j)

Carex nebrascensis Herbaceous Vegetation

Nebraska Sedge Herbaceous Vegetation

Nebraska Sedge Wet Meadow CEGL001813

DESCRIPTION: In Nebraska and Colorado, this community occurs as bands parallel to streams and is dominated by medium-tall (<1 m) herbaceous species. Woody species are rare. Stands are dominated by the perennial graminoid *Carex nebrascensis*, a widespread species that generally forms small to medium-sized meadows. In Nebraska, common species include *Agrostis stolonifera, Carex hystericina, Carex pellita (= Carex lanuginosa), Eleocharis erythropoda, Equisetum* spp., *Juncus balticus, Schoenoplectus pungens (= Scirpus pungens)*, and *Triglochin* spp. (Steinauer and Rolfsmeier 2000).

This community is found in nearly level, poorly drained sites that are wet or saturated for much of the year (Jones 1992). In eastern Wyoming and the panhandle of western Nebraska, soils were gleyed sandy, silty loam, clay loam, or clays (Jones and Walford 1995, Steinauer and Rolfsmeier 2000). In Colorado, these wetlands form open meadows that occur along the margins of stream banks, lakes and seeps on the plains. The soils are generally saturated for much of the growing season and are subject to compaction by livestock.

COMMENTS: *1, WCS*. In the Black Hills, classification of stands was problematic due to identification problems with *Carex nebrascensis* and *Carex aquatica*. The two are difficult to distinguish based on available keys and written descriptions (Marriott and Faber-Langendoen 2000).

CONSERVATION RANK: *G4.* This type is widely distributed, but many examples have been heavily grazed by cattle, lowering their floristic quality.

DISTRIBUTION: This sedge meadow type is widely distributed from the western Great Plains into the western mountains of the United States, ranging from South Dakota and Montana to possibly as far west as Washington, south to California and east to New Mexico.

USFS ECOREGIONS: 331A:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 341D:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CC, M242C:CC, M261A:CC, M261D:CC, M261E:CC, M261G:CC, M313A:CC, M331A:C?, M331B:CC, M331D:CC, M331H:CC, M332A:CC, M332B:CC, M332C:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333B:CC, M333C:CC, M333D:CC, M334A:CC, M341B:CC
CONSERVATION REGIONS: 10:C, 11:C, 25:C, 26:C, 27:C, 6:C
STATES: AZ CA CO ID MT NE NM? NV OR SD UT WA? WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE sedge-bulrush wet meadow =

OTHER SYNONYMY:

USNVC HIERARCHY: CAREX NEBRASCENSIS SEASONALLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.k)

Eleocharis palustris Herbaceous Vegetation

Common Spikerush Herbaceous Vegetation

Creeping Spikerush Wet Meadow CEGL001833

DESCRIPTION: In northwestern Nebraska, stands are dominated by submersed and emergent rooted vegetation under 1 m tall. *Eleocharis acicularis* and *Eleocharis palustris* commonly cover the bottoms of the pools and emerge above the water as the pools dry out. Ephemeral submersed aquatics, such as *Callitriche palustris (= Callitriche verna), Potamogeton diversifolius* and *Marsilea vestita*, may be present. As the pools dry out in mid-summer, ephemeral annual forbs, such as *Limosella aquatica* and *Plagiobothrys scouleri*, may appear. By late summer *Amaranthus californicus* and *Gnaphalium palustre* may dominate in the lowest parts of the depression (Steinauer and Rolfsmeier 2000). In southwestern South Dakota, vegetation is composed of nearly homogeneous stands of *Eleocharis palustris*. Other emergents, such as *Polygonum amphibium, Marsilea vestita*, and *Eleocharis ovata* are occasionally found. Herbaceous cover is greater than 75% except in areas of deeper open water where floating and submerged aquatic plants including *Bacopa rotundifolia* and *Heteranthera limosa* occur (H. Marriott pers. comm. 1999).

In northwest Nebraska and southwest South Dakota, this community occurs in small depressions in intermittent stream beds and depression ponds that flood early in the season and dry out by summer. Soils are silty clay formed from weathered siltstone and shale (Steinauer and Rolfsmeier 2000). In southwestern South Dakota, the type occupies depression ponds in prairies (H. Marriott pers. comm. 1999).

COMMENTS: *1, WCS*.

CONSERVATION RANK: *G5.*

DISTRIBUTION: This spikerush wet meadow community is found in the central Great Plains of the United States and Canada, and in the western United States, ranging from South Dakota northwestward to Montana and Saskatchewan, west to Washington, south to possibly California and east to Nevada.

USFS ECOREGIONS: 331D:CC, 331F:CC, 331G:CC, 341B:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342G:CC, 342I:C?, M242C:CC, M261G:CC, M331A:CC, M331D:CC, M331E:CC, M331G:CC, M331H:CC, M331I:CC, M332A:CC, M332B:CC, M332C:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M334A:CC, M341B:CC

CONSERVATION REGIONS: 10:C, 19:C, 20:C, 25:C, 26:C, 2:C, 6:C

STATES: CA? CO ID MT NE NV OR SD UT WA WY **PROVINCES:** SK

MIDWEST HERITAGE SYNONYMY: NE vernal pond; spikerush wet meadow -

OTHER SYNONYMY:

USNVC HIERARCHY: ELEOCHARIS PALUSTRIS SEASONALLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.k)

Juncus balticus Herbaceous Vegetation

Baltic Rush Herbaceous Vegetation

Baltic Rush Wet Meadow CEGL001838

DESCRIPTION: Stands are characterized by a dense sward of *Juncus balticus* and often minor cover of *Carex* species, including *Carex praegracilis* and *Carex nebrascensis*. Other common species include *Hordeum jubatum* and *Agrostis stolonifera*. Forb cover is generally low. Shrubs are not common and include *Salix* spp.

In eastern Wyoming, this community is found at low elevations (<8000 feet) on flat to gently sloping ground near seeps or meandering streams. Soils are usually sandy clay loam or fine sands and mottled or gleyed (Jones and Walford 1995).

COMMENTS: *1, WCS*. This association is often considered to be a grazing-induced community since it increases with grazing disturbance.

CONSERVATION RANK: *G5.*

DISTRIBUTION: This Baltic rush wet meadow community is found widely throughout the western United States, ranging from South Dakota and Montana west to Washington, south to possibly California, and east to New Mexico.

USFS ECOREGIONS: 313A:CC, 331D:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 341B:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342F:CC, 342G:CC, 342I:C?, M261G:CC, M262:C, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M332A:CC, M332B:CC, M332C:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M334A:CC, M341B:CC
CONSERVATION REGIONS: 10:C, 11:C, 17:C, 19:C, 20:C, 25:C, 26:C, 27:C, 2:C, 6:C
STATES: CA? CO ID MT NM NV OR SD UT WA WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: JUNCUS BALTICUS SEASONALLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.k)

Panicum virgatum - (Pascopyrum smithii) Herbaceous Vegetation

Switchgrass - (Western Wheatgrass) Herbaceous Vegetation

Switchgrass Wet-mesic Tallgrass Prairie CEGL001484

DESCRIPTION: In Badlands National Park, South Dakota, the switchgrass grassland type provides dense ground cover, typically between 50-80%. *Panicum virgatum* is the dominant species in more mesic area. *Pascopyrum smithii* is more abundant on elevated sites within the drainages and basins, and *Schizachyrium scoparium* is the dominant species along the upper margin of the type. Where this type is found in drainages, the distribution often becomes 'patchy' and *Calamovilfa longifolia* replaces *Schizachyrium scoparium* on the upper type margin. Commonly associated species include *Glycyrrhiza lepidota, Symphyotrichum ericoides (= Aster ericoides)*, and occasionally *Populus deltoides*.

Switchgrass is a common component of many wetlands and mesic sites, but becomes dominant in wetter parts of drainages and wetland basins (Von Loh et al. 1999).

COMMENTS: *3, WCS*. The concept of this type is still under review, as well as its alliance placement. There is no documentation for this type at the Montana Natural Heritage Program (S.V. Cooper pers. comm.) *Panicum virgatum* does occur in southern Montana, but it seems unlikely that it would ever be a community dominant over any appreciable area. In addition, this type currently is defined to include stands from Badlands National Park, but there is minimal similarity between these and observed stands in Montana. This type may not be valid. The other candidate alliance is the *Panicum virgatum* Temporarily Flooded Herbaceous Alliance (A.1343), which is currently reported only from the southern United States.

CONSERVATION RANK: *G2Q*.

DISTRIBUTION: This moist switchgrass type occurs in the northern Great Plains of the United States. It has been reported from eastern Wyoming, eastern Montana and western South Dakota, but its range is not well understood.

USFS ECOREGIONS: 331F:CC
CONSERVATION REGIONS: 26:C
STATES: MT SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: PASCOPYRUM SMITHII TEMPORARILY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.j)

Pascopyrum smithii - Eleocharis spp. Herbaceous Vegetation

Western Wheatgrass - Spikerush Species Herbaceous Vegetation

Western Wheatgrass - Spikerush Mixedgrass Prairie CEGL001581

DESCRIPTION: This type includes low herbaceous vegetation growing in closed basins. *Pascopyrum smithii* and *Eleocharis acicularis* generally dominate, and the plants common in the surrounding steppe generally are absent or contribute very little cover. Stands of this type typically include two zones, resulting from differences in the period of inundation. The following information is from two stands surveyed by Jones (1997): the lowest part of the stand, which is inundated most often and for the longest time, is dominated by *Eleocharis acicularis* and may contain *Hordeum brachyantherum, Juncus balticus*, and *Alopecurus aequalis* or *Alopecurus carolinianus*, and bare soil accounts for about 75% of the ground surface; the higher part of the stand is dominated by *Pascopyrum smithii* and may contain substantial amounts of *Carex douglasii* and *Vulpia octoflora (= Festuca octoflora)*. According to Thilenius et al. (1995), *Hordeum jubatum* occurs on the margins of the stands.

COMMENTS: *2, WCS*. Species composition varies among stands of this type depending on the degree of inundation, but the degree of variation is unknown. More stand data might indicate that this association and *Pascopyrum smithii - Hordeum jubatum* Herbaceous Vegetation (CEGL001582) should be combined as it also occupies small playas.

CONSERVATION RANK: *G1*. This association has been described from a small area (ca. 250 square miles) in northeastern Wyoming, mainly on the divide between the Belle Fourche River drainage and the Cheyenne River drainage. The range of the type may extend into eastern Montana and western South Dakota, but further inventory and classification work are needed to confirm this. The area covered by stands of this association is estimated to be <100 acres because the playas are each 2 acres or smaller, and less than 50 occur in northeastern Wyoming where the association is best known. Enough additional stands may exist in other Northern Great Plains states (eastern Montana and the western Dakotas) to increase the estimated area to 100-1000 acres. The rank has been changed from G2G3 to G1 to reflect the very limited known distribution, the small number of stands, and the small proportion of stands that are undisturbed.

DISTRIBUTION: This association has been described from a small area (ca. 250 square miles) in northeastern Wyoming, mainly on the divide between the Belle Fourche River drainage and the Cheyenne River drainage. Two stands apparently have been described from the area of the Montana - South Dakota border as well (Hansen and Hoffman 1988, Table A-5, stands 61 and 136), suggesting that the range of the type may extend into eastern Montana and western South Dakota.

USFS ECOREGIONS: 331F:C?, 331G:CC
CONSERVATION REGIONS: 26:C
STATES: MT? SD WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: Clayey overflow range site (Soil Conservation Service 1986) B. Stands of this association occur on the clayey overflow range site., *Agropyron smithii / Carex filifolia* Habitat Type (Hansen et al. 1984) B. Hansen and Hoffman (1988) apparently include two stands of this association in their *Agropyron smithii / Carex filifolia* habitat type (Table A-5, pp. 42-43, stands 61 and 136) that contain only *Pascopyrum smithii, Eleocharis acicularis*, and *Hordeum jubatum*., *Agropyron smithii* concentrations of sodium (Thilenius et al. 1995) B. The description of the *Agropyron smithii* sodgrass steppe (Thilenius et al. 1995) suggests that it is the same association, but the summary table, which shows low constancy of *Eleocharis* and high constancy or coverage of *Poa secunda, Stipa comata*, and *Koeleria macrantha*, suggests that Thilenius et al. (1995) included vegetation on drier sites in their sodgrass steppe type., *Agropyron smithii - Eleocharis acicularis* vegetation type (Bergman and Marcus 1976) =. See also U74PAR01MTUS (Paris and Paris 1974); their stands (Table E-6, pp. IX-E-18 & 19) included *Carex eleocharis*., playa (Holpp 1977). Holpp described vegetation from 10 playas in Campbell County, Wyoming, that seem very similar to the playas containing this association. His stands generally were dominated by *Pascopyrum smithii* and contained some wetland species (*Juncus balticus, Alopecurus carolinianus*), but they showed no consistency in species composition and none contained *Eleocharis acicularis*.

USNVC HIERARCHY: PASCOPYRUM SMITHII TEMPORARILY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.j)

Scolochloa festucacea Herbaceous Vegetation

Sprangletop Herbaceous Vegetation

Sprangletop Marsh CEGL002260

DESCRIPTION: This community is dominated by graminoids 0.5-1.0 m tall. Forbs are not common and shrubs are very rare. Total vegetation cover is typically moderately dense to dense. *Scolochloa festucacea* is the single most abundant species and may occur in almost monotypic stands (Dix and Smeins 1967, Walker and Coupland 1970). Other abundant species include *Carex atherodes* (especially on less saline sites), *Carex laeviconica, Eleocharis palustris, Glyceria grandis, Juncus balticus, Sium suave*, and *Typha latifolia* (in wetter stands).

This community is found on sites with standing water for part of the growing season. The water table may be above the surface for only a few weeks in spring after heavy rains or constantly until mid-summer (Walker and Coupland 1970, Looman 1982). Stands dominated by *Scolochloa festucacea* can be found on marginally fresh to moderately saline stands (Looman 1981a, 1982). The soils are typically medium- to fine-textured and have an accumulation of organic matter (Smith 1973).

COMMENTS: *2, MCS*. This community is similar to *Carex atherodes* Herbaceous Vegetation (CEGL002220). Both communities often contain *Carex atherodes* and *Scolochloa festucacea*. The relationship between these two community types needs to be better defined. *Carex atherodes* tends to be on non-saline sites while *Scolochloa festucacea* tends to do better on mildly to moderately saline sites (Walker and Coupland 1970). However, the two can co-occur or codominate on mildly saline sites. *Carex atherodes* may also be found on drier ground (Smith 1973).

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This sprangletop marsh type is found in the northeastern Great Plains and northern tallgrass prairie region of the United States and Canada.

USFS ECOREGIONS: 251Aa:CCC, 251Ab:CCC
CONSERVATION REGIONS: 26:C, 34:C, 35:C
STATES: MN ND **PROVINCES:** MB

MIDWEST HERITAGE SYNONYMY: MN wet meadow +

OTHER SYNONYMY: Meadows (Dix and Smeins 1967) B, Groups 6 and 15 (Walker and Coupland 1970) =. uncertain if equivalent, *Scolochloion festucea* association (Looman 1981a) =, *Scolochloion festucea* association (Looman 1982) =

USNVC HIERARCHY: SCOLOCHLOA FESTUCACEA SEASONALLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.k)

Spartina pectinata - Carex spp. Herbaceous Vegetation

Prairie Cordgrass - Sedge Species Herbaceous Vegetation

Prairie Cordgrass - Sedge Wet Meadow CEGL001477

DESCRIPTION: At Wind Cave National Park in South Dakota, this type has dense herbaceous cover, greater than 75%. Species dominance is patchy within stands, with various graminoids locally abundant, often to the exclusion of other species. In the single sampled stand, *Spartina pectinata, Carex nebrascensis*, and *Eleocharis palustris* were locally dominant. *Epilobium ciliatum* was common in shallow water (H. Marriott pers. comm. 1999). At Theodore Roosevelt National Park in North Dakota *Spartina pectinata* is the dominant species. Species richness is generally low. *Hordeum jubatum* and *Pascopyrum smithii* are the most prominent secondary species (J. Butler pers. comm. 1999).

At Badlands National Park in South Dakota, prairie cordgrass stands are small, but dense. Aerial cover of the entire herbaceous layer is typically estimated at 75-100%. *Spartina pectinata* is the dominant species. The stands occupy moist soils and occur adjacent to spikerush *Eleocharis palustris, Polygonum amphibium, Typha angustifolia, Typha latifolia*, and *Schoenoplectus pungens (= Scirpus pungens)* stands; the latter stands occupy saturated to inundated soils. Adjacent uplands are typically vegetated by *Pascopyrum smithii*.

At Wind Cave National Park in South Dakota, stands occur in drainage bottoms where the soil is wet for at least part of the growing season (H. Marriot pers. comm. 1999). At Theodore Roosevelt and Badlands national parks, stands occur in poorly drained depressions within floodplains of major rivers.

Sites may occasionally flood from rivers or ponding up of depressions.

COMMENTS: *2, WCS*. It is possible that *Panicum virgatum - (Pascopyrum smithii)* Herbaceous Vegetation (CEGL001484) could be considered a variant of this type. This type is restricted to the Great Plains ecoregions and is not found in the tallgrass prairie regions of the Midwest, where *Spartina pectinata - Calamagrostis stricta - Carex* spp. Herbaceous Vegetation (CEGL002027) is found.

CONSERVATION RANK: *G3?.* This type has a relatively restricted distribution, and occurs in somewhat specialized wetland habitats in an arid climate. In addition, many such wetland sites are subject to heavy grazing pressure by cattle, which favor these moist locations. No element occurrences have been documented for this type, but at least several stands occur within three National Parks in the western Dakotas.

DISTRIBUTION: This cordgrass wet prairie type is found in the northwestern Great Plains of the United States, particularly in the western Dakotas and eastern Montana.

USFS ECOREGIONS: 331D:C?, 331G:CC, M334A:CC
CONSERVATION REGIONS: 10:C, 25:C, 26:C
STATES: MT ND SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: SPARTINA PECTINATA TEMPORARILY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.j)

Spartina pectinata - Eleocharis spp. - Carex spp. Herbaceous Vegetation

Prairie Cordgrass - Spikerush Species - Sedge Species Herbaceous Vegetation

Southern Great Plains Cordgrass Wet Prairie CEGL002223

DESCRIPTION: This community is characterized by tall, dense graminoids with moderate forb diversity and few woody species. The dominant species, *Spartina pectinata*, can form near monocultures in some locations (Johnson and Knapp 1995). Other common species include *Carex annectens, Carex blanda, Eleocharis* spp., *Juncus interior, Juncus torreyi, Panicum virgatum, Rumex altissimus*, and *Verbena hastata*.

This community is found on deep, poorly drained soils on level to nearly level sites near lakes, seeps, or alluvial lowlands (Kuchler 1974, Johnson and Knapp 1995). The soils are usually inundated for short periods during the year, but may be saturated for much of the growing season.

COMMENTS: *2, MCS*. In Oklahoma, this association may contain *Eleocharis montevidensis* and *Eleocharis tenuis*.

CONSERVATION RANK: *G2G4*. There are probably more than 20 occurrences rangewide. Six have been documented in Kansas, where the community is ranked SU. Although no other occurrences have been documented, the community is also reported in Oklahoma (S2). It occurs in 4 ecoregional subsections and has moderately restrictive environmental requirements.

DISTRIBUTION: This wet prairie community is found in the south-central Great Plains on level, deep, poorly drained soils.

USFS ECOREGIONS: 251Cp:CCC, 251Cq:CCC, 251Ea:CCC, 255Aa:CCC, 311A:PP, 332E:PP
CONSERVATION REGIONS: 32:C, 33:P, 37:C
STATES: KS OK **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: Freshwater Marsh (Kuchler 1974) B

USNVC HIERARCHY: SPARTINA PECTINATA TEMPORARILY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.j)

Calamagrostis stricta - Carex sartwellii - Carex praegracilis - Plantago eriopoda Saline Herbaceous Vegetation

Western Bluejoint - Sartwell's Sedge - Clustered Field Sedge - Alkali Plantain Saline Herbaceous Vegetation

Northern Tallgrass Saline Wet Meadow CEGL002255

DESCRIPTION: The vegetation cover of this community is moderately dense to dense. Graminoids of medium and short stature are the dominant lifeform. Species diversity may be low, dependant on salinity, and forbs may be common or sparse. Shrubs may invade this community in the absence of fire, especially on less saline sites (MNNHP 1993). The most abundant species are *Symphyotrichum lanceolatum (= Aster lanceolatus), Calamagrostis stricta, Carex praegracilis, Carex sartwellii, Juncus balticus*, and *Plantago eriopoda*. Shay and Shay (1986) also included *Hordeum jubatum* and *Distichlis spicata (= Distichlis stricta)* within the moderately saline wet meadow. *Spartina pectinata* may be present to common in some stands.

This community is found on level ground in depressions where the water table is at or near the surface for part of the year. It may occupy the central area of shallower wetland basins and may occur as a peripheral band around deeper wetlands (Stewart and Kantrud 1971). The soil and water are moderately saline.

Fire may be important to prevent encroachment of shrubs, especially on less saline sites.

COMMENTS: *2, MCS*. Type's placement in this alliance needs review. Distinction between wet meadow and saline wet meadow is unclear in Minnesota (R. Dana pers. comm. 1999). Tallgrass species, such as *Andropogon gerardii, Schizachyrium scoparium*, and *Panicum virgatum* may be associated with this type.

CONSERVATION RANK: *G2G3*. There are probably fewer than 100 occurrences of this community rangewide; currently they are documented from Minnesota and North Dakota where the type is ranked S3 (but as part of a broader wet meadow type) and SU, respectively. It is also reported from Manitoba and possibly also occurs in South Dakota. There are probably less than 10,000 acres rangewide; currently over 1400 acres have been documented, with sizes ranging from 1 to 300 acres. Many sites are grazed or cut for hay; a few sites were plowed a long time ago. This community has very restricted environmental requirements, and has a moderately restricted range in the Agassiz lakeplain in central and western Minnesota and eastern North Dakota. Half of the currently documented occurrences are in good condition.

DISTRIBUTION: This saline wet meadow community is found in the northern tallgrass prairie region of the United States and adjacent Canada, ranging from Minnesota and the Dakotas to Manitoba.

USFS ECOREGIONS: 222Na:CCC, 251Aa:CCC, 251Ba:CCC
CONSERVATION REGIONS: 26:C, 34:C, 35:C
STATES: MN ND SD **PROVINCES:** MB

MIDWEST HERITAGE SYNONYMY: MN wet prairie (southwest section) saline subtype; wet prairie (northwest section) saline subtype -

OTHER SYNONYMY: Temporary ponds, slightly brackish, central wet meadow zone (Stewart and Kantrud 1971) B

USNVC HIERARCHY: CAREX SPP. - PLANTAGO ERIOPODA TEMPORARILY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.j)

Distichlis spicata - (Hordeum jubatum, Poa arida, Sporobolus airoides) Herbaceous Vegetation

Saltgrass - (Foxtail Barley, Plains Bluegrass, Alkali Sacaton) Herbaceous Vegetation

Southern Great Plains Saline Meadow CEGL002042

DESCRIPTION: This community is dominated by halophytic short and mid grasses. The predominant vegetation is moderately dense and taller on less saline sites and moderately sparse and shorter on more saline sites. Species diversity also increases on less saline sites. *Distichlis spicata* is typically one of the most abundant species. *Iva annua, Hordeum jubatum, Poa arida*, and *Sporobolus airoides* can be present to codominant. Other common species include *Leptochloa fusca ssp. fascicularis (= Leptochloa fascicularis), Pascopyrum smithii* (especially on less saline sites), *Suaeda calceoliformis*, and *Salicornia rubra*. Low shrubs, notably *Atriplex patula* and *Sarcobatus vermiculatus*, may be scattered across this community. In Nebraska, stands are dominated by *Distichlis spicata* and *Sporobolus airoides*, with *Carex praegracilis, Hordeum jubatum*, and *Poa arida* frequent in more mesic areas. Forbs are scattered and include *Atriplex subspicata, Symphyotrichum ciliatum (= Brachyactis ciliata), Rayjacksonia annua (= Machaeranthera annua)*, and *Thelypodium integrifolium*. Eurasian halophytes , such as *Atriplex micrantha (= Atriplex heterosperma), Atriplex prostrata, Lepidium perfoliatum*, and *Puccinellia distans,* may invade these sites, but they appear to pose little threat to the native species ('alkali graminoid zone' in Steinauer and Rolfsmeier 2000).

This community is found on level to gently sloping stream terraces, foot slopes, and shallow depressions that are flooded for a few weeks in the spring (Steinauer 1989). Soils are fine sand to clay, well- to moderately poorly drained, and usually deep (Ungar 1967, Steinauer 1989). The soils are moderately to strongly saline and tend to have alkaline pH, in some cases as high as 9.5 (Johnston 1987, Steinauer and Rolfsmeier 2000).

COMMENTS: *2, MCS*. The Oklahoma association placed in synonymy here is common in central and western Oklahoma. Further details about this type are available in Steinauer and Rolfsmeier (2000). The type needs to be compared to *Sporobolus airoides* Southern Plains Herbaceous Vegetation (CEGL001685), which occurs in the southwestern Plains, and to *Sporobolus airoides* Northern Plains Herbaceous Vegetation (CEGL002274), which occurs in the northwestern Great Plains.

CONSERVATION RANK: *G3.* The total number of occurrences is unknown. Thirteen have been documented in Nebraska, where the community is ranked S3. It is also reported from Kansas (S2), Oklahoma (S1), and possibly Texas (SP). The community has moderately restricted environmental requirements.

DISTRIBUTION: This saline wetland community is found in the central and southern Great Plains of the United States, ranging from western Nebraska to possibly Texas.

USFS ECOREGIONS: 331C:C?, 331H:CP, 332C:PP
CONSERVATION REGIONS: 24:?, 27:C
STATES: KS NE OK TX **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE western alkaline meadow =

OTHER SYNONYMY: *Distichlis-Hordeum-Iva* Community (Ungar 1967) =, Alkali Sacaton Prairie (Kuchler 1974) I. Kuchler's type is restricted to southwestern Kansas and appears to include less saline communities than *Distichlis spicata* - (*Hordeum jubatum - Poa arida - Sporobolus airoides*) Herbaceous Vegetation., *Distichlis spicata / Elytrigia smithii - Sporobolus airoides* Plant Association (Johnston 1987) I

USNVC HIERARCHY: DISTICHLIS SPICATA - (HORDEUM JUBATUM) TEMPORARILY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.j)

Distichlis spicata - Hordeum jubatum - (Poa arida, Iva annua) Herbaceous Vegetation

Saltgrass - Foxtail Barley - (Prairie Bluegrass, Annual Marsh-elder) Herbaceous Vegetation

Central Tallgrass Saline Meadow CEGL002031

DESCRIPTION: This community is dominated by salt-tolerant mid and short grasses (<1 m tall). Trees are very rare. In the saline prairie zone, *Distichlis spicata, Elymus caninus, Hordeum jubatum, Panicum virgatum*, and *Poa arida* are the dominant species. *Ambrosia artemisiifolia, Helianthus annuus, Bassia scoparia (= Kochia scoparia)*, and *Iva annua* are also common. In the salt-flat zone, dominants include *Distichlis spicata and. Suaeda calceoliformis. Salicornia rubra* is common in deeper, wet saline depressions. In less saline parts, prairie grasses typical of clay soils are present; species include *Bouteloua gracilis, Buchloe dactyloides*, and *Pascopyrum smithii* (Steinauer and Rolfsmeier 2000).

This community occurs on nearly level bottomlands and in upland depressions. The parent material is loess, glacial till, or alluvium (Steinauer 1989). Soils are silty clay loams, somewhat poorly drained to poorly drained, and moderately to very strongly saline. The salts accumulate from saline seeps associated with Dakota sandstone underlying these areas. During the spring, bottomland sites have a high water table that fluctuates from near the surface to 2-3 m underground. Occasional flooding occurs in lower portions of the community and salts can accumulate at the surface (Steinauer and Rolfsmeier 2000).

Fires were common during the dry season in this community.

COMMENTS: *2, MCS*. Type concept has been taken from Nebraska state type - eastern saline meadow (Steinauer and Rolfsmeier 2000).

CONSERVATION RANK: *G2G3.* There are probably fewer than 100 occurrences of this community rangewide. This community has a restricted natural distribution; it is reported only from eastern Nebraska, where it is ranked S2. It occurs on level bottomlands and upland depressions where the soils are moderately to very strongly saline. Probably it has always been rare. Currently there are no documented occurrences of this community.

DISTRIBUTION: This community is found in the central tallgrass region of eastern Nebraska on nearly level bottomlands and in upland depressions. It has a very restricted distribution, known only from Lancaster and Saunders counties, primarily in the valleys of Salt Creek, Little Salt Creek, and Rock Creek (Steinauer and Rolfsmeier 2000).

USFS ECOREGIONS: 251Cp:CCC
CONSERVATION REGIONS: 36:C
STATES: NE **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE eastern saline meadow =

OTHER SYNONYMY: *Distichlis spicata* Community (Ungar et al. 1969) F, *Hordeum-Iva* Community (Ungar et al. 1969) F

USNVC HIERARCHY: DISTICHLIS SPICATA - (HORDEUM JUBATUM) TEMPORARILY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.j)

Distichlis spicata - Hordeum jubatum - Puccinellia nuttalliana - Suaeda calceoliformis Herbaceous Vegetation

Saltgrass - Foxtail Barley - Nuttall's Alkali Grass - Sea-blite Herbaceous Vegetation

Northern Great Plains Saltgrass Saline Meadow CEGL002273

DESCRIPTION: This community has low species diversity and is dominated by salt-tolerant graminoids. Total vegetation cover is sparse to moderate, and bare ground is common (Hanson and Whitman 1938, Redmann 1972). Graminoids dominate the stand. The dominant species are *Distichlis spicata* and *Hordeum jubatum*. Other common species include *Muhlenbergia asperifolia, Muhlenbergia richardsonis, Puccinellia nuttalliana, Suaeda calceoliformis*, and *Spartina gracilis*. *Pascopyrum smithii* and *Bouteloua gracilis* can be common on relatively dry inclusions within this community (Hirsch 1985), and *Elymus lanceolatus* may be found on the upland border (Hanson and Whitman 1938). *Carex hallii, Carex praegracilis*, and *Sporobolus compositus (= Sporobolus asper)* can also be found. *Andropogon gerardii, Schizachyrium scoparium, Panicum virgatum*, and other tall grasses can be a component of these wet meadows. Common forbs include *Ambrosia psilostachya (= Ambrosia coronopifolia), Symphyotrichum ericoides (= Aster ericoides), Chenopodium leptophyllum, Grindelia squarrosa, Melilotus officinalis, Plantago elongata, Plantago eriopoda* (western Minnesota), *Plantago patagonica*, and *Salicornia rubra*. Shrubs are very rare. *Artemisia frigida, Atriplex nuttallii*, and *Sarcobatus vermiculatus* are the only shrubs that have been noted from the western part of the type's range (Hirsch 1985, USFS 1992, R. Dana pers. comm. 1999).

This community is found on terraces, floodplains, swales and other low sites where drainage is poor. The soils are moderately to strongly saline, fine-textured, and moderately deep to deep (Redmann 1972, USFS 1992). Hirsch (1985) found this community on a variety of soil textures, including sandy clays, clay loam, sandy loams, and sandy clay loams. Periodic flooding is common, and this may result in soil deposition and consequent poor soil development (Hanson and Whitman 1938). The water table is often high, and salt encrustations may be present on the surface (Hirsch 1985).

COMMENTS: *2, MCS*. The relationship between this community and *Hordeum jubatum* Herbaceous Vegetation (CEGL001798) is unclear. Both communities usually contain *Distichlis spicata* and *Hordeum jubatum*. *Hordeum* may be more common on heavily grazed sites (R. Dana pers. comm. 1999). The presence of *Puccinellia nuttalliana* or *Suaeda calceoliformis* may be distinguishing factors. They appear to be more characteristic of strongly saline areas while *Hordeum jubatum* can dominate on less saline sites (Redmann 1972). Classification problems may arise on intermediate sites when *Hordeum jubatum* is the dominant species and *Distichlis spicata, Puccinellia nuttalliana*, and *Suaeda calceoliformis* are present in minor amounts. Compare type with *Sporobolus airoides* Northern Plains Herbaceous Vegetation (CEGL002274), found in western North Dakota.

CONSERVATION RANK: *G2G3.* This type is fairly restricted in distribution and occurs in relatively localized saline depressions. Many sites have been heavily grazed (R. Dana pers. comm. 1999).

DISTRIBUTION: This inland saltgrass wet meadow is found in the northeastern and north-central Great Plains and tallgrass prairie regions of the United States and adjacent Canada, ranging from Minnesota and the Dakotas to Manitoba.

USFS ECOREGIONS: 251Aa:CCC, 331:?, 332:?
CONSERVATION REGIONS: 26:C, 34:C, 35:C
STATES: MN ND SD **PROVINCES:** MB

MIDWEST HERITAGE SYNONYMY: MN wet meadow +

OTHER SYNONYMY: Saltgrass - Alkali Meadow Grass Type (Hanson and Whitman 1938) =, *Distichlis* Type (Redmann 1972) =. Redmann (1972) described a *Hordeum* Type that is treated as an example of a separate community, *Hordeum jubatum* Herbaceous Vegetation. Further classification work may result in these two types being merged to describe *Distichlis spicata - Hordeum jubatum - Puccinellia nuttalliana - Suaeda calceoliformis* Saline Herbaceous Vegetation., *Distichlis spicata - Puccinellia nuttalliana* Habitat Type (Hirsch 1985) =, *Distichlis spicata / Puccinellia airoides* (Johnston 1987) B, *Puccinellia nuttalliana / Distichlis spicata* Habitat Type (U.S. Forest Service (USFS) 1992) =

USNVC HIERARCHY: DISTICHLIS SPICATA - (HORDEUM JUBATUM) TEMPORARILY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.j)

Distichlis spicata - Schoenoplectus maritimus - Salicornia rubra Herbaceous Vegetation

Saltgrass - Saltmarsh Clubrush - Red Saltwort Herbaceous Vegetation

Eastern Great Plains Saline Marsh CEGL002043

DESCRIPTION: This community is dominated by herbaceous plants. Trees and other woody plants are almost completely absent. The dominant species are *Distichlis spicata, Salicornia rubra*, and *Schoenoplectus maritimus (= Scirpus maritimus)*. *Symphyotrichum subulatum (= Aster subulatus), Hordeum jubatum, Iva annua, Sporobolus texanus*, and *Suaeda calceoliformis* are all common. Few individuals in this community exceed 1 m and most are less than 0.5 m. There can be unvegetated ground, especially in the wettest and most saline parts of this community. *Ruppia maritima* and *Stuckenia pectinata (= Potamogeton pectinatus)* may persist in pools in the wettest areas. The vegetation is more dense with few stretches of bare ground on the drier and less saline parts (Lauver et al. 1999, Steinauer and Rolfsmeier 2000).

In Nebraska, this community is known to occur where Dakota sandstone has been exposed in basins or stream valleys. Water seeping through this sandstone comes from deeper brine deposits. Over time the salt from this water was deposited in low-lying areas or along the floodplains of creeks as saline water accumulated and evaporated repeatedly (Steinauer and Rolfsmeier 2000). This process may also occur in other parts of this community's range, but little is known of the hydrology of locations outside of Nebraska.

Throughout its range this community is found in basins or floodplains. It is dependent on periodic influx of saline water to maintain the characteristic soil and water chemistry. The soils of this community are deep and poorly drained. They are silty clay loams in Nebraska and peat, muck or mineral soils in Kansas (Lauver et al. 1999, Steinauer and Rolfsmeier 2000). The parent material rangewide is alluvium or loess. This community is flooded or saturated for most of the year. It may dry out in late summer and fall.

COMMENTS: *2, MCS*. The global name needs review, as *Distichlis spicata* is not common in stands in Nebraska. *Typha angustifolia* may also be found in Nebraska stands as an exotic (S. Rolfsmeier pers. comm. 1999). Nebraska stands may also contain small pools of *Ruppia maritima* and *Stuckenia pectinata (= Potamogeton pectinatus)*. The relation of stands in central Kansas to those of eastern Nebraska and western Missouri needs further review. In Missouri, two state types--saline seep and saline marsh--are placed in this type, but the saline marsh has essentially been extirpated from the state, leaving the seep and associated mud flats (M. Leahy pers. comm. 1999). A similar saline marsh is known from Arkansas near the lower Saline River (D. Zollner pers. comm. 1998).

CONSERVATION RANK: *G1G2.* There are probably fewer than 30 occurrences of this community rangewide. It is reported from western Missouri (where it is ranked S1), eastern Nebraska (S1), and Kansas (SU); it may also occur in Arkansas and Texas. Currently there are 23 occurrences documented from Missouri and Nebraska. Its natural distribution is restricted to sites in basins or floodplains with periodic influxes of saline water. Many former occurrences have been drained or filled for development or agriculture, or they have been heavily grazed. In Missouri, the saline marsh has now been extirpated, leaving only the seeps and associated mudflats (M. Leahy pers. comm. 1999).

DISTRIBUTION: This community is found in the southeastern Great Plains of the United States in basins or floodplains, extending from western Missouri to eastern Nebraska, south to Arkansas and possibly Texas.

USFS ECOREGIONS: 251Cb:CCP, 251Cp:CCC, 251Ea:CCC, 332E:PP
CONSERVATION REGIONS: 36:C
STATES: AR? KS MO NE TX? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO saline marsh; saline seep ?
NE eastern saline marsh =

OTHER SYNONYMY:

USNVC HIERARCHY: DISTICHLIS SPICATA - (HORDEUM JUBATUM) TEMPORARILY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.j)

Hordeum jubatum Herbaceous Vegetation

Foxtail Barley Herbaceous Vegetation

Foxtail Barley Meadow CEGL001798

DESCRIPTION: The vegetation is dominated by short and medium-tall graminoids with a total vegetation cover of nearly 100% (Barnes 1978). Shrubs are usually absent. *Hordeum jubatum* dominates the community. Other common species in this community are *Elymus trachycaulus, Distichlis spicata, Pascopyrum smithii, Poa arida, Poa compressa, Rumex crispus*, and *Sonchus arvensis*.

Stands are located in lowlands with moderately to strongly saline soils (Barnes 1978). The topography is flat and the soils are often flooded or saturated in the spring (Redmann 1972).

COMMENTS: *3, WCS*. This type is poorly defined. This abstract is based on two descriptions of *Hordeum jubatum*-dominated stands which are assumed to be examples of this community. These stands may be variants of *Distichlis spicata - Hordeum jubatum - Puccinellia nuttalliana - Suaeda calceoliformis* Herbaceous Vegetation (CEGL002273). The relationship between *Hordeum jubatum* Herbaceous Vegetation (CEGL001798) and that type is unclear. Both communities usually contain *Distichlis spicata* and *Hordeum jubatum* in varying amounts. The presence of *Puccinellia nuttalliana* or *Suaeda calceoliformis* may be distinguishing factors. They appear to be more characteristic of strongly saline areas while *Hordeum jubatum* can dominate on less saline sites (Redmann 1972). Classification problems may arise on intermediate sites when *Hordeum jubatum* is the dominant species and *Distichlis spicata, Puccinellia nuttalliana*, and *Suaeda calceoliformis* are present in minor amounts.

CONSERVATION RANK: *G4.*

DISTRIBUTION: This foxtail barley community type is found in the northern and central Great Plains of the United States and Canada, ranging from Colorado to Saskatchewan.

USFS ECOREGIONS: 251Aa:CCC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 332:?, M332C:CC, M332D:CC, M332E:CC
CONSERVATION REGIONS: 26:C, 35:C
STATES: CO MT ND SD? **PROVINCES:** SK

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Hordeum* Type (Redmann 1972) =. uncertain if equivalent, Foxtail Barley Community (Barnes and Tieszen 1978) =

USNVC HIERARCHY: HORDEUM JUBATUM TEMPORARILY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.j)

Pascopyrum smithii - Distichlis spicata Herbaceous Vegetation

Western Wheatgrass - Saltgrass Herbaceous Vegetation

Western Wheatgrass - Saltgrass Saline Prairie CEGL001580

DESCRIPTION: The vegetation is dominated by graminoids, which may be as tall as 1 m, but typically are less than 0.6 m. The depth to the clay layer affects the height and amount of vegetation, and the deeper the clay layer is buried, the taller the vegetation (Hirsch 1985). The dominants are *Pascopyrum smithii* and *Distichlis spicata*. Other common graminoids include *Bouteloua gracilis, Koeleria macrantha, Hesperostipa comata (= Stipa comata), Hordeum jubatum*, and *Carex duriuscula (= Carex eleocharis)*. Forbs that may be present are *Iva annua, Helianthus petiolaris, Plantago patagonica, Gutierrezia sarothrae*, and *Aster* spp. (including *Symphyotrichum falcatum (= Aster falcatus)*). Woody plants are rare. In Wyoming, some stands may have scattered *Artemisia frigida* or *Artemisia cana ssp. cana*. In Nebraska stands may have scattered *Populus deltoides*. There, alkaline indicators such as *Muhlenbergia asperifolia* and *Sporobolus airoides* may also be present. Exotic species, principally *Atriplex micrantha (= Atriplex heterosperma)* and *Cirsium arvense*, are ubiquitous and may contribute substantial cover in many stands (Steinauer and Rolfsmeier 2000).

This community is found in depressions and on stream terraces, including ephemeral streams. Stands contain moderately saline silt loam and sandy loam soils, sometimes with a clay subsoil (Hanson and Whitman 1938, Johnston 1987, Steinauer and Rolfsmeier 2000). Hirsch (1985) found the clay layer to be 0-25 cm below the surface. The soils are wet for part of the year and may flood periodically.

COMMENTS: *2, WCS*. This type is somewhat complex, with *Pascopyrum smithii* more important in less saline/alkaline areas, and *Distichlis spicata* and other alkaline indicators present in more alkaline areas. As such this type tends to share similarities to *Distichlis spicata - (Hordeum jubatum, Poa arida, Sporobolus airoides*) Herbaceous Vegetation (CEGL002042), which, in Nebraska, is called `western alkaline meadows' (Steinauer and Rolfsmeier 2000).

CONSERVATION RANK: *G4.* The G4 rank is based on a large geographic range and rather general environmental requirements. In light of the ubiquity of exotic plants in this type and the large proportion of stands in Nebraska (and perhaps elsewhere) that have been heavily disturbed by livestock (Steinauer and Rolfsmeier 2000), the rank probably should be reviewed.

DISTRIBUTION: This western wheatgrass saline prairie type is found in the northern Great Plains of the United States, extending from perhaps Montana south to Nebraska.

USFS ECOREGIONS: 331F:CC, 331G:CC, 342A:??, 342F:??, 342G:??
CONSERVATION REGIONS: 10:C, 26:C
STATES: MT? ND NE SD WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE western floodplain terrace grassland =

OTHER SYNONYMY: Saltgrass - Western Wheatgrass Type (Hanson and Whitman 1938) =, *Pascopyrum smithii - Bouteloua gracilis - Distichlis spicata* Habitat Type (Hirsch 1985) B, *Elytrigia smithii / Distichlis spicata* Plant Association (Johnston 1987) ?

USNVC HIERARCHY: PASCOPYRUM SMITHII TEMPORARILY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.j)

Pascopyrum smithii - Hordeum jubatum Herbaceous Vegetation

Western Wheatgrass - Foxtail Barley Herbaceous Vegetation

Western Wheatgrass - Foxtail Barley Saline Prairie CEGL001582

DESCRIPTION: Grasses contribute most of the cover in this association, although forbs and scattered shrubs may be present. *Pascopyrum smithii* or *Elymus lanceolatus* dominate, and *Hordeum jubatum* contributes substantial cover. Other species may be present but contribute little cover. Stands in south-central Wyoming contain scattered *Atriplex gardneri* from the surrounding vegetation (Medicine Bow Mine, no date).

Stands of this association occupy temporarily flooded sites (playas and stock ponds) with deep, poorly drained, clayey, alkaline-saline soils. This type occurs on drawdown zones around reservoirs in eastern Montana (S. Cooper, Montana Natural Heritage Program, pers. comm. 1998).

COMMENTS: *2, WCS*. Stands apparently occupy soils with higher sodium concentrations than do stands of the similar *Pascopyrum smithii - Eleocharis* spp. Herbaceous Vegetation (CEGL001581) (Bergman and Marcus 1976), or playas where the surface dries and the water table drops more quickly (BLM 1974). This association has not been described well. Further analysis of existing information and additional inventory will be helpful in determining the range of variation in stands of this type and how this type differs from other vegetation types of temporarily flooded sites.

CONSERVATION RANK: *G4.* The G4 rank is based on a fairly broad geographic range.

DISTRIBUTION: This wheatgrass saline prairie type is found in the northern Great Plains of the United States and adjacent Canada, extending from Colorado north to Montana and possibly Saskatchewan.

USFS ECOREGIONS: 331F:CC, 331G:CC, 342A:C?, 342F:CC
CONSERVATION REGIONS: 10:C, 26:C
STATES: CO? MT? ND NE? WY **PROVINCES:** SK?

MIDWEST HERITAGE SYNONYMY: NE? western floodplain terrace grassland ?

OTHER SYNONYMY:

USNVC HIERARCHY: PASCOPYRUM SMITHII TEMPORARILY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.j)

Salicornia rubra Herbaceous Vegetation

Red Saltwort Herbaceous Vegetation

Slender Glasswort Saline Meadow CEGL001999

DESCRIPTION: *Salicornia rubra* often forms a monoculture within extremely alkaline mudflat areas. Dodd and Coupland (1966) found that it made up to 88-100% of the vegetative cover in plots. Other species include *Puccinellia nuttalliana (= Puccinellia airoides), Distichlis spicata, Hordeum jubatum, Triglochin maritima, Chenopodium rubrum*, and *Suaeda calceoliformis*.

Salicornia rubra is found in exposed mud of alkali flats of saline wetland depressions during the dry or drawdown phase. This community is also found in the peripheral shallow-marsh zone of subsaline semipermanent ponds and lakes (Stewart and Kantrud 1971). In some areas, the major source of salinity is groundwater discharge (Dodd and Coupland 1966). The principle salts are sulfates and chlorides of sodium and magnesium (Stewart and Kantrud 1972). Few species can tolerate the extreme salinity of these wetlands. Dodd and Coupland (1966) found *Salicornia rubra* to be the principal dominant of alkali mudflats with fine-textured soils in southern Saskatchewan.

COMMENTS: *2, WCS*.

CONSERVATION RANK: *G2G3.* This type occurs over a broad geographic range, and has been recorded from Nebraska, South Dakota, North Dakota, Minnesota, Montana, Colorado, and north into Saskatchewan, Canada. However, it has very specific habitat needs (Ungar 1974), and there may be fewer than 50 occurrences rangewide. Hypersaline wetland basins which support the association have been impacted by water diversion, livestock grazing, and land conversion in many places. Saline wetlands in the Great Plains and upper Midwest have been described as especially vulnerable to habitat fragmentation and loss due to increasing population and agricultural development (Gersib and Steinauer 1991). The maintenance of stands of this association requires protection of hydrological processes such as seasonal inundation, evaporative drydown, and mineral accumulation, as well as preservation of suitable habitat.

DISTRIBUTION: This community is associated with highly alkaline wetlands or lakes in the northern Great Plains and Great Basin of the United States and adjacent Canada, ranging from western Minnesota to Saskatchewan, south to Colorado and possibly Nevada and California.

USFS ECOREGIONS: 322:P, 331D:CC, 331E:C?, 331F:C?, 331G:CC, 331H:C?, 331J:C?, 341:P, M331I:CC
CONSERVATION REGIONS: 20:C, 26:C
STATES: CA? CO MN MT ND NV? SD **PROVINCES:** MB SK

MIDWEST HERITAGE SYNONYMY: MN mud flat saline subtype =

OTHER SYNONYMY: Slender glasswort herbaceous vegetation (Greenall 1996) =, *Salicornia rubra* community (Dodd and Coupland 1966) =

USNVC HIERARCHY: SALICORNIA RUBRA SEASONALLY FLOODED HERBACEOUS ALLIANCE (V.D.2.N.h)

Sporobolus airoides Northern Plains Herbaceous Vegetation

Alkali Sacaton Northern Plains Herbaceous Vegetation

Northern Plains Alkali Sacaton Saline Meadow CEGL002274

DESCRIPTION: This community has low species diversity and is dominated by moderately salt-tolerant graminoids. Total vegetation cover is sparse to moderate and bare ground is common. The dominant species is *Sporobolus airoides*. Graminoids of high constancy in Montana include *Poa fendleriana (= Poa cusickii)* and *Poa secunda (= Poa juncifolia)*. Less common graminoids include *Distichlis spicata, Hordeum jubatum*, and *Pascopyrum smithii*. Forbs of highest constancy in Montana include *Symphyotrichum falcatum (= Aster falcatus), Plantago eriopoda*, and *Iva axillaris* (Cooper et al. 2000, S. Cooper pers. comm. 2000).

Stands occur in moderately saline sites.

COMMENTS: *3, MCS*. The small patch size of this type complicates its classification. Compare this type with *Distichlis spicata - Hordeum jubatum - Puccinellia nuttalliana - Suaeda calceoliformis* Herbaceous Vegetation (CEGL002273), which is more saline and more common in the eastern Dakotas; this type is only reported from the western Dakotas and Montana. *Sporobolus airoides* does not occur in Minnesota or the eastern Dakotas. This type is replaced southward by *Sporobolus airoides* Southern Plains Herbaceous Vegetation (CEGL001685), but diagnostic species that distinguish the two are not known. Southeastward a third type occurs that may also overlap in concept, the *Distichlis spicata - (Hordeum jubatum, Poa arida, Sporobolus airoides)* Herbaceous Vegetation (CEGL002042). A possible ranking of salinity tolerance for many of the species in this type could be, from least to most salt-tolerant: *Pascopyrum smithii, Poa fendleriana, Sporobolus airoides, Puccinellia nuttalliana, Distichlis spicata*.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This moderately saline alkali sacaton community is found in small patches in the northwestern Great Plains of the United States, ranging from the western Dakotas to Montana.

USFS ECOREGIONS: 251:?, 331E:C?, 331F:CC, 332:?, 342G:??, M334A:CC
CONSERVATION REGIONS: 10:C, 25:C, 26:C
STATES: MT ND SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: SPOROBOLUS AIROIDES HERBACEOUS ALLIANCE (V.A.5.N.d)

Sporobolus airoides Southern Plains Herbaceous Vegetation

Alkali Sacaton Southern Plains Herbaceous Vegetation

Alkali Sacaton Southern Plains Grassland CEGL001685

DESCRIPTION: This community is dominated by medium-tall and short grasses. *Sporobolus airoides* is a dominant, often accompanied by *Symphyotrichum subulatum (= Aster subulatus), Buchloe dactyloides, Distichlis spicata, Hordeum jubatum*, and *Pascopyrum smithii* (Lauver et al. 1999).

In Kansas, this community is found on slightly to moderately saline, nearly level bottomland and terraces. They have shallow, moderately well- to poorly drained silty clay soils formed in alluvium (Lauver et al. 1999).

COMMENTS: *3, WCS*. Compare this association with *Sporobolus airoides - Bouteloua gracilis* Herbaceous Vegetation (CEGL001686). Stands in Montana are placed with *Sporobolus airoides* Northern Plains Herbaceous Vegetation (CEGL002274), which occurs in the northwestern Great Plains, and this type is restricted to the southwestern Great Plains and southwestern United States. In the southeastern Plains see *Distichlis spicata - (Hordeum jubatum, Poa arida, Sporobolus airoides)* Herbaceous Vegetation (CEGL002042).

CONSERVATION RANK: *G3Q.* The number of occurrences is unknown. The community is reported from Colorado (S3), Kansas (SP), New Mexico (S2), Texas (S?), and Mexico (S?) and may occur in California (SP). The community is found on slightly to moderately saline, nearly level bottomland and terraces with alluvial silty clay soils.

DISTRIBUTION: This alkali sacaton mesic grassland community is found in the southwestern Great Plains and elsewhere in the southwestern United States and Mexico, ranging from Kansas and Colorado (Rio Puerco) south to Texas, New Mexico (Otero County, in Ecoregion 24), and possibly California.

USFS ECOREGIONS: 262:P, 313B:CC, 321A:CC, 322:P, 331F:C?, 331G:C?, 331I:CC, 341:P, M331G:CC, M331I:CC
CONSERVATION REGIONS: 19:C, 20:C, 24:C, 27:C
STATES: CA? CO KS NM TX **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: SPOROBOLUS AIROIDES HERBACEOUS ALLIANCE (V.A.5.N.d)

* Nonstandard type (needs review)

Northern Prairie Pothole Wetland Complex*

Northern Prairie Pothole Wetland Complex

Northern Prairie Pothole Wetland Complex CECX002005

DESCRIPTION: The flora of a prairie wetland is a function of the water regime, salinity, and disturbance by humans. Within a pothole, water depth and duration determine the local gradient of species. Potholes deep enough to have standing water, even during droughts, will have a central zone of submersed aquatics (open water). In wetlands that go dry during periods of drought, or annually, the central zone will be dominated by either tall emergents (deep marsh) or mid-height emergents (shallow marsh), respectively. Potholes that are only flooded briefly in the spring are dominated by grasses, sedges, and forbs (wet meadow). The depth of the deepest part of the pothole and the relative steepness of the local relief will determine how many zones occur in a given pothole. These patterns are impacted by the extent of drainage, grazing, mowing, and burning occurring in the pothole, and by sedimentation, nutrient runoff, and pesticides from adjacent plowing (Kantrud et al. 1989).

Because of periodic droughts and wet periods, many wetlands undergo vegetation cycles. Periods of above normal precipitation can raise water levels high enough to drown out emergent vegetation or produce "eat outs" due to increases in the size of muskrat populations that accompany periods of high water (Kantrud et al. 1989). The elimination of emergents creates an open-water marsh, dominated by submerged aquatics. During the next drought when the marsh bottom is exposed by receding water levels (a drawdown), seeds of emergents and mudflat annuals in the soil seed bank germinate (dry marsh). When the marsh refloods, the emergents survive and spread vegetatively (Kantrud et al. 1989).

Zonation patterns are conspicuous in prairie potholes, because each zone often is dominated by a single species that has a lifeform different from those in adjacent zones. But each zone is constantly adjusting to the shifting environmental gradients within the pothole, which can create a lag in response among various species, and cloud the compositional patterns within the zones (Kantrud et al. 1989, Johnson et al. 1987). The combination of vegetation cycles and clouded zonation patterns makes classification of prairie pothole wetlands difficult.

Prairie potholes are mostly closed basins that receive irregular inputs of water from their surroundings, and export water as groundwater. Climate of the region is characterized by mid-continent temperature and precipitation extremes, with areas in the region having summer highs of over 38 degrees C and winter lows below -40 degrees C. Precipitation ranges from over 56 cm in the southeast to barely 25 cm along the western edge of the region. Wetlands typically fill in the spring, when snowmelt runs off the frozen soil. The prairie pothole region is covered by a thin mantle of glacial drift overlying stratified sedimentary rocks of Mesozoic and Cenozoic ages. The rocks consist primarily of limestones, sandstones, and shales. Highly mineralized water can discharge upward from these sedimentary rocks into the glacial drift. The geomorphology of the drift consists of end moraines, stagnation moraines, ground moraines, outwash plains, and lakeplains. The drift is thickest in areas of end and stagnation moraines, generally 60 to 120 m. In areas of ground moraines and lakeplains, the drift is generally less than 30 m thick. The drift is generally fine-grained, silty and clayey soils. The end and stagnation moraines can rise up from 10 to greater than 100 m above the surrounding flatter plains, creating relatively steep local relief. On other drift, the land slopes are slight, and local relief may only be a few meters (Winter 1989).

Hydrology of the potholes is complex. The generally low land surface relief results in low runoff velocities. Numerous small depressions in morainal areas are not part of an integrated drainage system, and contribute little to stream flow. Finally, because the geological materials have low permeability, infiltration also is minimal. Infiltration is further limited because climatic conditions are such that soil frosts are usually deep (1 to 1.3 m), causing spring snowmelt to run off into the potholes until they would overflow from one pothole to the next. Groundwater recharge and discharge can lead to areas of seepage, as topographically high wetlands discharge into adjacent lower areas. This can lead, e.g., to freshwater springs discharging into saline lakes. Both the spring melt and groundwater phenomenon illustrate how pothole hydrology is best studied when the wetlands complexes are treated as interconnected hydrologic units (Winter 1989).

Precipitation and runoff from snowmelt are often the principal water sources, with groundwater inflow secondary with about 15% of total inflow. Evapotranspiration is the major water loss, with seepage loss only about 15-20% of total outflow (Winter 1989).

Most of the wetlands and lakes contain water that is alkaline (pH >7.4), and pH values of 10.8 have been reported. The concentration of dissolved solids in these waters ranges from fresh to extremely saline. Calcium, magnesium, sodium, and potassium have each been determined to be the most abundant cations in these prairie wetlands, and bicarbonate, sulfate, and chloride the most abundant anions. The least saline waters commonly are a calcium

bicarbonate type, and the most saline waters commonly are a sodium sulfate type. However, water type and salinity are independent. On the basis of phosphorus supply and concentration of phosphorus, many of these wetlands are eutrophic (LaBaugh 1989).

Chemical characteristics vary both seasonally and annually, especially in larger potholes (>5 ha). Seasonal variation in major ions is affected by concentration under ice cover, dilution due to snowmelt and runoff, concentration by evaporation, dilution from rainfall, and interaction with groundwater. A variety of classifications exist in the literature with respect to salinity. The most widely used in the U.S. was that of Stewart and Kantrud (1972), who based their scale on the correlation between distinctly different plant communities and the relative concentrations of dissolved solids, indicated by specific conductance. Their categories were fresh (<500 uS/cm), slightly brackish (500-2000 uS/cm), moderately brackish (2000-5000 uS/cm), brackish (5000-15,000 uS/cm), subsaline (15,000-45,000 uS/cm), and saline (>45,000 uS/cm). Millar (1976) used a similar approach in western Canada, but defined four categories: fresh (<1400 ppm or <2000 uS/cm), moderately saline (1400-10,500 ppm), saline (10,500-31,500 ppm) and hypersaline (>31,500 ppm). Numerous wetlands and lakes in the northern prairies are more saline than the ocean (approximately 50,000 uS/cm). Because surface water chemistry can change dramatically in prairie lakes and wetlands, it can be difficult to classify a body of water into a particular salinity type (LaBaugh 1989).

Floods can occur during spring melt, because soil frosts are usually deep (1 to 1.3 m). This causes the spring snowmelt to run off into the potholes until they overflow prominent potholes (Winter 1989). Because of periodic droughts and wet periods, many prairie wetlands undergo vegetation cycles. Periods of above normal precipitation can raise water levels high enough to drown out emergent vegetation or cause them to be eaten out by muskrat populations that increase during periods of high water (Kantrud et al. 1989). Wave action can also cause disturbances of the shoreline vegetation. During the next drought when the marsh bottom is exposed by receding water levels (a drawdown), seeds of emergents and mudflat annuals in the soil seed bank germinate (dry marsh). When the marsh refloods, the emergents survive and spread vegetatively (Kantrud et al. 1989).

The drawdown zone is particularly dynamic. Vegetation tends to be more sparse around permanent ponds and more dense in temporary ponds. The zone is typically inundated early in the season, but is generally dry by late spring or early summer. The vegetation is often very diverse, since drawdowns happen to varying degrees from year to year.

Prairie fires could also be expected to sweep through these wetlands, particularly during drawdown periods.

COMMENTS: *2, MCS*. The complex proposed here is an alternative to applying the USNVC to prairie pothole wetlands. The USNVC, like that of the national wetland classification (Cowardin et al. 1979), in principal classifies each zone as a separate association or wetland type, respectively. By contrast, Stewart and Kantrud (1972) developed a classification system of prairie potholes that recognized different phases of vegetation zones dominated by the major lifeforms in each, from open water to wet meadow. They also used the composition of the zone as an indicator of the water regime, water chemistry and disturbance. Each pothole was assigned to a type based on the deepest part (zone).

The prairie pothole complex proposed here relies in part on the method of Stewart and Kantrud (1972). The complex is still a preliminary idea, and could take several approaches. First, the complex could be treated most broadly as a single unit, putting all wetlands across the entire region into a single unit. Second, the complex could be subdivided into major subregions. Three possibilities, suggested by D. Ode (pers. comm. 1999) are: (1) Tallgrass Prairie/Aspen Parkland Region (Province 251), where a higher proportion of open water and deep emergent marshes with fresh water chemistry occur; (2) James Basin and Missouri Coteau Region (Province 332), where the vast majority of wetlands are shallow marsh and wet meadow types; and (3) Northwestern Region (Province 331), where brackish and saline types predominate. Finer divisions at section or subsection levels would also be possible and have been used in Alberta (L. Allen pers. comm. 1999).

Third, the complex could be defined based on the deepest zone within a complex, following Steward and Kantrud (1972). There would be the following subtypes: (1a) open marsh, freshwater complex; (1b) open marsh, brackish/saline complex; (2a) deep marsh, freshwater complex; (2b) deep marsh, brackish/saline complex; (3a) shallow marsh, freshwater complex; (3b) shallow marsh, brackish/saline complex; (4a) wet meadow, freshwater complex; (4b) wet meadow, brackish/saline complex; (5a) fens/seeps, freshwater complex; (5b) fens/seeps, brackish/saline complex; (6a) drawdown, freshwater complex; (6b) drawdown brackish/saline complex. Individual associations found within each of these complexes would then be listed (see below). Any combination of these options is also possible. Regardless of the approach taken, a complete list of associations found within a given complex can be developed, and a first start at a comprehensive list across the entire range of complexes is provided below, categorized by Steward and Kantrud's categories.

Sandhill prairie wetlands in northwestern Nebraska could be considered another kind of prairie pothole wetland complex. They are not glaciated and are located in areas of sand dunes. Northern glaciated prairie lakes (approximately >8 ha or 20 acres in size, and over 2 m deep using Cowardin et al. 1979 criteria) are not included in this wetland complex.

CONSERVATION RANK: *G3G5.* This rank has been assigned based on the widespread distribution of the complex, the commonness of many of the component associations, and the high rank of a few associations. Thus individual potholes typically do not contain rare vegetation types, but some may. Many potholes are small, landscapes have been extensively ditched for drainage, and farming and ranching activities can lead to plowing, high levels of nutrient run-off and siltation, or heavy grazing.

DISTRIBUTION: This complex occurs widely throughout the glaciated northern Great Plains of the United States and Canada. The range can be approximated by referring to Bailey's (1994) U.S. Ecoregional Section map. It covers the northern parts of Provinces 251 (251A?,251B), 332 (332A,332B,332D), and 331 (331D, 331E) in western Minnesota, eastern South Dakota and North Dakota, and extreme northern Montana, as well their equivalents in southwestern Manitoba, southern Saskatchewan and southeastern Alberta (see Bailey 1997).

USFS ECOREGIONS: 251A:C?, 251B:CC, 331D:CC, 331E:CC, 332A:CC, 332B:CC, 332D:CC
CONSERVATION REGIONS: 26:C, 34:C, 35:C
STATES: MT ND NE? SD WY **PROVINCES:** AB MB SK

MIDWEST HERITAGE SYNONYMY: NE? no state equivalent

OTHER SYNONYMY:

USNVC HIERARCHY: N/A

Eleocharis palustris - (Eleocharis compressa) - Leptochloa fusca ssp. fascicularis Herbaceous Vegetation

Common Spikerush - (Flat Spikerush) - Bearded Sprangletop Herbaceous Vegetation

Spikerush Playa Lake CEGL002259

DESCRIPTION: The vegetation is dominated by low (<0.5 m) graminoids and forbs. *Eleocharis macrostachya* is dominant or codominant. Other species that may be present include *Ambrosia artemisiifolia, Ambrosia grayi, Symphyotrichum subulatum (= Aster subulatus), Coreopsis tinctoria, Eleocharis compressa, Hordeum jubatum, Leptochloa fusca ssp. fascicularis (= Leptochloa fascicularis), Marsilea vestita, Polygonum pensylvanicum (= Polygonum bicorne)*, and others (Hoagland 1997, Lauver et al. 1999).

Stands occur in wet depressions, bison wallows, interdunal swales, and playa lakes. Soils are poorly drained, dense clays (Hoagland 1997, Lauver et al. 1999).

COMMENTS: *3, MCS*. Type may be in the eastern part of Oklahoma, rather than Great Plains part. *Eleocharis macrostachya* is a synonym of *Eleocharis palustris* (Kartesz 1994).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This spikerush basin wetland is found in the south-central Great Plains of the United States, particularly in Kansas and possibly Oklahoma.

USFS ECOREGIONS: 331:P, 332:P
CONSERVATION REGIONS: 27:C, 33:C
STATES: KS OK **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: ELEOCHARIS PALUSTRIS TEMPORARILY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.j)

Heteranthera limosa - Bacopa rotundifolia - Sagittaria latifolia Herbaceous Vegetation

Blue Mud-plantain - Midwestern Water-hyssop - Broadleaf Arrowhead Herbaceous Vegetation

Forb Playa Marsh CEGL002279

DESCRIPTION: Forbs dominate the vegetation, including *Heteranthera limosa, Bacopa rotundifolia*, and *Sagittaria latifolia*. Other characteristic species include *Ammannia coccinea, Echinochloa* sp., *Leptochloa fusca ssp. fascicularis (= Leptochloa fascicularis), Marsilea vestita, Polygonum pensylvanicum (= Polygonum bicorne), Rorippa sinuata*, and *Sagittaria longiloba* (Hoagland 1997, Lauver et al. 1999).

Stands occur in interdunal swales along major streams and in depressional features in upland plains (playas). Soils are dense, poorly drained clays (Hoagland 1997, Lauver et al. 1999).

COMMENTS: *2, SCS*.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This emergent forb playa vegetation is found in the southern Great Plains of the United States, from Kansas to possibly Texas.

USFS ECOREGIONS: 311A:CC, 315B:CC, 331B:CC
CONSERVATION REGIONS: 27:C, 28:C, 33:C
STATES: KS OK TX **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: HETERANTHERA LIMOSA PERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.C.2.N.a)

Pascopyrum smithii - Buchloe dactyloides - (Phyla cuneifolia, Oenothera canescens) Herbaceous Vegetation

Western Wheatgrass - Buffalo Grass - (Wedgeleaf Frogfruit, Spotted Evening-primrose) Herbaceous Vegetation

Wheatgrass Playa Grassland CEGL002038

DESCRIPTION: Perennial herbaceous graminoids and forbs <1 m tall dominate the community, with composition varying depending on water levels. In the central Plains *Pascopyrum smithii* is most abundant, with *Agrostis hyemalis, Eleocharis palustris, Eleocharis macrostachya, Elymus virginicus*, and *Hordeum jubatum* locally abundant. *Buchloe dactyloides* can be abundant in grazed sites. Early-season ephemeral annuals include *Alopecurus carolinianus, Elatine rubella, Myosurus minimus, Veronica peregrina ssp. xalapensis*, and, more westward *Limosella aquatica* and *Plagiobothrys scouleri*. Perennial forbs, including *Ambrosia grayi, Phyla cuneifolia, Oenothera canescens, Rorippa sinuata*, and *Vernonia fasciculata,* are conspicuous in places (Lauver et al. 1999, Steinauer and Rolfsmeier 2000). In the southern Plains, species characteristic of the type include *Buchloe dactyloides, Distichlis spicata*, and *Panicum obtusum* (Weakley et al. 1998).

This type is found in playa type depressional wetlands across the southern and central Great Plains of the United States. In the central Plains soils are dense, (occasionally loess derived) silts and clays that flood in winter and dry out by early summer (Steinauer and Rolfsmeier 2000).

COMMENTS: *2, MCS*. In Nebraska this type includes stands in the Rainwater Basin of south-central Nebraska, and perhaps even some stands in eastern Nebraska where *Pascopyrum smithii* is found in clay pan depressions. However, some of these eastern or more northern depressions may better fit with *Pascopyrum smithii - (Elymus trachycaulus)* Clay Pan Herbaceous Vegetation (CEGL002239). Compare with associations in V.A.5.N.j *Pascopyrum smithii* Temporarily Flooded Herbaceous Alliance (A.1354).

CONSERVATION RANK: *G2G3.* This community is reported from four states: Kansas, Nebraska, Oklahoma, and Texas. It is ranked S2 in Oklahoma, S1 in Nebraska, and either S? or SU in the other states. The estimated number of occurrences is between 20 and 100. The total area is unknown, but individual occurrences may be fairly small. The community is restricted to playa lakebeds in very dry areas. It is known from four ecoregion subsections. The condition of occurrences is unknown, but they are quite likely to be heavily impacted by cattle grazing.

DISTRIBUTION: This wheatgrass playa grassland community is found in playa lake basins (depressional wetlands) in the southern and central Great Plains of the United States.

USFS ECOREGIONS: 311:?, 315:?, 321:?, 331C:PP, 331F:P?, 332E:CC
CONSERVATION REGIONS: 24:?, 26:?, 27:C, 28:C, 33:?
STATES: KS NE OK TX **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE wheatgrass playa grassland =

OTHER SYNONYMY:

USNVC HIERARCHY: PASCOPYRUM SMITHII INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.i)

Polygonum spp. - Echinochloa spp. - Distichlis spicata Playa Lake Herbaceous Vegetation

Smartweed Species - Barnyard Grass Species - Saltgrass Playa Lake Herbaceous Vegetation

Playa Marsh CEGL002039

DESCRIPTION: Annual herbaceous graminoids and forbs, mostly <1 m tall, dominate the exposed mudflats. Species composition and the extent of the community fluctuate from site to site and year to year. In Nebraska, graminoids include *Cyperus acuminatus, Eleocharis engelmannii*, and *Echinochloa muricata*, and forbs include *Bacopa rotundifolia, Coreopsis tinctoria, Elatine rubella, Heteranthera limosa, Limosella aquatica, Lindernia dubia, Mollugo verticillata, Polygonum pensylvanicum (= Polygonum bicorne), Polygonum lapathifolium, Rumex stenophyllus*, and *Sagittaria calycina* (Steinauer and Rolfsmeier 2000). In Kansas, graminoids include *Hordeum jubatum*, and forbs include *Ambrosia grayi, Symphyotrichum subulatum (= Aster subulatus)*, and *Chenopodium berlandieri* (Lauver et al. 1999).

This community is found in the central Great Plains of the United States, where it occurs in shallow depressions on gently to moderately sloping topography. Soils are deep to moderately deep loams or clay loams underlain by a dense clay sublayer. Ponds often draw down periodically in these playa-type habitats (Lauver et al. 1999).

The frequent water fluctuations and thick clay pan prevent establishment of most perennial hydrophytes, such as *Scirpus* spp. and *Typha* spp.

COMMENTS: *3, MCS*. Steinauer and Rolfsmeier (2000) note that stands in northwestern Nebraska may or may not belong to this type because they are associated with artificial impoundments. The global name for this type is weak, and better characteristic species are needed to name this type. It is unclear whether stands from Nebraska, Kansas, and Oklahoma really fit into the same type.

CONSERVATION RANK: *G2G4*. The number of occurrences is unknown. The community is reported from Nebraska (where it is ranked S1), Kansas (SU), and possibly Oklahoma (SP). It occurs in two ecoregional sections. The community is found in shallow depressions on gently sloping topography with deep to moderately deep loams or clay loams underlain by a dense clay sublayer.

DISTRIBUTION: This wetland playa marsh community is found in the central Great Plains of the United States, ranging from Nebraska to possibly Oklahoma.

USFS ECOREGIONS: 331C:CP, 332E:CP
CONSERVATION REGIONS: 27:C
STATES: KS NE OK? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE playa wetland =

OTHER SYNONYMY:

USNVC HIERARCHY: POLYGONUM SPP. - ECHINOCHLOA SPP. TEMPORARILY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.j)

Calamagrostis canadensis Western Herbaceous Vegetation

Bluejoint Western Herbaceous Vegetation

Canadian Reedgrass Wet Meadow CEGL001559

DESCRIPTION: The vegetation has few shrubs and contains a fairly dense cover of grasses dominated by *Calamagrostis canadensis*.

These grasslands are a relatively small, meadow association that occurs in broad glaciated valleys, openings in moist forests, silted-in beaver ponds, and narrow floodplains of lower montane canyons.

COMMENTS: *2, WCS*.

CONSERVATION RANK: *G4.*

DISTRIBUTION: This type occurs widely throughout mountainous areas of the western United States and probably into Canada.

USFS ECOREGIONS: M242B:C?, M242C:CC, M261A:CC, M261D:CC, M261E:CC, M331A:CC, M331D:C?, M331G:CC, M331H:CC, M331I:CC, M331J:C?, M332A:CC, M332B:CC, M332C:CC, M332D:CC, M332E:CC, M332F:CC, M333A:CC, M333B:CC, M333C:CC, M333D:CC, M334A:CC
CONSERVATION REGIONS: 10:C, 20:C, 25:C, 26:C, 2:C
STATES: CA CO ID MT ND OR SD UT WA WY **PROVINCES:** BC?

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Abies lasiocarpa / Calamagrostis canadensis* Association (Crowe and Clausnitzer 1997) =, *Calamagrostis canadensis* Association (Crowe and Clausnitzer 1997) =, *Calamagrostis canadensis* Association (Kovalchik 1993) =

USNVC HIERARCHY: CALAMAGROSTIS CANADENSIS SEASONALLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.k)

1.6. Wooded Swamps and Floodplains

Larix laricina - Acer rubrum / (Rhamnus alnifolia, Vaccinium corymbosum) Forest

Tamarack - Red Maple / (Alderleaf Buckthorn, Highbush Blueberry) Forest

Central Tamarack - Red Maple Rich Swamp CEGL005232

DESCRIPTION: The tree canopy varies from open to closed (25-100% cover). *Larix laricina* is the dominant species, with at least 50% cover. Other canopy associates include *Acer rubrum, Fraxinus nigra, Betula alleghaniensis*, and *Pinus strobus*. The shrub layer contains a diverse mix of species, including *Photinia melanocarpa (= Aronia melanocarpa), Ilex verticillata, Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda), Rhamnus alnifolia*, and *Vaccinium corymbosum* (in the eastern parts of its range). *Alnus incana, Lindera benzoin, Toxicodendron vernix*, and *Viburnum lentago* may also be present. The herbaceous layer is also diverse, and includes *Carex* spp. (including *Carex stricta*), *Calamagrostis canadensis, Impatiens capensis, Symplocarpus foetidus, Saxifraga pensylvanica, Thelypteris palustris*, and others. The *Sphagnum* layer is discontinuous to sparse (Anderson 1982, Chapman et al. 1989, MNNHP 1993).

This community is found in minerotrophic conditions on glacial outwash drainages, stream headwaters, and kettle depressions in kettle-kame or coarse end moraine topography, and rarely on sandy glacial lakeplains. In at least part of the range (Michigan), the saturated muck soil is neutral due to groundwater infusion, but surface soil layers may be acid (Chapman et al. 1989).

Larch sawfly outbreaks may have periodically opened up the canopy, increasing plant diversity (Chapman et al. 1989). Fires may also have occurred in these stands (E. Epstein pers. comm. 1999).

COMMENTS: *2, MCS*. The distinction between tamarack-dominated swamps and red maple-dominated swamps needs to be made clear. Cover of tamarack should be at least 25 (50?) % to place a stand in this type. If less, see the mixed hardwood swamp type, *Acer rubrum - Fraxinus spp. - Betula papyrifera / Cornus canadensis* Forest (CEGL002071).

CONSERVATION RANK: *G2G3.*

DISTRIBUTION: This community is found in the central Great Lakes region, including southern Ontario, Canada, and the northern parts of the central United States, ranging from southern Minnesota east to southern-central Michigan and southern Ontario.

USFS ECOREGIONS: 221F:PP, 222Ha:CCP, 222I:C?, 222Jb:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Ke:CC?, 222Kf:CCC, 222Kj:CCC, 222L:CC, 222Mc:CCC, 222Md:CCP

CONSERVATION REGIONS:

STATES: IN MI MN OH? WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IN	forested fen +
MI	southern relict conifer swamp (tamarack) +
MN	tamarack swamp minerotrophic subtype =
OH?	tamarack-hardwood bog ?
WI	tamarack fen (southern) =

OTHER SYNONYMY: Wet Northern Forest (Sytsma and Pippen 1981a)

USNVC HIERARCHY: LARIX LARICINA SATURATED FOREST ALLIANCE (I.B.2.N.g)

Larix laricina / Alnus incana Forest

Tamarack / Speckled Alder Forest

Northern Tamarack Rich Swamp CEGL002471

DESCRIPTION: The canopy layer varies from closed (60-100% cover) to open (25-60% cover), and may also range from 3-10 m in height. *Larix laricina* is the dominant tree species, with associates of *Picea mariana* and *Thuja occidentalis*. The shrub, herb and moss layers can be very rich to somewhat poor. The shrub layer typically contains *Alnus incana*, along with *Abies balsamea, Cornus sericea, Rhamnus alnifolia*, and *Picea mariana*. The dwarf-shrub layer is strongly ericaceous, including *Ledum groenlandicum* and *Gaultheria hispidula*. Other dwarf-shrubs include *Cornus canadensis, Linnaea borealis, Lonicera villosa, Ribes triste, Rosa acicularis*, and *Rubus pubescens*. Herbaceous species include *Carex disperma, Coptis trifolia, Equisetum sylvaticum, Galium triflorum, Maianthemum canadense, Maianthemum trifolium, Mitella nuda, Trientalis borealis*, and *Viola renifolia*. The moss layer, which is sometimes patchy, includes *Dicranum polysetum, Hylocomium splendens, Pleurozium schreberi, Ptilium crista-castrensis, Rhytidiadelphus triquetrus, Sphagnum capillifolium, Sphagnum girgensohnii*, and *Sphagnum capillifolium (= Sphagnum nemoreum)*. (Sims et al. 1989, MNNHP 1993, Harris et al. 1996).

Stands are found on the shores of lakes and rivers above the flooding level, as well as margins of flowage areas of peatland complexes. The substrate is primarily a well-decomposed woody peat in wet, saturated soils, but can also be a moist mineral soil (Sims et al. 1989, MNNHP 1993, Harris et al. 1996).

Fires may move through this community in dry years (MNNHP 1993).

COMMENTS: *2, MCS*. This type in concept is found in the boreal/mixed conifer-hardwood region (Province 212). It varies from having a tall-shrub layer and more minerotrophic indicators to a more patchy layer with dwarf-shrub/sphagnum mat and fewer minerotrophic indicators. This type lacks the more southern species found in central tamarack minerotrophic swamps, such as *Larix laricina / Photinia melanocarpa / Sphagnum* spp. Forest (CEGL002472), which is found in the hardwood and prairie-forest border regions.

CONSERVATION RANK: *G4.*

DISTRIBUTION: This rich to moderately poor tamarack swamp community is found in the northern Great Lakes region of the United States and Canada, ranging from the northern and central parts of Minnesota, Wisconsin, and Michigan to Ontario, Manitoba, and probably elsewhere.

USFS ECOREGIONS: 212Ha:CPP, 212Hb:CPP, 212He:CPP, 212Hh:CPP, 212Hi:CPP, 212Hj:CPP, 212Hk:CPP, 212Hl:CPP, 212Hm:CPP, 212Hn:CPP, 212Ho:CPP, 212Hp:CPP, 212Hq:CPP, 212Hr:CPP, 212Hs:CPP, 212Ht:CPP, 212Hv:CPP, 212Hw:CPP, 212Hy:CPP, 212Ib:C??, 212Ja:CCC, 212Jb:CCP, 212Jc:CCP, 212Jk:CCP, 212Jl:CCP, 212Jm:CCP, 212Jn:CCP, 212Jo:CCP, 212Jr:CCP, 212Ka:CCP, 212Kb:CCC, 212La:CCC, 212Mb:CCC, 212Na:CCC, 212Nb:CCP, 212Nc:CCC, 222Na:CCC, M212:C

CONSERVATION REGIONS: 35:C, 47:C, 48:C

STATES: MI? MN WI **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY:
MI? rich conifer swamp
MN tamarack swamp seepage subtype; tamarack swamp minerotrophic subtype; tamarack swamp sphagnum subtype -
WI northern wet forest (tamarack rich subtype); tamarack fen (northern) -

OTHER SYNONYMY: Tamarack (Black Spruce) / Speckled Alder / Labrador Tea (V23) (Sims et al. 1989) =, Rich conifer swamp: cedar-(tamarack) (W32) (Harris et al. 1996) I, Forested fingers (Glaser 1992b) =

USNVC HIERARCHY: LARIX LARICINA SATURATED FOREST ALLIANCE (I.B.2.N.g)

Pinus strobus - (Acer rubrum) / Osmunda spp. Forest

Eastern White Pine - (Red Maple) / Royal Fern Species Forest

White Pine - Red Maple Swamp CEGL002482

DESCRIPTION: The overstory is dominated by *Pinus strobus* and may contain *Acer rubrum, Betula alleghaniensis, Tsuga canadensis*, and *Ulmus americana*. Shrubs can be sparse, but include *Alnus incana* and *Ilex verticillata*. Understory species include *Carex* spp., *Osmunda cinnamomea, Osmunda regalis* and *Symplocarpus foetidus*. *Sphagnum* spp. may occur as a ground cover. In Wisconsin, common species include *Carex folliculata* and *Thelypteris simulata*, which are more common in the eastern United States (E. Epstein pers. comm. 1999).

This community is flooded or saturated for at least part of the year. The soils have at least a thin layer of organic material on the surface, which may be thick enough to qualify as a soil layer itself. Glacially deposited sand usually lies beneath the organic layer, and these, in turn, are underlain, or interrupted by, impermeable silts and clays (E. Epstein pers. comm. 1999).

COMMENTS: *2, MCS*. See Golet et al. (1993 p. 51) for a description of this type in the northeastern United States. In Wisconsin, *Ilex verticillata* and *Osmunda cinnamomea* are typical. Elsewhere, *Osmunda regalis* may be more typical. In Michigan this type may be in Montcalm County. Status in Indiana is not clear.

CONSERVATION RANK: *G3G4.* The total number of occurrences is unknown. One has been documented in Ohio (where the community is ranked S1), and 7 in Wisconsin (S2), where its distribution is very local on central Wisconsin glacial lake beds, with few good occurrences. Although no other occurrences have been documented, the community is also reported in Maine (S?), New Hampshire (S?), Vermont (S?), Massachusetts (S?), Connecticut (S?), New York (S?), Ontario (S2), and possibly Minnesota (SP). It is usually found on a layer of organic soil over glacially deposited sand which is flooded or saturated for at least part of the year.

DISTRIBUTION: This white pine - red maple swamp forest type is found in the southern Great Lakes region of the United States and Canada, ranging locally from central Wisconsin east to Ohio, and northeastward from New York to Connecticut and north to Maine.

USFS ECOREGIONS: 212Ha:CPP, 212Hb:CPP, 212He:CPP, 212Hh:CPP, 212Hi:CPP, 212Hj:CPP, 212Hk:CPP, 212Hl:CPP, 212Hm:CPP, 212Hp:CPP, 212Hq:CPP, 212Hr:CPP, 212Hs:CPP, 212Ht:CPP, 212Hv:CPP, 212Hx:CPP, 212Ja:CCP, 212Jb:CCP, 212Jc:CCP, 212Jh:CCC, 212Jk:CCP, 212Jl:CCP, 212Jn:CCP, 212Jo:CCP, 212Jr:CCP, 221Fa:CCC, 222Ka:CCC, 222Lb:CCC
CONSERVATION REGIONS: 46:C, 47:C, 48:C, 61:C, 63:C
STATES: CT MA ME MI MN NH NY OH VT WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

MI	hardwood-conifer swamp +
MN	mixed hardwood swamp ?
OH	white pine-red maple swamp =
WI	northern wet-mesic forest (white pine-red maple swamp subtype) =

OTHER SYNONYMY: Successional mixed forest? (NAP)

USNVC HIERARCHY: PINUS STROBUS - (ACER RUBRUM) SATURATED FOREST ALLIANCE (I.C.3.N.d)

Thuja occidentalis - (Larix laricina) Seepage Forest

Northern White-cedar - (Tamarack) Seepage Forest

White-cedar Seepage Swamp CEGL002455

DESCRIPTION: The canopy is heavily dominated by *Thuja occidentalis*, sometimes to the exclusion of other trees. Other tree species that may be present are *Acer rubrum, Betula alleghaniensis*, and *Larix laricina*. The understory contains *Cornus sericea, Cystopteris bulbifera, Drosera rotundifolia, Maianthemum canadense, Mitchella repens, Mitella nuda*, and *Rubus pubescens*. The ground layer may be dominated by mosses (MNNHP 1993).

This community is found where water seeps from the ground. The water is moderately to highly mineralized with circumneutral pH (Wilcox et al. 1986). Soils are usually organic but may be mineral (MNNHP 1993).

COMMENTS: *3, MCS*. This type was based initially on the Minnesota NHP state type - white cedar swamp, seepage subtype. Globally the type is conceptually restricted to the southern-central parts of Wisconsin, Michigan, Minnesota and Ontario, with scattered occurrences in northern parts of Illinois, Indiana, and Ohio. There is only one site in Indiana. However, the demarcation between this type and *Thuja occidentalis - (Picea mariana, Abies balsamea) / Alnus incana* Forest (CEGL002456) or other more northern white-cedar swamps is not entirely clear.

CONSERVATION RANK: *G3G4*. The total number of occurrences is unknown. Four have been documented: 2 in Wisconsin (where the community is ranked S2), 1 in Indiana (S1), and 1 in Illinois (S1S2). Although no other occurrences have been documented, the community is also reported in Michigan (S4), Minnesota (S2?), Ohio (S2), and Ontario (S?). It is usually found on organic soils where moderately to highly mineralized water seeps from the ground.

DISTRIBUTION: This lowland conifer forest is found in the upper and central midwestern United States and Canada (Great Lakes region), ranging from southern Minnesota east to Ohio and southern Ontario.

USFS ECOREGIONS: 212Ha:CPP, 212Hb:CPP, 212He:CPP, 212Hh:CPP, 212Hi:CPP, 212Hj:CPP, 212Hk:CPP, 212Hm:CPP, 212Hn:CPP, 212Ho:CPP, 212Hp:CPP, 212Hq:CPP, 212Hr:CPP, 212Hs:CPP, 212Ht:CPP, 212Hu:CPP, 212Hv:CPP, 212Hw:CPP, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jk:CPP, 212Jl:CPP, 212Jn:CPP, 212Jo:CPP, 212Jr:CPP, 212Nb:CP?, 212Nc:CPP, 222Hd:CCC, 222Jj:CCC, 222Kf:CCC
CONSERVATION REGIONS: 45:C, 46:C, 47:P, 48:C
STATES: IL IN MI MN OH WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	forested fen +
IN	forested fen +
MI	rich conifer swamp (cedar) +
MN	white cedar swamp seepage subtype =
OH	arbor vitae fen =
WI	white cedar swamp (southern subtype? (not tracked)) ?

OTHER SYNONYMY: Arbor Vitae Association (Frederick 1974) =, *Thuja occidentalis* swamp (Wilcox et al. 1986) =, Rich Conifer Swamp: Cedar (Tamarack) (Type W33) (Harris et al. 1996) =

USNVC HIERARCHY: THUJA OCCIDENTALIS SATURATED FOREST ALLIANCE (I.A.8.N.g)

Thuja occidentalis - (Picea mariana, Abies balsamea) / Alnus incana Forest

Northern White-cedar - (Black Spruce, Balsam Fir) / Speckled Alder Forest

White-cedar - (Mixed Conifer) / Alder Swamp CEGL002456

DESCRIPTION: The canopy is often moderately dense to dense (MNNHP 1993, Schwintzer 1981). The understory structure consists of high hummocks and deep, water-filled hollows, with fallen, moss-covered logs common. *Thuja occidentalis* is moderately to strongly dominant in the canopy, or *Picea mariana* may overtop the subdominant *Thuja occidentalis*. Other species include *Abies balsamea, Acer rubrum, Betula papyrifera, Fraxinus nigra, Larix laricina* and, more rarely, *Picea glauca* (in northern Minnesota and northwestern Ontario), or *Tsuga canadensis*. The shrub layer in this community is sparse to dense, in inverse proportion to the tree canopy. Species present in this stratum include *Alnus incana, Chamaedaphne calyculata, Cornus canadensis, Cornus sericea, Gaultheria hispidula, Ledum groenlandicum, Linnaea borealis, Rosa acicularis, Rubus pubescens*, and *Vaccinium myrtilloides*. *Nemopanthus mucronatus* and *Viburnum nudum var. cassinoides* are more common eastward. The most common herbaceous species are *Carex* spp. (including *Carex disperma), Coptis trifolia, Clintonia borealis, Dryopteris carthusiana, Galium triflorum, Maianthemum canadense, Mitella nuda, Trientalis borealis*, and *Viola renifolia*. Mosses include *Hylocomium splendens, Pleurozium schreberi, Ptilium crista-castrensis, Rhytidiadelphus triquetrus, Sphagnum capillifolium, Sphagnum girgensohnii*, and *Sphagnum magellanicum*. Moss cover may be thin where the canopy is very dense. Diagnostic species include *Thuja occidentalis* as a dominant/codominant species, with a combination of acidic and more minerotrophic understory species, such as *Alnus incana* and *Cornus sericea*. (Sims et al. 1989, Harris et al. 1996, Chambers et al. 1997)

This community is found on level to gently sloping ground with wet, organic (Sims et al. 1989) or mineral soil (MNNHP 1993). It is typically along the margins of peatlands, in drainage courses, or shallow depressions. Schwintzer and Tomberlin (1982) reported detailed results on the chemical characteristics of the groundwater of several wetland types in Lower Michigan. They found that it was difficult to differentiate swamps dominated by conifers from those dominated by other vegetation on the basis of groundwater. The swamps were moderately to strongly minerotrophic and had circumneutral pH.

Tip-up mounds caused by blowdowns are common, in part because the very wet soils permit only shallow rooting by *Thuja occidentalis*.

COMMENTS: *2, MCS*. The white-cedar seepage type, *Thuja occidentalis - (Larix laricina)* Seepage Forest (CEGL002455) could be lumped with this type, but this type may represent more northern stands. This type may need to be separated into a slightly poorer *Thuja - Larix - Picea* type, *Thuja occidentalis - Larix laricina / Sphagnum* spp. Forest (CEGL005225), and a richer *Thuja* type (see Harris et al. 1996, W31, W32).

CONSERVATION RANK: *G4.* This rank may need to be higher. In Wisconsin, for example, there is very poor regeneration of cedar in many stands. There was also widespread strip cutting on federal lands several decades ago, but little cedar reproduction has occurred. Currently, there is a moratorium on cutting on federal and state lands, but cutting continues on private lands (E. Epstein pers. comm. 1999). Deer browse is also a major factor affecting regeneration (Van Deelen 1999).

DISTRIBUTION: This sub-boreal white-cedar - mixed conifer swamp forest is found in the northern Great Lakes region on level to gently sloping ground with wet, organic or mineral soil.

USFS ECOREGIONS: 212Ha:CCC, 212Hb:CCC, 212Hd:CCC, 212He:CCC, 212Hh:CCC, 212Hi:CCP, 212Hj:CCC, 212Hk:CCP, 212Hl:CCC, 212Hm:CCC, 212Hn:CCP, 212Ho:CCP, 212Hp:CCC, 212Hq:CCC, 212Hr:CCP, 212Hs:CCC, 212Ht:CCC, 212Hv:CCC, 212Hw:CCC, 212Hy:CCC, 212Ib:CCC, 212Ja:CCC, 212Jb:CCP, 212Jc:CCC, 212Je:CCP, 212Jf:CCC, 212Jj:CCC, 212Jk:CCC, 212Jl:CCC, 212Jm:CCC, 212Jn:CCP, 212Jo:CCP, 212Jr:CCP, 212Ka:CCC, 212La:CCC, 212Lb:CCP, 212Lc:CCC, 212Mb:CCC, 212Na:CCC, 212Nb:CCC, 212Nc:CCC, 212Nd:CCC, 212Oa:CCC, 212Pa:CCC, 222Jc:CCC, 222Ke:CCC, 222Mc:CCC, 222Na:CCC

CONSERVATION REGIONS: 35:C, 46:C, 47:C, 48:C

STATES: MI MN WI **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY:

MI	rich conifer swamp (cedar) +
MN	white cedar swamp +
WI	white cedar swamp (cedar-mixed conifer subtype) =

OTHER SYNONYMY: Segments 7 and 8 of northern swamps (Clausen 1957) =. uncertain if equivalent, Conifer Swamp (Schwintzer 1981) =, Cedar (inc. Mixedwood) / Speckled Alder / Sphagnum Forest (Sims et al. 1989) =, White Cedar-Goldthread-Sphagnum (V38) (Chambers et al. 1997) =, Rich conifer swamp: cedar (tamarack) (W32) (Harris et al. 1996) I

USNVC HIERARCHY: THUJA OCCIDENTALIS SATURATED FOREST ALLIANCE (I.A.8.N.g)

Thuja occidentalis - Fraxinus nigra Forest

Northern White-cedar - Black Ash Forest

White-cedar - Black Ash Swamp CEGL005165

DESCRIPTION: Canopy cover is variable, sometimes fairly open. *Thuja occidentalis* and *Fraxinus nigra* dominate the canopy, but some stands may have *Fraxinus* in the upper canopy and *Thuja* in the lower canopy. *Thuja* tends to occur on the hummocks and *Fraxinus* in the hollows. *Populus tremuloides* can be a major component, but this may be caused by logging of *Thuja*. *Acer rubrum, Betula alleghaniensis*, and *Picea glauca* may also be present. Shrubs include *Acer spicatum, Cornus alternifolia, Lonicera canadensis, Ribes* spp., and *Rubus pubescens*. The herb rich layer includes *Aralia nudicaulis, Arisaema triphyllum, Clintonia borealis, Cornus canadensis, Dryopteris carthusiana, Galium triflorum, Maianthemum canadense, Tiarella cordifolia*, and *Trientalis borealis* (Chambers et al. 1997).

Stands occur on wet, saturated soils. Substrate is either wet mineral soils or well-decomposed peat, and hummocky topography is present.

COMMENTS: *3, MCS*. This type occurs on wet hummocky soils. Soils may be more minerotrophic than those found in pure white-cedar swamps. This type may better fit into a mixed conifer-hardwood category. Type may also be the same as *Thuja occidentalis - Acer rubrum / Cornus sericea* Forest (CEGL006199) or the White Cedar - (Mixed Conifer) / Alder Swamp, *Thuja occidentalis - (Picea mariana, Abies balsamea) / Alnus incana* Forest (CEGL002456). It may also be in Minnesota (Norm Aaseng). Distinctions at the association level are not clear, but will be reviewed as part of a Minnesota statewide analysis.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This white-cedar - black ash swamp type is found in the northern Great Lakes region of the United States and Canada.

USFS ECOREGIONS: 212Ha:CCP, 212Hb:CCP, 212He:CCP, 212Hh:CCP, 212Hi:CCP, 212Hj:CCC, 212Hk:CCP, 212Hl:CCC, 212Hm:CCC, 212Hn:CCP, 212Ho:CCP, 212Hp:CCP, 212Hq:CCP, 212Hr:CCP, 212Hs:CCC, 212Ht:CCC, 212Hu:CCP, 212Hv:CCC, 212Hw:CCP, 212Ja:CCP, 212Jb:CCC, 212Jc:CCP, 212Jk:CCP, 212Jl:CCP, 212Jn:CCP, 212Jo:CCP, 212Jr:CCP, 222If:CCC, 222Jc:CCC, 222Jg:CCC, 222Jh:CCC, 222Jj:CCC
CONSERVATION REGIONS: 47:P, 48:C
STATES: MI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI hardwood-conifer swamp +

OTHER SYNONYMY: White Cedar-Hardwoods-Fragrant Bedstraw-Herb Rich (V8) (Chambers et al. 1997) =. Uncertain if equivalent; this type may be broader than 5165.

USNVC HIERARCHY: THUJA OCCIDENTALIS - ACER RUBRUM SATURATED FOREST ALLIANCE (I.C.3.N.d)

Thuja occidentalis - Larix laricina / Sphagnum spp. Forest

Northern White-cedar - Tamarack / Peatmoss Species Forest

White-cedar - Tamarack Peat Swamp CEGL005225

DESCRIPTION: The vegetation contains a tree layer dominated by *Thuja occidentalis* often mixed with *Larix laricina*. Occasionally *Picea mariana* may overtop both of these species, as *Thuja occidentalis* is sometimes <10 m tall. The ground layer consists of high hummocks and deep, water-filled pools. The tall-shrub layer can contain *Thuja occidentalis* and *Picea mariana*. Low shrubs include *Alnus incana, Cornus canadensis, Cornus sericea, Gaultheria hispidula, Ledum groenlandicum, Linnaea borealis, Rosa acicularis, Rubus pubescens*, as well as scattered *Abies balsamea*. The herbaceous layer contains the graminoid *Carex disperma* and the forbs *Coptis trifolia, Maianthemum canadense, Maianthemum trifolium, Mitella nuda, Trientalis borealis*, and *Viola renifolia*. Mosses include *Hylocomium splendens, Pleurozium schreberi, Rhytidiadelphus triquetrus, Sphagnum capillifolium, Sphagnum girgensohnii* and *Sphagnum magellanicum* (Harris et al. 1996).

Stands occur on shores of lakes and rivers above the flooding level, and on margins of flowage areas of peatland complexes. The substrate is saturated, well-decomposed woody peat (Harris et al. 1996).

COMMENTS: *3, MCS*. Diagnostic features of the type are a canopy of *Larix laricina* and *Thuja occidentalis*, each comprising at least 25% relative cover (?). This type is analogous to Ontario's W31 (Harris et al. 1996). As canopy dominants change, this type can grade into *Picea mariana - (Larix laricina) / Ledum groenlandicum / Sphagnum* spp. Forest (CEGL005271), the White Cedar-Mixed Conifer/Alder Swamp, *Thuja occidentalis - (Picea mariana, Abies balsamea) / Alnus incana* Forest (CEGL002456), and the Northern Tamarack Rich Swamp, *Larix laricina / Alnus incana* Forest (CEGL002471). This type may simply represent a somewhat nutrient-poor example of CEGL005271. Distinctions between this type and the other conifer swamp types still need clarification.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This white cedar swamp type is found in the northern parts of the Great Lakes region and in adjacent areas of central Canada, ranging from northern Minnesota into Ontario and probably elsewhere.

USFS ECOREGIONS: 212La:CCC
CONSERVATION REGIONS: 47:C
STATES: MI? MN WI? **PROVINCES:** ON?

MIDWEST HERITAGE SYNONYMY:
MI? no state equivalent
MN white cedar swamp +
WI? white cedar swamp (peat swamp subtype?) ?

OTHER SYNONYMY: rich conifer swamp: cedar-tamarack (black spruce) (W31) (Harris et al. 1996) =

USNVC HIERARCHY: THUJA OCCIDENTALIS - ACER RUBRUM SATURATED FOREST ALLIANCE (I.C.3.N.d)

Tsuga canadensis - Betula alleghaniensis Saturated Forest

Eastern Hemlock - Yellow Birch Saturated Forest

Hemlock - Yellow Birch Swamp Wet-mesic Forest CEGL005003

DESCRIPTION: The overstory of this community is composed of conifers with a moderate amount of deciduous trees. *Tsuga canadensis* is usually the most abundant species with *Abies balsamea, Acer rubrum, Acer saccharum, Betula alleghaniensis, Picea glauca, Pinus strobus*, and *Thuja occidentalis* less common. The shrub layer is not well-developed in mature stands with dense canopies, but shrubs are often abundant in disturbed or young stands. Shrubs that may be present include *Amelanchier* spp., *Corylus cornuta, Lonicera canadensis, Prunus pensylvanica*, and *Vaccinium* spp. Common herbaceous species include *Clintonia borealis, Coptis trifolia, Cornus canadensis, Dryopteris carthusiana, Maianthemum canadense, Oxalis montana, Trientalis borealis, Viola* spp., and others.

This community is typically found on wet-mesic areas with imperfectly drained loamy sand, sandy loam, and loam soils that are often saturated. These areas occur on gentle slopes, drainageways, and bordering lakes and wetlands. The nutrient status is generally poor to medium (Kotar et al. 1988).

COMMENTS: *3, MCS*. Type probably varies from mixed evergreen-deciduous to evergreen, with at least 25% *Tsuga canadensis* present (cover or basal area), and the rest either hardwoods or some conifers. If *Thuja occidentalis* is prominent (>50% cover (or basal area?) of the conifer component?), place with *Thuja occidentalis* white-cedar types, such as *Thuja occidentalis - (Picea mariana, Abies balsamea) / Alnus incana* Forest (CEGL002456). Mixed stands of *Thuja* and *Tsuga* have been identified on the Chequamegon National Forest in Wisconsin, and are currently placed with this *Tsuga* type until field verification can be conducted (M. Brzeskiewicz pers. comm. 1997). Type may equal *Tsuga canadensis - Betula alleghaniensis / Ilex verticillata / Sphagnum* spp. Forest (CEGL006226) in the Northeast, but would make a broad type. Stands in northeastern Ohio are placed with that CEGL006226, found in New York and the northeastern United States. Ohio stands have no *Rhododendron* spp. (at least, not currently), and appear to resemble CEGL006226 more than CEGL006279. In Michigan this type is found in Gogebic and Iron counties in the western Upper Peninsula.

CONSERVATION RANK: *G3.* This type is fairly widespread in, e.g., Wisconsin, but few good occurrences have been recorded (E. Epstein pers. comm. 1999).

DISTRIBUTION: This community is found in the central Great Lakes region of the United States and adjacent Canada, ranging from northern Wisconsin to southern Ontario.

USFS ECOREGIONS: 212Ha:CCC, 212Hb:CCP, 212Hh:CCP, 212Hl:CCP, 212Hm:CCP, 212Ho:CCP, 212Hr:CCP, 212Ht:CCP, 212Hu:CCP, 212Hv:CC?, 212Hw:CCP, 212Ia:C??, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jf:CPP, 212Jl:CPP, 212Jm:CPP, 212Jn:CPP, 212Jo:CPP, 221Fa:CCC, 221Fb:CCC, 222Ia:CCC, 222Ja:CCC
CONSERVATION REGIONS: 47:P, 48:C, 49:C
STATES: MI? OH WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:
MI? rich conifer swamp
OH hemlock-hardwood swamp =
WI northern wet-mesic forest (hemlock swamp subtype) =

OTHER SYNONYMY: *Tsuga / Maianthemum - Coptis* (Kotar et al. 1988) =

USNVC HIERARCHY: TSUGA CANADENSIS SATURATED FOREST ALLIANCE (I.A.8.N.g)

Acer rubrum - Fraxinus spp. - Betula papyrifera / Cornus canadensis Forest

Red Maple - Ash Species - Paper Birch / Canadian Bunchberry Forest

Red Maple - Ash - Birch Swamp Forest CEGL002071

DESCRIPTION: The canopy structure is variable, with cover ranging from open (25-60%) to closed (60-100%). Common canopy dominants include *Acer rubrum, Betula alleghaniensis, Betula papyrifera, Fraxinus nigra, Fraxinus pennsylvanica*, and occasional *Larix laricina, Pinus strobus*, and *Ulmus americana* (at least historically). *Pinus strobus* may form a patchy supercanopy above the hardwood canopy. Common shrubs include *Alnus incana*, and *Toxicodendron vernix* may be common in parts of the range. Other associates include *Ilex verticillata, Ribes* spp., and *Rubus idaeus ssp. strigosus (= Rubus strigosus)*. The herbaceous layer contains *Carex stipata, Impatiens capensis, Mitella nuda, Onoclea sensibilis, Osmunda cinnamomea, Osmunda claytoniana, Saxifraga pensylvanica*, and others (MNNHP 1993, Wovcha et al. 1995). A seepage swamp subtype can occur where steep sandy slopes and gravelly slopes merge with a river or stream terrace. The ground layer can be exceptionally diverse, with characteristic seepage species including *Angelica atropurpurea, Carex bromoides, Hydrocotyle americana, Poa paludigena, Saxifraga pensylvanica*, and *Symplocarpus foetidus* (MNNHP 1993, Wovcha et al. 1995).

Stands are typically found on muck and shallow peat on lakeplains and floodplains (MNNHP 1993).

COMMENTS: *2, MCS*. Hydrology of this type may be a combination of seasonally flooded and saturated. This type can arise as a result of logging cedar swamps, or where hydrology has been altered (E. Epstein pers. comm. 1999). *Fraxinus nigra* is less than 50% of the cover; if greater, then see the *Fraxinus nigra* type (CEGL002105). If *Larix laricina* is at least 25% of the canopy, then see *Larix laricina - Acer rubrum / (Rhamnus alnifolia, Vaccinium corymbosum*) Forest (CEGL005232) or *Larix laricina / Alnus incana* Forest (CEGL002471).

CONSERVATION RANK: *G4.* In Wisconsin, where the type is ranked S2, few high-quality occurrences have been documented (E. Epstein pers. comm. 1999).

DISTRIBUTION: This red maple swamp forest type is found in the northern parts of the Great Lake states region of the United States and in adjacent Canada, ranging from Minnesota east to Michigan and Ontario.

USFS ECOREGIONS: 212He:CCP, 212Hl:CCP, 212Hm:CCP, 212Hn:CCP, 212Ho:CCP, 212Hp:CCP, 212Hq:CCP, 212Hr:CCP, 212Hs:CCP, 212Ht:CCP, 212Hu:CCP, 212Hv:CCC, 212Hw:CCP, 212Hx:CCP, 212Hy:CCP, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jl:CPP, 212Jn:CPP, 212Jo:CPP, 212Kb:CCC, 212La:CPP, 212Mb:CPP, 212Na:CCP, 212Nb:CCP, 212Nc:CCC, 222Jc:CCC, 222Jg:CCC, 222Mc:CCC, 222Md:CCC, 222Na:CCC

CONSERVATION REGIONS: 35:C, 45:P, 46:C, 47:C, 48:C

STATES: MI MN WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

MI	southern swamp +
MN	mixed hardwood swamp; mixed hardwood swamp seepage subtype -
WI	northern hardwood swamp (red maple-ash-birch subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: FRAXINUS NIGRA - ACER RUBRUM SATURATED FOREST ALLIANCE (I.B.2.N.g)

Fraxinus nigra - Mixed Hardwoods - Conifers / Cornus sericea / Carex spp. Forest

Black Ash - Mixed Hardwoods - Conifers / Red-osier Dogwood / Sedge Species Forest

Black Ash - Mixed Hardwood Swamp CEGL002105

DESCRIPTION: Canopy structure is variable, ranging from 30-90% cover. The canopy is dominated by *Fraxinus nigra* (at least 50% cover), with a diverse mix of hardwoods and conifers in the main and sub canopies, including *Abies balsamea, Acer rubrum, Betula papyrifera, Betula alleghaniensis, Fraxinus pennsylvanica, Picea glauca, Populus balsamifera, Populus tremuloides, Thuja occidentalis, Tilia americana*, and *Ulmus americana*. Shrub and sapling species include *Abies balsamea, Acer spicatum, Cornus sericea, Corylus cornuta, Lonicera canadensis, Prunus virginiana, Ribes triste, Rubus idaeus*, and *Rubus pubescens*. Herbaceous species include *Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Athyrium filix-femina, Carex gracillima, Carex intumescens, Cinna latifolia, Circaea alpina, Clintonia borealis, Dryopteris carthusiana, Equisetum sylvaticum, Fragaria virginiana, Maianthemum canadense, Mitella nuda, Streptopus lanceolatus (= Streptopus roseus), Thalictrum pubescens*, and *Trientalis borealis*. Mosses include *Climacium dendroides, Plagiomnium* spp. (Sims et al. 1989, MNNHP 1993, Cleland et al. 1994, Harris et al. 1996, Chambers et al. 1997). A floodplain variant may also occur, with more hardwood dominance, with wetter species present, such as *Alnus incana, Calamagrostis canadensis*, and *Caltha palustris* (Harris et al. 1996). Diagnostic features include the dominance by *Fraxinus nigra*.

Sites are found on well-decomposed woody peat or fine mineral soil. The type is found where perched wet pockets occur on fine sandy, clay loamy to fine loamy soils in valleys with impeded drainage or near shores. Hydrology can vary from seasonally flooded to saturated. Conditions are often transitional to uplands (Sims et al. 1989, MNNHP 1993, Cleland et al. 1994, Chambers et al. 1997).

COMMENTS: *2, MCS*. This type description is essentially boreal to sub-boreal in content, emphasizing the northern/western part of the range. Southern/eastern stands may differ and may warrant a separate type. For examples, see the description in Michigan provided by the Manistee National Forest FEC, ELTP 74 (Cleland et al. 1994), which lists *Hamamelis virginiana, Salix* spp. *Viburnum acerifolium*, and *Viburnum nudum var. cassinoides* in the shrub layer; and descriptions from central Minnesota (MNNHP 1993, Wovcha et al. 1995), which include virtually no conifers, lack a number of boreal species, and include others, such as the shrubs *Ilex verticillata* and *Toxicodendron vernix*, and the herbs *Arisaema triphyllum, Glyceria striata, Impatiens capensis, Osmunda cinnamomea*, and *Onoclea sensibilis*. A seepage variant has also been described in Minnesota, containing *Carex bromoides* and *Symplocarpus foetidus*. This seepage variant may resemble the riparian variant described in northern Ontario (MNNHP 1993, Harris et al. 1996 -W34).

CONSERVATION RANK: *G4.*

DISTRIBUTION: This black ash - hardwood swamp forest type is found widely in the northern midwestern region of the United States and into the boreal region of central Canada, ranging from northern Indiana and northern Illinois northward to Ontario and Manitoba.

USFS ECOREGIONS: 212Ha:CCP, 212Hb:CCP, 212Hd:CCC, 212He:CCP, 212Hh:CCP, 212Hi:CCP, 212Hj:CCP, 212Hk:CCP, 212Hl:CCP, 212Hm:CCC, 212Hn:CCP, 212Ho:CCP, 212Hp:CCP, 212Hq:CCP, 212Hr:CCP, 212Hs:CCP, 212Ht:CCP, 212Hv:CCP, 212Hw:CCP, 212Hy:CCP, 212Ib:CCC, 212Ja:CCP, 212Jb:CCC, 212Jc:CCC, 212Jd:CCC, 212Je:CCP, 212Jf:CCP, 212Jj:CCP, 212Jk:CCP, 212Jl:CCP, 212Jm:CCC, 212Jn:CCP, 212Jo:CCP, 212Jr:CCP, 212Ka:CCC, 212Kb:CCC, 212La:CCC, 212Lb:CC?, 212Mb:CCC, 212Na:CCC, 212Nb:CCP, 212Nc:CCC, 212Oa:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Lc:CCC, 222Ld:CCC, 222Lf:CCC, 222Mc:CCC, 222Md:CCC, 222Na:CCC, 251Aa:CCC, 251Dc:CCC
CONSERVATION REGIONS: 35:C, 36:C, 46:C, 47:C, 48:C
STATES: IL IN? MI MN ND WI **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY:

IL	forested fen +
IN?	circumneutral seep +
MI	northern swamp =
MN	black ash swamp seepage subtype; black ash swamp -
WI	northern hardwood swamp (black ash subtype) =

OTHER SYNONYMY: Black Ash Hardwood and Mixedwood (V2) (Sims et al. 1989) =, Black Ash-Hardwoods-Herb Rich (V7) (Chambers et al. 1997) =, ELTP 74 - Black ash-basswood-Viola plant association (Cleland et al. 1994) =, Hardwood swamp: black ash (other hardwood): upland transition (W33) (Harris et al. 1996) F, Hardwood swamp: black ash (other hardwood): riparian (W34) (Harris et al. 1996) F

USNVC HIERARCHY: FRAXINUS NIGRA - ACER RUBRUM SATURATED FOREST ALLIANCE (I.B.2.N.g)

Populus tremuloides - Populus balsamifera - Mixed Hardwoods Lowland Forest

Quaking Aspen - Balsam Poplar - Mixed Hardwoods Lowland Forest

Aspen - Balsam Poplar Lowland Forest CEGL005036

DESCRIPTION: Stands are dominated by deciduous trees, but can contain a mix of evergreen species. Dominants include *Populus tremuloides* and *Populus balsamifera*. Other associates include *Abies balsamea, Betula papyrifera*, and *Picea glauca*. The shrub and herb layer are often fairly rich. Typical shrubs/saplings include *Abies balsamea, Alnus incana, Amelanchier* spp., *Cornus sericea, Cornus canadensis, Ribes* spp., *Rosa acicularis, Rubus idaeus*, and *Rubus pubescens*. The herb layer contains *Aralia nudicaulis, Symphyotrichum ciliolatum (= Aster ciliolatus), Eurybia macrophylla (= Aster macrophyllus), Anemone quinquefolia, Calamagrostis canadensis, Carex* spp., *Clintonia borealis, Dryopteris carthusiana, Equisetum* spp. (including *Equisetum sylvaticum*), *Galium triflorum, Maianthemum canadense, Mertensia paniculata, Mitella nuda, Petasites frigidus var. palmatus, Streptopus lanceolatus (= Streptopus roseus)*, and *Viola renifolia*. *Calamagrostis canadensis* can be abundant in the herb layer (Sims et al. 1989, McCarthy et al. 1994).

Stands are found on lower slopes and draws, occasionally under seepage conditions. Soils are deep, fresh to moist, poorly drained, and often fine-textured and of lacustrine origin (Sims et al. 1989).

COMMENTS: *2, MCS*. This type may arise from clearcut sites on moist spruce-fir or spruce-fir aspen sites. In Wisconsin, this type may arise from widespread logging of spruce-fir stands followed by catastrophic fires that burn the humus out of the soil and prevent spruce-fir regeneration (E. Epstein pers. comm. 1999). It appears that, as result of the cut, soils become very wet because the trees are no longer "pulling" moisture out of the soil horizons. *Alnus incana* can be common in these situations. In fact the ground layer of spruce-fir types such as *Picea glauca - Abies balsamea / Acer spicatum / Rubus pubescens* Forest (CEGL002446), at its moistest end, can resemble this type (see e.g. Sims et al. 1989 V24, which can contain *Alnus incana*). The hydrology of this type may be close to saturated.

CONSERVATION RANK: *G5.*

DISTRIBUTION: This lowland aspen forest is found in the boreal/sub-boreal regions of the Great Lakes region of the United States and adjacent Canada., ranging from Minnesota east to Michigan and Ontario, and perhaps elsewhere in central Canada.

USFS ECOREGIONS: 212Ib:CCC, 212Ja:CPP, 212La:CCC
CONSERVATION REGIONS: 48:C
STATES: MI? WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI? northern swamp
WI lowland aspen forest? (not tracked) ?

OTHER SYNONYMY: Balsam Poplar Hardwood and Mixedwood Forest (V1) (Sims et al. 1989) =

USNVC HIERARCHY: POPULUS TREMULOIDES TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Alnus incana Swamp Shrubland

Speckled Alder Swamp Shrubland

Speckled Alder Swamp CEGL002381

DESCRIPTION: The vegetation is dominated by tall shrubs, 2-8 m tall, with a moderately open to dense shrub canopy. There is an understory of shorter shrubs and herbaceous species. The density of the understory varies inversely with the tall-shrub canopy. The overstory is usually overwhelmingly dominated by *Alnus incana*, but where it is not as dominant, other shrubs, such as *Cornus sericea, Rubus idaeus, Salix* spp., *Spiraea alba*, and *Viburnum* spp., can be found. The herbaceous layer contains species such as *Symphyotrichum lanceolatum var. lanceolatum (= Aster simplex), Calamagrostis canadensis, Caltha palustris, Carex lacustris, Carex prairea, Eupatorium maculatum, Impatiens capensis, Lycopus uniflorus, Scirpus atrovirens, Symplocarpus foetidus, Thelypteris palustris*, and *Typha* spp. Mosses include *Climacium dendroides*. Where the tall-shrub canopy is open, the graminoids can become dense. Trees are found in many stands, including *Acer rubrum, Fraxinus nigra*, and *Thuja occidentalis* (Anderson 1982, Curtis 1959, Harris et al. 1996, MNNHP 1993). Where stands border on saturated conditions with peaty soils, peatland species such as *Chamaedaphne calyculata* and *Sphagnum* spp. may be present.

Sites are typically along streams, lakeshores, edges of beaver meadows, swales associated with small streams in peatlands or upland forests, or near seeps. Most have little to no slope, but some sites are on moderate slopes. Hydrologic conditions can range from temporarily flooded to seasonally flooded, or even saturated, but are typically seasonally flooded/saturated. The water is non-stagnant, nutrient-rich, and often slightly calcareous (Curtis 1959). Soils are wet, often mucks or peats (Anderson 1982, Chapman et al. 1989). This community is found on Precambrian Shield bedrock that is overlaid with sandy loam soils, which are moderately well-drained and deep (>60 cm). In northeastern Minnesota stands can occur on northeast- and south-facing slopes that are moderate to steep, with slopes ranging from 4 to 45% (Ohmann and Ream 1971). The climate is highly variable, with temperature extremes between -46 and 38 degrees C and 58-91 cm precipitation.

COMMENTS: *3, MCS*. Type has a very broad distribution and there may be a need to separate a northern (more boreal) type from a southern (more temperate) type based on floristic differences. Hydrology may be quite variable, ranging from temporarily flooded to semipermanently flooded. In Ohio, this association sometimes merges with *Alnus serrulata* stands in the *Alnus serrulata* Eastern Shrubland type (CEGL005082). With increasing tree canopy cover, this association can be similar to *Larix laricina* forest types, *Thuja occidentalis* saturated forest types and *Fraxinus nigra - Acer rubrum* saturated forest types.

CONSERVATION RANK: *G5?*.

DISTRIBUTION: This alder swamp community type is widespread in the midwestern and northeastern United States and southern Canada, ranging from Maine west to Manitoba, south to Iowa, and east to New Jersey.

USFS ECOREGIONS: 212Ha:CCP, 212Hb:CCP, 212He:CCP, 212Hh:CCP, 212Hi:CCP, 212Hj:CCP, 212Hk:CCP, 212Hl:CCC, 212Hm:CCP, 212Hn:CCP, 212Ho:CCP, 212Hp:CCP, 212Hq:CCC, 212Hr:CCP, 212Hs:CCP, 212Ht:CCC, 212Hv:CCP, 212Hw:CCP, 212Hy:CCP, 212Ib:CCC, 212Ja:CCP, 212Jb:CCP, 212Jc:CCP, 212Je:CCP, 212Jf:CCC, 212Jj:CCP, 212Jk:CCP, 212Jl:CCP, 212Jm:CCP, 212Jn:CCP, 212Jo:CCP, 212Jr:CCC, 212Ka:CCP, 212Kb:CCC, 212La:CCC, 212Lb:CCC, 212Mb:CPP, 212Na:CCC, 212Nb:CCP, 212Nc:CCC, 221:C, 222Je:CCC, 222Lb:CCC, 222Lc:CCC, 222Mc:CCC, 222Md:CCC, 222Na:CCC, 251Aa:CCC, 251Ab:CCC, M212:C

CONSERVATION REGIONS: 34:C, 35:C, 46:C, 47:C, 48:C

STATES: IA IL IN? MA ME MI MN ND NH NJ NY OH PA WI **PROVINCES:** MB? ON

MIDWEST HERITAGE SYNONYMY:

IL	shrub swamp (N) +
IN?	shrub swamp ?
MI	northern shrub thicket =
MN	alder swamp =
OH	alder shrub swamp +
WI	alder thicket =

OTHER SYNONYMY: Alder Thicket (Curtis 1959) =, Thicket Swamp: Speckled Alder / Bluejoint Grass type , W35 (Harris et al. 1996) =, Alder Shrub Swamp (Anderson and Barren 1991) =

USNVC HIERARCHY: ALNUS INCANA SEASONALLY FLOODED SHRUBLAND ALLIANCE (III.B.2.N.e)

Alnus serrulata Eastern Shrubland

Smooth Alder Eastern Shrubland

Smooth Alder Swamp CEGL005082

DESCRIPTION: The vegetation is dominated by tall shrublands, and characterized by *Alnus serrulata, Physocarpus opulifolius, Viburnum recognitum, Cornus* spp., and *Salix* spp. Saplings of *Acer rubrum* are typical. Herbaceous associates include *Calamagrostis canadensis, Osmunda regalis, Thelypteris palustris, Galium* spp., *Typha latifolia, Peltandra virginica*, and *Carex stricta*. Other shrubs present include *Cephalanthus occidentalis, Decodon verticillatus, Ilex verticillata, Rhododendron viscosum*, and *Sambucus canadensis* (Anderson 1996, Fike 1999).

These shrublands are found on muck overlying mineral soils (peat deposits are not typical) of upland marsh borders, at the edges of red maple swamps, or in acid colluvium at bases of slopes. The pH of these systems is broadly circumneutral to somewhat calcareous (Fike 1999).

COMMENTS: *3, ECS*. This type overlaps with *Alnus incana* Swamp Shrubland (CEGL002381) in Ohio.

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This smooth alder swamp is found widely throughout the northeastern United States, ranging from Maine south to Rhode Island and Connecticut, west to Ohio and Pennsylvania, and possibly into eastern Canada.

USFS ECOREGIONS: 212:C, 221Ec:CCP, 221Ed:CCP, 221Ef:CCC, 222:?, M212:C, M221Ab:PPP, M221Ac:PPP
CONSERVATION REGIONS: 49:C, 59:C
STATES: CT MA ME NH NY OH PA RI VT **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: OH alder shrub swamp +

OTHER SYNONYMY: Smooth alder shrub thicket (CAP)

USNVC HIERARCHY: ALNUS SERRULATA SEASONALLY FLOODED SHRUBLAND ALLIANCE (III.B.2.N.e)

Acer (rubrum, saccharinum) - Fraxinus spp. - Ulmus americana Forest

(Red Maple, Silver Maple) - Ash Species - American Elm Forest

Maple - Ash - Elm Swamp Forest CEGL005038

DESCRIPTION: This community is a wet bottomland deciduous hardwood forest. Canopy cover is complete and dominated by *Acer rubrum, Acer saccharinum* (in parts of the range), *Fraxinus pennsylvanica*, and *Ulmus americana*. *Ulmus americana* was probably the dominant species in the type prior to the introduction of Dutch elm disease (*Ceratostomella ulmi*) around 1930. *Quercus palustris, Quercus bicolor, Quercus macrocarpa*, and *Nyssa sylvatica* are also commonly encountered. The subcanopy consists primarily of *Acer rubrum* and *Ulmus americana* underlain by a shrub layer which may contain a mixture of *Carpinus caroliniana, Ilex verticillata, Lindera benzoin, Sambucus canadensis, Viburnum recognitum*, and *Alnus incana ssp. rugosa (= Alnus rugosa)* (in the northern parts of its range). Vines often dominate the forest understory including *Parthenocissus quinquefolia* and *Toxicodendron radicans*. The depth and duration of flooding and light penetrating the forest canopy regulate density and diversity found in the herbaceous layer. *Impatiens capensis, Arisaema triphyllum, Glyceria striata*, and a variety of *Juncus* spp. and *Carex* spp. are among the most common species encountered (see Anderson 1996 for a more comprehensive list). *Arundinaria gigantea* can form dense thickets within this forest at its southern limits (TNC 1995a).

Stands occur in wetland depressions on level or undulating topography or in backwater sloughs away from direct flooding on the floodplain. Soils can be deep (>100 cm) silt loam, silty clay loam, to clay loam. The water table is at or near the surface for at least a few months of the year, and ponding is common. During the summer the soils can become quite dry.

Natural disturbances which can affect this community include prolonged saturation and severe storms (with excessive winds and lightning).

COMMENTS: *2, MCS*. Golet et al. (1993) describe regional variation in northeastern United States red maple swamps. Subtypes or separate types may need to be recognized. *Ulmus americana* is no longer a dominant canopy component of this natural community due to the ravages of Dutch elm disease. *Phalaris arundinacea* can become a serious problem in this type, due to grazing, ditching, and the open canopy caused by Dutch elm disease. This type is primarily found in the glaciated portions of the northeastern United States. The distribution limits toward the south are not yet well defined, but it does not occur in southern Illinois or Indiana. Concept and distribution of this association in the Southeast needs assessment.

CONSERVATION RANK: *G4?.* Few good EOs remain in southern Wisconsin (E. Epstein pers. comm. 1999)

DISTRIBUTION: This silver and red maple forest swamp community type occurs in the east-central United States and adjacent Canada, ranging from Wisconsin east to central Pennsylvania, northward to New York and Ontario, and possibly elsewhere in eastern Canada.

USFS ECOREGIONS: 212Fb:CPP, 212Hb:CCP, 212Hd:CCC, 212He:CCC, 212Je:CPP, 212Ka:CPP, 221Ed:CC?, 221Ef:CCC, 221Fa:CCC, 221Fb:CCC, 222Ga:CCC, 222Ha:CCC, 222Hb:CCC, 222Ia:CCC, 222Id:CCP, 222If:CCC, 222Ig:CCC, 222Ja:CC?, 222Je:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ke:CCC, 222Kf:CCC, 251Dg:CCC, M221:?, M222A:??
CONSERVATION REGIONS: 36:C, 44:C, 45:C, 46:C, 47:P, 48:C, 49:C, 59:?
STATES: IL IN MI NY OH PA WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	wet floodplain forest (S) +
IN	wet floodplain forest +
MI	southern swamp +
OH	mixed swamp; maple-ash swamp I
WI	southern hardwood swamp (red maple-ash subtype) =

OTHER SYNONYMY: Maple-Ash-Oak Swamps (Anderson 1996) =

USNVC HIERARCHY: ACER RUBRUM - FRAXINUS PENNSYLVANICA SEASONALLY FLOODED FOREST ALLIANCE (I.B.2.N.e)

Fraxinus pennsylvanica - Celtis occidentalis - Tilia americana - (Quercus macrocarpa) Forest

Green Ash - Northern Hackberry - American Basswood - (Bur Oak) Forest

Ash - Elm - Mixed Lowland Hardwood Forest CEGL002081

DESCRIPTION: This community is dominated by deciduous trees that can tolerate the saturated soil conditions. The tree canopy is typically closed and often has a mixture of several tree species. Among the most abundant are *Celtis occidentalis, Fraxinus pennsylvanica*, and *Tilia americana*. *Quercus macrocarpa* is often abundant in the prairie-forest border region. Other common tree species include *Acer negundo, Ulmus americana, Betula papyrifera*, and *Populus tremuloides*. The shrub layer is patchy and composed of both upland and lowland shrubs. The herbaceous layer contains a variety of upland herbs. (MNNHP 1993).

This community is found in stream and river valleys, on low plateaus, and along lake margins. The sites have seasonally high (within the rooting zone) water tables but do not flood regularly. The mineral soils are deep, fertile, and moderately well-drained to poorly drained (Kurmis et al. 1986, MNNHP 1993).

COMMENTS: *2, MCS*. Ground layer composition of this type needs better characterization. In the northern tallgrass prairie region, this type concept overlaps with *Tilia americana - (Quercus macrocarpa) / Ostrya virginiana* Forest (CEGL002012), but, unlike that type, this type is generally found in bottomlands that are outside of the floodplain. A similar type is defined for stands in Missouri (*Fraxinus pennsylvanica - Celtis spp. - Quercus spp. - Platanus occidentalis* Bottomland Forest (CEGL002410)).

CONSERVATION RANK: *G4?.*

DISTRIBUTION: This ash-elm lowland hardwood forest community type is found in the northern tallgrass region of the midwestern United States and Canada.

USFS ECOREGIONS: 212Kb:CCC, 212Mb:CCC, 212Na:CCC, 212Nb:CCP, 212Nc:CCC, 222Lc:CCC, 222Lf:CCC, 222Ma:CCC, 222Mb:CCC, 222Mc:CCC, 222Me:CCC, 222Na:CCC, 251Aa:CCC, 251Ab:CCC, 251Ba:CCC, 251Bb:CCC
CONSERVATION REGIONS: 35:C, 46:C, 47:C
STATES: MN ND **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY: MN lowland hardwood forest +

OTHER SYNONYMY: Ash-Elm-Trillium (Kurmis et al. 1986) =. uncertain if equivalent

USNVC HIERARCHY: FRAXINUS PENNSYLVANICA - ULMUS AMERICANA - CELTIS (OCCIDENTALIS, LAEVIGATA) TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Fraxinus pennsylvanica - Celtis spp. - Quercus spp. - Platanus occidentalis Bottomland Forest

Green Ash - Hackberry Species - Oak Species - Sycamore Bottomland Forest

Ash - Oak - Sycamore Mesic Bottomland Forest CEGL002410

DESCRIPTION: The species in the dominant tree layer include *Celtis occidentalis, Fraxinus pennsylvanica, Platanus occidentalis, Quercus macrocarpa* (or more rarely *Quercus alba*). *Laportea canadensis* is common in the ground layer.

Stands of this forest association occur on level to gently sloping terraces and levees of stream and river floodplains, typically on larger streams. Soils are moderately well-drained and moist throughout the year, but only wet in spring. Ponding is typically absent (Nelson 1985).

COMMENTS: *3, MCS*. See similar concept of bottomland forest *Fraxinus pennsylvanica - Celtis occidentalis - Tilia americana - (Quercus macrocarpa)* Forest (CEGL002081), but that type is in an upland formation. Compare to *Acer saccharum - Quercus rubra - Carya cordiformis / Asimina triloba* Forest (CEGL002060), which occurs on smaller streams. More information on this type in Missouri is available from T. Nigh (pers. comm. 1998).

CONSERVATION RANK: *G3G4.* Most sites have been cleared for agriculture (M. Leahy pers. comm. 1999).

DISTRIBUTION: This ash - oak - sycamore mesic bottomland forest is found in Missouri and possibly other parts of the southeastern United States.

USFS ECOREGIONS: 222Ac:CCC, 222Ad:CCC, 222Ae:CCC, 222Af:CCC, 222Aj:CCC, 222Ak:CCC, 222Am:CCC, 251Cd:CPP, 251Eb:CCC
CONSERVATION REGIONS: 37:C, 38:C
STATES: MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO mesic bottomland forest +

OTHER SYNONYMY:

USNVC HIERARCHY: PLATANUS OCCIDENTALIS - (FRAXINUS PENNSYLVANICA, CELTIS LAEVIGATA, ACER SACCHARINUM) TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Quercus palustris - Quercus bicolor - (Liquidambar styraciflua) Mixed Hardwood Forest

Pin Oak - Swamp White Oak - (Sweetgum) Mixed Hardwood Forest

Pin Oak Mixed Hardwood Forest CEGL002432

DESCRIPTION: Stands contain a closed to partially open canopy dominated by *Quercus palustris* and *Acer rubrum*. Oaks should comprise at least 25% of the dominants. Other typical canopy associates may dominate, including *Liquidambar styraciflua, Nyssa sylvatica*, and *Quercus bicolor*. Other wetland hardwood species can occur, including *Acer saccharinum, Betula nigra, Quercus macrocarpa*, and *Quercus rubra*. Shrub and vine species are variable and may include *Cornus* spp., *Lindera benzoin, Parthenocissus quinquefolia*, and *Sambucus canadensis*. Herbaceous species also vary widely (see Anderson 1996 maple-ash-oak type for a list of species). Some herbs reported from this or related vegetation in the bluegrass basin of Kentucky by Bryant (1978) include *Lycopus virginicus, Alisma subcordatum, Ludwigia alternifolia, Penthorum sedoides, Polygala sanguinea, Polygala verticillata, Polygonum sagittatum, Conoclinium coelestinum (= Eupatorium coelestinum), Eupatorium perfoliatum, Mimulus ringens, Liparis liliifolia, Platanthera peramoena, Saururus cernuus, Ophioglossum engelmannii, Carex squarrosa, Scirpus atrovirens, Juncus effusus, Eleocharis* spp., and *Luzula* sp. This more acidic swamp vegetation would be unusual in the Central Bluegrass, but occurs more frequently in the Knobs Transition Region (Meijer et al. 1981).

This community is found on flat, poorly drained areas. Many stands are seasonally wet, with a seasonally saturated hydrology. It is primarily, but not exclusively, found in unglaciated terrain. Habitat in Kentucky includes terraces which are not frequently flooded, or in upland swales in the Karst Plain.

COMMENTS: *3, MCS*. Type is similar to *Quercus palustris - Quercus bicolor - Nyssa sylvatica - Acer rubrum* Sand Flatwoods Forest (CEGL002100); it should also be compared with *Quercus bicolor / Vaccinium corymbosum / Carex stipata* Forest (CEGL006241). Related Arkansas vegetation is found in *Quercus palustris* Pond Forest (CEGL007809). This type is broadly defined to include stands with *Quercus palustris, Quercus bicolor*, and *Acer rubrum* as dominants, and *Liquidambar styraciflua* as a diagnostic species. Perhaps *Quercus palustris* and *Quercus bicolor* should together represent between 25-50% of the dominance (cover, basal area). However, there are stands in central Illinois and Missouri beyond the range of *Liquidambar styraciflua* that have been placed, at least temporarily, in this type. Stands in the Western Allegheny Plateau ecoregion may differ from stands further west. Stands in central Indiana and northwest Ohio (lakeplain) with *Fagus grandifolia* and *Quercus palustris* are placed in *Fagus grandifolia - Acer saccharum - Quercus bicolor - Acer rubrum* Flatwoods Forest (CEGL005173) or without beech, with *Quercus bicolor*, and till or clayey lacustrine deposits into *Quercus palustris - Quercus bicolor - Acer rubrum* Flatwoods Forest (CEGL005037). This community is found in extreme southwest Ohio on the Illinoisan till plain. In Indiana, which also contains the Illinoisan till plain, the type occurs more widely. Bryant (1978) reports forests on "flat, poorly drained land" in an abandoned Pliocene channel of the Kentucky River in the Inner Bluegrass Subsection (222Fa).

CONSERVATION RANK: *G3G4.* Many stands have been drained and converted to agriculture (M. Leahy pers. comm. 1999).

DISTRIBUTION: This pin oak - swamp white oak forest community type is found in the central United States, ranging from Iowa, Missouri, Kentucky, and Tennessee east in a band to southwestern Ohio and possibly to Pennsylvania and West Virginia.

USFS ECOREGIONS: 221Ec:CCP, 221Ed:CCP, 221Ef:CCC, 221Eg:CCC, 221F:CC, 221He:CCC, 222Ab:C??, 222Ag:C??, 222Ch:CPP, 222Db:CCC, 222De:CCP, 222Di:CCP, 222Ej:CCC, 222Ek:CCP, 222Em:CCC, 222Fa:CCC, 222Fe:CCC, 222Ff:CCC, 222Ga:CCC, 222Gc:CCC, 222Ge:CCC, 222H:CC, 234An:CCC, 251Cc:CCC, 251Cf:CCC, M222Ab:C??
CONSERVATION REGIONS: 36:C, 38:?, 42:C, 43:?, 44:C, 48:C, 49:C, 50:C
STATES: IA IL IN KY MO OH PA? TN? WV? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	wet floodplain forest (S); wet-mesic floodplain forest (N) I
IN	wet-mesic floodplain forest +
MO	wet-mesic bottomland forest +
OH	maple-ash-oak swamps +

OTHER SYNONYMY: maple-ash-oak swamps (Anderson 1996) B. Anderson (1996) appears to lump maple-ash and maple-ash-oak together. Here, they are separated, as done in Anderson (1982) with maple-ash having less than 25% oaks., pin oak-red maple-elm-sweet gum associes (Braun 1936)

USNVC HIERARCHY: QUERCUS PALUSTRIS - (QUERCUS BICOLOR) SEASONALLY FLOODED FOREST ALLIANCE (I.B.2.N.e)

Cephalanthus occidentalis / Carex spp. Northern Shrubland

Buttonbush / Sedge Species Northern Shrubland

Northern Buttonbush Swamp CEGL002190

DESCRIPTION: The shrub layer can vary from very open to closed (20-80%). *Cephalanthus occidentalis* typically comprises nearly 90% of the shrub layer in waters 1-2 m deep. Other shrubs commonly encountered include *Cornus sericea, Decodon verticillatus, Ilex verticillata, Rosa palustris*, and *Salix nigra*. The herbaceous layer can be very sparse, due to flooding. Rooted or floating aquatics may dominate, including *Lemna minor* and *Nuphar lutea ssp. advena (= Nuphar advena)*. Herbs present on the shallow margins include *Bidens frondosa, Boehmeria cylindrica, Carex lacustris, Glyceria striata*, and others. In Missouri *Hibiscus laevis (= Hibiscus militaris)* is common. A scattered tree canopy may occur, including the following species: *Acer rubrum, Acer saccharinum, Fraxinus nigra, Fraxinus pennsylvanica*, and *Ulmus americana* (Anderson 1996, Faber-Langendoen and Maycock 1989).

This wet shrubland community occupies shallow water depressions, oxbow ponds, and backwater sloughs of stream and river floodplains throughout swampy forested areas in glaciated terrain. Inundation is usually continuous throughout the year, but these sites can become dry in mid or late summer or during periods of prolonged drought (Faber-Langendoen and Maycock 1989). Soils are deep (>100 cm) consisting of peat or muck over alluvial parent material.

COMMENTS: *2, MCS*. The limits of glaciation used to define the southern boundary of this type include all glacial periods. It may, however, be more practical to use the ecoregion map divisions, such that the southern limit is approximately equal to the southern boundaries of Sections 251C, 222G, 222H and 221F. A rule as to the percentage dominance of *Cephalanthus occidentalis* (e.g. at least 50% cover) is probably needed to distinguish this type from dogwood-willow swamps. See also *Cephalanthus occidentalis* Semipermanently Flooded Shrubland [Placeholder] (CEGL003908), found in Lower New England and the mid-Atlantic and central Appalachian regions of the eastern United States.

CONSERVATION RANK: *G4.*

DISTRIBUTION: This buttonbush swamp shrubland community occurs throughout glaciated regions of the midwestern and northeastern United States and adjacent Canada, ranging from northern Missouri north to southern Michigan, east to Ohio and southern Ontario, and south to Indiana and Illinois.

USFS ECOREGIONS: 212Hv:CCC, 221Ec:CPP, 221Ed:CPP, 221Ef:CPP, 221Fa:CCC, 221Fc:CCC, 222Ga:CCC, 222Gb:CCC, 222Ge:CCC, 222Ha:CCC, 222Hb:CCC, 222Hf:CCP, 222Jb:CCC, 222Jc:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kg:CCC, 222Kh:CCC, 222Kj:CCC, 251Cc:CCC, 251Cf:CCC, 251Cj:CCC, 251Ck:CCC, 251Dd:CCP, 251De:CCP, 251Dg:CCC, 251Dh:CCP, M221:P

CONSERVATION REGIONS: 36:C, 44:C, 45:C, 46:C, 48:C, 49:C

STATES: IL IN MI MO OH **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	pond (N); pond (S); shrub swamp (N) I
IN	shrub swamp +
MI	inundated shrub swamp =
MO	shrub swamp +
OH	buttonbush shrub swamp =

OTHER SYNONYMY:

USNVC HIERARCHY: CEPHALANTHUS OCCIDENTALIS SEMIPERMANENTLY FLOODED SHRUBLAND ALLIANCE (III.B.2.N.f)

Cornus sericea - Salix (bebbiana, discolor, petiolaris) / Calamagrostis stricta Shrubland

Red-osier Dogwood - (Bebb's Willow, Pussy Willow, Meadow Willow) / Western Bluejoint Shrubland

Dogwood - Mixed Willow Shrub Meadow CEGL002187

DESCRIPTION: Shrub cover is at least 25% but does not become thick. Dominant species include *Cornus sericea, Salix bebbiana, Salix discolor, Salix petiolaris*, and *Spiraea alba*. Herbaceous species are typical of wet herbaceous meadows, and include the sedges *Carex aquatilis, Carex atherodes, Carex haydenii, Carex lacustris, Carex pellita (= Carex lanuginosa), Carex rostrata, Carex stricta*, or grasses *Calamagrostis canadensis* and *Calamagrostis stricta*. Forbs include *Asclepias incarnata, Symphyotrichum lanceolatum (= Aster lanceolatus), Symphyotrichum lateriflorum (= Aster lateriflorus), Symphyotrichum novae-angliae (= Aster novae-angliae), Symphyotrichum puniceum (= Aster puniceus), Chelone glabra, Eupatorium maculatum*, and *Mentha arvensis* (MNNHP 1993, E. Epstein pers. comm. 1999). In northern Illinois prairie meadow species may include *Asclepias purpurascens, Coreopsis tripteris, Gentianella quinquefolia (= Gentiana quinquefolia)*, and *Heliopsis helianthoides* (Steffen and Anderson 1997).

Stands may occur along stream courses or adjacent to lakes or in upland depressions. Soils are wet mineral, muck, or shallow peat (<0.5 m). Standing water is present in the spring and after heavy rains, but the water table draws down by mid-summer. Seepage areas may also occur (MNNHP 1993).

The wet shrub meadow type described here may succeed to shrub swamps (CEGL002186), particularly in the absence of fire, or if the water table is lowered by drought or ditching.

COMMENTS: *2, MCS*. A seepage subtype may be needed. Information in Illinois is taken from a 1998 draft classification document for the Chicago Wilderness area (their wet-mesic fine-textured soil shrubland, Steffen et al. 1997), though stands may better fit under a temporarily flooded hydrology, rather than seasonally flooded. In Wisconsin, this type does occur, but seems intermediate between sedge meadow and shrub swamp, and may result from either fire disruption or hydrologic alteration, rather than forming a natural community (E. Epstein pers. comm. 1999).

CONSERVATION RANK: *G3G4.* Type has been extensively impacted by agricultural drainage and clearing. However, it may be that the type is a result of either fire disruption or hydrologic alteration, rather than forming a natural community (E. Epstein pers. comm. 1999).

DISTRIBUTION: This wet shrub meadow type is found in the northern prairie-forest border area of the midwestern United States and Canada, extending from Illinois to Manitoba.

USFS ECOREGIONS: 212Kb:CCC, 212Mb:CCC, 212Na:CCP, 212Nb:CCP, 212Nc:CCC, 222Mc:CCC, 222Md:CCC, 222Na:CCC, 251Aa:CCC, 251Ab:CCC
CONSERVATION REGIONS: 26:C, 34:C, 35:C, 46:C, 47:C
STATES: IA IL MN ND WI **PROVINCES:** MB

MIDWEST HERITAGE SYNONYMY:

IL	shrub prairie +
MN	wet meadow shrub subtype =
WI	wet meadow (shrub subtype (not tracked)) ?

OTHER SYNONYMY:

USNVC HIERARCHY: CORNUS SERICEA - SALIX SPP. SEASONALLY FLOODED SHRUBLAND ALLIANCE (III.B.2.N.e)

Cornus sericea - Salix spp. - (Rosa palustris) Shrubland

Red-osier Dogwood - Willow Species - (Swamp Rose) Shrubland

Dogwood - Willow Swamp CEGL002186

DESCRIPTION: The vegetation is dominated by tall shrubs between 1 and 3 m tall, with at least 25% cover, and often very dense (>60% cover). More open stands may have high graminoid cover. Trees may be scattered, but cover less than 25%. Composition of the shrub layer is quite diverse, primarily due to the diversity of *Salix* spp., which collectively share dominance with *Cornus sericea*. Willow species include *Salix bebbiana, Salix discolor, Salix eriocephala, Salix exigua (= Salix interior), Salix fragilis*, and *Salix petiolaris*. Other shrubs associates include *Cephalanthus occidentalis* (southeastward), *Cornus amomum, Ribes americanum, Rosa palustris* (more common eastward), *Rosa blanda* and *Rosa woodsii var. woodsii (= Rosa macounii)* (more common westward), *Rubus pubescens* (northward), *Rubus idaeus ssp. strigosus (= Rubus strigosus), Sambucus canadensis, Spiraea alba*, and *Viburnum lentago*. Woody vines present include *Clematis virginiana, Parthenocissus quinquefolia*, and *Toxicodendron radicans*. Characteristic herbs include *Asclepias incarnata, Symphyotrichum lanceolatum var. lanceolatum (= Aster simplex), Calamagrostis canadensis, Eupatorium maculatum, Glyceria striata (= Glyceria nervata), Impatiens capensis (= Impatiens biflora), Lycopus americanus, Lycopus uniflorus, Phalaris arundinacea, Solidago gigantea*, and *Thalictrum dasycarpum*. A variety of sedges may dominate more open stands, including *Carex lacustris* and *Carex stricta*. Tree species include *Acer rubrum, Fraxinus pennsylvanica*, and *Ulmus americana* (Curtis 1959, White and Madany 1978, Chapman et al. 1989, Reschke 1990, MNNHP 1993, Harris et al. 1996).

Stands are found along streams and lakes, or in upland depressions. Hydrology is variable, but is typically seasonally flooded. Soils are wet, organic, and minerotrophic, with either highly decomposed peat or fine mineral soils (Curtis 1959, Harris et al. 1996).

Shrub swamps may naturally succeed herbaceous wet meadows as part of successional series in lakes and ponds. They may also originate from clearing of forested swamps (Curtis 1959), or draining of wet meadows (MNNHP 1993).

COMMENTS: *2, MCS*. The closely related shrub meadow type is *Cornus sericea - Salix (bebbiana, discolor, petiolaris) / Calamagrostis stricta* Shrubland (CEGL002187), with which this type intergrades, and which generally has a more open shrub cover (25-50% cover). It's conceivable that the two types could be combined. It is also possible that a number of different *Salix* and *Cornus* shrub swamp types could be recognized with further study. A boreal/sub-boreal type may also be needed (e.g. Harris et al. 1996). Rich shrub fens, typically on a more peaty substrate or with calcareous indicators overlap to some degree with this type, but are a separate group. In Ontario, a coarsely defined type, Mixed Deciduous Thicket Swamp Shrubland (CEGL005086), covers a number of more locally dominant species recorded there, e.g., shrub swamps dominated by any of the following: *Acer spicatum, Lindera benzoin, Viburnum dentatum, Viburnum lentago* (Bakowsky and Lee 1996, Lee et al. 1998). In New York, this type may occur on the Great Lakes plain.

CONSERVATION RANK: *G5.*

DISTRIBUTION: This dogwood - willow shrub swamp community type is found in the upper midwestern region of the United States and adjacent Canada, ranging from Minnesota east to western New York and Ontario, south to Illinois and Indiana.

USFS ECOREGIONS: 212Hb:CPP, 212He:CP?, 212Hh:CP?, 212Hi:CP?, 212Hj:CP?, 212Hl:CP?, 212Hm:CP?, 212Hr:CP?, 212Hs:CP?, 212Ht:CPP, 212Hu:CPP, 212Hv:CP?, 212Hw:CP?, 212Hx:CP?, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Je:CPP, 212Jf:CPP, 212Jj:CPP, 212Jl:CPP, 212Jm:CPP, 212Ka:CCP, 212Kb:CCC, 212La:CPP, 212Mb:CPP, 212Na:CCP, 212Nb:CCP, 212Nc:CCC, 221Ea:CCC, 222Ib:CPP, 222Ic:CPP, 222Id:CPP, 222Ja:CC?, 222Je:CCC, 222Ji:CCC, 222Ke:CCC, 222Kf:CCC, 222Lc:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 222Na:CCC, 251Ba:CCC, 251Cf:CCC

CONSERVATION REGIONS: 35:C, 36:C, 45:C, 46:C, 47:C, 48:C, 49:C

STATES: IL IN MI MN NY OH WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	shrub swamp (N) I
IN	shrub swamp +
MI	southern shrub-carr +
MN	willow swamp =
OH	mixed shrub swamp +
WI	shrub carr =

OTHER SYNONYMY: Shrub Carr (Curtis 1959) =, Thicket swamp: tall willow (W36) (Harris et al. 1996) =, shrub swamps (Anderson 1996) B

USNVC HIERARCHY: CORNUS SERICEA - SALIX SPP. SEASONALLY FLOODED SHRUBLAND ALLIANCE (III.B.2.N.e)

Cornus spp. - Salix spp. - Vaccinium corymbosum - Rhamnus alnifolia - Toxicodendron vernix Shrubland

Dogwood Species - Willow Species - Highbush Blueberry - Alderleaf Buckthorn - Poison-sumac Shrubland

Dogwood - Willow - Blueberry Swamp CEGL005083

DESCRIPTION: The vegetation is dominated by tall shrubs, with at least 25% cover, and a fairly continuous covering of sphagnum moss. Herbaceous cover is variable, and tree cover is less than 10%. The dominant shrubs are *Photinia melanocarpa (= Aronia melanocarpa), Cornus sericea (= Cornus stolonifera), Gaylussacia baccata, Ilex verticillata, Nemopanthus mucronatus, Toxicodendron vernix (= Rhus vernix)*, and *Vaccinium corymbosum*. A sphagnum mat is fairly continuous. The herbaceous layer is not well characterized. The exotic shrub *Frangula alnus (= Rhamnus frangula)* can be problematic (White and Madany 1978, Anderson 1982, Homoya et al. 1985).

Stands are found in kettle lakes associated with kettle-kame-end moraine topography. Soils are saturated peat. The tall-shrub zone occupies the most consolidated peat (White and Madany 1978, Anderson 1982, Homoya et al. 1985).

COMMENTS: *2, MCS*. This is the tall-shrub counterpart to the low-shrub bog in kettle lakes, *Chamaedaphne calyculata / Carex oligosperma - Eriophorum virginicum* Dwarf-shrubland (CEGL005092). It is distinguished from the *Vaccinium corymbosum* (highbush blueberry) bogs, *Vaccinium corymbosum - Gaylussacia baccata - Photinia melanocarpa / Calla palustris* Shrubland (CEGL005085), by the more diverse shrub layer, and less than 25% (?) cover of *Vaccinium corymbosum*. However, this distinction needs to be further studied. In addition, this tall shrub zone is not always tracked by state Heritage programs, being too small a zone or too transitional a type. It also overlaps in concept with *Cornus amomum - Salix spp. - Toxicodendron vernix - Rhamnus lanceolata* Fen Shrubland (CEGL005087); however, that type is typically associated with calcareous fens.

CONSERVATION RANK: *G4?.*

DISTRIBUTION: This tall-shrub swamp or poor fen type is found in kettle lake areas from southern parts of the Great Lake states and northern parts of adjacent central states of the midwestern United States. Stands range from the southern parts of Wisconsin, Michigan, and Ontario to northern parts of Illinois, Indiana, and Ohio.

USFS ECOREGIONS: 222Kf:CCC, 222Kg:CCC
CONSERVATION REGIONS: 46:C, 48:C
STATES: IL IN? MI? OH WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	tall shrub bog =
IN?	shrub swamp ?
MI?	southern shrub-carr
OH	mixed shrub swamp +
WI	southern tall shrub swamp (not tracked) ?

OTHER SYNONYMY:

USNVC HIERARCHY: CORNUS SERICEA - PHOTINIA MELANOCARPA - TOXICODENDRON VERNIX SATURATED SHRUBLAND ALLIANCE (III.B.2.N.g)

Acer saccharinum - Ulmus americana - (Populus deltoides) Forest

Silver Maple - American Elm - (Eastern Cottonwood) Forest

Silver Maple - Elm - (Cottonwood) Forest CEGL002586

DESCRIPTION: Canopy cover is more-or-less closed and dominated by *Acer saccharinum*. Codominants may include *Populus deltoides, Platanus occidentalis, Ulmus americana, Ulmus rubra, Salix nigra, Acer negundo, Betula nigra, Celtis occidentalis*, and *Fraxinus pennsylvanica*. The shrub and sapling layer is often open (<25% cover). Species that may be present include *Sambucus canadensis* or *Lindera benzoin*. Woody and herbaceous vines can be prominent, including, among the woody vines, *Parthenocissus quinquefolia* and *Vitis riparia*. Herbaceous vines species include *Apios americana, Amphicarpaea bracteata*, and *Echinocystis lobata*. Herbaceous grasses, forbs, and ferns dominate the ground layer, including *Symphyotrichum lateriflorum (= Aster lateriflorus), Boehmeria cylindrica, Elymus virginicus, Impatiens pallida, Laportea canadensis, Matteuccia struthiopteris, Onoclea sensibilis, Pilea pumila, Urtica dioica*, and others. A variety of exotics may be present, including *Lysimachia* spp., *Microstegium vimineum*, and *Lonicera japonica* (Anderson 1996, MNNHP 1993, Central Appalachian Ecoregional Team pers. comm. 1998).

This community occurs on temporarily flooded soils along major rivers and smaller perennial streams. Soils may be well-drained and sandy, more loamy on infrequently flooded bottomlands and levees, or deep silts on stabilized sites along larger rivers. The structure and composition of the type is influenced by the flooding regime. Floods leave river-deposited debris on the forest floor, ice scars on trees, and abandoned channels that retain water at or above the level of the main river channel.

The structure and composition of the type is influenced by the flooding regime, which is typically an annual flooding of relatively brief duration (several weeks), but may be absent in dry years or extensive during flash-flood years . Floods leave river-deposited debris on the forest floor, ice scars on trees, and abandoned channels that retain water at or above the level of the main river channel.

COMMENTS: *2, MCS*. This type includes stands where *Acer saccharinum* represents the majority of trees (>50% cover or basal area?). This type is most clearly expressed on larger rivers. To some degree this type is more northern, separable from the more southern type *Acer saccharinum - Celtis laevigata - Carya illinoinensis* Forest (CEGL002431), but this distinction is not yet well resolved. In the southern parts of its range, this type may overlap with *Platanus occidentalis - Acer saccharinum - Juglans nigra - Ulmus rubra* Forest (CEGL007334), but that type is generally a higher terrace, small stream type. Compare this type with SAF cover type 62 (Eyre 1980). In Minnesota stands with less than either 50% cottonwood or silver maple and not in northwestern Minnesota tend to occur here (i.e., a mixed floodplain forest), as do silver maple stands with a supercanopy of cottonwoods. In southwestern Minnesota, stands with only some swamp white oak go here. If swamp white oak is dominant the stands probably belong with either an association in the *Quercus palustris - (Quercus bicolor)* Seasonally Flooded Forest Alliance (A.329), or *Quercus macrocarpa - Quercus bicolor - Carya laciniosa / Leersia spp. - Cinna spp.* Forest (CEGL002098), at least in the Midwest. *Fraxinus pennsylvanica* is a typical codominant in this type. In Wisconsin, this type may better be named *Acer saccharinum - Fraxinus pennsylvanica - Betula nigra* Forest (E. Epstein pers. comm. 1999).

CONSERVATION RANK: *G4?.* There has been significant conversion of stands to agriculture, hydrologic modifications due to river dams, etc., and siltation caused by modified flooding regimes.

DISTRIBUTION: This silver maple - elm - cottonwood forest community is found throughout the midwestern United States and parts of the eastern United States, ranging from Pennsylvania west to Minnesota, south to Arkansas, and east to Virginia.

USFS ECOREGIONS: 212Hb:CCC, 212He:CCC, 212Hm:CCC, 212Ht:CCP, 212Hv:CCC, 212Hw:CCP, 212Hx:CCP, 212Hy:CCP, 212Ja:CCC, 212Je:CCC, 212Jf:CCC, 212Jj:CC?, 212Jl:CCC, 212Js:CCC, 212Ka:CC?, 212Kb:CCC, 212Mb:CPP, 212Na:CC?, 212Nb:CCP, 212Nc:CCC, 212Nd:CCC, 221Ea:CCC, 221Ec:CCC, 221Ed:CCC, 221Ef:CCC, 221Fa:CCC, 222Aj:CCC, 222Ap:CCC, 222Aq:CCC, 222Ch:CCC, 222Db:CCC, 222Dc:CCP, 222De:CCC, 222Df:CCP, 222Ei:CPP, 222Ek:CPP, 222El:CPP, 222Em:CPP, 222Fa:CCP, 222Fb:CCC, 222Fc:CCP, 222Fd:CCP, 222Fe:CCP, 222Ff:CCP, 222Ga:CCC, 222Gb:CCC, 222Gc:CCC, 222Gd:CCP, 222Ge:CCC, 222Ha:CCC, 222Hb:CCC, 222Hc:CCC, 222Hf:CCC, 222If:CCC, 222Jb:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ka:CCC, 222Kb:CCC, 222Kd:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Kj:CCP, 222Lc:CCC, 222Ld:CCC, 222Lf:CCC, 222Ma:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 234Aa:CC?, 234Am:CCC, 234An:CCC, 251Ba:CCC, 251Be:CCC, 251Cc:CCC, 251Cd:CCC, 251Cf:CCC, 251Dd:CCP, 251De:CCC, 251Df:CCC, 251Dg:CCC, 251Dh:CCC, 251Eb:CCC, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCC, M221Bb:CCC, M221Da:CCC

CONSERVATION REGIONS: 35:C, 36:C, 37:C, 38:C, 40:?, 42:C, 43:P, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C, 50:P, 52:C, 59:C

STATES: AR IA IL IN KY MI MN MO OH PA TN VA WI WV **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	wet floodplain forest (N); wet floodplain forest (S) I
IN	wet floodplain forest +
MI	southern floodplain forest +
MN	floodplain forest silver maple subtype; floodplain forest swamp white oak subtype -
MO	wet bottomland forest +
OH	maple-cottonwood-sycamore floodplain forest +
WI	floodplain forest (silver maple subtype) =

OTHER SYNONYMY: Silver Maple - Mixed Hardwood Floodplain Forest, Silver maple-American elm-cottonwood floodplain forest (CAP)

USNVC HIERARCHY: ACER SACCHARINUM TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Fraxinus pennsylvanica - Ulmus americana - (Acer negundo, Tilia americana) Northern Forest

Green Ash - American Elm - (Box-elder, American Basswood) Northern Forest

Northern Ash - Elm Floodplain Forest CEGL002089

DESCRIPTION: The overstory is dominated by *Fraxinus pennsylvanica* and, at least prior to Dutch elm disease, *Ulmus americana*. Associates in parts of its range include *Acer negundo, Acer saccharinum, Acer rubrum, Celtis occidentalis* (rarely), and *Tilia americana*. The shrub/sapling layer, which is variable in structure and composition, may include *Cornus alternifolia, Carpinus caroliniana, Cornus sericea*, and *Salix* spp. The herbaceous ground cover contains *Asclepias incarnata, Carex* spp., *Elymus virginicus, Eupatorium maculatum, Eupatorium perfoliatum, Impatiens capensis, Laportea canadensis, Rudbeckia laciniata, Toxicodendron radicans*, and a variety of ferns, including *Matteuccia struthiopteris, Osmunda claytoniana*, and *Osmunda cinnamomea* (Eyre 1980, Chapman et al. 1989, E. Epstein pers. comm. 1999).

This community occurs primarily along higher terraces of river bottoms and floodplains and beside lakes and larger streams, where flooding is relatively brief. Soils are well-drained and moist. They are both organic and medium-textured to fine-textured mineral soils. Rarely, soils are clays and gravels (Eyre 1980, Chapman et al. 1989).

This community may succeed cottonwood-willow forests on floodplains in the absence of flooding. Flooding and windthrow disturbances alter the vegetation structure and composition.

COMMENTS: *3, MCS*. This type is intended as a more species-poor and more northern version of *Fraxinus pennsylvanica - Ulmus spp. - Celtis occidentalis* Forest (CEGL002014) in the Great Lakes states, and it also occurs in the northern Great Plains states. These Great Plains stands may fit better with *Fraxinus pennsylvanica - Ulmus spp. - Celtis occidentalis* Forest (CEGL002014), but they are not likely to be species-rich. In Ontario, this type extends to the Ottawa River. Type is usually on the second terrace of floodplain. In Wisconsin, this type could be considered simply a more northern depauperate version of *Acer saccharinum - Ulmus americana - (Populus deltoides)* Forest (CEGL002586). This community description was modified from the Society of American Foresters' silver maple-American elm (62) forest cover type (Eyre 1980).

CONSERVATION RANK: *G3G4*. Stands are relatively uncommon throughout the range of the type, but its relation to other similar floodplain types is still somewhat unclear.

DISTRIBUTION: This ash - elm floodplain forest is found in the northern midwestern United States and adjacent southern Canada, ranging from central and northern Michigan and Wisconsin to southern Manitoba.

USFS ECOREGIONS: 212Hb:CC?, 212He:CCP, 212Hm:CCP, 212Hq:CCC, 212Hr:CCP, 212Hs:CCP, 212Ht:CCP, 212Hu:CCP, 212Hx:CCP, 212Hy:CCP, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jl:CPP, 212Jm:CPP, 212Jn:CPP, 212Jo:CPP, 212Nd:CCC, 222If:CCC, 222Jb:CCC, 222Jc:CCC, 222Md:CCC, 222Na:CCC, 251Aa:CCC, 251Ab:CCC, 251Ba:CCC
CONSERVATION REGIONS: 35:C, 46:C, 47:C, 48:C
STATES: MI MN ND SD WI **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY:

MI	southern floodplain forest +
MN	floodplain forest =
WI	floodplain forest (green ash-elm subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: FRAXINUS PENNSYLVANICA - ULMUS AMERICANA - CELTIS (OCCIDENTALIS, LAEVIGATA) TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Fraxinus pennsylvanica - Ulmus spp. - Celtis occidentalis Forest

Green Ash - Elm Species - Northern Hackberry Forest

Central Green Ash - Elm - Hackberry Forest CEGL002014

DESCRIPTION: The vegetation has an open to closed tree canopy that is dominated by *Fraxinus pennsylvanica, Celtis occidentalis*, and *Ulmus americana*. Other tree species that may be present include *Juglans nigra, Tilia americana, Acer saccharinum, Populus deltoides*. *Ulmus rubra* can be part of the subcanopy. The shrub layer in the western part of the range includes *Cornus drummondii, Ribes missouriense, Symphoricarpos occidentalis*, and *Zanthoxylum americanum*, as well as woody vines, such as *Parthenocissus vitacea, Smilax tamnoides (= Smilax hispida), Toxicodendron radicans*, and *Vitis riparia*. The herbaceous layer in the western part of the range includes *Elymus virginicus, Festuca subverticillata, Galium aparine, Geum canadense*, and *Laportea canadensis* (Steinauer and Rolfsmeier 2000).

Stands occur along upper floodplain terraces of rivers and streams and in upland ravine bottoms. Soils are moderately well-drained to poorly drained.

COMMENTS: *2, MCS*. The distinction between this type and *Fraxinus pennsylvanica - Ulmus americana - (Acer negundo, Tilia americana)* Northern Forest (CEGL002089) needs clarification. This type could be in Wisconsin.

CONSERVATION RANK: *G3G5.*

DISTRIBUTION: This community is found in the central United States along upper floodplain terraces of rivers and streams and in upland ravine bottoms, ranging from Ohio and Ontario west to Iowa, south to Kansas, and east to Indiana.

USFS ECOREGIONS: 221Ec:CCP, 221Ed:CCP, 221Ef:CCC, 222Dc:CCC, 222Ek:CCC, 222Em:CCP, 222Fd:CCC, 222Fe:CCC, 222Ha:CCC, 222Hb:CCC, 222Hf:CCC, 222If:CCC, 222Jb:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 251Be:CCC, 251Cp:CCC, 251Cq:CCC, 251Fd:CCC, 251G:CC, 255:C
CONSERVATION REGIONS: 33:C, 35:C, 36:C, 37:C, 44:P, 45:C, 48:C, 49:C
STATES: IA IL IN KS MI NE OH? **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	wet-mesic floodplain forest (N) I
IN	wet-mesic floodplain forest +
MI	southern floodplain forest +
NE	eastern lowland forest =
OH?	mixed floodplain forest ?

OTHER SYNONYMY:

USNVC HIERARCHY: FRAXINUS PENNSYLVANICA - ULMUS AMERICANA - CELTIS (OCCIDENTALIS, LAEVIGATA) TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Populus deltoides - Salix nigra Forest

Eastern Cottonwood - Black Willow Forest

Cottonwood - Black Willow Forest CEGL002018

DESCRIPTION: This community is dominated by broadleaf deciduous trees. Canopy closure is complete, or nearly so, with few shrubs and limited tree species found in the type. The tree canopy is tall (to 30 m) and dominated by *Populus deltoides* and *Salix nigra,* although *Fraxinus pennsylvanica, Acer saccharinum, Acer negundo, Platanus occidentalis*, and *Ulmus americana* are also commonly encountered. Tree diversity is limited due to the dynamics of flooding and deposition/scouring of sediments. The subcanopy is almost exclusively *Salix nigra*. The shrub layer is conspicuously absent in many parts of the range. Herbaceous growth can be thick and lush but is often patchy and sparse due to frequent inundation. Species most often encountered in the ground layer include *Carex* spp., *Leersia oryzoides, Bidens* spp., and *Aster* spp. (TNC 1995a).

This community is quick to colonize newly deposited substrates adjacent to rivers, lakes, streams, and in frequently flooded, low, wet depressions in floodplains. Dynamic substrate availability caused by frequent flooding encourages the establishment and maintenance of this community type.

Prolonged flooding in late winter and early spring is the only source of significant natural disturbance. Wind and lightning damage also occur. Stands develop on bare, moist soil on recently formed sand bars, front-land ridges, and well-drained flats, often forming a patchy scrub phase that includes other pioneer species.

COMMENTS: *2, MCS*. The name of the community must have an additional species added to highlight the distinction between this and *Populus deltoides - Salix nigra / Mikania scandens* Forest (CEGL007346). Kentucky occurrences are intermediate between the two. This type does not occur in Nebraska, where *Salix nigra* is a very uncommon tree species. In fact it is thought to have been incorrectly reported as more widespread in the state because it can been confused with *Salix amygdaloides* (G. Steinauer pers. comm. 2000).

CONSERVATION RANK: *G3G4.* The current range of this community is much smaller than the presettlement range due to extensive logging, ditching, draining, and land clearing for conversion to croplands. The reduced water flows and channelization of rivers decreases the frequency of natural floods necessary for the scouring and deposition of new substrates that favor cottonwood regeneration.

DISTRIBUTION: This cottonwood - black willow forest is characteristic of the fronts and banks of most major rivers and streams throughout the Central Forest Region, extending into the northern forest particularly within the Mississippi, Ohio, and Missouri River systems, extending from Ohio west to Minnesota, southward to Oklahoma, and east to Kentucky.

USFS ECOREGIONS: 222Ad:CP?, 222Ae:CP?, 222C:CP, 222D:CP, 222E:CP, 222F:CP, 222G:CP, 222H:CP, 222I:CP, 222J:CP, 222K:CP, 222Lf:CCC, 222Mb:CCC, 222Me:CCC, 231A:PP, 231B:PP, 231E:PP, 231F:PP, 231G:PP, 232B:PP, 232C:PP, 234A:PP, 251Ba:CCC, 251Bb:CCC, 251Cd:CC?, 251Cg:CCC, 251D:CP
CONSERVATION REGIONS: 35:C, 36:C, 37:C, 38:P, 39:?, 42:C, 43:C, 44:C, 46:C
STATES: AR? IA IL IN KS KY MN MO OH? OK WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	wet floodplain forest (S) +
IN	wet floodplain forest +
MN	floodplain forest =
MO	wet bottomland forest +
OH?	maple-cottonwood-sycamore floodplain forest ?
WI	floodplain forest (cottonwood-willow subtype) =

OTHER SYNONYMY: *Populus deltoides - Salix nigra / Leersia* community (Voigt and Mohlenbrock 1964) =

USNVC HIERARCHY: POPULUS DELTOIDES TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Acer saccharum - Carya cordiformis / Asimina triloba Floodplain Forest

Sugar Maple - Bitternut Hickory / Common Pawpaw Floodplain Forest

Maple - Hickory Mesic Floodplain Forest CEGL005035

DESCRIPTION: The vegetation is dominated by broadleaf deciduous trees. *Acer saccharum* and *Carya cordiformis* dominate the overstory. These stout-branched trees display broad crowns and stout columnar trunks and grow to 20-30 m in height. The subcanopy contains a variety of tree saplings, including *Ulmus americana, Ulmus rubra, Morus rubra*, and *Prunus serotina var. serotina*. The shrub layer is often quite dense and tangled with vines. Species include *Toxicodendron radicans, Parthenocissus quinquefolia, Campsis radicans, Smilax tamnoides (= Smilax hispida), Smilax rotundifolia, Wisteria frutescens*, and *Vitis vulpina*. *Asimina triloba* dominates the shrub layer, but *Lindera benzoin, Aralia spinosa, Corylus americana, Ilex decidua, Crataegus viridis, Crataegus pruinosa*, and *Cornus florida* are also commonly encountered. On better sites, the herbaceous stratum is dense and diverse. Typical species include *Laportea canadensis, Symphyotrichum lanceolatum (= Aster lanceolatus), Polygonum virginianum, Poa sylvestris, Ruellia strepens, Tradescantia subaspera, Vernonia gigantea, Eupatorium purpureum, Teucrium canadense*, and *Dioscorea quaternata*. Stands on the floodplains of the Ohio and Mississippi rivers in western Kentucky contain other canopy species, such as *Gymnocladus dioicus, Quercus pagoda, Quercus shumardii, Quercus macrocarpa, Quercus muehlenbergii, Carya illinoinensis, Quercus alba, Quercus rubra, Nyssa sylvatica*, and *Juglans nigra* (TNC 1995a).

Stands occur on level to gently sloping ridges, terraces, natural levees, or higher elevations which border river floodplains or streams. Sites often have a ridge-and-swale topography. Mesic moisture conditions are maintained throughout most of the growing season, but some flooding does occur. Soils are moist and well- to moderately-drained. In general, they have medium-textured silts and colluvial, deep, clay loams derived from sandstone and shales.

Natural disturbance includes flooding, wind, and storm damage.

COMMENTS: *3, MCS*. This type is not well-defined, occupying a relatively narrow segment of the moisture/topographic gradient and containing a diverse mixture of tree species. Further study is needed to determine its characteristics. Only a few remnants remain in Kentucky (e.g., Bayou Creek Ridge Natural Area, McCracken County). Many occurrences have been cleared for agriculture. This type resembles *Acer saccharum - Quercus rubra - Carya cordiformis / Asimina triloba* Forest (CEGL002060) but is east of the Mississippi, whereas CEGL002060 is west. A related mesic hardwood floodplain type, *Fagus grandifolia - Quercus spp. - Acer rubrum - Juglans nigra* Forest (CEGL005014), is dominated by *Fagus* rather than *Acer* and *Carya*.

CONSERVATION RANK: *G2.* There are probably fewer than 100 occurrences of this community rangewide. This community occurs in Illinois (where it is ranked S3S4), Ohio (S?), Kentucky (S?), and Tennessee (S?); it may also occur in Indiana. Currently three occurrences are documented from Illinois and Ohio. There are probably fewer than 1000 acres rangewide. Currently 16 acres have been documented from two occurrences in Illinois. Many occurrences may have been degraded by logging, and others have been cleared for conversion to agriculture.

DISTRIBUTION: This maple - hickory mesic floodplain forest is found in the central United States, ranging from Tennessee, Kentucky, and southern Illinois east to Ohio and possibly Indiana.

USFS ECOREGIONS: 222Aq:CPP, 222C:CP, 222Dh:CCC, 222Di:CCC, 222Gb:CCC, 222Hb:CCC, 251Cj:CCC
CONSERVATION REGIONS: 36:C, 42:C, 43:C, 44:C, 45:C
STATES: IL IN? KY OH? TN **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:
IL mesic floodplain forest (S); wet-mesic upland forest (S) I
IN? mesic floodplain forest ?
OH? mixed floodplain forest ?

OTHER SYNONYMY: *Fagus - Liquidambar/Rhus [Toxicodendron]* Community (Voigt and Mohlenbrock 1964) B. Despite the difference in name and presence of *Fagus* in Voigt and Mohlenbrock's (1964) type, the topographic position and associated species are very similar., No equivalent (Eyre 1980)

USNVC HIERARCHY: ACER SACCHARUM - CARYA CORDIFORMIS TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Quercus macrocarpa - Quercus bicolor - Carya laciniosa / Leersia spp. - Cinna spp. Forest

Bur Oak - Swamp White Oak - Kingnut Hickory / Cutgrass Species - Woodreed Species Forest

Bur Oak - Swamp White Oak Mixed Bottomland Forest CEGL002098

DESCRIPTION: The tree canopy contains *Quercus macrocarpa, Quercus bicolor*, and *Carya laciniosa*. In swaley places in the Inner Bluegrass of Kentucky, tree associates include *Quercus shumardii, Fraxinus pennsylvanica*, and *Ulmus americana*.

Stands are found in wet-mesic bottomland habitats.

Historically this type may have had a woodland structure because of fire.

COMMENTS: *3, MCS*. This type has been so heavily impacted by settlement and grazing that characterization is difficult.

CONSERVATION RANK: *G2G3.* There are probably fewer than 100 occurrences of this community rangewide; twenty-two occurrences have been documented in five states (Illinois, Kansas, Missouri, Ohio, and Wisconsin). This community is also reported from Iowa, Kentucky, and Ontario. There are probably less than 10,000 acres rangewide; over 1600 acres are currently documented. This community is restricted to river bottoms, low terraces, and low slopes along river floodplains. This forest is documented from 14 subsections in two provinces. Nearly half of the documented occurrences are in good condition.

DISTRIBUTION: This bur oak - hardwoods bottomland forest type occurs in the central United States, ranging from southern Ohio west to Wisconsin, south to Missouri, and east to Kentucky.

USFS ECOREGIONS: 222Fb:CCC, 222Ga:CCC, 222Gb:CCC, 222Ha:CCC, 222Kf:CCC, 222Kg:CCC, 222Lc:CCC, 251Cc:CCC, 251Cd:CC?, 251Cf:CCC, 251Cg:CCC, 251Ci:CCC, 251Cq:CCC, 251Df:CCC, 251Dg:CCC, 251Ea:CCC
CONSERVATION REGIONS: 36:C, 37:C, 44:C, 45:C, 46:C, 48:C
STATES: IA? IL IN KY MO OH? WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	wet-mesic floodplain forest (N) I
IN	wet-mesic floodplain forest +
MO	wet-mesic bottomland forest +
OH?	maple-ash-oak swamps ?
WI	floodplain forest (bur oak-swamp white oak subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS MACROCARPA - QUERCUS BICOLOR - (CARYA LACINIOSA) TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Fagus grandifolia - Acer saccharum - Quercus bicolor - Acer rubrum Flatwoods Forest

American Beech - Sugar Maple - Swamp White Oak - Red Maple Flatwoods Forest

Beech - Hardwoods Till Plain Flatwoods CEGL005173

DESCRIPTION: This community is dominated by trees that can be found in both upland and lowland sites. Among the most common are *Acer rubrum, Acer saccharum, Fagus grandifolia, Quercus bicolor, Quercus macrocarpa*, and *Ulmus rubra*. Associates include *Carya ovata, Carya cordiformis, Celtis occidentalis, Fraxinus pennsylvanica, Liriodendron tulipifera, Quercus rubra, Quercus shumardii*, and *Ulmus americana*. Typical shrub species include *Asimina triloba, Euonymus obovata*, and *Lindera benzoin*. The herbaceous layer includes *Arisaema triphyllum (= Arisaema atrorubens), Actaea pachypoda, Circaea X intermedia (= Circaea canadensis), Galium* spp., and *Pilea pumila*, among others (Homoya et al. 1988, Anderson 1996).

This community is found on flat to gently sloping sites on till plains. Soils are imperfectly to poorly drained and aerated. Soil types include Crosby, Blount, Fincastle, Brookston, and Pewamo (Homoya et al 1988)

COMMENTS: *2, MCS*. The type is based on the concept of the Indiana state type - central till plain flatwoods (Homoya et al. 1988). This type occurs as a mosaic of upland rises with *Fagus grandifolia* and other hardwoods and wetland areas with *Quercus palustris, Quercus bicolor, Acer rubrum*, and other wetland hardwoods. It is possible that the mosaic may become extensive enough in some areas that the two parts could be treated separately, but this needs field checking. In any case, no other states or provinces report this kind of patterning. To help define the type, stands may require at least 25% beech basal area or cover to fit this type (Anderson 1996). In Ontario the type may occur above the escarpment in the Niagara Peninsula, but these may have been treated as part of the Great Lakes lakeplain type, *Quercus palustris - Quercus bicolor - Acer rubrum* Flatwoods Forest (CEGL005037).

CONSERVATION RANK: *G2G3.* There are probably fewer than 25 occurrences of this community rangewide; it is only known from central Indiana, where it is ranked S2, and from southeastern Michigan and northeastern Ohio. Currently 19 occurrences have been documented from Indiana. There are probably fewer than 1000 acres of this community rangewide. Currently over 175 acres have been documented (some sites lack acreage data); the average size documented is 35 acres. Historical acreage is unknown. Many sites have been degraded by grazing and selective logging, and there has probably been some overall reduction in acreage. This community has somewhat restricted environmental requirements: it is found over till plains with imperfectly to poorly drained and aerated soils. The range is somewhat restricted; it is reported from four subsections in one ecoregion province.

DISTRIBUTION: This community is found in the central midwestern United States and adjacent Canada, ranging from central Indiana, western Ohio, and southeastern Michigan to possibly adjacent Ontario.

USFS ECOREGIONS: 222Ha:CCC, 222Hb:CCC, 222Hf:CCC, 222If:CCC
CONSERVATION REGIONS: 45:C
STATES: IN MI? OH? **PROVINCES:** ON?

MIDWEST HERITAGE SYNONYMY:

IN	central till plain flatwoods =
MI?	pin oak depression
OH?	beech-oak-red maple forest ?

OTHER SYNONYMY: South LaPorte Woods (Lindsey et al. 1969) =, Wet Beech Forests (Anderson 1996) B. Anderson describes the differences between Wet Beech Forest stands in southwestern Ohio from those in the west/northwest part of Ohio. Some of Anderson's mixed swamp type may also fall here, depending on percentage of beech used to separate his wet beech forest type from this type.

USNVC HIERARCHY: FAGUS GRANDIFOLIA - QUERCUS SPP. - ACER SPP. FOREST ALLIANCE (I.B.2.N.a)

Fagus grandifolia - Quercus alba - (Quercus michauxii) - Acer rubrum Flatwoods Forest

American Beech - White Oak - (Swamp Chestnut Oak) - Red Maple Flatwoods Forest

Beech - Oak - Red Maple Flatwoods CEGL005015

DESCRIPTION: This community has a moderately dense to dense canopy of deciduous trees. *Fagus grandifolia* is consistently common. Other common trees include *Acer rubrum, Liriodendron tulipifera, Nyssa sylvatica, Quercus alba, Quercus bicolor, Quercus palustris*, and *Quercus michauxii*. *Fraxinus americana, Liquidambar styraciflua,* and *Quercus shumardii* may be present. *Asimina triloba, Carpinus caroliniana, Lindera benzoin, Toxicodendron radicans*, and *Sambucus canadensis* are common shrubs. *Vitis labrusca* is a common, and perhaps characteristic, vine. Abundant understory species include the ferns *Botrychium oneidense* and *Onoclea sensibilis* and the herbs *Chimaphila maculata, Cinna arundinacea, Impatiens capensis (= Impatiens biflora), Panax trifolius, Podophyllum peltatum*, and *Rubus hispidus*.

This community is usually found on loess-covered glacial drift of Illinoisan age, with level topography and poorly drained silt loam soils (Braun 1936). The substrate can form a mosaic of slightly higher, wet-mesic raised areas, and wet depressions. An impermeable layer beneath the topsoil slows drainage often resulting in wet soil conditions (Chapman 1942). In droughty periods, the upper soils dry out, and the impermeable subsoil limits the availability of deeper water sources.

COMMENTS: *2, MCS*. This type is based largely on the Indiana state type - Bluegrass Till Plain Flatwoods (Homoya et al. 1988) and Ohio's Wet Beech Forests (Anderson 1996). The type consists of a mosaic of raised, wet-mesic areas and depressions that are wet. The vegetation varies accordingly. Floristic distinctions between the bluegrass region and the central tillplain need to be worked out, but the bluegrass occurrences do contain *Quercus michauxii* and *Liquidambar styraciflua*. Anderson (1996) cites Braun (1936) as noting that *Carpinus caroliniana, Photinia floribunda (= Aronia prunifolia), Spiraea tomentosa, Ilex verticillata, Vitis labrusca*, and *Viburnum dentatum var. deamii* are characteristic of this type. To help define the type, stands may require at least 25% basal area or cover of beech (Anderson 1996). In Indiana, this type may also occur in the southwestern part of the state (Spencer County).

CONSERVATION RANK: *G3.* There are probably fewer than 100 occurrences rangewide. Seven have been documented in Ohio, where the community is ranked S3, and 11 in Indiana (S2). The community occurs in 6 ecoregional subsections. There are probably fewer than 10,000 acres rangewide. Sizes of 11 occurrences total 1480 acres. The community occurs on level, poorly drained silt loams (usually loess-covered glacial drift) with an impenetrable layer beneath the topsoil that impedes drainage and accessibility to deeper water.

DISTRIBUTION: This lowland forest community is found in the United States in southeastern Indiana and southwestern Ohio.

USFS ECOREGIONS: 222Ek:CCC, 222Fc:CC?, 222Fd:CCC, 222Fe:CCC, 222Ff:CCC, 222Ha:CCC, 222Hc:CCC
CONSERVATION REGIONS: 44:C, 45:C, 48:C, 49:C
STATES: IN OH **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IN bluegrass till plain flatwoods =
OH beech-oak-red maple forest =

OTHER SYNONYMY: Beech - White Oak - Sweet Gum Community (Braun 1936) F, Beech - White Oak - Red Maple Community (Braun 1936) F, Beech - White Oak - Red Maple - Sweet Gum Community (Braun 1936) F, Beech - White Oak Associes I, Wet Beech Forests (Anderson 1996) B. Anderson describes differences between the stands in southwest Ohio from those in the west/northwest part of the state. Parts of Anderson's mixed swamp type may also fall into this type, depending on the percentage of beech used to define his wet beech forest type.

USNVC HIERARCHY: FAGUS GRANDIFOLIA - QUERCUS SPP. - ACER SPP. FOREST ALLIANCE (I.B.2.N.a)

Quercus palustris - Quercus bicolor - Acer rubrum Flatwoods Forest

Pin Oak - Swamp White Oak - Red Maple Flatwoods Forest

Northern (Great Lakes) Flatwoods CEGL005037

DESCRIPTION: Deciduous hardwoods and softwoods predominate. Diagnostic species include *Quercus bicolor, Quercus ellipsoidalis, Quercus palustris*, and *Acer rubrum*. Other associates include *Ilex verticillata* and *Ulmus americana*. The herbaceous layer, which can be sparse, contains *Carex muskingumensis, Glyceria striata, Maianthemum canadense, Mitchella repens*, and *Osmunda cinnamomea* (White and Madany 1978, Homoya et al. 1988, Pat Comer pers. comm. 1997).

This type is found on glaciated plains in the midwestern United States. This community occurs on poorly drained uplands or in depressions on level glacial lakeplains or outwash plains. There is a layer of acidic sand over a layer of impermeable or nearly impermeable clay resulting in a shallow, perched water table. Ponding is common during the wet seasons. In the dry months, the clay layer prevents water from moving up to the surface by capillary action from deeper, more moist soil. Thus, the soil moisture fluctuates widely over the year (White and Madany 1978, Homoya et al. 1988).

Given that fire was probably common in adjacent landscapes, flatwoods may have experienced fire during drought periods and contained a more open canopy. Some may have supported a prairie flora prior to onset of fire suppression (White and Madany 1978).

COMMENTS: *2, MCS*. This type is found on glaciated plains in the Midwest. The terms "swamp" and "flatwoods" may overlap (see e.g., Lee et al. 1998, who include flatwoods types in their swamp category). These terms need clarification. In Indiana, stands may also be related to the lakeplain oak opening type, *Quercus macrocarpa - Quercus palustris - Quercus bicolor / Calamagrostis canadensis* Wooded Herbaceous Vegetation (CEGL005120). In Michigan this type occurs only in Calhoun County. Ontario sands on the clayplain of the Niagara Peninsula should be compared with *Fagus grandifolia - Acer saccharum - Quercus bicolor - Acer rubrum* Flatwoods Forest (CEGL005137).

CONSERVATION RANK: *G2G3.* There are probably fewer than 100 occurrences of this community rangewide. It is reported from Ohio (where it is ranked S3), Indiana (S2), Illinois (S2), Ontario (S?), and Michigan (S?). Currently there are 19 occurrences documented from Illinois, Indiana, Ohio, and Michigan. This community has moderately restricted environmental requirements. Many sites of this community have been drained or cleared.

DISTRIBUTION: This pin oak - swamp white oak flatwoods community type is found in the midwestern United States and Canada near Lake Michigan and Lake Erie, ranging from northern Illinois, northern Indiana, northern Ohio, and southeastern Michigan, to southern Ontario.

USFS ECOREGIONS: 221Fb:CCC, 222Ha:CCC, 222Hb:CCC, 222Ia:CCC, 222If:CCC, 222Jb:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kf:CCC, 222Kg:CCC, 222Kj:CCC
CONSERVATION REGIONS: 45:C, 46:C, 48:C, 49:C
STATES: IL IN MI OH **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	northern flatwoods =
IN	boreal flatwoods =
MI	pin oak depression +
OH	oak-maple swamp +

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS PALUSTRIS - (QUERCUS BICOLOR) SEASONALLY FLOODED FOREST ALLIANCE (I.B.2.N.e)

Quercus palustris - Quercus bicolor - Nyssa sylvatica - Acer rubrum Sand Flatwoods Forest

Pin Oak - Swamp White Oak - Blackgum - Red Maple Sand Flatwoods Forest

Pin Oak - Swamp White Oak Sand Flatwoods CEGL002100

DESCRIPTION: Deciduous hardwoods and softwoods dominate the tree canopy. Dominants include several oaks, *Quercus palustris* and *Quercus bicolor*, as well as *Acer rubrum* and *Nyssa sylvatica*. The shrub layer may contain *Ilex verticillata, Spiraea tomentosa*, and *Vaccinium angustifolium*. Herbaceous species include *Maianthemum canadense, Mitchella repens, Osmunda cinnamomea*, and *Osmunda regalis* (White and Madany 1978).

This community occurs on poorly drained uplands or in depressions on level glacial lakeplains or outwash plains. There is typically a layer of strongly acid sand over a layer of impermeable or nearly impermeable clay. The clay layer causes a shallow, perched water table. Ponding is common during the wet seasons, but water levels drop through the growing season. Clays may then prevent water from moving back up through capillary action during drought periods (White and Madany 1978).

Given that fire was probably common in adjacent landscapes, sand flatwoods may have experienced fire during drought periods. Some may have supported sand prairie flora prior to onset of fire suppression (White and Madany 1978, P. Comer pers. comm. 1997).

COMMENTS: *2, MCS*. Concept of the type is that of a somewhat acidic sand flatwoods. *Glyceria striata* may be common in the understory. Type shows some similarity to *Quercus palustris - Quercus bicolor - (Liquidambar styraciflua)* Mixed Hardwood Forest (CEGL002432), which occurs further south.

CONSERVATION RANK: *G2?.* There are probably fewer than 100 occurrences rangewide. Eighteen occurrences have been documented from 3 states (Illinois, Indiana, and Michigan); it is also reported from Ohio and Ontario. Several occurrences are in good condition. This community is ranked S3 in Ohio (though only one stand has been documented), and S1 in Illinois, Indiana, and Michigan. There are probably less than 10,000 acres rangewide, over 1000 acres are currently documented, but several sites are small (less than 20 acres). This flatwoods community is restricted to moist, sandy lake plains. It is documented from 10 subsections in two provinces.

DISTRIBUTION: This pin oak - swamp white oak sand flatwoods community is found in the midwestern United States and adjacent Canada, ranging from northern Illinois, southern Michigan, northern Indiana, and southern Ontario, to northwestern Ohio.

USFS ECOREGIONS: 222Ab:CCC, 222Af:CCC, 222Aj:CCC, 222If:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ki:CCC, 251Cc:CCC, 251Cf:CCC, 251Dg:CCC, 251Dh:CC?
CONSERVATION REGIONS: 36:C, 38:C, 43:?, 48:C
STATES: IL IN MI OH **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	sand flatwoods =
IN	sand flatwoods =
MI	pin oak depression +
OH	oak-maple swamp +

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS PALUSTRIS - (QUERCUS BICOLOR) SEASONALLY FLOODED FOREST ALLIANCE (I.B.2.N.e)

Nyssa aquatica / Cephalanthus occidentalis Pond Forest

Water Tupelo / Buttonbush Pond Forest

Water Tupelo Sinkhole Pond Swamp CEGL004712

DESCRIPTION: The tree canopy is variable, depending on water depth, ranging from 50-90% closure, at times forming a zone around an open pond. *Nyssa aquatica* is the major dominant, with occasional presence of *Acer rubrum*, and *Quercus palustris*. The shrub layer may contain *Cephalanthus occidentalis, Itea virginica, Acer rubrum*, and *Nyssa biflora*. Typical herbaceous species in Missouri examples include *Carex decomposita, Triadenum walteri, Hottonia inflata*, and *Lemna minor*. In Tennessee examples, herbaceous species are limited, but *Carex joorii* and *Saccharum baldwinii* may be present, particularly in more open areas around the depression perimeter (Nelson 1985, TNC 1998).

Stands occur in sinkholes or other natural depressions associated with karst topography or terraces. Some examples are more-or-less permanently flooded, but water volumes can severely diminish in drought years. Tennessee examples may exhibit depths of up to a meter in winter and spring and can become virtually dry in the summer and fall (Nelson 1985, TNC 1998).

COMMENTS: *2, SCS*. This type is based on the Missouri state type - "pond swamp" (Nelson 1985).

CONSERVATION RANK: *G1?*. There are probably fewer than 20 occurrences rangewide. Currently 4 occurrences have been documented from Missouri (where it is ranked S2). This community may also occur in Arkansas. There are probably fewer than 100 acres rangewide; currently 8 acres have been documented from 4 Missouri locations. This community is documented from two ecoregion subsections in the Ozark Highlands of southeastern Missouri. Also known from Arnold Air Force Base, Coffee County, Tennessee, where it is found at Westall Swamp and Sinking Pond State Natural Area. The global rank reflects its limited distribution. Several examples are disjunct from the bulk of the range of *Nyssa aquatica*.

DISTRIBUTION: This water tupelo sinkhole pond type is found in the south-central midwestern United States, from southeastern Missouri and Arkansas to the Interior Low Plateau of southeastern middle Tennessee.

USFS ECOREGIONS: 222A:CC, 222Eb:CCC
CONSERVATION REGIONS: 38:?, 43:?, 44:C, 50:?
STATES: AR? MO TN **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO pond swamp +

OTHER SYNONYMY:

USNVC HIERARCHY: NYSSA (AQUATICA, BIFLORA, OGECHE) POND SEASONALLY FLOODED FOREST ALLIANCE (I.B.2.N.e)

Quercus lyrata Pond Forest

Overcup Oak Pond Forest

Overcup Oak Pond Forest CEGL004642

DESCRIPTION: These forests are *Quercus lyrata*-dominated and occur in seasonally flooded ponds in upland situations. These ponds may also have *Liquidambar styraciflua* and *Nyssa biflora* in the canopy. These canopy species also occur in the shrub layer with *Acer rubrum*. Herbaceous species, such as *Eleocharis obtusa*, can be present in the center of the pond, along with hummocks of *Sphagnum*. When these ponds draw down, leaf litter can comprise 60-70% of the ground cover, with only scattered herbs on the *Sphagnum* hummocks and at the bases of trees. Small thickets of *Smilax rotundifolia* occur around the edges of these ponds and on hummocks, with occasional *Vaccinium pallidum*. Additional species that occur on hummocks and tree bases include *Toxicodendron radicans, Asplenium platyneuron*, and moss species.

This community is a small, isolated, upland feature, occurring in basins of sinkholes or other isolated depressions on uplands. Soils are very poorly drained, and surface water may be present for extended periods of time. These small ponds can dry out completely, but can fill again with a single rain event. Water depth may average close to 0.5 m in depth. Soils may be deep (100 cm or more), consisting of peat or muck, with parent material of peat, muck or alluvium (Nelson 1985).

Extreme droughts may cause the ponds to go dry for an extended period.

COMMENTS: *2, SCS.* This description is based on an example in the Arkansas Ozarks, at the edge of *Quercus lyrata*'s range. Similar isolated, upland oak ponds dominated by *Quercus lyrata, Quercus phellos, Quercus palustris*, or combinations of these three species also occur in the Arkansas Ozarks (at the edge of all three species' ranges) [see *Quercus phellos* Seasonally Flooded Forest [Placeholder] (CEGL007402) and *Quercus palustris* Pond Forest (CEGL007809)]. Dominance by any one species can be related to length of hydroperiod, with *Quercus lyrata* having the longest, and *Quercus palustris* the shortest, and with related differences in vascular species richness. However, field application of three separate oak pond associations based on dominance can be problematic. Consideration should be given to creating one or two alliances for oak ponds that each cover large geographic areas (i.e., southern vs. northern), rather than having them split up by dominance. CEGL007809 has a shorter hydroperiod and more diverse vascular flora. For related vegetation in Kentucky, see *Quercus lyrata - Quercus (palustris, phellos) - Liquidambar styraciflua - (Populus heterophylla)* Forest (CEGL004421).

CONSERVATION RANK: *G1G3.* While incompletely known and defined, this association is restricted to isolated locations at the edge of the range of the primary nominal oak (*Quercus lyrata*). This type was very likely always rare, as it occurs in a rare geologic feature. This community is a small, isolated, upland feature, occurring in basins of sinkholes or other isolated upland depressions. Examples are threatened by timber removal and hydrological alteration (draining and filling of wetlands), including changes to the surrounding upland landscape (land-use change, development).

DISTRIBUTION: This overcup oak pond forest is found in the south-central United States in southern Missouri and Arkansas.

USFS ECOREGIONS: M222Aa:CCC
CONSERVATION REGIONS: 38:C, 42:C
STATES: AR MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO pond swamp +

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS LYRATA - (CARYA AQUATICA) SEASONALLY FLOODED FOREST ALLIANCE (I.B.2.N.e)

Quercus palustris - (Quercus bicolor) / Carex crinita / Sphagnum spp. Forest

Pin Oak - (Swamp White Oak) / Fringed Sedge / Peatmoss Species Forest

Pin Oak - Swamp White Oak Sinkhole Flatwoods CEGL002406

DESCRIPTION: The forest is a mixed deciduous hardwoods community. The dominant trees are 20-30 m tall and the canopy is closed. *Quercus palustris, Quercus bicolor*, and *Diospyros virginiana* are present. The understory is poorly developed or absent. When present, it ranges from 5-7 m in height. Shrubs may occur with small trees to make up the understory. Species include *Alnus serrulata* and *Cephalanthus occidentalis*. The ground cover consists of ferns, mixed sedges, and moss tussocks. Ferns include *Osmunda regalis* and *Onoclea sensibilis*, herbs include *Viola lanceolata*, and mosses include *Climacium americanum* and *Sphagnum* spp. (Nelson 1985).

This community occurs in broad sinkhole basins. The slopes on which it occurs are level to gentle. Soils have a fragipan which impedes drainage and roots. The soils of this community receive groundwater seepage. The groundwater fluctuates, causing water levels to flood the surface in highly acidic sinkhole ponds. This water, combined with rainwater, keeps the soils saturated during wet periods and moist during dry periods (Nelson 1985).

COMMENTS: *2, MCS*. Concept of the type was originally taken from the Missouri state type - forested acid seep (Nelson 1985), but that type was amended so that forested acid seeps were combined with acid seeps, *Carex crinita - Osmunda spp. / Sphagnum spp*. Herbaceous Vegetation (CEGL002263), and acid sinkhole ponds were separated out as a sinkhole flatwoods (M. Leahy pers. comm. 1999). This type has been ammended to follow the new Missouri concept. Type fits a seasonally saturated hydrology.

CONSERVATION RANK: *G3?.* There are probably fewer than 20 occurrences rangewide. Currently 5 occurrences are documented from Missouri, where it is ranked S1. This community is also reported from Arkansas. There are probably fewer than 500 acres rangewide; currently 52 acres have been documented in Missouri. This community is reported from 5 ecoregion subsections in the Ozark Highlands section of southern Missouri. It may also occur in northern Arkansas.

DISTRIBUTION: This pin oak - swamp white oak sinkhole flatwoods is found in the United States in Missouri and Arkansas.

USFS ECOREGIONS: 222Aa:CCC, 222Ab:CCC, 222Af:CCC, 222Ag:CCC, 222Al:CCC, 222An:CCC, 234An:CCC, M222Ab:CCC
CONSERVATION REGIONS: 38:C, 42:C
STATES: AR MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO forested acid seep I

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS PALUSTRIS - (QUERCUS BICOLOR) SEASONALLY FLOODED FOREST ALLIANCE (I.B.2.N.e)

Cephalanthus occidentalis / Hibiscus moscheutos ssp. moscheutos Shrubland

Buttonbush / Eastern Rose-mallow Shrubland

Buttonbush Sinkhole Pond Swamp CEGL004742

DESCRIPTION: This shrubland occupies the central portions of small shallow water depressions which have little or no arborescent overstory; adjacent trees are commonly *Quercus phellos* and *Liquidambar styraciflua*. *Cephalanthus occidentalis* and *Hibiscus moscheutos ssp. moscheutos* comprise the shrub stratum in water less than 1 m deep. Other woody species commonly encountered along drier margins of Tennessee examples include *Cornus amomum, Cornus foemina, Cornus racemosa, Nyssa biflora, Vaccinium fuscatum, Acer rubrum, Carpinus caroliniana, Oxydendrum arboreum, Itea virginica, Smilax rotundifolia*, and *Salix humilis*. Sedges and grasses are the dominant herbaceous species present and may include *Juncus repens, Rhynchospora corniculata, Carex gigantea, Carex intumescens, Leersia hexandra, Saccharum baldwinii, Glyceria septentrionalis, Panicum hemitomon*, and *Dulichium arundinaceum*. The last two species may develop into separate associations forming a mosaic within the small open depressions. Other herbs which may occur include *Polygonum hydropiperoides, Polygonum amphibium, Proserpinaca pectinata, Triadenum walteri*, and *Ludwigia* spp. In Missouri, species include *Bidens discoidea, Carex alata, Carex comosa, Decodon verticillatus, Galium tinctorium, Glyceria acutiflora, Hibiscus moscheutos ssp. lasiocarpos, Triadenum walteri (= Hypericum walteri)*, and *Hottonia inflata* (Nelson 1985). State-rare species that may be found in Tennessee examples of this community include *Ludwigia sphaerocarpa, Carex barrattii, Panicum hemitomon*, and *Dichanthelium dichotomum var. ensifolium (= Dichanthelium ensifolium)* (TNC 1998).

Inundation is usually continuous throughout the year, but these sites can become dry in mid or late summer or during periods of prolonged drought. Soils are silt loams, which are poorly drained soils derived from a thin layer of loess-like silt overlying cherty limestone residuum. They are also underlain by fragipans which may occur as little as 30 cm below the surface or up to 1 meter deep. This layer is rarely uniform in thickness, ranging from 15 to 75 cm thick, or in development, ranging from weakly to strongly developed. These soils have variable chemistry, but can be very acidic and low in nutrients (Nelson 1985, TNC 1998).

COMMENTS: *2, SCS*. Type concept of the former CEGL002414 was taken from the Missouri state type - "pond shrub swamp" (Nelson 1985). The herbaceous equivalent of Missouri examples of this type (Nelson's "pond shrub swamp") is *Carex comosa - Carex decomposita - Dulichium arundinaceum - Lycopus rubellus* Herbaceous Vegetation (CEGL002413), and distinctions between the two may be difficult to make. Type needs continuing rangewide review and integration. At Arnold Air Force Base, Coffee and Franklin counties, Tennessee, examples of this community can be found at Clay Pond, Cow Pond, Lemm Pond, and Heron Ponds.

CONSERVATION RANK: *G2G3*. There are probably fewer than 100 occurrences rangewide. Currently 22 occurrences have been documented from Missouri (where it is ranked S1). The community may also occur in Indiana. There are probably fewer than 500 acres rangewide. Currently 85 acres have been documented at 17 of the 22 known sites. This community is documented from 6 ecoregion subsections in the Ozark Highlands section. This community has fairly narrow habitat requirements and may have always been rare. Very few high-quality examples are known in Tennessee.

DISTRIBUTION: This buttonbush sinkhole pond type occurs in the south-central United States, ranging from Missouri, Illinois, and Indiana, south to Tennessee and Georgia, and possibly Alabama and Mississippi.

USFS ECOREGIONS: 222Eb:CCC
CONSERVATION REGIONS: 38:C, 43:P, 44:C, 50:C
STATES: AL? GA IL IN KY MO MS? TN **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	shrub swamp (S) +
IN	sinkhole pond +
MO	pond shrub swamp =

OTHER SYNONYMY:

USNVC HIERARCHY: CEPHALANTHUS OCCIDENTALIS SEASONALLY FLOODED SHRUBLAND ALLIANCE (III.B.2.N.e)

Platanus occidentalis - Acer saccharinum - Juglans nigra - Ulmus rubra Forest

Sycamore - Silver Maple - Black Walnut - Slippery Elm Forest

Sycamore - Silver Maple Floodplain Forest CEGL007334

DESCRIPTION: Stands are dominated by *Platanus occidentalis*, with a mixture of other species, including *Acer negundo, Acer saccharinum, Fraxinus americana, Fraxinus pennsylvanica, Juglans nigra, Ulmus americana*, and *Ulmus rubra*. Shrubs include *Asimina triloba* and *Lindera benzoin*. Vines may be abundant, including *Parthenocissus quinquefolia* and *Toxicodendron radicans*. Herbaceous species include *Arisaema triphyllum, Asarum canadense, Boehmeria cylindrica, Elymus virginicus, Pilea pumila, Polygonum virginianum*, and others (Van Kley et al. 1995, Weakley et al. 1998).

This association occurs along riverfronts in calcareous areas, including forests along small streams (Weakley et al. 1998).

COMMENTS: *2, SCS*. This type could be in Illinois and Missouri. It is not well characterized yet and may be difficult to distinguish from other floodplain forests where *Platanus* is conspicuous without being dominant. For example, see *Acer saccharinum - Ulmus americana - (Populus deltoides)* Forest (CEGL002586), *Fraxinus pennsylvanica - Celtis spp. - Quercus spp. - Platanus occidentalis* Bottomland Forest (CEGL002410), *Fraxinus pennsylvanica - Ulmus americana - Celtis laevigata / Ilex decidua* Forest (CEGL002427), and *Fraxinus pennsylvanica - Ulmus spp. - Celtis occidentalis* Forest (CEGL002014). It is possible that CEGL002410 could be merged with this type, depending on level of dominance required for *Platanus*.

CONSERVATION RANK: *G4.* This type is apparently somewhat restricted in habitat, but with a wide range, and not highly threatened. Timber removal will cause disruption, but permanent conversion to other forest types is less likely. This community, and other types of floodplain forests, are threatened by alteration of the hydroperiod by artificial impoundments or river diversion projects, or the disruption of the floodplain communities by forestry or agriculture.

DISTRIBUTION: This sycamore - silver maple floodplain forest occurs along riverfronts in calcareous areas of the east-central United States from Indiana and Kentucky east to West Virginia, Virginia and North Carolina, and possibly Ohio.

USFS ECOREGIONS: 221D:CC, 221Ec:CCC, 221Ed:CCP, 221Ef:CCP, 221Eg:CCC, 221Ha:CCC, 221Hb:CCC, 221Hc:CCC, 221He:CCC, 222Cg:CCC, 222De:CCP, 222Eb:CCC, 222Em:CCP, 222En:CCC, 222Eo:CCC, 222Fa:CCC, 222Fb:CCC, 222Fc:CCC, 222Fd:CCC, 222Hb:CCC, 222Hf:CCC, 231A:CC, 232Ad:CCC, M221Cd:CCC
CONSERVATION REGIONS: 44:C, 45:C, 49:C, 50:C, 52:?, 59:C, 61:C
STATES: IN KY MD OH? SC TN VA WV **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IN wet-mesic floodplain forest +
OH? maple-cottonwood-sycamore floodplain forest ?

OTHER SYNONYMY: IA6e. Southern Appalachian Alluvial Forest (Allard 1990), ELTP 61: *Platanus / Asarum*, Wet-mesic Bottomlands (Van Kley et al. 1995) =, Silver Maple - Sycamore Forest on Base-rich Alluvium (Palmer-Ball et al. 1988) =, Sycamore-green ash floodplain forest (CAP)

USNVC HIERARCHY: PLATANUS OCCIDENTALIS - (FRAXINUS PENNSYLVANICA, CELTIS LAEVIGATA, ACER SACCHARINUM) TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Acer rubrum - Fraxinus pennsylvanica / Carex spp. / Climacium americanum Forest

Red Maple - Green Ash / Sedge Species / Climacium Moss Forest

Red Maple Forested Seep CEGL002407

DESCRIPTION: The overstory is composed of mixed deciduous bottomland hardwoods that form a closed canopy 20-30 m tall. Typical tree dominants include *Acer rubrum, Fraxinus pennsylvanica*, and *Carpinus caroliniana*. Other tree associates include *Ulmus rubra* and *Diospyros virginiana*. The subcanopy is medium to tall in height (5-10 m) and is generally well-developed. Vines and shrubs are often present and they form entangled thickets. Species present include *Lindera benzoin*. The ground cover is composed of mixed sedges, ferns, and forbs. Species present include *Carex lurida, Carex tribuloides, Gentiana andrewsii, Onoclea sensibilis, Dichanthelium clandestinum (= Panicum clandestinum), Pedicularis lanceolata, Rudbeckia fulgida var. umbrosa, Scirpus polyphyllus, Solidago gigantea*, and *Solidago rugosa*. Dense hummocks of mosses are often prominent in areas of shallow ponding. Species include *Climacium americanum* and *Thuidium delicatulum* (Nelson 1985).

Stands occur on terraces or floodplains that are relatively flat to gently sloping. Soils are at least partially saturated with water, which originates from a combination of groundwater seepage and rainwater. Soils are somewhat poorly drained, ranging from seasonally saturated to moist with a pH above 6.0. They are deep (100+ cm) and equivalent to wet-mesic bottomland soils. The parent material is alluvium. Bedrock is not detectable (Nelson 1985).

COMMENTS: *3, MCS*. The concept of the type is taken from the Missouri state classification - forested fen (Nelson 1985). This type may better fit in the *Acer rubrum - Nyssa sylvatica* Saturated Forest Alliance (A.348). The concept of this type is not clear, as the type may represent a human-modified fen (M. Leahy pers. comm. 2000). This type may be a special feature of other, more extensive wetlands.

CONSERVATION RANK: *GU.* Most of the examples of this type of forested fen have been lost to logging and grazing, but the type is localized and classification is not clear. Stands may in fact arise through modifications to more natural Ozark fens.

DISTRIBUTION: This red maple forested fen community type can be found in the Ozarks region of the midwestern United States, and perhaps in localized parts of the Interior Plateau, such as Indiana and Illinois.

USFS ECOREGIONS: 222Aa:CCC, 222Ad:CC?, 222Ae:CC?, 222Af:CCC, 222Al:CCC, M221:?
CONSERVATION REGIONS: 38:C
STATES: IL? IN? MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:
IL? forested fen ?
IN? circumneutral seep ?
MO forested fen =

OTHER SYNONYMY:

USNVC HIERARCHY: FRAXINUS NIGRA - ACER RUBRUM SATURATED FOREST ALLIANCE (I.B.2.N.g)

Acer saccharum - Quercus rubra - Carya cordiformis / Asimina triloba Forest

Sugar Maple - Northern Red Oak - Bitternut Hickory / Common Pawpaw Forest

Sugar Maple - Oak - Bitternut Hickory Mesic Bottomland Forest CEGL002060

DESCRIPTION: Overstory canopy is generally open because of flash flooding, but on more mesic sites it may be closed. The understory is open and weakly structured in dry-mesic sites, but more closed in mesic ones. The tree layer is dominated by *Acer saccharum, Carya cordiformis, Celtis occidentalis, Quercus alba*, and *Quercus rubra*. Associates include *Juglans nigra, Liquidambar styraciflua*, and *Platanus occidentalis*. Subcanopy trees include *Aesculus glabra, Carpinus caroliniana, Cornus florida, Diospyros virginiana*, and *Ostrya virginiana*. The shrub layer includes *Asimina triloba, Corylus americana, Dirca palustris, Hypericum prolificum (= Hypericum spathulatum)*, and *Lindera benzoin*. Vines, such as *Vitis riparia*, may be present. The herbaceous layer, which ranges from more open in dry-mesic sites to more closed in mesic ones, is quite diverse. Species present, as described from Missouri, include *Anemone canadensis, Aplectrum hyemale, Arundinaria gigantea, Campanulastrum americanum (= Campanula americana), Carex davisii, Carex jamesii, Cystopteris fragilis, Elephantopus carolinianus, Erythronium albidum, Enemion biternatum (= Isopyrum biternatum), Mertensia virginica, Nothoscordum bivalve, Phacelia ranunculacea, Scrophularia marilandica, Silene nivea, Tradescantia subaspera*, and *Viola striata* (Nelson 1985). In Oklahoma, other characteristic species are *Celtis laevigata, Elymus virginicus, Euonymus atropurpurea, Ilex decidua, Sapindus saponaria var. drummondii*, and *Staphylea trifolia*.

This type is largely restricted to narrow valleys and floodplains of small to medium-sized, high-energy streams in hilly topography. During heavy rainstorms, rapid watershed drainage results in high-velocity stream waters. Soils are well-drained to moderately drained, somewhat deep (40-100 cm) to very deep (>100 cm), with soils generally moist through much of the year. Parent material in dry-mesic bottomlands is alluvium, often with massive, but scattered, deposits of gravel and boulders (Nelson 1985).

Flash floods often knock down, bend, or scar tree trunks (Nelson 1985).

COMMENTS: *2, MCS*. The concept of this type is derived from Missouri's Dry-mesic and Mesic Bottomland Forest types (Nelson 1985). Dry-mesic stands are more oak-dominated (and may need their own type), mesic stands are more maple-oak-hickory-dominated. See Floodplain equivalent *Acer saccharum - Carya cordiformis / Asimina triloba* Floodplain Forest (CEGL005035). This association needs to be distinguished from other western mesophytic forests (M. Evans pers. comm. 1997). Compare to *Acer (nigrum, saccharum) - Carya cordiformis* Forest (CEGL004411). According to Hoagland (1997), this community occurs on mesic slopes and floodplains in the eastern tier of Oklahoma counties (Adair, Cherokee, Delaware, LeFlore, Mayes, McCurtain, Muskogee, Ottawa, and Sequoyah). Compare also to *Liquidambar styraciflua - (Quercus alba, Acer saccharum) / Carpinus caroliniana / Lindera benzoin* Forest (CEGL007826). In Arkansas, this vegetation is closely related to *Quercus alba - Quercus rubra - Acer saccharum - Carya cordiformis / Lindera benzoin* Forest (CEGL002058). Douglas Zollner (pers. comm. 1997) suggests that fire frequency may account for the differences, since *Acer saccharum* is more susceptible to fire.

CONSERVATION RANK: *G3.* The total number of occurrences is unknown. Eight have been documented in Missouri, where the community is ranked S3,S3. Although no other occurrences have been documented, the community is also reported in Arkansas (S?), Oklahoma (S?), and possibly Kentucky (SP). It is found in 8 ecoregional subsections. This type is largely restricted to narrow valleys and floodplains of small to medium-sized, high-energy streams in hilly topography. Soils are well drained to moderately drained, somewhat deep (40-100 cm) to very deep (>100 cm), with soils generally moist through much of the year. Most sites have been heavily grazed or logged in the past.

DISTRIBUTION: This dry-mesic to mesic bottomland forest is found in the south-central United States, especially in the Ozark/Ouachita regions.

USFS ECOREGIONS: 222Aa:CCC, 222Af:CCC, 222Ag:CCC, 222Aj:CCP, 222Ak:CCP, 222Al:CCC, 222An:CCC, M222:C, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC
CONSERVATION REGIONS: 32:?, 38:C, 39:C
STATES: AR MO OK **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO dry-mesic bottomland forest; mesic bottomland forest I

OTHER SYNONYMY:

USNVC HIERARCHY: ACER SACCHARUM - CARYA CORDIFORMIS TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Fagus grandifolia - Quercus spp. - Acer rubrum - Juglans nigra Forest

American Beech - Oak Species - Red Maple - Black Walnut Forest

Beech - Mixed Hardwood Floodplain Forest CEGL005014

DESCRIPTION: The closed, deciduous tree canopy has a mixed set of species, with few dominants. Typical constants include *Acer saccharum, Carya cordiformis, Celtis occidentalis, Fagus grandifolia, Fraxinus americana, Juglans nigra, Liriodendron tulipifera, Quercus rubra, Tilia americana, Ulmus americana*, and *Ulmus rubra* among the more typical upland species, and *Acer negundo, Acer rubrum, Acer saccharinum, Fraxinus pennsylvanica*, and *Platanus occidentalis* among the more typical bottomland species. Perhaps the more dominant include *Acer saccharum, Fagus grandifolia, Liriodendron tulipifera, Platanus occidentalis*, and *Ulmus americana*. The tall shrubs, subcanopy trees, and vine species include *Carpinus caroliniana, Hamamelis virginiana, Lindera benzoin, Parthenocissus quinquefolia*, and *Toxicodendron radicans* (Anderson 1996). A wide variety of mesic to wet-mesic herbaceous species are found, and Anderson (1996) presents a fairly comprehensive list.

This community is found on high terraces of small stream floodplains. Soils are well-drained and at least partially alluvial in origin, flooding only occasionally (Anderson 1996). This community is most common in small, headwater valleys that flood for durations short enough to allow for persistence of mesic species. Downstream, this type can be found where the natural levee development is high enough to allow mesic species to persist. This type may then be surrounded on the river side by wetter floodplain types, and on the other side by backwater swamps (Anderson 1996).

COMMENTS: *2, MCS*. This type can be difficult to distinguish from upland beech - maple forests or lower terrace floodplain forests. Vegetation will probably need to be linked to physical site characteristics in order to accurately identify the type, including features such as small stream terraces, presence of occasional, though not annual, flooding, and some alluvial material (Anderson 1996). Disturbed sites may often be more dominated by the wetter and more rapidly colonizing floodplain species, such as *Acer saccharinum* or *Populus deltoides* (Anderson 1996). A related mesic hardwood floodplain type with dominance of *Acer* and *Carya* rather than *Fagus* is the *Acer saccharum - Carya cordiformis / Asimina triloba* Floodplain Forest (CEGL005035). Attribution of Ontario to this type may be stretching this type too far north. Ontario crosswalk may better fit with *Acer saccharum - Fraxinus spp. - Tilia americana / Osmorhiza claytonii - Caulophyllum thalictroides* Forest (CEGL005008). The distribution in central Indiana and western Ohio should be reviewed.

CONSERVATION RANK: *G2G3*. There are probably fewer than 100 occurrences of this community rangewide. Currently 23 occurrences are documented from Indiana (where it is ranked S1) and Ohio (S?). It is also reported from Pennsylvania (S?), and it may occur in Ontario. There are probably fewer than 1000 acres of this community rangewide. Currently 65 acres are documented from 3 occurrences in Indiana. This community is documented from 12 ecoregion subsections.

DISTRIBUTION: This beech - hardwoods floodplain forest community is found in the central United States and adjacent Canada, ranging from Tennessee, Kentucky, Indiana and Ontario, east to Maryland and possibly Pennsylvania.

USFS ECOREGIONS: 221Eg:CCC, 221Fa:CCC, 221Ha:CCC, 221Hb:CCC, 222Db:CCC, 222Dc:CCP, 222De:CCC, 222Df:CCP, 222Ei:CCP, 222Ek:CCC, 222El:CCP, 222Em:CCP, 222Fc:CCP, 222Fd:CCP, 222Fe:CCC, 222Ff:CCC, 222Gc:CPP, 222Gd:CPP, 222Ge:CPP, 222Ha:CCC, 222Hb:CCC, 222Hf:CCC, 222If:CCC, 222Jh:CCP, 222Ji:CCC, 222Jj:CCP
CONSERVATION REGIONS: 44:C, 45:C, 48:C, 49:C, 50:C
STATES: IN KY MD OH? PA? TN? **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: IN mesic floodplain forest =
OH? no state equivalent

OTHER SYNONYMY: Mixed Floodplain Forests (Anderson 1996) =

USNVC HIERARCHY: FAGUS GRANDIFOLIA TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Arundinaria gigantea ssp. gigantea Shrubland

Giant Cane Shrubland

Floodplain Canebrake CEGL003836

DESCRIPTION: The vegetation is dominated by *Arundinaria gigantea*. In Illinois, records from the General Land Office surveys and other sources indicate that canebrakes were common in the southern third of the state. There were canebrakes containing only scattered trees, and other sites that had a fairly well-developed overstory. Some sites of this latter type remain today. Cane was abundant along the Wabash and Ohio drainage systems (B. McClain pers. comm. 2000). In Missouri, these canebrakes were also thought to be common in the Ozark Highlands, particularly in southward-draining rivers and streams with finer-textured, more developed soils on upper floodplain terraces (T. Nigh pers. comm. 2000). Stands may be found along larger rivers (Buffalo, White, Norfork) in the Arkansas Ozarks. In the Central Appalachians various wetlands, including those on alluvial or loess substrates (streamside flats, bottomlands), were dominated by *Arundinaria*, without an overstory, or with widely scattered trees (Central Appalachian Forest Ecoregional Team pers. comm. 1998).

Stands occur on alluvial and loess soils often associated with bottomland hardwood forest vegetation

Canebrakes may have been in part the result of burning by Native Americans, or they may have been successional on extensive aboriginal floodplain agricultural lands which were abandoned following the collapse of Native American populations due to exotic diseases.

COMMENTS: *2, SCS.* This is a general placeholder; several associations are likely to be recognized. Dense, monospecific stands of *Arundinaria gigantea ssp. gigantea* were historically found in bottomland sites in the Southeast. Today, high-quality examples are extremely rare, if not absent. In Louisiana, this vegetation could be of anthropogenic origin (succession following abandonment of Native American agricultural fields?), or could have originated naturally following large windstorms.

CONSERVATION RANK: *G2?.* Stands of this vegetation type were historically widespread, but now are rare or occupy very little acreage. It is thought to be maintained by frequent fire and may have historically resulted from aboriginal agriculture and burning. Dense, monospecific stands of *Arundinaria gigantea ssp. gigantea* were historically found in bottomland sites in the southeastern United States. Today, this vegetation exists as small remnants, and high-quality examples are extremely rare, if not absent.

DISTRIBUTION: These canebrakes occur sporadically throughout the Interior Highlands and other regions of the southern and eastern United States, ranging from Missouri and Arkansas east to North Carolina and possibly Virginia, south to Georgia, and west to Texas. They may have been widespread historically but in localized floodplain areas.

USFS ECOREGIONS: 221Ha:CC?, 221Hc:CCP, 221Hd:CCP, 221He:CC?, 221Ja:CCC, 221Jb:CCP, 221Jc:CCP, 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222An:CCC, 222Ca:CCP, 222Cb:CCP, 222Cc:CCP, 222Cd:CCP, 222Ce:CCP, 222Cf:CCP, 222Cg:CCP, 222Ch:CCP, 222Da:CCP, 222Db:CCP, 222Dc:CCP, 222Dd:CCP, 222De:CCP, 222Dg:CCP, 222Di:CCP, 222Dj:CCP, 222Ea:CCC, 222Eb:CCC, 222Ec:CCC, 222Ed:CCC, 222Ef:CCP, 222Eg:CCP, 222Eh:CCC, 222Ei:CCP, 222Ej:CC?, 222Ek:CCP, 222El:CCP, 222Em:CCP, 222En:CC?, 222Eo:CC?, 222Fa:CCC, 222Fb:CCC, 222Fc:CCC, 222Fd:CCC, 222Ff:CC?, 231Aa:CCP, 231Ab:CC?, 231Ac:CCP, 231Ad:CCP, 231Ae:CCP, 231Af:CCP, 231Ag:CC?, 231Ah:CC?, 231Ai:CCP, 231Am:CC?, 231An:CC?, 231Ao:CCP, 231Ba:CCP, 231Bb:CCP, 231Bc:CCP, 231Bd:CCP, 231Be:CCP, 231Bf:CCP, 231Bg:CCP, 231Bh:CCP, 231Bi:CCP, 231Bj:CCP, 231Bk:CCP, 231Bl:CCP, 231Ca:CCP, 231Cb:CCP, 231Cc:CCP, 231Cd:CCP, 231Ce:CCP, 231Cf:CCP, 231Cg:CCP, 231Da:CCP, 231Db:CCP, 231Dc:CCP, 231Dd:CCP, 231De:CCP, 231Ea:CCP, 231Eb:CCP, 231Ec:CCC, 231Ed:CCC, 231Ee:CCP, 231Ej:CCP, 231Ek:CCP, 231Em:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 234Aa:CCC, 234Ab:CC?, 234Ac:CCP, 234Ad:CCP, 234Ae:CCC, 234Af:CCP, 234Ag:CCC, 234Ah:CC?, 234Ai:CCC, 234Aj:CC?, 234Ak:CC?, 234Al:CCP, 234Am:CCC, 234An:CCC, M221Dc:CCC, M221Dd:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC

CONSERVATION REGIONS: 38:C, 40:C, 41:X, 42:C, 43:P, 44:C, 50:?, 51:C, 52:P, 53:P, 59:C

STATES: AL AR GA IL KY LA MO MS NC OK SC TN TX VA? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL wet-mesic upland forest (S) +
MO no state equivalent

OTHER SYNONYMY: P5A4bIII. *Arundinaria gigantea* (Foti et al. 1994), Canebrake, No equivalent (Allard 1990)

USNVC HIERARCHY: ARUNDINARIA GIGANTEA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (III.A.2.N.g)

Quercus falcata Flatwoods Forest

Southern Red Oak Flatwoods Forest

Southern Red Oak Flatwoods Forest CEGL004412

DESCRIPTION: The vegetation is dominated by *Quercus falcata*. The canopy may also contain some *Quercus alba* and *Quercus stellata*, and possibly *Carya alba*. The ground cover is predominantly leaf litter, and most occurrences are thought to be fire-suppressed.

Stands occur on somewhat poorly drained sites. It is perhaps marginally a wetland.

Fire appears to be important to maintaining the open structure of these stands.

COMMENTS: *2, SCS*. In Kentucky, historic occurrences have been cleared, drained and tiled, and remaining sites are small and degraded. Similar flatwoods vegetation occurs elsewhere in Kentucky but have temporarily flooded hydrology and different canopy dominants [see I.B.2.N.d *Fraxinus pennsylvanica - Ulmus americana - Celtis (occidentalis, laevigata)* Temporarily Flooded Forest Alliance (A.286) and I.B.2.N.e *Quercus palustris - (Quercus bicolor)* Seasonally Flooded Forest Alliance (A.329)]. This type is also better drained than *Quercus phellos* flatwoods. It is known historically from the Upper East Gulf Coastal Plain of western Kentucky (eastern Gulf Coastal Plain on tertiary terraces), western Tennessee, and northwestern Mississippi (the "flatwoods belt"), as well as the Shawnee Hills and the Knobs region of Kentucky. See the dissertation of Wharton (1945) for information on this association in the Knobs region.

CONSERVATION RANK: *G2?.* This is an unusual upland wetland community, never abundant in the landscape and severely impacted by agriculture and other intensive land uses. Even historically, it was known only from the Upper East Gulf Coastal Plain of western Kentucky, western Tennessee, and northwestern Mississippi (the "flatwoods belt"), and the Shawnee Hills and Knobs region of Kentucky. Most occurrences are small in size and lack any jurisdictional wetland protection. Most historic occurrences have been cleared, drained and tiled, and the few remaining sites are small and degraded. Fire suppression has also caused degradation of remaining examples.

DISTRIBUTION: This southern red oak flatwoods forest is found in parts of the Interior Low Plateau of the United States, ranging from Kentucky and Tennessee into parts of Indiana and Mississippi.

USFS ECOREGIONS: 222Cb:CCC, 222Cc:CCP, 222Ce:CCP, 222Da:CCC, 222E:C?
CONSERVATION REGIONS: 43:C, 44:C
STATES: IN? KY MS TN **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IN? mesic southwestern lowland flatwoods ?

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS FALCATA FOREST ALLIANCE (I.B.2.N.a)

Quercus palustris - (Quercus stellata) - Quercus pagoda / Isoetes spp. Forest

Pin Oak - (Post Oak) - Cherrybark Oak / Quillwort Species Forest

Pin Oak - Post Oak Lowland Flatwoods CEGL002101

DESCRIPTION: This community is dominated by broadleaf deciduous trees, with sparse to well-developed understory, shrub, and herbaceous strata. Dominant canopy species are *Quercus palustris* and *Quercus pagoda*. Other trees often encountered include *Ulmus americana, Fraxinus* spp., *Liquidambar styraciflua, Quercus shumardii*, and *Quercus stellata*. *Quercus bicolor* can be plentiful in northern extensions of this element, while *Quercus texana (= Quercus nuttallii)* is commonly found in southern occurrences. The subcanopy is sparse and dominated by red *Acer rubrum*, although a diverse mixture of bottomland species can be present as well. *Ilex decidua* and *Crataegus viridis* dominate the shrub layer. *Carex* spp. dominate the herbaceous layer, but a diverse mixture of forbs can also be present. *Pycnanthemum tenuifolium*, an aromatic herbaceous species more commonly associated with dry uplands, reflects the dry conditions seasonally found in this forest. Numerous ubiquitous species grow in this natural community; the most commonly encountered are *Campsis radicans* and *Toxicodendron radicans* which dominate the vine stratum.

Soils are slowly to very slowly permeable due to a high clay content or the presence of a fragipan. This results in a shallow, perched water table during the rainy season (winter and spring) and dry conditions during the summer and fall, thereby restricting rooting depth. Soils are silt loam to silty clay loam, deep, heavy, strongly acid (pH 5.1-5.5), and poorly drained. These soils have a moderate to high clay content and a high shrink-swell capacity. Subsequently, when soils are wet, they are very impermeable; when dry, they crack excessively. This tendency to contract and expand in response to moisture creates a hummocky, uneven surface with many slight depressions. As with other flatwood forests, vegetative density and diversity are largely regulated by the duration and depth of seasonal flooding and summer drought (TNC 1995a).

Natural disturbance includes damage caused by flooding, wind, lightning, drought, and fire. These may favor more heliotrophic plant species. Unnatural flood severity due to levees and channelization may have eliminated *Quercus stellata* from most examples of this forest.

COMMENTS: *2, MCS*. *Quercus palustris* and *Quercus pagoda* are good indicator species and should be the dominant contributors to the forest canopy. Less dominant but also diagnostic is the presence of *Quercus stellata*, which is indicative of periods of dry to very dry conditions.

CONSERVATION RANK: *G2G3.* There may be less than 20 occurrences of this community rangewide. It is reported from southwestern Indiana (where it is ranked S1), southern Illinois (S2), and southeastern Missouri (S2); it may also occur in Arkansas, Tennessee, and Kentucky. It has a restricted natural distribution; it is a bottomland community restricted to poorly drained terrace "flats" along major river floodplains. Currently there are 10 occurrences documented from Illinois, Indiana, and Missouri. There are probably more examples of this type in earlier successional stages, dominated by *Quercus palustris* (M. Leahy pers. comm. 1999).

DISTRIBUTION: This community is found in southern Illinois, southwestern Indiana, southeastern Missouri, and possibly eastern Kentucky. Further field research is needed to verify the occurrence of this community in Kentucky, Arkansas, and Tennessee.

USFS ECOREGIONS: 222Ao:CPP, 222Ch:CCC, 222Db:CCC, 222Dc:CCC, 222De:CC?, 222Di:CCC, 222E:CP, 222Ga:CCC, 222Gb:CCC, 222Ge:CCC, 231B:PP, 234Ac:CCC, 234Am:CCC
CONSERVATION REGIONS: 42:C, 43:C, 44:C
STATES: AR? IL IN KY? MO TN? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	southern flatwoods +
IN	mesic southwestern lowland flatwoods =
MO	flatwoods +

OTHER SYNONYMY: *Quercus phellos - Quercus palustris* shallow floodplain type (Robertson et al. 1984). Flatwoods occupy low-lying dry timber land on level to nearly level soil that has an impermeable or slowly permeable layer (hardpan) which causes a shallow, perched water table and widely fluctuating soil moisture (White and Madany 1978, Nelson 1985)., Pin Oak - Sweetgum: 65, in part (Eyre 1980)

USNVC HIERARCHY: QUERCUS PALUSTRIS - (QUERCUS BICOLOR) SEASONALLY FLOODED FOREST ALLIANCE (I.B.2.N.e)

Decodon verticillatus Seasonally Flooded Shrubland

Swamp-loosestrife Seasonally Flooded Shrubland

Swamp-loosestrife Pond CEGL003905

DESCRIPTION: The wetland vegetation is dominated by *Decodon verticillatus*, typically in peaty backwater or depression situations. Few other species are present because the *Decodon* is extremely dense; the only other species that are common are *Cephalanthus occidentalis* and possibly *Itea virginica*.

Some examples occur in depression ponds, while others may be found in floodplain pools and lakeshores.

COMMENTS: *3, SCS*. A number of associations may be needed to reflect the disparate hydrologic and floristic situations in which *Decodon* dominates. Examples of *Decodon*-dominated vegetation are known from Paynes Prairie State Park, Florida, Reelfoot Lake, Tennessee, waterfowl impoundments in South Carolina, swamps on Fort Benning, Georgia, as well as from Arkansas. In Indiana, at least one pond is completely covered with *Decodon* (M. Homoya pers. comm. 2000).

CONSERVATION RANK: *G4.*

DISTRIBUTION: This vegetation is known in the outer Atlantic Coastal Plain of North and South Carolina, peninsular Florida, and the northern Mississippi River Alluvial Plain. It is found in Alabama, Arkansas, Florida, Georgia, Indiana, North Carolina, South Carolina, Tennessee, Kentucky, and possibly others.

USFS ECOREGIONS: 222E:PP, 231B:CC, 232Bf:CCC, 232Cb:CCC, 232Ce:CCC, 234An:CCC
CONSERVATION REGIONS: 42:C, 43:C, 44:P, 53:C, 55:C, 56:C, 57:C
STATES: AL AR FL GA IN KY NC SC TN **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IN sinkhole pond +

OTHER SYNONYMY:

USNVC HIERARCHY: DECODON VERTICILLATUS SEASONALLY FLOODED SHRUBLAND ALLIANCE (III.B.2.N.e)

Acer negundo Forest

Box-elder Forest

Box-elder Floodplain Forest CEGL005033

DESCRIPTION: These early successional forests are dominated by *Acer negundo*. Other characteristic species include *Platanus occidentalis, Celtis laevigata, Acer rubrum, Liquidambar styraciflua, Acer saccharinum, Ulmus alata, Ulmus rubra, Carpinus caroliniana, Morus rubra*, and *Populus deltoides*. The shrub and herb layers range from sparse to relatively lush, and the vine component often is heavy. The range, dynamics, and variability of this type are complicated by the 'weedy' nature of *Acer negundo*, e.g., in Kentucky, *Acer negundo* may be dominant in old fields, with *Dichanthelium clandestinum* and *Carex* spp. in the ground layer. Elsewhere in the Midwest, logged and grazed stands of *Fraxinus pennsylvanica* and *Ulmus americana* may be dominated by *Acer negundo*.

Stands occur on large rivers in the active floodplain and on sandbars, and may form farther from the riverfront following disturbance. They are typically temporarily flooded in the spring. In Kentucky, these forests may also occur in old fields.

This type is an early successional community that arises from natural and cultural disturbances on floodplains. Stands where occasional flash floods that create extensive open alluvial deposits may be colonized by this type.

COMMENTS: *2, SCS*. The range, dynamics, and variability of this type is complicated by the 'weedy' nature of *Acer negundo*. For example, disturbed stands in the *Fraxinus pennsylvanica - Ulmus americana - Celtis (occidentalis, laevigata)* Temporarily Flooded Forest Alliance (A.286) often become dominated by *Acer negundo*. And in the upper Midwest *Acer negundo*-dominated stands are treated as part of the *Fraxinus pennsylvanica - (Ulmus americana) / Symphoricarpos occidentalis* Forest (CEGL002088). Thus, some consistency is needed in the application of this type across its range. In Arkansas, these forests can be pure *Acer negundo* or have *Acer rubrum* and *Platanus occidentalis* as associates (T. Foti pers. comm. 1999). Composition is variable. In central Kentucky, a simple strip of *Acer negundo* and *Platanus occidentalis*, plus *Ulmus americana*, etc., is common along all medium-sized streams, with almost no *Acer saccharinum* or *Populus deltoides* (J. Campbell pers. comm. 1999). This type occurs along the Arkansas River in Arkansas (D. Zollner pers. comm. 1999). In Missouri, stands would probably be combined with *Betula nigra - Platanus occidentalis* Forest (CEGL002086) (M. Leahy pers. comm. 1999). In Kentucky, this may be found at the Licking River impoundment (Cave Run Lake).

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This *Acer negundo* floodplain forest is found sporadically on floodplains in the southern, eastern, and midwestern United States, ranging from Maryland west to Iowa, south to Louisiana, and east to Georgia.

USFS ECOREGIONS: 221Hb:CCC, 222C:CP, 222Eo:CCC, 231B:PP, 234Aa:CCC, 234Ab:CCC, 234Ac:CCC, 234Ad:CCC, 234Ae:CCC, 234Af:CCC, 234Ag:CCC, 234Ah:CCC, 234Ai:CCC, 234Aj:CCC, 234Ak:CCC, 234Al:CCC, 234Am:CCC, 234An:CCC
CONSERVATION REGIONS: 31:?, 32:P, 39:C, 40:C, 41:P, 42:C, 43:C, 44:C, 50:C, 53:P, 56:?, 57:C, 58:?, 59:P
STATES: AL AR GA IA KY LA MD MO MS OK SC TN TX? VA WV **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO no state equivalent

OTHER SYNONYMY:

USNVC HIERARCHY: ACER NEGUNDO TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Fraxinus pennsylvanica - Ulmus americana - Celtis laevigata / Ilex decidua Forest

Green Ash - American Elm - Sugarberry / Possum-haw Forest

Southern Green Ash - Elm - Sugarberry Forest CEGL002427

DESCRIPTION: This community is a broadleaf deciduous floodplain forest which exhibits high canopy diversity and good herbaceous diversity (although lower herbaceous diversity than mesic floodplain forest). *Ulmus americana* was once the most prominent member of this forest, but Dutch elm disease (*Ceratostomella ulmi*) and logging have eliminated many of the largest mature *Ulmus* spp. from most of the species natural range (Collingwood and Bush 1984). *Fraxinus pennsylvanica* dominates on moist flats and shallow sloughs, while *Celtis laevigata* is most prevalent on new land or front sites. Other species commonly encountered include *Carya aquatica, Quercus lyrata, Liquidambar styraciflua*, and *Acer negundo*. The subcanopy is often dense and dominated by *Fraxinus pennsylvanica* which sprouts prolifically. *Fraxinus pennsylvanica*, however, is considered a pioneer species and does not maintain its canopy position under intense shading found in later successional stages (Voigt and Mohlenbrock 1964). Shrubs typical of this forest include *Cornus drummondii, Ilex decidua*, and *Crataegus* spp. The herbaceous layer is dense and diverse, dominated by *Galium* spp., *Viola* spp., *Carex* spp., *Leersia* spp., *Boehmeria cylindrica, Laportea canadensis, Pilea pumila, Impatiens capensis (= Impatiens biflora)*, and *Impatiens pallida*. Vines most often encountered include *Toxicodendron radicans, Campsis radicans*, and *Parthenocissus quinquefolia*. (TNC 1995a)

This community occurs in floodplains of major rivers, generally alluvial or brownwater rivers, on low ridges, flats, and sloughs; terrace flats and sloughs; and occasionally on new lands or fronts. In terms of hydrology, this is a Zone IV community (Wharton 1982). Soils are clay or silt loams that are seasonally inundated or saturated for 1 or 2 months during the growing season, with a 50-100% annual frequency (Eyre 1980, Smith and Craig 1990). Alluvial deposition and nutrient input occurs, but less than in more frequently flooded forest types (Schafale and Weakley 1990).

Frequent or prolonged ponding due to excessive rainfall or beaver activity results in considerable variations in vegetative structure and composition, often causing high tree mortality.

COMMENTS: *2, SCS.*

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This green ash - elm - hackberry community is found throughout the central and southern United States on floodplains of major rivers from Texas, Oklahoma, Arkansas, north to southern Illinois and adjacent Indiana, east to Tennessee, and south to Louisiana. The range formerly included states of the Atlantic Coastal Plain, now see *Fraxinus pennsylvanica - Ulmus americana / Carpinus caroliniana / Boehmeria cylindrica* Forest (CEGL007806).

USFS ECOREGIONS: 221D:CC, 222C:CC, 222D:CP, 222E:CP, 231Ba:CPP, 231C:CP, 231D:CP, 231E:CC, 231G:C?, 232D:CP, 232F:CC, 234A:CC, 255:C, M231A:CP
CONSERVATION REGIONS: 31:C, 39:C, 40:C, 41:C, 42:C, 43:P, 44:C, 50:P, 52:C, 53:C
STATES: AR IL IN? KY LA MO MS OK TN TX? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	wet-mesic floodplain forest (S) +
IN?	wet-mesic floodplain forest ?
MO	no state equivalent

OTHER SYNONYMY: Southern Green Ash - Elm - Sugarberry Forest, IIA6d. Sugarberry - American Elm - Green Ash Bottomland Forest (Allard 1990), P1B3cIV9a. *Celtis laevigata - Fraxinus pennsylvanica - Ulmus americana* (Foti et al. 1994)

USNVC HIERARCHY: FRAXINUS PENNSYLVANICA - ULMUS AMERICANA - CELTIS (OCCIDENTALIS, LAEVIGATA) TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Quercus lyrata - Carya aquatica - (Quercus texana) / Forestiera acuminata Forest

Overcup Oak - Water Hickory - (Nuttall Oak) / Swamp-privet Forest

Overcup Oak - Nuttall Oak Bottomland Forest CEGL002423

DESCRIPTION: This community is a bottomland mixed hardwoods forest. The trees are tall (30-45 m) and the canopy is well-developed (60-100% cover). Typical dominants include *Quercus lyrata, Carya aquatica*, and *Quercus texana*. The dense shrub/sapling layer reaches heights of 8 m or more. *Forestiera acuminata* is among the shrubs found there. Lianas are common. The moderately dense (20-60% cover) ground layer is composed of mixed herbaceous species.

Stands occur on level to gently sloping bottomlands along streams and rivers. Flooding occurs during periods of heavy precipitation often resulting in ponding. A high water table is present. The deep soils (>100 cm) are somewhat poorly drained and are seasonally or intermittently wet. The parent material is alluvium.

COMMENTS: *3, SCS*. This association, and the related *Quercus lyrata - Liquidambar styraciflua / Forestiera acuminata* Forest (CEGL002424), have been compared to related associations in the Southeast (e.g., CEGL007397), and differences resolved. *Quercus lyrata - Carya aquatica* Forest (CEGL007397) was a related broad-ranging type which has been split. The portion of CEGL007397 west and north of the East Gulf Coastal Plain has been conceptually transferred to CEGL002424/CEGL002423. *Quercus texana* is a preferred synonym for *Quercus nuttallii*.

CONSERVATION RANK: *G2Q.* Few intact or recovering sites remain of this community type in Missouri and Illinois. Most have been drained, logged, and cleared for agriculture or development.

DISTRIBUTION: This community is found in the Mississippi River Alluvial Plain of southeastern Missouri (and presumably Illinois) south to Louisiana and Mississippi, and west into the West Gulf Coastal Plain and adjacent ecoregions of Texas.

USFS ECOREGIONS: 222:C, 231Bh:PPP, 234Aa:CCC, 234Ac:CCC, 234Ad:CCC, 234Ae:CCC, 234Af:CCC, 234Ag:CCC, 234Ah:CCC, 234Ai:CCC, 234Aj:CCC, 234Ak:CCC, 234Al:CCC, 234Am:CCC, 234An:CCC
CONSERVATION REGIONS: 31:?, 40:P, 41:C, 42:C, 43:C
STATES: AR IL KY LA MO MS TN TX **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL wet floodplain forest (S) +
MO wet bottomland forest +

OTHER SYNONYMY: Overcup Oak - Water Hickory: 96, in part (Eyre 1980) B. The SAF cover type (Overcup Oak - Water Hickory) is broader and has a much more extensive range.

USNVC HIERARCHY: QUERCUS LYRATA - (CARYA AQUATICA) SEASONALLY FLOODED FOREST ALLIANCE (I.B.2.N.e)

Quercus lyrata - Liquidambar styraciflua / Forestiera acuminata Forest

Overcup Oak - Sweetgum / Swamp-privet Forest

Overcup Oak - Sweetgum Bottomland Forest CEGL002424

DESCRIPTION: This forest is dominated by broad-leaved deciduous trees with a southern affinity (Voigt and Mohlenbrock 1964), but in southern Illinois, *Quercus palustris* often occurs within this element. *Quercus lyrata* and *Liquidambar styraciflua* are usually dominant. Other canopy species commonly encountered include *Ulmus americana, Fraxinus profunda, Quercus palustris, Celtis laevigata*, and *Acer saccharinum*. Trees in this forest often exhibit thick trunks and stout branches which form a broad, irregular crown. Oaks are generally of medium height, while *Liquidambar styraciflua* may reach 45 m in height with tall, straight trunks that are clear of branches for two-thirds of its height. The subcanopy in some occurrences is dense and is dominated by *Crataegus viridis* and *Ulmus americana*. *Forestiera acuminata, Ilex decidua*, and *Cephalanthus occidentalis* dominate the shrub layer. Commonly encountered herbaceous species include *Laportea canadensis, Boehmeria cylindrica, Pilea pumila*, and *Cinna arundinacea*. Vines are often quite dense and include *Brunnichia ovata (= Brunnichia cirrhosa), Campsis radicans*, and *Vitis* spp. Vegetative density and diversity within this natural community fluctuates with the depth and duration of seasonal flooding.

Flooding occurs seasonally or during periods of heavy precipitation, often resulting in ponding. A high water table is present. The deep soils (greater than 100 cm in depth), derived from alluvial parent material, are somewhat poorly drained and are seasonally wet. Soils which support this community include dominantly level or nearly level soils that formed in alluvium on poorly drained floodplains. These soils are deep, fine- to very fine-textured (clays) and have excessive moisture available for vegetation during the growing season. In Illinois, the soil series are poorly to very poorly drained, light-colored, extremely acid, and formed on deep silty clay sediments more than 125 cm thick. This community is subject to frequent, shallow flooding which can extend well into the growing season. Occasional prolonged deep flooding causes increased tree mortality, creating openings which are quickly recolonized after the water recedes (Johnson and Bell 1976).

Natural disturbance includes flooding, wind, and storm damage.

COMMENTS: *2, SCS*. This element is found on the most poorly drained floodplain backwaters where flooding extends well into the growing season and soils are clayey. In this environment, *Quercus lyrata* is often present in nearly pure stands. In southern Illinois, where this community reaches the northern extension of its range, species with a more northern affinity (*Quercus palustris, Acer rubrum*) may occur in sufficient numbers to cause classification difficulties. The presence and relative density of *Quercus lyrata* should be the primary species characteristic used to identify this natural community.

CONSERVATION RANK: *G4G5*. It is possible that this type may be ranked higher (G3G4) because of extensive clearing, timber harvesting, and drainage of stands.

DISTRIBUTION: This community is most prevalent in northwestern Louisiana, southwestern Arkansas, and extreme eastern Texas but extends northward into Missouri, southern Illinois, western Tennessee, western Kentucky, and southern Indiana, and east to parts of Mississippi and Alabama.

USFS ECOREGIONS: 231A:PP, 231B:PP, 231C:PP, 231E:PP, 232B:PP, 232C:PP, 232F:PP, 234Aa:CCC, 234Ac:CCC, 234Ad:CCC, 234Ae:CCC, 234Af:CCC, 234Ag:CCC, 234Ah:CCC, 234Ai:CCC, 234Aj:CCC, 234Ak:CCC, 234Al:CCC, 234Am:CCC, 234An:CCC
CONSERVATION REGIONS: 31:?, 40:C, 41:C, 42:C, 43:P, 53:P
STATES: AL AR IL IN KY LA MO MS TN TX **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	wet floodplain forest (S) +
IN	forested swamp +
MO	wet bottomland forest +

OTHER SYNONYMY: P1B3cI1a. *Quercus lyrata - Carya aquatica* (Foti et al. 1994), P1B3cI. *Quercus lyrata*, in part (Foti et al. 1994), Overcup Oak / *Justicia* Clayey/Loamy Seasonally Flooded Low River Floodplains, in part (Turner et al. 1999), Overcup Oak - Water Hickory: 96, in part (Eyre 1980), Wet Floodplain Forest B.

USNVC HIERARCHY: QUERCUS LYRATA - (CARYA AQUATICA) SEASONALLY FLOODED FOREST ALLIANCE (I.B.2.N.e)

Quercus michauxii - Quercus shumardii - Liquidambar styraciflua / Arundinaria gigantea Forest

Swamp Chestnut Oak - Shumard Oak - Sweetgum / Giant Cane Forest

Swamp Chestnut Oak - Sweetgum Mesic Floodplain Forest CEGL002099

DESCRIPTION: This is a floodplain forest dominated by broad-leaved deciduous trees. Although canopy diversity can be high, this community is dominated by *Quercus michauxii, Quercus shumardii, Liquidambar styraciflua*, and sometimes *Carya laciniosa*. Trees exhibit good growth and attain heights in excess of 30 m (up to 60 m for *Quercus shumardii*), with straight, thick trunks which are clear of branches for nearly two-thirds of their height. Canopy closure is at or near 100%. The subcanopy is dense and dominated by *Carpinus caroliniana* and *Ulmus alata*. Dominant shrubs include *Ilex decidua, Cornus foemina*, and *Viburnum dentatum*. The herbaceous layer is dense and dominated by *Carex* spp. and a diverse and varied assemblage of grasses and forbs, including *Arundinaria gigantea*, which often forms dense, almost impenetrable stands particularly where canopy openings allow sunlight to reach the forest floor. Vines are prevalent in the subcanopy and understory of this community; the most commonly encountered are *Toxicodendron radicans, Campsis radicans*, and *Parthenocissus quinquefolia* (TNC 1995a). In the southern Cumberland Plateau of northern Alabama, the community is found on limestone-derived soils. The midstory stratum is dominated by *Ulmus rubra, Acer barbatum* and *Carpinus caroliniana*. Also in this area, *Aesculus pavia* is a characteristic species of the understory in addition to scattered dense patches of *Arundinaria gigantea*.

Stands occur on level or nearly level to gently sloping soils that formed in alluvium on floodplains. They are subject to infrequent, short-duration, shallow flooding (<1.5 m). Seasonal flooding (early winter and late spring) contributes nutrients and sediments to this dynamic and productive ecosystem. Soils are deep, medium-textured, typically with a somewhat acidic or circumneutral pH. Ponding of water may occur where impermeable clay layers are present. Soils can be sandy on terraces and first bottoms.

Natural disturbance includes flooding, wind, and storm damage.

COMMENTS: *2, SCS*. Distribution of this association in the Midwest needs further assessment. In Kentucky, the type is known from the Peal Wildlife Management Area, Ballard County, in the Upper East Gulf Coastal Plain, where it occurs adjacent to cypress sloughs and swamps. Examples occur on Macon Ridge, Louisiana. *Quercus shumardii* produces large quantities of acorns, but germination is low and regeneration is subsequently poor. As a result of these characteristics, *Quercus shumardii* may be absent from much of its original range. In such cases *Quercus michauxii* and *Quercus pagoda* are often the dominant oaks in this community type. The presence of only a few *Quercus shumardii* individuals may warrant its inclusion in this element. Careful consideration of past disturbance must be considered when determining the classification status of this natural community. Stands in the Bankhead National Forest of Alabama may occur on limestone-derived soils.

CONSERVATION RANK: *G3G4*. This is a widely distributed community, but high-quality extensive examples are rare. Extensive logging and drainage have reduced the extent of this type. Hydrological changes resulting from impoundments threaten the long-term existence and replacement of this type.

DISTRIBUTION: This community can occur on bottomlands and along streams and the borders of swamps in the Mississippi, Ohio and Tennessee river valleys from central Arkansas, Louisiana and Mississippi, to west-central Tennessee, northern Alabama, western Kentucky, southern Missouri, southern Illinois, and extreme southwestern Indiana. Distribution of this association in the Midwest needs further assessment.

USFS ECOREGIONS: 221He:CCC, 222Al:CCC, 222Ao:CCP, 222Ca:CCC, 222Cb:CCC, 222Ch:CCC, 222Db:CCC, 222Dc:CCC, 222Di:CCC, 222Eb:CPP, 222Ff:CCC, 222Gc:CCC, 231A:CP, 231B:CP, 231Cd:CCC, 231E:CP, 232B:CP, 232C:CP, 232F:CP, 234Ac:CCC, 234An:CCC, M221Cd:CCC

CONSERVATION REGIONS: 38:C, 39:?, 40:C, 42:C, 43:C, 44:C, 50:C

STATES: AL AR IL IN KY LA MO MS OK? TN **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	mesic floodplain forest (S) I
IN	wet-mesic floodplain forest +
MO	wet-mesic bottomland forest +

OTHER SYNONYMY: *Liquidambar styraciflua - Ulmus americana* lower slope - shallow floodplain type (Robertson et al. 1984) I. *Quercus - Carya / Hymenocaulis* community (Voigt and Mohlenbrock 1964) =.

USNVC HIERARCHY: QUERCUS (MICHAUXII, PAGODA, SHUMARDII) - LIQUIDAMBAR STYRACIFLUA TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Quercus phellos - (Quercus lyrata) / Carex spp. - Leersia spp. Forest

Willow Oak - (Overcup Oak) / Sedge Species - Cutgrass Species Forest

Willow Oak Bottomland Forest CEGL002102

DESCRIPTION: This community is dominated by broad-leaved deciduous trees and has sparse to well-developed understory, shrub, and herbaceous strata. Dominant trees include *Quercus phellos, Celtis laevigata, Fraxinus pennsylvanica*, and *Ulmus americana*. *Quercus lyrata* and *Quercus texana* also frequently occur. Trees in this forest are usually of medium height (20-30 m) (Nelson 1985), and unfavorable soil conditions often cause them to be stunted. The understory and shrub layers are poorly developed (less than 50% cover) consisting primarily of *Acer rubrum, Ilex decidua*, and *Forestiera acuminata*. The herbaceous stratum is dominated by *Carex* spp., *Leersia oryzoides*, and *Cinna arundinacea*. Herbaceous density is generally low but fluctuates with canopy openness. Elevated rises exhibit plants common of dry and dry-mesic soils such as *Porteranthus stipulatus* and *Pycnanthemum tenuifolium*, while wet and wet-mesic soils found in shallow ephemeral or seasonal ponds in depressions are dominated by sedges. *Symphyotrichum lanceolatum (= Aster lanceolatus)* is a ubiquitous species often encountered in flatwoods, as are the vines *Toxicodendron radicans* and *Campsis radicans* (Voigt and Mohlenbrock 1964, TNC 1995a).

This willow oak flatwoods forest occurs in bottomland flatwoods environments of major rivers in the south-central United States. This type most often occurs on first bottoms and terrace flats with poorly drained, heavy silty clay soils that are flooded with shallow water each winter and spring. The relatively high clay content (sometimes forming a fragipan) in these soils produces a perched water table that contributes to prolonged wet conditions and equally severe summer dry periods when soils become hard and develop excessive cracks. This restricted soil permeability is characteristic of flatwoods, which contain species typical of drier upland sites on slight rises and shallow ephemeral seasonal ponds in depressions.

Natural disturbance includes damage caused by flooding, wind, lightning, drought, and fire.

COMMENTS: *3, SCS*. This community is most prevalent in the poorly drained bottomlands of the Mississippi River and its major tributaries. It can be found in extreme southern Illinois and southeastern Missouri, from where it was initially described; however, in Illinois, *Quercus phellos* is reported only from Massac County (Mohlenbrock and Voigt 1959), and in Missouri this type could be lumped with *Quercus palustris - (Quercus stellata) - Quercus pagoda / Isoetes* spp. Forest (CEGL002101) (M. Leahy pers. comm. 1999). Further field research is needed to document this community outside the Mississippi River Alluvial Plain. This type or related vegetation has been reported from and attributed to the Interior Low Plateau of Kentucky (J. Campbell pers. comm. 1999), as well as Louisiana (L. Smith pers. comm. 1999), and southern Arkansas (D. Zollner pers. comm. 1999). More information is needed on these occurrences. Its proposed occurrence in Mississippi and Tennessee is speculative.

This type may need to be split as more information becomes available. Similar *Quercus phellos* flatwoods occur in southern Kentucky's karst region (Pennyroyal Plateau) and are wetter than other Kentucky flatwoods types (J. Campbell pers. comm.). Given that the alliance concept includes communities primarily found in upland depressions, the placement of this association here is problematic and needs to be assessed. *Quercus phellos* is the indicator species and should be the dominant contributor to the forest canopy. Another unique diagnostic attribute of this community is the presence of dry and dry-mesic herbaceous species on slight rises and wet or wet-mesic herbaceous plants in shallow ephemeral pools.

CONSERVATION RANK: *G3G4Q*. Rank cannot be assigned until SCS completes review of type.

DISTRIBUTION: This willow oak flatwoods forest occurs in bottomland flatwoods environments of major rivers in the south-central United States, ranging from extreme southern Illinois and southeast Missouri south to Arkansas, Louisiana, and perhaps elsewhere.

USFS ECOREGIONS: 221:C, 222C:CP, 231A:CP, 231B:CP, 231Ej:CCC, 232B:PP, 234Ac:CCC, 234Ad:CCC
CONSERVATION REGIONS: 39:P, 40:C, 42:C, 43:?, 44:C
STATES: AR IL KY? LA MO? MS? TN? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL wet-mesic floodplain forest (S) ?
MO? flatwoods ?

OTHER SYNONYMY: *Quercus phellos - Quercus palustris* shallow floodplain type (Robertson et al. 1984) F

USNVC HIERARCHY: QUERCUS PHELLOS SEASONALLY FLOODED FOREST ALLIANCE (I.B.2.N.e)

Acer rubrum - Gleditsia aquatica - Planera aquatica - Fraxinus profunda Forest

Red Maple - Water-locust - Planertree - Pumpkin Ash Forest

Red Maple - Water Locust Mixed Bottomland Forest CEGL002422

DESCRIPTION: This community is dominated by broadleaf deciduous trees and well-developed understory, shrub, and herbaceous strata. It is characterized by dense growth and a great diversity of species. *Acer rubrum* and *Fraxinus profunda* are the dominant overstory species in this community, but *Liquidambar styraciflua, Quercus lyrata, Quercus bicolor*, and *Ulmus rubra* occur almost as frequently. *Populus heterophylla* is an uncommon associate. *Acer rubrum* and *Fraxinus profunda* dominate the subcanopy. The shrub layer can include a diverse mixture, including *Cephalanthus occidentalis, Forestiera acuminata*, and *Ilex decidua*, but *Itea virginica* is characteristic of this community. Even with dense shading, the herbaceous layer is usually well-developed, displaying a preponderance of *Carex* spp. and *Leersia* spp., *Glyceria* spp., and *Boehmeria cylindrica, Laportea canadensis, Pilea pumila*. *Vitis* spp. are characteristic vines of this community, but *Toxicodendron radicans* and *Campsis radicans* are also prominent. The Coastal Plain is well represented in this community by *Taxodium distichum, Fraxinus profunda*, and *Gleditsia aquatica*. Basal area can reach 40-42 m2/ha (Robertson et al. 1984, TNC 1995a).

Stands occur on the seasonally flooded bottomlands along rivers and large streams. Soils which support this forest are predominantly medium- and fine-textured, clayey, slowly permeable, alluvial sediments deposited in slackwater areas of floodplains. The water regime is characterized by seasonal shallow flooding, although hydrologic conditions are often extremely variable.

Frequent or prolonged ponding due to excessive rainfall or beaver activity results in considerable variations in vegetative structure and composition, often causing high tree mortality.

COMMENTS: *2, MCS*. *Acer rubrum var. drummondii* is the variety found in this type. Distribution of this community in the Southeast needs verification. This natural community supports a diverse assemblage of bottomland hardwoods. Perhaps the most diagnostic characteristic of this community is the mixture of bottomland hardwoods found there. Species typical of wetter and drier sites are commonly encountered, but the diagnostic feature is shallow standing water or soil saturation for a significant portion of the growing season. Slight ridges within these flooded zones provide drier habitat for less flood-tolerant species. Dominance will vary according to site-specific physical conditions.

CONSERVATION RANK: *G3G5.*

DISTRIBUTION: This red maple - southern hardwoods bottomland forest type is found in the Mississippi River Alluvial Plain of the United States, ranging from Indiana and Illinois to Kentucky and Missouri, and possibly in Tennessee and Arkansas.

USFS ECOREGIONS: 222Ao:CPP, 222Db:CCC, 222Df:CCC, 222Ek:CCC, 234Ac:CCC, 234An:CCP
CONSERVATION REGIONS: 38:C, 42:C, 43:C, 44:C
STATES: AR IL IN? KY MO TN? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	wet floodplain forest (S) +
IN?	wet floodplain forest ?
MO	wet bottomland forest +

OTHER SYNONYMY: *Taxodium - Fraxinus tomentosa / Itea virginica* community (Voigt and Mohlenbrock 1964) I, *Acer rubrum - Nyssa aquatica* floodplain type (Robertson et al. 1984) =, *Fraxinus lanceolata [pennsylvanica] - Populus heterophylla / Cephalanthus* (Voigt and Mohlenbrock 1964) I. The *Fraxinus lanceolata* [*pennsylvanica*] - *Populus heterophylla* / *Cephalanthus* community has no equivalent dominants to this association, but hydrology and understory dominants are very similar.

USNVC HIERARCHY: ACER RUBRUM - FRAXINUS PENNSYLVANICA SEASONALLY FLOODED FOREST ALLIANCE (I.B.2.N.e)

Nyssa aquatica Forest

Water Tupelo Forest

Water Tupelo Swamp Forest CEGL002419

DESCRIPTION: The vegetation is dominated by dense, and occasionally pure, stands of *Nyssa aquatica* but often in association with *Taxodium distichum* (never very abundant in this type), *Planera aquatica, Nyssa biflora, Gleditsia aquatica, Fraxinus profunda*, and *Cephalanthus occidentalis*. The herbaceous layer is conspicuously sparse, and density is wholly dependent upon the extent and duration of flooding. Where water is permanent, herbaceous plants rely on substrates found on rotting logs, stumps, terraces, and buttresses of trees. Subcanopy density and forest tree recruitment are poor due to fluctuating water levels (TNC 1995a).

Stands occur on permanently saturated soils on low, wet flats and sloughs, swales and backswamps, and the association is more common on floodplains of brownwater, rather than blackwater, rivers. Both organic and mineral soils may be present.

Neither bald-cypress nor water tupelo are able to germinate in water and require dry periods to produce seedlings. Seedlings are unable to survive complete submergence, and prolonged flooding with excessive water levels can kill even mature trees. Subcanopy and herbaceous components of this community are very dynamic, and densities fluctuate with availability of substrate.

COMMENTS: *2, SCS*. More work needs to be done to understand development of this community where the ranges of *Nyssa aquatica* and *Taxodium distichum* overlap, to determine the differences between this and a *Nyssa aquatica*-dominated forest that develops following logging of *Taxodium distichum*, and to determine the extent of geographic variation. Where bald-cypress and water tupelo ranges overlap, little is known about conditions which select for either or both species. Selective removal of bald-cypress can shift dominance in mixed bald-cypress - water tupelo stands to favor water tupelo. Water tupelo seem to select transitional zones between permanent water and upland habitat and seldom occur as a dominant component of the canopy where inundation is semipermanent or permanent.

CONSERVATION RANK: *G5?.* Depending on how historic distribution and abundance are factored into the rank, the rank could be considerably higher, perhaps a G3G4. Many stands have been extensively cleared.

DISTRIBUTION: This water tupelo swamp forest is found on the lower Atlantic Coastal Plain from southeastern Virginia to southeastern Georgia, the Gulf Coastal Plain from about Tallahassee, Florida, west to southeastern Texas, and the Mississippi River Alluvial Plain to southern Illinois and southeastern Missouri.

USFS ECOREGIONS: 222A:CC, 222C:CP, 222D:CP, 231B:PP, 231E:P?, 232B:CC, 232C:CC, 232F:CC, 234A:CC
CONSERVATION REGIONS: 31:?, 40:C, 41:C, 42:C, 43:P, 44:C, 53:C, 56:C, 57:C
STATES: AL AR FL GA IL KY LA MO MS NC SC TN TX VA **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL swamp +
MO swamp +

OTHER SYNONYMY: *Taxodium - Nyssa aquatica / Rosa palustris* community (Voigt and Mohlenbrock 1964) B, *Nyssa aquatica - Taxodium distichum* swamp (Robertson et al. 1984) =. Robertson et al. (1984) appear to include pure *Nyssa aquatica* and some mixed *Nyssa aquatica - Taxodium distichum* stands in this type., IIA4d. Tupelo Swamp, in part (Allard 1990), P1B3dII3a. *Nyssa aquatica* (Foti et al. 1994)

USNVC HIERARCHY: NYSSA AQUATICA - (TAXODIUM DISTICHUM) SEMIPERMANENTLY FLOODED FOREST ALLIANCE (I.B.2.N.f)

Quercus lyrata - Quercus palustris / Acer rubrum var. drummondii / Itea virginica - Cornus foemina - (Lindera melissifolia) Forest

Overcup Oak - Pin Oak / Swamp Red Maple / Virginia-willow - Stiff Dogwood - (Pondberry) Forest

Mixed Oak - Hardwood Sand Pond Forest CEGL004778

DESCRIPTION: The vegetation forms a closed-canopy bottomland hardwood forest (Heineke 1987). The wettest areas within the ponds are dominated by *Quercus lyrata, Quercus palustris*; *Diospyros virginiana* is present, rarely also *Taxodium distichum*. Other canopy taxa include *Carya aquatica, Celtis laevigata, Fraxinus pennsylvanica, Fraxinus profunda, Liquidambar styraciflua, Ulmus americana*, and an occasional *Nyssa sylvatica* (Heineke 1987). *Acer rubrum var. drummondii* is abundant in the midstory. *Lindera melissifolia* is concentrated in this zone, but is not restricted to it. Where it is abundant, it may exclude other shrubs except for an occasional *Cephalanthus occidentalis* (Heineke 1987). Areas of hummocky topography have a shrub/understory stratum of *Itea virginica* and *Cornus foemina*. *Ilex decidua* and *Styrax americanus* are also found where the *Lindera* is thin or absent. *Brunnichia ovata* is a common and abundant vine, especially in openings. The herbaceous flora is typically sparse; it may include *Symphyotrichum lateriflorum (= Aster lateriflorus), Carex crus-corvi, Carex hyalinolepis, Carex louisianica, Cinna arundinacea, Iris fulva, Ludwigia glandulosa, Lysimachia radicans, Pilea pumila, Polygonum virginianum*, and *Saururus cernuus*. The vegetation grades up to *Quercus texana - Quercus michauxii* or *Quercus phellos - Quercus nigra* forest, and then to *Quercus alba - Quercus shumardii* forest with non-wetland shrubs and small trees including *Lindera benzoin, Asimina triloba*, and *Cornus florida*.

Stands occur in wet bottomland hardwoods in depressions in eolian sand deposits (Heineke 1987).

COMMENTS: *2, SCS*. This community is difficult to characterize. It is known from the western edge of the Mississippi Alluvial Plain in Arkansas (Clay, Jackson, Lawrence, and Woodruff counties) and Ripley County, Missouri (Sand Ponds Natural Area).

CONSERVATION RANK: *G2?*. This type was always likely rare, given the unique habitat that it is found in. It is restricted to wet bottomland hardwoods in depressions in eolian sand deposits, in the western edge of the Mississippi River Alluvial Plain in eastern Missouri and Arkansas. Stands are threatened by timber removal (clearcutting or high-grading), hydrological alteration (ditching and draining), and sand mining. Protected examples are very limited, and much of the landscape in which this association is found has been altered by agriculture.

DISTRIBUTION: This mixed oak-hardwood sand pond forest is found in the western edge of the Mississippi River Alluvial Plain of the United States, in eastern Missouri and Arkansas.

USFS ECOREGIONS: 234Ac:CCC
CONSERVATION REGIONS: 42:C
STATES: AR MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO wet bottomland forest +

OTHER SYNONYMY: P1B3cI1a. *Quercus lyrata - Carya aquatica,* in part (Foti et al. 1994), Eolian Sand Communities (Heineke 1987), Sandpond

USNVC HIERARCHY: QUERCUS LYRATA - (CARYA AQUATICA) SEASONALLY FLOODED FOREST ALLIANCE (I.B.2.N.e)

Taxodium distichum - (Nyssa aquatica) / Forestiera acuminata - Planera aquatica Forest

Bald-cypress - (Water Tupelo) / Swamp-privet - Planertree Forest

Bald Cypress - (Water Tupelo) Swamp CEGL002421

DESCRIPTION: This type tends to be dominated by *Taxodium distichum* and *Nyssa aquatica* with *Taxodium* most often emergent in the overstory above shorter individuals of *Nyssa aquatica*. In some instances *Carya aquatica* and (rarely) *Quercus lyrata* may also be present. Dominant trees exhibit tall, straight growth and swelled buttresses. The canopy can be closed but is more commonly partially open. Water depth is highly correlated with canopy dominance, with *Taxodium distichum* dominating deeper, more permanent water, small *Taxodium distichum* and mature *Nyssa aquatica* in shallower zones, and mixed bottomland species in expansive shallower zones (Faircloth 1971). The subcanopy is sparse, consisting primarily of *Forestiera acuminata, Cephalanthus occidentalis*, and *Planera aquatica*. Shrubs and herbs tend to occur sporadically, most often growing on old stumps, tree buttresses, fallen logs, or along slough margins. Shrubs may include *Cephalanthus occidentalis* and *Itea virginica* with a variety of other species, such as *Acer rubrum var. drummondii, Acer negundo, Cornus obliqua (= Cornus amomum ssp. obliqua), Fraxinus pennsylvanica, Ilex decidua*, and *Liquidambar styraciflua*, mostly occurring around the slough margins. Woody vines are uncommon but may include *Ampelopsis arborea* and *Berchemia scandens*. Common herbaceous species may include *Asclepias perennis, Bidens aristosa, Bignonia capreolata, Boehmeria cylindrica, Carex lupulina, Carex joorii, Commelina virginica, Cyperus* sp., *Erechtites hieraciifolia, Leersia oryzoides, Lemna minor, Onoclea sensibilis, Pilea pumila, Polygonum hydropiperoides, Saururus cernuus*, and *Triadenum tubulosum*.

Stands occur in semipermanently flooded back sloughs, abandoned tributaries, and floodplain depressions. They are often linear in shape and range in size from less than one acre to hundreds of acres. All examples are characterized by shallow standing water all or most of the year. Soils are poorly drained and tend to be organic. Deep accumulation of duff and litter can occur where not scoured by floodwaters. This community can be found adjacent to all other floodplain forests.

Flooding and drought effects are seasonal, of variable duration, and subject to local weather patterns. Extensive beaver predation on water tupelo may severely impact community composition. Beaver may alter vegetative composition, hydrologic conditions, and sedimentation rates by removing trees and pooling water.

COMMENTS: *2, SCS*. Generally, semipermanently flooded bald-cypress - water tupelo swamps are found across the entire southeastern U.S. Coastal Plain. The type described here is intended to represent only the Mississippi River Alluvial Plain examples and those occurring immediately westward into the Gulf Coastal Plains of Arkansas, Texas, and Louisiana and eastward into the Upper East Gulf Coastal Plain and the adjacent Interior Low Plateau. The eastern equivalent of this type along the outer coastal plains of the Atlantic and East Gulf is represented by *Taxodium distichum - Nyssa aquatica / Fraxinus caroliniana* Forest (CEGL007431). Dominance of bald-cypress and water tupelo varies considerably among coastal plain swamps, and it is not always clear how to best distinguish this community from *Nyssa aquatica* Forest (CEGL002419) and *Taxodium distichum / Lemna minor* Forest (CEGL002420). Both bald-cypress and water tupelo trees live to be very old, and successional stages may last hundreds of years. Where swamp forest stands are very open with lots of *Cephalanthus occidentalis*, the distinction between forest and shrubland may be unclear.

CONSERVATION RANK: *G3G5.*

DISTRIBUTION: This community occurs primarily in the Mississippi River Alluvial Plain and adjacent ecoregions. The type occurs in the southern United States, from Louisiana and Mississippi northward to southeastern Missouri, extreme southern Illinois, and southern Indiana. Remnant bald-cypress and bald-cypress - water tupelo swamps still exist in southern Illinois, with the most significant occurrences found in the Cache River Basin.

USFS ECOREGIONS: 222C:CC, 222D:CC, 231B:PP, 231G:PP, 234A:CC
CONSERVATION REGIONS: 39:P, 40:C, 41:C, 42:C, 43:P, 44:C
STATES: AR IL IN? KY LA MO MS TN **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	swamp +
IN?	forested swamp ?
MO	swamp +

OTHER SYNONYMY: Cypress - Tupelo Swamp B, Baldcypress - Tupelo: 102, in part (Eyre 1980) B

USNVC HIERARCHY: NYSSA AQUATICA - (TAXODIUM DISTICHUM) SEMIPERMANENTLY FLOODED FOREST ALLIANCE (I.B.2.N.f)

Taxodium distichum - Populus heterophylla Forest

Bald-cypress - Swamp Cottonwood Forest

Bald Cypress - Swamp Cottonwood Forest CEGL005201

DESCRIPTION: Mature *Taxodium distichum* and *Populus heterophylla* dominate the canopy of this type. *Acer rubrum, Liquidambar styraciflua*, and *Quercus palustris* are important on the borders in more shallow water. Within the swamp *Cephalanthus occidentalis* forms a subcanopy, along with an occasional *Rosa palustris* shrub. On floating logs and bases of trees, *Bidens discoidea* and *Triadenum walteri* occur. Floating in the water are species of *Lemna, Spirodela*, and *Wolffia*. Emergent aquatics include *Glyceria septentrionalis, Hottonia inflata, Sium suave*, and *Ranunculus flabellaris*. Herbaceous and vine components of shallow borders include *Saururus cernuus, Onoclea sensibilis*, and occasionally *Vitis palmata* (Homoya pers. comm. 1998).

Water levels fluctuate considerably. Typically water is present in winter through mid-summer, with a complete dry down in fall; however, standing water may be present throughout the year. The deepest part of the swamp is probably over 1 m deep, with less than 0.5 m being the probable norm. The water is usually clear and tea-colored except when recently flooded (Homoya pers. comm. 1998).

COMMENTS: *3, MCS*. This type is described from a *Taxodium - Populus heterophylla* swamp (Twin Swamp, Posey County, Indiana), where *Populus* may actually be the dominant. Hydrology is Zone II (almost continuous flooding) and is wet enough to exclude *Acer rubrum* and *Quercus lyrata*. Classification issues rangewide include what to do with *Taxodium* stands that have other mixed hardwoods codominating. They could either be treated as their own mixed types or placed with either a *Taxodium* type or a bottomland hardwoods types. For example, this type should be compared to *Quercus lyrata - Quercus (palustris, phellos) - Liquidambar styraciflua - (Populus heterophylla)* Forest (CEGL004421) of Kentucky, which is apparently very similar except for the absence of *Taxodium distichum*. Alternatively this type may simply be a variant of the *Taxodium distichum / Lemna minor* Forest (CEGL002420).

CONSERVATION RANK: *G?.* This type cannot be ranked until agreement is reached on the way to classify this kind of transitional swamp type.

DISTRIBUTION: This narrowly defined, low-confidence type is only known from the Interior Low Plateau, being reported from the east-central United States, in southern Indiana.

USFS ECOREGIONS: 222Db:CCC, 222Gc:CPP
CONSERVATION REGIONS: 44:C
STATES: IN **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IN forested swamp +

OTHER SYNONYMY:

USNVC HIERARCHY: TAXODIUM DISTICHUM SEMIPERMANENTLY FLOODED FOREST ALLIANCE (I.B.2.N.f)

Taxodium distichum / Lemna minor Forest

Bald-cypress / Lesser Duckweed Forest

Bald-cypress Swamp CEGL002420

DESCRIPTION: The vegetation is characterized by a monospecific canopy of straight, tall individuals of *Taxodium distichum* with a sparse to moderate subcanopy and depauperate shrub and herb layers. Trees are generally very tall and straight with their trunks forming swelled buttresses. Canopy cover is extremely variable, from densely closed forests to sparse canopies. *Taxodium distichum* regeneration is absent in areas of permanent inundation, as seed germination does not occur in standing water. The subcanopy and herbaceous layers are dependent upon timing, duration, and depth of flooding. *Cephalanthus occidentalis* and *Rosa palustris* are common shrubs in this community, while *Fraxinus caroliniana* (in its range) and *Acer rubrum var. drummondii* are common in the subcanopy. Shallow water emergents, floating-leaved aquatics, such as *Azolla caroliniana, Brasenia schreberi, Cabomba caroliniana, Limnobium spongia, Spirodela punctata, Wolffia columbiana, Lemna minor, Nymphaea* spp., and submerged hydrophytes, such as *Ceratophyllum demersum*, are common in permanent water zones throughout the range of this type. In the southern part of the range (e.g., southern Alabama) *Lemna minor* is replaced by *Lemna valdiviana*. Common herbaceous species from occurrences in southwestern Arkansas include *Bidens discoidea, Carex lupulina, Carex glaucescens, Echinodorus cordifolius, Heliotropium indicum, Leersia oryzoides, Limnobium spongia, Lycopus rubellus, Polygonum hydropiperoides, Proserpinaca palustris*, and *Saururus cernuus* (J. Campbell pers. comm. 1999, D. Zollner pers. comm. 1999, TNC 1995a).

This community occurs on a variety of inundated topographic habitats, including oxbow ponds, natural lakes, drowned floodplains, backwater sloughs, along river edges, and in various isolated depressions within the floodplain. It is more commonly associated with brownwater than blackwater rivers. Soil types on which it is found are very poorly drained.

Prolonged flooding can cause even mature trees to die. Drought encourages woody and herbaceous regeneration. Excessive sedimentation can increase the rate of fill common to all wetlands. Beaver predation, wind throws, senescence, and fire are ongoing seasonal and cyclic occurrences which can dramatically affect community composition.

COMMENTS: *1, SCS*. This is the only community type currently defined outside Florida with *Taxodium distichum* as the sole dominant. Stands are possible in suitable habitat anywhere within the range of *Taxodium distichum*; however, it is more commonly recognized outside of, or near the edge of, the range of *Nyssa aquatica* which otherwise is frequently codominant with *Taxodium distichum*. Classification can become difficult where excessive logging has removed most of the mature bald-cypress. Logging, and possibly alteration of hydrologic regimes, may create an unnaturally open canopy more typical of woodland communities. Water tupelo regeneration is prevalent at these disturbed sites, often replacing bald-cypress as the dominant plant species. Unless canopy composition is severely altered, this criterion is currently used to establish species dominance.

CONSERVATION RANK: *G5.*

DISTRIBUTION: This bald-cypress swamp is found in the Atlantic and Gulf coastal plains of the United States. Stands are possible in suitable habitat anywhere within the range of *Taxodium distichum*, i.e., the lower Atlantic Coastal Plain from Virginia to southern Florida, the lower Gulf Coastal Plain to southeastern Texas, and the Mississippi River Alluvial Plain to southern Illinois. However, it is more commonly recognized outside of, or near the edge of, the range of *Nyssa aquatica* which otherwise is frequently codominant with *Taxodium distichum*.

USFS ECOREGIONS: 222A:CC, 222C:CC, 222D:CP, 222G:CC, 231B:CC, 231E:CP, 232B:CC, 232C:CC, 232F:CC, 234A:CC
CONSERVATION REGIONS: 31:C, 38:C, 40:C, 41:C, 42:C, 44:C, 53:C, 55:C, 56:C, 57:C
STATES: AL AR FL GA IL IN KY LA MO MS NC OK SC TN TX VA? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	swamp +
IN	forested swamp +
MO	swamp +

OTHER SYNONYMY: *Taxodium - Nyssa aquatica / Rosa palustris* community (Voigt and Mohlenbrock 1964) B, *Taxodium distichum - Nyssa aquatica* swamp (Robertson et al. 1984) B, IIA4a. Bald Cypress Swamp, in part (Allard 1990) B, P1B3dI1a. *Taxodium distichum* (Foti et al. 1994), Closed-canopy cypress swamps & open (deep water) cypress swamps

USNVC HIERARCHY: TAXODIUM DISTICHUM SEMIPERMANENTLY FLOODED FOREST ALLIANCE (I.B.2.N.f)

Acer saccharinum - Betula nigra / Cephalanthus occidentalis Forest

Silver Maple - River Birch / Buttonbush Forest

Silver Maple – River Birch / Buttonbush Forest CEGL007810

DESCRIPTION: *Acer saccharinum* and *Betula nigra* are the dominant species. *Fraxinus pennsylvanica* may also be present in the canopy. The fairly well-developed shrub layer is composed of *Cephalanthus occidentalis* and *Alnus serrulata*. The herbaceous layer is sparse and is composed of *Triadenum walteri, Boehmeria cylindrica, Onoclea sensibilis*, and others.

Stands occur along the flat margins of oxbows.

COMMENTS: *3, SCS*. This association differs from *Acer saccharinum - Ulmus americana - (Populus deltoides)* Forest (CEGL002586) by occurring on oxbow margins, rather than on alluvial flats, and by having a less species-rich composition in the canopy and herbaceous strata. It also has different species present in the shrub stratum. The distribution, species composition, and variability of this association need further refinement. It is not clear that the oxbow habitat is distinct enough to warrant separating this type from other silver maple types. In Illinois this type, if present, would only be found in the Mississippi River region and the Illinois Ozarks regions.

CONSERVATION RANK: *G3Q.* This association, as described, is restricted to a specific habitat, the flat margins of oxbow lakes in the Ozark region. It differs from *Acer saccharinum - Ulmus americana - (Populus deltoides)* Forest (CEGL002586) by occurring only on oxbow margins and not on alluvial flats. The distribution, species composition, and variability of this association need further refinement. The Grank was formerly G3?. Adding a Q to the rank indicates that there are issues about the taxonomy of this type, and that its merger with other silver maple types would make it less rare.

DISTRIBUTION: This forest occurs along the flat margins of oxbows in the Ozark region of the United States, particularly Arkansas, and possibly Illinois.

USFS ECOREGIONS: 222Ao:CCC
CONSERVATION REGIONS: 38:C
STATES: AR IL? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL? wet floodplain forest (S) ?

OTHER SYNONYMY:

USNVC HIERARCHY: ACER SACCHARINUM TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Acer saccharinum - Celtis laevigata - Carya illinoinensis Forest

Silver Maple - Sugarberry - Pecan Forest

Silver Maple - Sugarberry - Pecan Floodplain Forest CEGL002431

DESCRIPTION: Canopy cover is more or less complete (80-100%), and dominated by *Acer saccharinum, Celtis laevigata*, and *Carya illinoinensis*. *Carya illinoinensis* seldom occurs in high densities but grows to be one of the largest trees on the floodplain. Less dominant species encountered are *Acer negundo, Populus deltoides, Salix nigra, Liquidambar styraciflua, Quercus palustris*, and *Betula nigra*. Trees are tall (25-35 m) and straight with rounded, spreading, open crowns and massive branches. The understory is sparse, dominated by *Celtis laevigata, Acer saccharinum*, and *Ulmus americana*. *Forestiera acuminata* and *Ilex decidua* dominate the shrub layer. Herbaceous species most commonly encountered are *Boehmeria cylindrica, Laportea canadensis*, and *Urtica dioica*. Although the understory may be sparsely populated, a diverse variety of species can be encountered. Vines may form dense thickets and include *Vitis* spp., *Smilax* spp., *Toxicodendron radicans*, and *Campsis radicans*. (TNC 1995a)

Stands occur in deep (greater than one meter), moist alluvial soils of river bottoms and occasionally at the base of protected slopes. These soils are deep, medium-textured, and have adequate or excessive moisture available for vegetation during the growing season. Often the deposition of impermeable clay layers causes ponding of water in low areas. Many of these soils have a high shrink-swell capacity. This community is subject to periodic flooding, although it is seldom deeply inundated (>1.5 m) for more than several days at a time.

This natural community is subject to flooding during periods of heavy precipitation and wind and storm damage.

COMMENTS: *2, MCS*. This is a more southern type, separable from *Acer saccharinum - Ulmus americana - (Populus deltoides)* Forest (CEGL002586), but the distinction needs more clarity. Missouri isn't sure they can distinguish these two types in the state. Stands are found on Kentucky's Mississippi River Alluvial Plain, *Carya illinoinensis* can codominate (M. Evans pers. comm. 1999). This forest occurs on the Arkansas River (T. Foti pers. comm. 1999).

CONSERVATION RANK: *G3G4.* Many sites have been drained and cleared for agriculture.

DISTRIBUTION: This silver maple forest type is found in the central United States, ranging from southern Indiana west to Missouri, south to Arkansas, Oklahoma and possibly Mississippi, and east to Kentucky.

USFS ECOREGIONS: 222A:CP, 222C:CP, 231E:CC, 231Ga:CCC, 234A:PP, 251Cf:CCC
CONSERVATION REGIONS: 36:C, 39:C, 40:C, 42:C, 43:C, 44:C
STATES: AR IL IN? KY MO? MS? OK? TN **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL wet floodplain forest (S) +
IN? wet floodplain forest ?
MO? wet bottomland forest ?

OTHER SYNONYMY: *Acer saccharinum - Populus deltoides/Aster* community Forest (Voigt and Mohlenbrock 1964) =

USNVC HIERARCHY: ACER SACCHARINUM TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Betula nigra - Platanus occidentalis Forest

River Birch - Sycamore Forest

River Birch - Sycamore Forest CEGL002086

DESCRIPTION: *Betula nigra* and *Platanus occidentalis* are the typical dominants in this type. They are fast-growing (especially young trees), relatively short-lived, and do not tolerate excessive shade at any stage of growth. *Betula nigra* prefers acid soils and is often the dominant tree found along streams affected by acid mine drainage. A wide range of canopy species are present because, along with common bottomland species (e.g., *Ulmus americana, Acer rubrum, Acer negundo, Quercus* spp., and *Celtis laevigata*), mesophytic species from nearby uplands and terraces may be found, including *Juglans nigra, Prunus serotina*, and *Fraxinus americana*. A variety of swamp species may be found on more poorly drained sites. Stands are subjected to frequent, fast, short-duration flooding, which contributes to a thin understory. Commonly encountered herbaceous species include *Saururus cernuus, Arisaema dracontium, Impatiens capensis, Symphyotrichum ontarionis (= Aster ontarionis)*, and *Pilea pumila*. This forest harbors a number of ubiquitous species and tends to extend into and mix with adjacent communities, resulting in numerous transitional variants. Occurrences may have a rather high percentage of standing dead trees. There may be remnant snags from previous earlier successional communities of cottonwood - black willow forests (TNC 1995a).

Betula nigra requires soils near field capacity throughout the year but is relatively intolerant of flooding. *Platanus occidentalis* is also intolerant of flooding during the growing season and will die if the entire tree is inundated for more than two weeks. The absence of this community in the lower Mississippi Alluvial Plain is attributed to this intolerance, as is its most common location on levees of smaller rivers. The community usually is found on the natural levee of the watercourse and, therefore, is slightly elevated from the flats behind the levee. The community is more common along small streams and blackwater streams than along alluvial floodplains, largely because of the higher sustained flow rates of these larger rivers. It is also found along flowages of larger rivers.

This community experiences seasonal inundation or groundwater saturation for approximately 12.5-25% of the year, usually during spring and early summer with a frequency of 51-100% (the Zone IV community of Clark and Benforado 1981). Large stream sections with longer flooding durations are more strongly dominated by *Betula nigra* and *Acer saccharinum* alone. The smaller streams on narrow floodplains of younger valleys have greater canopy mixtures.

COMMENTS: *2, MCS*. As currently described, this association and *Betula nigra - Platanus occidentalis / Alnus serrulata / Boehmeria cylindrica* Forest (CEGL007312) appear to be largely overlapping. These two defined associations need to be reconciled. In Kentucky, this association (CEGL002086) would be found on the northern part of the Daniel Boone National Forest, in contrast to CEGL007312, which is more southern. Other bottomland hardwood communities contain river birch in the canopy but at lower densities. It may be helpful to require that *Betula nigra* contribute at least 50% (80%?) of the tree density to be placed in this community. The community described herein is naturally occurring on minimally to undisturbed sites.

CONSERVATION RANK: *G5.* The community is widespread and common.

DISTRIBUTION: This river birch - sycamore forest community is found throughout the eastern United States, ranging from south-central Ohio west to Iowa, south to Arkansas and Mississippi, and east to West Virginia.

USFS ECOREGIONS: 221Ea:CCC, 221Ec:CCC, 221Ed:CCP, 221Ef:CCC, 221Eg:CCC, 221Fa:CCC, 221Fc:CCC, 221Ha:CCC, 221Hb:CCC, 221He:CCC, 222Ad:CCP, 222Ae:CCP, 222Af:CCC, 222Ca:C??, 222Ch:C??, 222En:CCC, 222Eo:CCC, 222Ga:CCC, 222Ha:CCC, 222If:CCC, 231:P, 232:P, 234:P, 251:?, M221Cd:CCC, M222:P, M231:P
CONSERVATION REGIONS: 36:P, 37:P, 39:C, 42:C, 44:C, 45:C, 48:C, 49:C, 50:C
STATES: AR IA IL IN KY MO MS OH OK TN WV **PROVINCES:** ON?

MIDWEST HERITAGE SYNONYMY:

IL	wet floodplain forest (S) +
IN	wet floodplain forest +
MO	wet bottomland forest +
OH	river birch-maple floodplain forest =

OTHER SYNONYMY: River Birch - Sycamore (61) (Eyre 1980) =, IIA7b. River Birch - Sycamore Riverfront Forest (Allard 1990) =, *Betula nigra - Acer saccharinum / Pilea* community (Voigt and Mohlenbrock 1964) =, *Acer negundo - Platanus / Rhus [Toxicodendron] radicans* community (Voigt and Mohlenbrock 1964) ?. Perhaps this type should go with CEGL007334, a *Platanus* type, which has not yet been described for Illinois., River Birch Floodplain Forests (Anderson 1996) =, R13cII4a. *Betula nigra - Platanus occidentalis* (Foti 1994a)

USNVC HIERARCHY: BETULA NIGRA - (PLATANUS OCCIDENTALIS) TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Salix caroliniana Temporarily Flooded Shrubland

Carolina Willow Temporarily Flooded Shrubland

Carolina Willow Shrubland CEGL003899

DESCRIPTION: This is a broadly defined type for riverside and streamside thickets dominated by *Salix caroliniana*. Further information is needed to characterize this type.

COMMENTS: *2, SCS*. Missouri suggests that this type be lumped with *Hamamelis vernalis - Cornus obliqua - Hypericum prolificum* Shrubland (CEGL003898) as part of a more complex gravel wash shrub type.

CONSERVATION RANK: *G5?.*

DISTRIBUTION: This carolina willow shrubland type is found widely throughout the southeastern United States, from Arkansas (and possibly Missouri), east to North Carolina and possibly Virginia, and south to Florida.

USFS ECOREGIONS: 221H:PP, 222Aa:CPP, 222Ae:CP?, 222Af:CPP, 222Ag:CP?, 231:C, 232Bq:CCC, M222:C, M231:C
CONSERVATION REGIONS: 38:C, 39:C, 43:P, 44:P, 50:P, 52:P, 53:?, 55:?, 56:C
STATES: AL? AR FL GA KY MO? NC SC TN VA? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO? gravel wash ?

OTHER SYNONYMY:

USNVC HIERARCHY: SALIX CAROLINIANA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (III.B.2.N.d)

Salix nigra Forest

Black Willow Forest

Black Willow Riparian Forest CEGL002103

DESCRIPTION: The vegetation is a closed-canopy forest dominated by *Salix nigra*. Associates include *Populus deltoides, Planera aquatica, Betula nigra, Platanus occidentalis, Celtis laevigata, Fraxinus pennsylvanica, Carya illinoinensis, Diospyros virginiana, Quercus nigra, Cornus drummondii, Ulmus americana, Acer rubrum, Acer negundo*, and *Acer saccharinum.* Shrubs and herbaceous plants are absent to fairly dense. They include *Ampelopsis arborea, Mikania scandens, Toxicodendron radicans, Polygonum* spp., *Erechtites hieraciifolia, Boehmeria cylindrica, Commelina virginica, Phytolacca americana*, and *Asplenium platyneuron* (Central Appalachian Ecoregional Team pers. comm. 1998).

Stands occur on the banks of small to large rivers where they are a component of point bar succession. Surface water is present for brief periods during the growing season, but the water table usually lies well below soil surface (Central Appalachian Ecoregional Team pers. comm. 1998).

Flooding is typically brief during the growing season.

COMMENTS: *3, SCS*. This type needs a thorough rangewide assessment to standardize its concept. In Missouri, stands of this nature are included in the *Populus deltoides - Salix nigra* Forest (CEGL002018).

CONSERVATION RANK: *G?.*

DISTRIBUTION: The black willow forest type is found widely, but sporadically across the eastern United States, ranging from Ohio west to Iowa, south to Arkansas and Louisiana, east to Florida and North Carolina.

USFS ECOREGIONS: 221Ec:CPP, 221Ed:CP?, 221Ef:CP?, 221Ha:CCC, 221Hb:CCC, 221Hc:CCC, 221He:CCC, 222A:CC, 222En:CCC, 222Eo:CCC, 231G:CC, 251E:CC, 251F:CC, 255A:CC, 255C:CC, 311A:CC, 332E:CC, M221Cd:CCC, M222A:CC, M231A:CC

CONSERVATION REGIONS: 31:?, 32:C, 33:C, 37:C, 38:P, 39:C, 40:P, 41:C, 42:C, 43:P, 44:C, 50:C, 51:P, 52:?, 53:C, 55:P

STATES: AL? AR FL IA IL? IN? KY LA NC OH? OK? TN TX? VA WV **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:
IL? wet floodplain forest (S) ?
IN? wet floodplain forest ?
OH? maple-cottonwood-sycamore floodplain forest ?

OTHER SYNONYMY:

USNVC HIERARCHY: SALIX NIGRA TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Salix nigra Temporarily Flooded Shrubland

Black Willow Temporarily Flooded Shrubland

Black Willow Riverbank Shrubland CEGL003901

DESCRIPTION: This broadly defined type represents vegetation dominated by scrubby forms of *Salix nigra* across the southeastern and northeastern United States, and possibly into Canada. Stature and closure may vary depending on disturbance. Additional types may be developed as more information becomes available.

COMMENTS: *2, SCS*. This type conceptually includes communities formerly treated as woodlands [see the archived *Salix nigra* Woodland (CEGL003731)].

CONSERVATION RANK: *G?.*

DISTRIBUTION: This is a potentially wide-ranging association found throughout the southeastern and northeastern United States, and possibly into Canada. This broadly defined association is found from the Ozarks and Interior Low Plateau, south to the West and East Gulf coastal plains and Florida Peninsula, east to the Atlantic Coastal Plain (excluding the Southern Blue Ridge) and north into the Central Appalachians and Northern Piedmont.

USFS ECOREGIONS: 221Ec:C??, 221Ed:C??, 221Ef:C??, 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222An:CCC, 231Ca:CCC, 231Cd:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232:C, M221Aa:CCP, M221Ab:CCP, M221Ac:CCC, M221Ad:CCC, M221Bb:CCC, M221Bf:CCC, M221Da:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC

CONSERVATION REGIONS: 38:C, 39:C, 40:C, 41:C, 42:C, 43:C, 44:P, 50:C, 52:C, 53:C, 55:P, 56:C, 57:C, 59:C, 61:C

STATES: AL AR FL GA IL? KY LA MD ME MS NC NH OH? OK PA SC TN TX VA VT WV **PROVINCES:** ON?

MIDWEST HERITAGE SYNONYMY: IL? shrub swamp (S) ?
OH? mixed shrub swamp ?

OTHER SYNONYMY: IIE3a. Riverside Shoal and Stream Bar Complex (Allard 1990)

USNVC HIERARCHY: SALIX NIGRA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (III.B.2.N.d)

Cephalanthus occidentalis / Carex spp. - Lemna spp. Southern Shrubland

Buttonbush / Sedge Species - Duckweed Species Southern Shrubland

Southern Buttonbush Pond CEGL002191

DESCRIPTION: *Cephalanthus occidentalis* comprises nearly 90% of the shrub layer in waters 1-2 m deep (Voigt and Mohlenbrock 1964). Other shrubs commonly encountered include *Cornus sericea (= Cornus stolonifera)* and *Salix* spp. Sedges are the dominant herbaceous species present, although *Hibiscus* spp. can also form dense stands in shallower water. *Lemna* spp. are also common plants in this natural community. *Populus heterophylla* and *Nyssa aquatica* may also occur within their range (TNC 1995a).

Stands occupy shallow water depressions, oxbow ponds, upland pond depressions, beaver ponds, and backwater sloughs of stream and river floodplains. Inundation is usually continuous throughout the year, but these sites can become dry in mid or late summer or during periods of prolonged drought. In floodplain situations, soils are deep (one meter or more) consisting of peat or muck over alluvial parent material (Nelson 1987, Lauver et al. 1999). Key environmental factors which favor the establishment and maintenance of this community include nearly continuous inundation from 1-2 m in depth (Voigt and Mohlenbrock 1964).

Seasonal flooding and heavy rains leading to inundation of stands to a depth of 1-2 m favor establishment of this type.

COMMENTS: *2, SCS.* This community can be highly dynamic from one season to the next, and species composition and density are wholly dependent on water regime (Niering 1985). Primary identifying characteristics include the near absence of trees and dominance of buttonbush (at least 25% coverage). Floristic characteristics that distinguish this type from more northern types are needed. Stands of buttonbush with widely scattered *Taxodium* (<10%?, <20% cover?) should be placed in this type.

CONSERVATION RANK: *G4.* This type is widespread with many occurrences suspected across its range. However, many sites have also been drained for conversion to cropland. A number of remaining examples of this community are protected, but even these can be threatened by accelerated siltation resulting from excessive soil erosion and channelization in adjacent areas.

DISTRIBUTION: This buttonbush shrubland type occurs widely throughout the southeastern United States, ranging from southern Ohio west to Kansas, south to Texas and east to North Carolina.

USFS ECOREGIONS: 221E:CC, 221Ha:CCC, 221Hb:CCC, 221Hc:CCC, 221He:CCC, 222Ab:CCC, 222Ad:CCC, 222Ag:CCC, 222Ah:CCC, 222Am:CCC, 222An:CCC, 222Aq:CCC, 222C:CP, 222D:CC, 222Eb:CCC, 222Ej:CCP, 222En:CCC, 222Eo:CCC, 222F:CP, 222G:CC, 231Cd:CCP, 231Ce:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 234A:CC, 255Db:CPP, M221Cd:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC
CONSERVATION REGIONS: 31:P, 32:C, 37:C, 38:C, 39:C, 40:P, 41:C, 42:C, 43:C, 44:C, 49:C, 50:C, 53:P, 56:C, 57:?
STATES: AL AR GA IL IN KS KY LA MO MS? NC? OH? OK SC TN TX **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	shrub swamp (S); pond (S) I
IN	shrub swamp +
MO	shrub swamp +
OH?	buttonbush shrub swamp ?

OTHER SYNONYMY: Shrub Swamp B

USNVC HIERARCHY: CEPHALANTHUS OCCIDENTALIS SEMIPERMANENTLY FLOODED SHRUBLAND ALLIANCE (III.B.2.N.f)

Acer negundo / Prunus virginiana Forest

Box-elder / Choke Cherry Forest

Box-elder / Choke Cherry Forest CEGL000628

DESCRIPTION: This is an early successional community dominated by *Acer negundo*. *Populus deltoides* may also be present. Tree density may be moderate to high. Shrubs are common and vary from short (<1 m) to tall (>2 m). *Prunus virginiana* and *Cornus sericea (= Cornus stolonifera)* are common. At Wind Cave National Park, these woodlands vary in composition, with *Acer negundo* usually present, but *Prunus virginiana* frequently absent. Tree cover typically is in the 10-25% range. Other tree species may be present or even common, including *Ulmus americana, Quercus macrocarpa, Fraxinus pennsylvanica*, and *Populus deltoides*. Total shrub cover (tall and short shrubs) is often greater than 50%. Common species, in addition to *Prunus virginiana*, include *Rhus trilobata, Symphoricarpos occidentalis, Ribes aureum* and *Toxicodendron pubescens*. Herbaceous cover is variable, but usually less than 50%. Species composition also varies; common species include *Poa pratensis, Monarda fistulosa* and *Apocynum cannabinum* (Hollis Marriott pers. comm. 1999). In Colorado, dense thickets of *Prunus virginiana* may occur. When left undisturbed, the shrub canopy can be very thick and nearly impenetrable. However, many stands in Colorado are in severely degraded states with very sparse shrub canopies (CONHP pers. comm. 1998).

This community is found in mesic situations, usually near streams or rivers or broad alluvial floodplains at warm elevations (CONHP pers. comm. 1998).

COMMENTS: *1, WCS*. In the Black Hills, see description by Marriott and Faber-Langendoen (2000).

CONSERVATION RANK: *G3.*

DISTRIBUTION: This riparian forest grows on broad alluvial floodplains at warm elevations in the western and northern Great Plains of the United States, ranging from Colorado to Montana.

USFS ECOREGIONS: 331D:CC, 331G:CC, 342A:CC, M331B:CC, M334A:CC, M341B:CC
CONSERVATION REGIONS: 10:C, 25:C, 26:C, 36:, 9:C
STATES: CO MT SD WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: ACER NEGUNDO TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Cornus drummondii - Amorpha fruticosa - Cornus sericea Shrubland

Roughleaf Dogwood - Tall Indigobush - Red-osier Dogwood Shrubland

Dogwood Floodplain Shrubland CEGL005220

DESCRIPTION: Vegetation consists of patches of moderate to locally dense cold-deciduous shrubs 2-3 m tall. *Amorpha fruticosa* and *Cornus drummondii* dominate the stands, with scattered patches of *Cornus sericea, Salix exigua* and *Populus deltoides* saplings. Herbaceous understory varies in response to flooding. Sedges, such as *Carex cristatella, Carex emoryi*, and *Carex pellita (= Carex lanuginosa)*, are found with mesophytic grasses, such as *Panicum virgatum* and *Andropogon gerardii*. In more xeric habitats, weedy annual forbs, such as *Ambrosia artemisiifolia*, may be abundant, whereas wetter sites are dominated by forbs typical of marshes, e.g., *Impatiens capensis, Mentha arvensis* (Steinauer and Rolfsmeier 2000).

This community type is currently known from eastern Nebraska where it is found along high banks, raised islands, and terraces above the stream channel, which experience periodic flooding in late winter or spring. Soils are moderately well-drained and formed in alluvium (Steinauer and Rolfsmeier 2000).

COMMENTS: *3, MCS*. Type concept is taken from Nebraska HP state type - dogwood floodplain shrubland. This community is similar in some respects to dogwood thickets associated with upland woodlands but differs in the presence of *Amorpha fruticosa*. Some sites surveyed along the Middle Loup River in Nebraska are far wetter than those described by Currier (1982) and may represent a separate subtype (but see also the "willow wetland zone of the *Salix exigua* Temporarily Flooded Shrubland (CEGL001197)).

CONSERVATION RANK: *G4?.* Rank is based on the state rank in Nebraska. Further review is needed.

DISTRIBUTION: This community is found along rivers and streams in the central Great Plains, particularly Nebraska.

USFS ECOREGIONS: 251C:CC, 332C:CP, 332E:CP
CONSERVATION REGIONS:
STATES: NE **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE dogwood floodplainshrubland =

OTHER SYNONYMY:

USNVC HIERARCHY: CORNUS SERICEA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (III.B.2.N.d)

Fraxinus pennsylvanica - (Ulmus americana) / Symphoricarpos occidentalis Forest

Green Ash - (American Elm) / Western Snowberry Forest

Great Plains Ash - Elm - Snowberry Forest CEGL002088

DESCRIPTION: The tree layer is variable in structure, ranging from open (25-50%) to closed (50% or more) canopy. *Fraxinus pennsylvanica* is the leading dominant. In some parts of the range *Juniperus scopulorum* is present in the subcanopy, particularly where the canopy is still open. *Populus deltoides* may be present as an emergent. Emergent *Populus deltoides* may also occur under a canopy of *Fraxinus pennsylvanica*, reflecting a successional shift in some stands (Girard et al. 1989). *Fraxinus pennsylvanica* is common in the subcanopy and sapling layer, and, in some stands, *Ulmus americana* may be an associate. *Acer negundo* may only be occasionally present in some parts of the range. The dominant shrub is *Symphoricarpos occidentalis*. Other shrub species may be present, including *Cornus sericea, Rosa woodsii*, and *Rhus aromatica*. A variety of herbs may be present, none at high cover values, including *Elymus canadensis, Maianthemum stellatum, Melilotus officinalis, Muhlenbergia racemosa, Parthenocissus vitacea, Poa pratensis, Thalictrum dasycarpum*, and *Toxicodendron rydbergii* (Hansen et al. 1984, Girard et al. 1989).

Stands are found on nearly level floodplains and lower terraces of rivers and streams, generally away from the river on older, stabilized sites. The water table may be relatively deep on higher terraces, allowing drier species to establish (Girard et al. 1989). Soils are typically clays or silty clays.

This type is usually found away from the river on older, stabilized floodplains. Proceeding towards the river, other more pioneer successional forest stages may occur, including, in the Little Missouri River drainage, a *Populus deltoides / Fraxinus pennsylvanica* community type (CEGL000658), and a *Populus deltoides / Juniperus scopulorum* woodland community type (CEGL002152). The latter community colonizes the freshly deposited alluvial substrates on the meanders of the streams and rivers. As the stream continues to move away from these deposits, the stand may eventually succeed to the *Fraxinus pennsylvanica* type, a process that could take 100 years (Girard et al. 1989).

COMMENTS: *2, MCS*. Where stands occur on higher terraces and the water table is deep, *Prunus virginiana* may be more common, and stands may resemble *Fraxinus pennsylvanica - Ulmus americana / Prunus virginiana* Woodland (CEGL000643). This type is placed under a temporarily flooded hydrologic regime, but because of the arid climate, the floodplain may be relatively dry. Type is conceptually equivalent to the *Fraxinus pennsylvanica / Symphoricarpos occidentalis* Habitat Type of Hansen et al. (1984) and Girard et al. (1989), at least in the western Dakotas. The relative importance of *Acer negundo* across the range of this type is not clear, nor whether stands with *Acer negundo* have been impacted by human activity to a greater degree.

CONSERVATION RANK: *G4?.*

DISTRIBUTION: This ash - elm forest type is found in the northeastern and north-central Great Plains of the United States and Canada, ranging from the Dakotas and northern Ontario to Saskatchewan.

USFS ECOREGIONS: 251Aa:CCC, 332:P
CONSERVATION REGIONS: 34:C, 35:C
STATES: ND SD **PROVINCES:** MB SK

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Fraxinus pennsylvanica / Symphoricarpos occidentalis* Habitat Type (Hansen et al. 1984) =, *Fraxinus pennsylvanica / Symphoricarpos occidentalis* Habitat Type (Girard et al. 1989) =

USNVC HIERARCHY: FRAXINUS PENNSYLVANICA - (ULMUS AMERICANA) TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Populus angustifolia / Cornus sericea Woodland

Narrowleaf Cottonwood / Red-osier Dogwood Woodland

Narrowleaf Cottonwood / Red-osier Dogwood Forest CEGL002664

DESCRIPTION: The vegetation is dominated by a closed to open canopy of deciduous trees. It is highly variable in the number of conifer and shrub species present; however, it is generally recognized by a clear dominance of *Populus angustifolia*, with less than 10% cover of other tree species and a thick understory of *Cornus sericea* (CONHP pers. comm. 1999).

Stands occur along moderate-sized rivers in the montane zone (Colorado NHP pers. comm. 1999).

COMMENTS: *1, WCS*.

CONSERVATION RANK: *G4.*

DISTRIBUTION: This narrowleaf cottonwood forest type is found in the western Great Plains and western mountain regions of the United States, ranging from Montana west to Oregon, south to possibly Nevada, east to Colorado and north to the Black Hills of South Dakota.

USFS ECOREGIONS: 331D:CC, 331G:C?, 341B:CC, 341F:CC, 341G:CC, 342B:CC, 342D:CC, M331A:C?, M331B:C?, M331D:CC, M331G:CC, M331H:CC, M331I:CC, M332B:CC, M332C:CC, M332D:CC, M334A:CC
CONSERVATION REGIONS: 10:C, 11:C, 19:C, 20:C, 25:C, 6:C
STATES: CO ID MT NM NV? OR SD UT WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: POPULUS ANGUSTIFOLIA TEMPORARILY FLOODED WOODLAND ALLIANCE (II.B.2.N.b)

Populus deltoides - (Salix amygdaloides) / Salix exigua Woodland

Eastern Cottonwood - (Peachleaf Willow) / Coyote Willow Woodland

Cottonwood - Peach-leaf Willow Floodplain Woodland CEGL000659

DESCRIPTION: This community has an open canopy 6-12 m tall and is typically dominated by *Populus deltoides* or with *Salix amygdaloides* as a codominant. *Fraxinus pennsylvanica* may be present, especially on the upland side of this community, and *Elaeagnus angustifolia* or *Juniperus* spp. may invade some sites. This woodland community has closely spaced shrubs and small trees. *Salix exigua*, a tall shrub, is usually more abundant along the streamside margins of this community and where the canopy of taller trees is most open, which may occur following a scouring (heavy flood) event. *Salix lutea* can also be conspicuous in some stands. Other shorter shrubs that can be found are *Amorpha fruticosa, Symphoricarpos occidentalis*, and *Toxicodendron rydbergii*. Graminoids adapted to mesic sites dominate the understory of most sites, the most common species including *Carex emoryi, Carex pellita (= Carex lanuginosa), Elymus canadensis, Elymus virginicus, Hordeum jubatum, Muhlenbergia racemosa, Pascopyrum smithii, Poa pratensis*, and *Spartina pectinata*. Forbs that are frequently abundant in relatively undisturbed sites include *Equisetum arvense* and *Glycyrrhiza lepidota*. Flooding often creates open patches in the herbaceous layer that are available for colonization by nearby species. The floristic composition of these patches is greatly affected by the species that are near and can invade the disturbed areas. Because of the high permeability of the sandy floodplain soils, species typical of upland prairie may invade in addition to annual forbs typical of disturbed sites. Widely distributed species that are adapted to these sites include *Ambrosia psilostachya, Artemisia campestris ssp. caudata, Artemisia ludoviciana, Calamovilfa longifolia, Cenchrus longispinus, Chamaesyce serpyllifolia (= Euphorbia serpyllifolia), Euphorbia esula, Grindelia squarrosa, Helianthus petiolaris, Heterotheca villosa, Phyla lanceolata (= Lippia lanceolata), Opuntia macrorhiza, Poa pratensis*, and *Sporobolus cryptandrus*. These sites are prone to invasion by exotic grasses and forbs, the most widely established being *Agrostis stolonifera, Bromus tectorum, Cirsium arvense, Bassia scoparia (= Kochia scoparia), Melilotus* spp., *Taraxacum officinale*, and *Tragopogon dubius*.

This community is found along the banks of streams and rivers, where it develops on newly deposited alluvium. The soils are predominantly sand, although silt, clay, or loam may be present. Soils are poorly developed. The water table fluctuates with the level of the river or stream and flooding is common, especially in the spring. In Wyoming, height above the stream channel varies from 0.5 to 3 m (1.5 to 10 feet) (Jones and Walford 1995).

This type is subject to, and maintained by, periodic flooding. In one study, it has been suggested that thirty years post-flood, this type will likely transition into a grassland type, as the cottonwood and willow species do not regenerate (Bellah and Hulbert 1974).

COMMENTS: *2, MCS*. This community's range into North Dakota and Manitoba needs review. It apparently does not occur in South Dakota. Check with other midwestern states regarding woodland status. Species nomenclature is *Populus deltoides ssp. monilifera* in Colorado.

CONSERVATION RANK: *G3G4.* In the absence of regular flooding, many sites will undergo succession to later seral stages. Many sites are overgrazed and invaded by exotic woody and herbaceous species.

DISTRIBUTION: This cottonwood - willow woodland is found widely in the central Great Plains, especially Colorado, Nebraska, Kansas, and Oklahoma, and possibly both north and south of this region.

USFS ECOREGIONS: 331H:CC, 331I:CC, M334A:CC
CONSERVATION REGIONS: 19:C, 20:C, 25:C, 26:C, 27:C, 33:C, 34:C
STATES: CO KS ND NE NM? OK? SD TX? WY? **PROVINCES:** MB? SK?

MIDWEST HERITAGE SYNONYMY: NE western floodplain woodland; diamond willow woodland -

OTHER SYNONYMY: Willow wetland community (Currier 1982) F, *Populus-Salix* Associes (Hefley 1937) B, *Populus sargentii / Ribes americanum* Plant Association (Johnston 1987) =, Plains Cottonwood/Western wheatgrass Community (Jones and Walford 1995) B, Willow-Poplar Community (Ramaley 1939) =

USNVC HIERARCHY: POPULUS DELTOIDES TEMPORARILY FLOODED WOODLAND ALLIANCE (II.B.2.N.b)

Populus deltoides - (Salix nigra) / Spartina pectinata - Carex spp. Woodland

Eastern Cottonwood - (Black Willow) / Prairie Cordgrass - Sedge Species Woodland

Cottonwood Floodplain Woodland CEGL002017

DESCRIPTION: In this floodplain woodland, the overstory is composed of medium to tall trees, including *Acer negundo, Fraxinus pennsylvanica, Populus deltoides, Carya illinoinensis, Quercus palustris, Salix nigra*, and *Ulmus americana*. The ground layer consists of tall and mid grasses and forbs. *Andropogon gerardii, Panicum virgatum*, and *Spartina pectinata* are commonly present in the ground layer. Ground layer species of this community are also typical of wet-mesic and wet prairie (Nelson 1985, Lauver et al. 1999).

This community occurs on floodplains of streams and rivers. It is a palustrine system in which the water table is near the surface and, in lower sites, standing water may be present in winter or spring. Soils of this type are deep sandy loam to sand and somewhat poorly drained. The parent material is alluvium (Nelson 1985, Lauver et al. 1999).

COMMENTS: *3, MCS*. *Salix nigra* is used to distinguish this community from other more western *Populus deltoides* woodlands, but *Salix nigra* could probably be dropped because there are other floristic differences between the communities. The type has recently been dropped from Nebraska and Missouri because of conceptual difficulties with the type (M. Leahy pers. comm. 1999, Steinauer and Rolfsmeier 2000); namely, stands are primarily wet prairie being invaded by colonizing bottomland trees forming a transition between wet prairie and bottomland forest, with a tree canopy that varies from savanna (10-25%) to woodland (25-60%).

CONSERVATION RANK: *G1*. There are probably fewer than 6 occurrences of this community rangewide. It is reported from western Missouri (where it is ranked S1) and northeastern Kansas (SU). It occurs on floodplains near the lower Missouri River and its tributaries. Currently only one occurrence is documented, from Missouri, but that stand is of poor quality and unstable, with bottomland trees from adjacent forests thought to be invading the wet prairie. Most sites of this community have been cleared for agriculture.

DISTRIBUTION: This cottonwood - willow woodland is found on floodplains near the lower Missouri River and its tributaries in the western tallgrass prairie region of the United States, including Kansas, Iowa, and possibly Missouri.

USFS ECOREGIONS: 222Ak:???, 251Cd:C??, 251Eb:CCC
CONSERVATION REGIONS: 37:C
STATES: IA KS MO? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO? wet-mesic savanna +

OTHER SYNONYMY:

USNVC HIERARCHY: POPULUS DELTOIDES TEMPORARILY FLOODED WOODLAND ALLIANCE (II.B.2.N.b)

Populus deltoides - Fraxinus pennsylvanica Forest

Eastern Cottonwood - Green Ash Forest

Cottonwood - Green Ash Floodplain Forest CEGL000658

DESCRIPTION: This community is a riparian forest with and open to closed canopy dominated by deciduous trees. Girard et al. (1989) sampled two stands in southwestern North Dakota that had an average of 293 trees/ha. Hansen et al. (1984) sampled four stands that had an average basal area of 41 m2/ha and 427 trees/ha. They found that the average cover by strata was shrubs 76.8%, graminoids 64.2%, and forbs 43.5%. *Populus deltoides* and *Fraxinus pennsylvanica* are the most abundant mature trees. *Acer negundo, Salix amygdaloides*, and *Juniperus scopulorum* may also be present in the tree layer. This community is seral and in younger stands *Populus deltoides* is the dominant, but as stands age *Fraxinus pennsylvanica* becomes more prominent until the stand becomes a different community. The closed canopy leads to poor reproduction by *Populus deltoides* in stands of all ages. The shrub layer is often vigorous. Species such as *Rosa woodsii, Symphoricarpos occidentalis, Juniperus scopulorum, Juniperus communis*, and *Cornus sericea ssp. sericea* can be abundant. The composition of the herbaceous layer is variable. Along the Missouri River, Keammerer (1972) found *Poa pratensis* to be the most prevalent species, with *Amphicarpaea bracteata, Bromus inermis*, and *Elymus virginicus* common. *Carex* spp., *Juncus* spp., *Leymus cinereus, Lysimachia ciliata, Thalictrum venulosum*, and *Elymus canadensis* are common. Weedy species are almost ubiquitous, among them *Poa* spp., *Bromus inermis, Melilotus officinalis, Ambrosia* spp., and *Urtica* spp.

This community occurs along rivers and streams and around ponds and lakes. The soils are developed from alluvium. In southwest North Dakota, Girard et al. (1989) found this community on silty clay loam, clay loam, clay, and loam. The soils were alkaline. Johnson (1971) found sandy loams, loamy sands, and silty clays along the Missouri River.

The species dominating this community are pioneers of bare soil. The community is sometimes considered a "postclimax" type that exists in otherwise arid areas because of groundwater along streams and rivers. It is often subject to flooding, deterioration during periodic droughts, and destruction by herbicides, after which it reappears following natural seeding. In the southern portion of its range, cottonwood-willow forests on river bottomlands often contain an understory of *Juniperus virginiana* that has developed as a result of seed dissemination by birds from individuals in windbreak plantings on adjacent uplands. This conifer component may be gradually altering the type.

COMMENTS: *3, MCS*. In North and South Dakota, woodland cottonwood types may only occur in the western half of the state, e.g., *Populus deltoides / Juniperus scopulorum* Woodland (CEGL002152), where such species as *Celtis occidentalis* do not occur. Further comparisons are needed between these stands and those in Nebraska, which may contain a different set of species.

CONSERVATION RANK: *G2G3*. The total number of occurrences is unknown. Three have been documented in Nebraska, where the community is ranked S3. Although no other occurrences have been documented, the community is also reported from Montana and may occur in North Dakota (SP), South Dakota (SP), and Saskatchewan (SP). It occurs in nine northern Great Plains ecoregional sections. The community is found on a variety of soils along streams and rivers and around ponds and lakes.

DISTRIBUTION: This cottonwood - green ash riparian forest community occurs throughout the northern and central Great Plains of the United States and adjacent Canada, ranging from the Dakotas northwest to Montana and Saskatchewan, and south to Nebraska.

USFS ECOREGIONS: 251Aa:CCC, 251Bb:CCC, 251Cg:CCC, 331E:CC, 331F:CC, 332A:CC, 332B:CP, 332C:CC, 332D:CP
CONSERVATION REGIONS: 25:C, 26:C, 35:C, 36:C
STATES: MT ND NE SD **PROVINCES:** MB? SK?

MIDWEST HERITAGE SYNONYMY: NE cottonwood-dogwood floodplain woodland; eastern floodplain woodland -

OTHER SYNONYMY: *Populus deltoides / Fraxinus pennsylvanica* Community Type (Girard et al. 1989) =, *Fraxinus pennsylvanica / Symphoricarpos occidentalis* Habitat Type (Hansen et al. 1984) =, *Populus sargentii / Symphoricarpos occidentalis*, Phase 1 Plant Association (Johnston 1987) B, Cottonwood, green ash, boxelder Floodplain Forest (Johnson 1971) =

USNVC HIERARCHY: POPULUS DELTOIDES TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Populus deltoides - Platanus occidentalis Forest

Eastern Cottonwood - Sycamore Forest

Cottonwood - Sycamore Forest CEGL002095

DESCRIPTION: The vegetation structure is open- to closed-canopy forest. Dominant trees include *Populus deltoides* and *Platanus occidentalis*. Associates include *Acer negundo, Carya illinoinensis, Celtis occidentalis*, and *Salix nigra* (Lauver et al. 1999).

Stands occur on nearly level to undulating soils on floodplains along major rivers and streams. Soils are deep, poorly drained to well-drained, and formed in silty and clayer alluvium (Lauver et al. 1999).

COMMENTS: *2, MCS*. Concept of this type is taken from the Kansas state classification -cottonwood-sycamore floodplain forest (Lauver et al. 1999). Placement in this alliance needs review. Type would appear to be very similar to *Platanus occidentalis - (Populus deltoides) - Acer negundo* Forest (CEGL002092). See also *Populus deltoides - Ulmus americana - Celtis laevigata* Forest (CEGL002096).

CONSERVATION RANK: *G1G2*. There are probably fewer than 20 occurrences in Kansas, the only state from which this community is reported. Currently there are 557 acres documented in 8 sites in Kansas, most under 100 acres. This community is restricted to floodplains, and is currently known from a restricted range in four ecoregion subsections from six counties in Kansas. Most of the documented occurrences are at least somewhat degraded or disturbed.

DISTRIBUTION: This cottonwood - sycamore floodplain forest is found in the central Great Plains of the United States, and is currently reported from eastern Kansas.

USFS ECOREGIONS: 251Cg:CCC, 251Cq:CCC, 251Ea:CCC, 251Fa:CCC
CONSERVATION REGIONS: 33:C, 36:C, 37:C
STATES: KS **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: POPULUS DELTOIDES TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Populus deltoides / Juniperus scopulorum Woodland

Eastern Cottonwood / Rocky Mountain Juniper Woodland

Cottonwood / Juniper Woodland CEGL002152

DESCRIPTION: The dominant species in this community is mature *Populus deltoides*. It has three times the cover of *Juniperus scopulorum*. Small amounts of *Fraxinus pennsylvanica* are often present as small trees and, more commonly, saplings. *Juniperus scopulorum* also occurs as saplings and seedlings but *Populus deltoides* reproduction is very limited. This community is a seral stage that may develop into a *Fraxinus pennsylvanica*-dominated system. Hansen et al. (1984) attributed the abundance of *Juniperus scopulorum* to adequate light available to the understory layers of the community as a result of wide spacing of the old *Populus*.

The prevalence of *Juniperus scopulorum* decreases in the lower layers of this community, while *Fraxinus pennsylvanica* increases. The shrub layer of this community is composed chiefly of *Rosa woodsii, Symphoricarpos occidentalis*, and small *Juniperus scopulorum*. The herbaceous stratum typically contains *Toxicodendron rydbergii, Elymus canadensis, Melilotus officinalis*, and *Thalictrum dasycarpum*.

This woodland community is found on soils with an upper profile of silt loam (0-60 cm) and a lower profile of sandy loam (61-90 cm). These soils developed from alluvial deposits. The pH is circumneutral and there is a high water holding capacity. This community occurs on broad, flat floodplains (Girard et al. 1989).

This type is found closest to the river on young, unstabilized floodplains, where it colonizes the freshly deposited alluvial substrates on the meanders of the streams and rivers. Proceeding away from the river, other later successional stages include, in the Little Missouri River drainage, a *Populus deltoides / Fraxinus pennsylvanica* community type (CEGL000658) and a *Fraxinus pennsylvanica - (Ulmus americana) / Symphoricarpos occidentalis* Forest (CEGL002088). As the stream continues to move away from the more recent deposits, the stand may eventually succeed to the *Fraxinus pennsylvanica* type, a process that could take 100 years (Girard et al. 1989).

COMMENTS: *3, MCS*. The former *Populus deltoides / Juniperus virginiana* Forest (CEGL002094) has been combined with this type. In northern and central Nebraska and central South Dakota this type can form a semi-natural type, where *Juniperus scopulorum* or *Juniperus virginiana* can form dense understories under *Populus deltoides*. This may arise when natural flooding regimes, which would otherwise prevent establishment of the juniper species, are altered (G. Steinauer pers. comm. 2000). Nebraska does not currently list this type. Floodplain stands that are heavily grazed or have soil disturbances can also be invaded by the junipers.

CONSERVATION RANK: *G1G2*. There are probably fewer than 20 occurrences of this community rangewide. No occurrences are currently documented. This community is ranked S1S2? in North Dakota, and it is only known from southwestern North Dakota, in one ecoregion section. Many stands have been subject to extensive grazing, and weedy species may predominate.

DISTRIBUTION: This cottonwood community is found in riparian areas of the northwestern Great Plains, especially in the Dakotas.

USFS ECOREGIONS: 331F:CC
CONSERVATION REGIONS: 26:C
STATES: ND SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Populus deltoides / Juniperus scopulorum* Community Type (Girard et al. 1989) =, *Populus deltoides / Cornus stolonifera* (Hansen et al. 1990). described in Montana; somewhat similar.

USNVC HIERARCHY: POPULUS DELTOIDES TEMPORARILY FLOODED WOODLAND ALLIANCE (II.B.2.N.b)

Populus deltoides / Panicum virgatum - Schizachyrium scoparium Woodland

Eastern Cottonwood / Switchgrass - Little Bluestem Woodland

Cottonwood/Switchgrass Floodplain Woodland CEGL001454

DESCRIPTION: This community is dominated by a sparse (15-25%) cover of *Populus deltoides* and often also *Salix amygdaloides*, which is less common than *Populus deltoides* when both are present. Locally, overall canopy coverage may be slightly greater than 25%. Woody subcanopy is poorly developed, though in some sites scattered individuals of *Elaeagnus angustifolia* and *Fraxinus pennsylvanica* may be present. The shrub layer is also poorly developed to nearly absent, with at most a sparse layer of *Shepherdia argentea* and *Symphoricarpos occidentalis*. The herbaceous understory is dominated by tall grasses 1-2 m tall, primarily *Panicum virgatum* and *Spartina pectinata*. Other graminoids frequently present include *Carex nebrascensis* and *Carex pellita*. In drier sites, the mid grasses *Bouteloua curtipendula, Pascopyrum smithii* and *Schizachyrium scoparium* may be common. Forb species present in Wyoming stands include *Ambrosia psilostachya, Artemisia ludoviciana, Asclepias speciosa, Glycyrrhiza lepidota, Grindelia squarrosa, Liatris punctata*, and *Opuntia polyacantha* (Jones and Walford 1995). Exotic species are usually uncommon in this community. Overall species diversity is low.

This community occurs on low floodplain ridges and stream banks. It is found along strongly meandering rivers with moderate to low gradients. Soils are deep and somewhat poorly drained to moderately well-drained and range from fine, sandy loams to silty clay.

COMMENTS: *2, MCS*. This community is similar to *Populus deltoides - (Salix amygdaloides) / Salix exigua* Woodland (CEGL000659) and is distinguished from it by the near absence of a shrub layer. It is likely that this type is no more than a subtype of that community in which the shrub layer has been removed through flooding or winter grazing. The literature on these types does not describe the herbaceous layer very well, and more research is needed to characterize it. See also Kittel et al. (1999a) for a recent description that needs to be incorporated with this type.

CONSERVATION RANK: *G2.* The distribution and extent of this community are limited. Sites are prone to invasion by brush and exotic weeds in the absence of flooding or as a result of overgrazing.

DISTRIBUTION: This community is found in floodplains of the central Great Plains of the United States, ranging from Nebraska and possibly South Dakota south to Texas.

USFS ECOREGIONS: 331B:C?, 331C:CC, 331H:CP
CONSERVATION REGIONS: 27:C
STATES: CO KS NE? OK SD? TX **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE? western floodplain woodland ?

OTHER SYNONYMY: Plains cottonwood/Switchgrass Panic Community (Jones and Walford 1995) =, *Populus* open meadow (Currier 1982). similar; decribed in Nebraska, Cottonwood Parkland Associes (Hefley 1937). similar; decribed in Oklahoma

USNVC HIERARCHY: POPULUS DELTOIDES TEMPORARILY FLOODED WOODLAND ALLIANCE (II.B.2.N.b)

Populus deltoides / Symphoricarpos occidentalis Woodland

Eastern Cottonwood / Western Snowberry Woodland

Cottonwood / Western Snowberry Woodland CEGL000660

DESCRIPTION: This community is typically dominated by a single deciduous tree species, *Populus deltoides*. In some stands other species, such as *Acer negundo* and *Fraxinus pennsylvanica*, may contribute to the canopy. The tallest trees exceed 15 m. *Populus deltoides* is a pioneer species that requires moist, sparsely vegetated alluvium to become established from seed; therefore stands of this community may be considered seral, but the stage is long persistent (up to 100 years) (Girard et al. 1989). The shrub layer is typically 0.5-1 m tall. It is dominated by *Symphoricarpos occidentalis* and commonly includes *Juniperus scopulorum* and *Rosa* spp. In Wyoming, *Ericameria nauseosa (= Chrysothamnus nauseosus)* is present and increases with heavy grazing (Thilenius et al. 1995). The herbaceous layer usually includes *Pascopyrum smithii* and *Elymus trachycaulus*. Weedy species such as *Cirsium arvense, Melilotus officinalis, Taraxacum officinale*, and *Poa secunda* are very common, especially in the presence of grazing (Jones and Walford 1995, Thilenius et al. 1995). *Maianthemum stellatum* is abundant only where grazing is absent.

This community is found on medium to coarse-textured alluvial soils on the floodplains of major rivers. The floodplains are both seasonally inundated and subirrigated (Thilenius et al. 1995). The meandering erosional and depositional pattern of rivers maintains and influences this community along rivers (Hanson et al. 1990). It is rarely found at higher elevations in the mountains of eastern Wyoming and western South Dakota (Johnston 1987).

This type is found closest to the river on young, unstabilized floodplains, where it colonizes the freshly deposited alluvial substrates on the meanders of the streams and rivers. Proceeding away from the river, other later successional stages may include *Populus deltoides / Fraxinus pennsylvanica* Forest (CEGL000658) and *Fraxinus pennsylvanica - (Ulmus americana) / Symphoricarpos occidentalis* Forest (CEGL002088). As the stream continues to move away from the more recent deposits, the stand may eventually succeed to the *Fraxinus pennsylvanica* type, a process that could take 100 years (Girard et al. 1989).

COMMENTS: *1, MCS*. Concept of the type may have come from Thilenius and Brown (1990). In eastern Montana, Hanson et al. (1990) describe a *Populus deltoides / Symphoricarpos occidentalis* type as a grazing-induced stage of the *Populus deltoides / Cornus sericea* type. This contrasts with information from Wyoming, where Thilenius et al. (1995) found that *Symphoricarpos occidentalis* decreases with grazing and *Ericameria nauseosa (= Chrysothamnus nauseosus)* increases.

CONSERVATION RANK: *G2G3.* The total number of occurrences is unknown. Thirteen have been documented in North Dakota, where the community is ranked S1S2?. Although no other occurrences have been documented, the community is also reported from Wyoming (S2), Colorado (S2) and may occur in South Dakota (SP). It is found in three northern Great Plains ecoregional sections. The community occurs on medium- to coarse-textured soils on the floodplains of major rivers.

DISTRIBUTION: This riparian woodland community is found in floodplains of the northwestern Great Plains of the United States, ranging from North Dakota to Colorado.

USFS ECOREGIONS: 331F:CC, 331G:CC, 331H:CC, M334A:CC
CONSERVATION REGIONS: 20:C, 25:C, 26:C, 27:C
STATES: CO ND SD? WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Populus sargentii / Symphoricarpos occidentalis - Leymus cinereus* Plant Association (Johnston 1987) B, *Populus deltoides / Symphoricarpos occidentalis* Community (Jones and Walford 1995) =, *Populus deltoides / Cornus stolonifera* (Hansen et al. 1990) B, *Populus sargentii / Symphoricarpos occidentalis* Deciduous forest (Thilenius 1970) =. Populus sargentii is equivalent to Populus deltoides ssp. monolifera according to Kartesz

USNVC HIERARCHY: POPULUS DELTOIDES TEMPORARILY FLOODED WOODLAND ALLIANCE (II.B.2.N.b)

Salix amygdaloides Woodland

Peachleaf Willow Woodland

Peachleaf Willow Woodland CEGL000947

DESCRIPTION: The peachleaf willow woodland type is found in the Northern Rocky Mountains, and possibly into parts of the western Great Plains. Stands occur in riparian areas. The vegetation is dominated by *Salix amygdaloides*.

COMMENTS: *1, WCS*. In the Black Hills, Peachleaf Willow Woodland has been documented from a single site, along Iron Creek near its confluence with Spearfish Creek. In this stand, peachleaf willow (*Salix amygdaloides*) forms a tall-shrub stratum with Bebb willow (*Salix bebbiana*) and red-osier dogwood (*Cornus sericea*). Stands occur as intermittent patches in a narrow zone along the creek. The overall size is less than 0.5 acres, and peachleaf willow forms a shrubland rather than a woodland. The very limited extent of the type and its atypical structure suggest that Peachleaf Willow Woodland may not be a valid type for the area (Marriott and Faber-Langendoen 2000).

CONSERVATION RANK: *G3.*

DISTRIBUTION: The peachleaf willow woodland type is found in the Northern Rocky Mountains, ranging from Idaho to Montana and possibly into parts of the western Great Plains.

USFS ECOREGIONS: 331D:CC, 331G:CC, 342B:CC, M331D:CC, M331G:CC, M332B:CC, M332D:CC, M333B:CC, M333D:CC, M334A:C?
CONSERVATION REGIONS: 19:C, 20:C, 25:C, 26:C, 6:C
STATES: ID MT SD? WY? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: SALIX AMYGDALOIDES TEMPORARILY FLOODED WOODLAND ALLIANCE (II.B.2.N.b)

Salix exigua / Mesic Graminoids Shrubland

Coyote Willow / Mesic Graminoids Shrubland

Sandbar Willow / Mesic Graminoid Shrubland CEGL001203

DESCRIPTION: The vegetation is dominated by shrubs with a fairly dense ground layer (at least 30% cover) of mesic graminoids and forbs. In Nebraska, the vegetation is quite variable and is dominated by perennial shrubs and grasses about 1 m tall. *Salix exigua* is the common shrub. Others include saplings of *Populus deltoides* or *Salix amygdaloides, Salix eriocephala, Salix lutea*, and *Amorpha fruticosa*. Tall perennial grasses can appear to codominate the stand, with *Spartina pectinata* the dominant. Other herbaceous species include *Bidens* spp., *Eleocharis* spp., *Juncus* spp., *Lobelia siphilitica, Lycopus americanus, Lythrum alatum, Polygonum* spp., *Schoenoplectus pungens (= Scirpus pungens), Sphenopholis obtusata*, and *Xanthium strumarium* (Steinauer and Rolfsmeier 2000). Lauver et al. (1999) note that *Andropogon gerardii* can be present.

In Nebraska, this community is found on sandbars, islands and shorelines of stream channels and braided rivers. Soils are poorly developed and composed of sand with lesser amounts of clay, silt and gravel formed in alluvium. Drainage varies with texture and height above the river surface (Steinauer and Rolfsmeier 2000).

Flooding and scouring occur during spring periods.

COMMENTS: *1, WCS*. This plant association now occupies a rather large range. Descriptions from the western part of its range are needed to determine if the type should be split. In Nebraska, this community intergrades and is a successional stage that appears after both the Riverine Sand Flats - Bars Sparse Vegetation (CEGL002049) and the *Salix exigua* Temporarily Flooded Shrubland (CEGL001197), which is more frequently disturbed and lacks many of the more mesic herbaceous species.

CONSERVATION RANK: *G5.*

DISTRIBUTION: This association is found primarily in the central Great Plains, but also parts of the Rocky Mountains and Intermountain Semi-desert regions, ranging from Wyoming west to possibly Idaho, south to Utah, and east to Oklahoma.

USFS ECOREGIONS: 251C:CC, 313A:PP, 313B:PP, 331C:CC, 331F:CC, 331H:CC, 331I:CC, 332C:CC, 332E:CP, 341:C, 342D:CC, 342G:CC, M331D:CC, M331E:CC, M331G:CC, M331H:CC, M331I:CC, M333C:CC, M341B:CC
CONSERVATION REGIONS: 10:C, 19:C, 20:C, 26:C, 27:C, 36:C, 6:C
STATES: CO ID? KS NE OK? UT WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE perennial sandbar =

OTHER SYNONYMY:

USNVC HIERARCHY: SALIX EXIGUA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (III.B.2.N.d)

Salix exigua Temporarily Flooded Shrubland

Coyote Willow Temporarily Flooded Shrubland

Sandbar Willow Shrubland CEGL001197

DESCRIPTION: This community is dominated by shrubs, generally between 2 and 4 m tall. The most common of these is *Salix exigua*. *Salix irrorata* and saplings of *Populus deltoides* or *Salix amygdaloides* are also frequently found in the shrub layer. This stratum can have moderate to high stem density in the community as a whole. The species in the shrub layer do not form a closed canopy, allowing significant light to reach the ground layer. There are often patches where the shrub layer is absent. The herbaceous cover is sparse to moderate, but rarely exceeds 30%. Older stands and places with less competition from the shrubs have greater herbaceous cover. The composition of the herbaceous layer can vary greatly. Species that are often found in this community are *Cenchrus longispinus, Polygonum lapathifolium, Schoenoplectus americanus (= Scirpus americanus), Triglochin maritima*, and *Xanthium strumarium*.

This community is found on recently deposited or disturbed alluvial material. The parent material is alluvial sand, although silt, clay, or gravel may be present. Soil development is poor to absent.

This type originates after flash floods that create new deposits or scour existing alluvial material. This community is a primary or early secondary community and requires floods to create new areas on which it can develop. Once established, this community may not exist for more than 10-20 years before it is replaced by a later seral stage.

COMMENTS: *1, WCS*. This type may be an early successional shrubland that matures into *Salix exigua* / Mesic Graminoids Shrubland (CEGL001203), or the two types may be essentially synonymous. This plant association occupies a wide range. Review of the western part of its range is needed to see if the type should be split.

CONSERVATION RANK: *G5.* This type is widespread and common throughout its range.

DISTRIBUTION: This sandbar willow shrubland community is found along rivers and streams at lower elevations throughout the northwestern United States and Great Plains, ranging sporadically from Illinois northwest to the Dakotas and Manitoba, west to Washington, and south to Oklahoma.

USFS ECOREGIONS: 251Aa:CCC, 251C:CC, 331C:C?, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 331J:CC, 332C:PP, 332E:PP, 342A:CC, 342B:CC, 342F:CC, 342G:CC, M331A:CC, M331B:CC, M331C:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M333C:CC, M334A:CC
CONSERVATION REGIONS: 10:C, 20:C, 25:C, 26:C, 27:C, 32:?, 33:?, 35:C, 36:C, 37:C, 38:C, 39:C, 6:C
STATES: AR IA ID IL? MT ND NE OK OR SD WA WY **PROVINCES:** MB

MIDWEST HERITAGE SYNONYMY: IL? shrub swamp (S) ?
NE sandbar willow shrubland =

OTHER SYNONYMY: P4B3cI2a. *Salix exigua* (Foti et al. 1994)

USNVC HIERARCHY: SALIX EXIGUA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (III.B.2.N.d)

Carya illinoinensis - Celtis laevigata Forest

Pecan - Sugarberry Forest

Pecan - Sugarberry Forest CEGL002087

DESCRIPTION: The vegetation is dominated by a closed-canopy forest. Characteristic dominants include *Carya illinoinensis* and *Celtis laevigata*. In Oklahoma, other characteristic species include *Fraxinus pennsylvanica, Ilex decidua, Quercus shumardii*, and *Sapindus saponaria var. drummondii* (Hoagland 1997), in Kansas they include *Acer negundo, Fraxinus pennsylvanica, Juglans nigra, Platanus occidentalis*, and *Ulmus americana*, and in Texas they include *Fraxinus pennsylvanica, Ulmus americana, Platanus occidentalis, Sapindus saponaria var. drummondii, Cornus drummondii, Ilex decidua*, and *Acer negundo*. Ground layer species include *Carex grayi, Parthenocissus quinquefolia, Verbesina virginica* and *Toxicodendron radicans* (Lauver et al. 1999).

Stands occur on nearly level floodplains and terraces along major streams and rivers. Soils are deep, poorly drained to well-drained, and formed in silty, loamy and clayey recent alluvium.

COMMENTS: *2, SCS.* Understory species need to be added. There are likely several associations that should be recognized, or the type itself may be a part of other associations, e.g., in Kansas, see *Fraxinus pennsylvanica - Ulmus spp. - Celtis occidentalis* Forest (CEGL002014). In Kansas, the type is found at Ft. Leavenworth (H. Loring pers. comm. 1999).

CONSERVATION RANK: *G4?.*

DISTRIBUTION: This pecan - sugarberry forest is found in the central and south-central United States, ranging from Kansas and Arkansas, south to Texas and Louisiana.

USFS ECOREGIONS: 231Em:CCC, 251Cg:CCC, 251E:CP, 255Ai:CCC, 255B:CC, 255Ca:CCC, 255D:CC, 315D:CC
CONSERVATION REGIONS: 29:C, 30:P, 31:P, 32:C, 33:P, 36:C, 37:C, 39:C, 40:C
STATES: AR KS LA OK TX **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: IIA6g. Pecan - Sugarberry Forest (Allard 1990), *Celtis laevigata - Fraxinus pennsylvanica - Carya illinoensis* (Foti et al. 1994)

USNVC HIERARCHY: CARYA ILLINOINENSIS - (CELTIS LAEVIGATA) TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Quercus macrocarpa - Quercus shumardii - Carya cordiformis / Chasmanthium latifolium Forest

Bur Oak - Shumard Oak - Bitternut Hickory / River-oats Forest

Bur Oak - Shumard Oak Mixed Bottomland Forest CEGL004544

DESCRIPTION: The vegetation is dominated by a closed-canopy layer of trees, with *Quercus macrocarpa, Quercus shumardii*, and *Carya cordiformis* the major dominants. Other characteristic species include *Carya illinoinensis, Frangula caroliniana, Populus deltoides*, and *Ulmus americana* in Oklahoma (Hoagland 1997) and *Acer negundo, Acer saccharinum, Fraxinus pennsylvanica*, and *Platanus occidentalis* in Kansas (Lauver et al. 1999). Ground layer species include *Carex* spp. and *Leersia oryzoides*.

Stands occur on floodplains, where they are temporarily flooded for short periods as a result of river flooding, and more rarely on other mesic habitats (Hoagland 1997). Soils are deep, medium-textured and formed in alluvium (Lauver et al. 1999).

COMMENTS: *3, SCS*.

CONSERVATION RANK: *G3?.* This type is ranked S1S2 in Kansas, S? in Oklahoma, and it is may occur in Missouri. The type has a very restricted distribution and few high quality occurrences have been reported.

DISTRIBUTION: This association is found in the United States in the southeastern Great Plains and possibly adjacent Ozark-Ouachita region, ranging from northeastern Oklahoma and the Arbuckle Mountains of Oklahoma to southeastern Kansas and adjacent Missouri.

USFS ECOREGIONS: 255Af:CCC, M231Ab:???
CONSERVATION REGIONS: 32:C, 37:C, 39:C
STATES: KS MO OK **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO no state equivalent

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS MACROCARPA - QUERCUS BICOLOR - (CARYA LACINIOSA) TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Betula occidentalis / Cornus sericea Shrubland

Water Birch / Red-osier Dogwood Shrubland

Water Birch / Red-osier Dogwood Shrubland CEGL001161

DESCRIPTION: The tall-shrub layer is dominated by *Betula occidentalis*. *Cornus sericea* often codominates the tall-shrub layer with *Betula occidentalis*, but it may be shorter and it may contribute less cover. Scattered *Populus angustifolia* often are present, but the trees contribute little cover (<10%). A number of other shrubs and trees may be present (Evans 1989a, Hansen et al. 1988, Padgett et al. 1988b, 1989, Youngblood et al. 1985b, Marriott and Faber-Langendoen 2000).

Stands of this association are known from streams at low elevations (4730-6020 feet), on loam or clay soils. In Utah, soils supporting stands of this association classify mainly as Cryoborolls and Haploborolls, with some Cryaquents, Udifluvents, and Xerofluvents.

COMMENTS: *2, WCS*.

CONSERVATION RANK: *G3?.*

DISTRIBUTION: This water birch shrubland is found in floodplains of the western United States, ranging sporadically from Wyoming and South Dakota west to Washington, south to California, and east to Utah.

USFS ECOREGIONS: 331F:CC, 341D:CC, 342B:CC, 342C:C?, 342F:CC, 342H:CC, 342I:CC, M261E:CC, M331A:CC, M331B:CC, M331D:CC, M331I:CC, M332E:CC, M332F:CC, M332G:CC, M333C:CC, M334A:CC
CONSERVATION REGIONS: 10:C, 11:C, 19:C, 20:C, 25:C, 26:C, 6:C
STATES: CA ID MT? OR UT WA WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Betula occidentalis* Dominance Type (Evans 1989a) =. (p.12)

USNVC HIERARCHY: BETULA OCCIDENTALIS TEMPORARILY FLOODED SHRUBLAND ALLIANCE (III.B.2.N.d)

Picea glauca Alluvial Black Hills Forest

White Spruce Alluvial Black Hills Forest

White Spruce Alluvial Black Hills Forest CEGL002057

DESCRIPTION: The type is characterized by somewhat open to closed canopies dominated by *Picea glauca*. The understory is highly variable. Smaller spruce and *Pinus ponderosa*, as well as *Populus tremuloides, Betula papyrifera* and *Acer negundo*, may form a subcanopy. Shrub and herbaceous cover and composition are highly variable among stands surveyed. In narrow canyons, the understory often is sparse, with shrub and herbaceous cover each less than 25%. Common associates in these situations are *Actaea rubra, Aralia nudicaulis, Maianthemum canadense, Lysimachia ciliata*, and several species of *Viola* and *Equisetum*. At other sites, the understory consists of riparian shrubland and wet meadow types, including those dominated by *Salix bebbiana, Betula occidentalis, Cornus sericea, Calamagrostis canadensis*, and *Carex nebrascensis* (Marriott and Faber-Langendoen 2000).

Stands occur in drainage bottoms at higher elevations (5000-6300 feet) (Steinauer 1984, Girard c. 1991, BHCI 1999). They have been found in both narrow canyons with moderate- to high-gradient channels, and in broader low- to moderate-gradient drainages. Sites are level, or gently sloping with northerly aspects. Flowing streams or standing water may be present. White spruce alluvial forest has been documented from the Central Core and Limestone Plateau in areas underlain by granite, schist, slate, quartzite and limestone (Marriott and Faber-Langendoen 2000).

Picea glauca may occur as scattered trees (less than 20% overall cover) in other riparian types, including *Betula papyrifera / Corylus cornuta* Forest (CEGL002079), *Salix bebbiana* Shrubland (CEGL001173), *Betula occidentalis / Cornus sericea* Shrubland (CEGL001161), and *Carex nebrascensis* Herbaceous Vegetation (CEGL001813), suggesting possible successional trends. Girard (c. 1991) considered the *Picea glauca / Linnaea borealis* Forest ecological type in the Black Hills (equivalent to CEGL000382) the end point of riparian succession at high elevations, with soils becoming drier and well-drained. She also observed that with a rise in the water table (for example, from beaver activity). *Picea glauca* stands appear to revert directly back to sedge- or willow-dominated types (Marriott and Faber-Langendoen 2000).

COMMENTS: *1, MCS*. This type often occurs in mosaics with other riparian types. The spruce generally occupies the driest areas within these mosaics. Scattered white spruce trees may occur in stands of those types as well. Moving upland, adjacent communities include White Spruce / Twinflower Forest, *Picea glauca / Linnaea borealis* Forest (CEGL000382) on slopes with northerly aspects, and ponderosa pine types on drier aspects. In narrow high-gradient drainages, White Spruce Alluvial Black Hills Forest may be the sole vegetation type in the drainage bottom.

This type is equivalent to the white spruce association in the Black Hills Riparian Vegetation Classification (RMS 1998). Girard (c. 1991) recognized only the white spruce / twinflower (*Linnaea borealis*) ecological type, and did not segregate out a separate type on wetter sites in drainage bottoms. The white spruce - twinflower habitat type of Steinauer (1984) does not include riparian spruce stands. The white spruce / twinflower habitat type by Hoffman and Alexander (1987) also did not include riparian stands. That type is considered an upland type in the current classification (CEGL000382), distinct from this type. This riparian type should be compared to stands further north in Canada.

CONSERVATION RANK: *G2G3.* This type has only been reported from the Black Hills, where it is locally abundant in higher-elevation streams. Nine A-B quality EOs were identified on Black Hills National Forest land during the survey of the Black Hills, with the preponderance of those with no special protection status (Marriott et al. 1999). Other occurrences are expected in the Hills, but depending on their quality, the rank of this type may need to be increased.

DISTRIBUTION: This white spruce forest type is found in riparian areas in the Black Hills of South Dakota.

USFS ECOREGIONS: M334A:CC
CONSERVATION REGIONS: 25:C
STATES: SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Picea glauca / Linnaea borealis* (Hoffman and Alexander 1987)

USNVC HIERARCHY: PICEA GLAUCA TEMPORARILY FLOODED FOREST ALLIANCE (I.A.8.N.e)

Salix bebbiana Shrubland

Bebb's Willow Shrubland

Beaked Willow Scrub CEGL001173

DESCRIPTION: This shrubland is typically dominated by a dense growth of shrubs 0.5-3 m tall. The most abundant species in the shrub layer are *Salix bebbiana, Salix scouleriana*, and *Salix lucida ssp. caudata (= Salix fendleriana)*. Other species found in this strata include *Betula occidentalis, Cornus sericea ssp. sericea, Salix exigua, Salix fluviatilis*, and *Prunus virginiana*. Multiple-stemmed trees and/or shrubs 1.5-5 m tall have 30-100% cover; single-stemmed trees have less than 30% cover. The herbaceous layer often contains *Schoenoplectus* spp. (= *Scirpus* spp.), *Carex* spp., *Triglochin palustris, Calamagrostis canadensis*, and *Equisetum* spp. along the wetter margins of the community. In the drier areas *Gentianella amarella ssp. acuta (= Gentiana strictiflora), Prunella vulgaris, Pyrola asarifolia, Zizia aptera (= Zizia cordata), Sanicula marilandica, Viola canadensis, Vicia americana*, and *Ranunculus macounii* are frequently present.

Stands occur on slightly to moderately alkaline soils, usually near low-gradient streams. The water table is well below the soil surface for over half the growing season. However, there are brief periods of several days to a few weeks when water is at the surface.

Brief floods can occur in spring or after heavy rains.

COMMENTS: *2, WCS*. The distribution and classification of this community need further investigation. Changes in historic natural processes, including flooding, and more recent human impacts, such as grazing, have altered this community.

CONSERVATION RANK: *G3?.* Most sites have been impacted by grazing.

DISTRIBUTION: This beaked willow shrubland is found in the montane regions and western plains of the United States, ranging from South Dakota and Montana south to New Mexico.

USFS ECOREGIONS: 313:?, 331D:CC, 331E:C?, 331F:C?, 331G:CC, 342F:CC, M331E:CC, M331I:CC, M332B:CC, M332C:CC, M332D:CC, M332E:CC, M333B:CC, M333C:CC, M333D:CC, M334A:CC, M341B:CC
CONSERVATION REGIONS: 10:C, 20:C, 25:C
STATES: CO MT NM SD WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Betula - Salix* Association (Hayward 1928) B

USNVC HIERARCHY: SALIX BEBBIANA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (III.B.2.N.d)

2.1. Shoreline Sand/Mud Strands, Beaches and Dunes

Cakile edentula Great Lakes Shore Sparse Vegetation

Sea-rocket Great Lakes Shore Sparse Vegetation

Great Lakes Beach CEGL005162

DESCRIPTION: *Cakile edentula, Ammophila breviligulata*, and *Salix myricoides (= Salix glaucophylloides)* typically grow on sand beaches. Other common plant species include *Chamaesyce polygonifolia (= Euphorbia polygonifolia), Argentina anserina (= Potentilla anserina), Salix* spp., *Schoenoplectus* spp. (= *Scirpus* spp.), and *Xanthium strumarium*. A shrub zone (*Physocarpus opulifolius, Cornus sericea, Rosa acicularis*, etc.) can develop at the inland margin of some gravel beaches. Species found on sand and gravel beaches in most cases are those of other shoreline habitats which gain a tenuous foothold on the beach.

Sites occur along unstable shorelines of the Great Lakes. Easily shifted sand or gravel substrate permits little vegetation to develop, unless protected by a shoreline configuration that breaks waves and blocks winter ice. Soils are typically sands and gravels with little organic matter. The beach can include the sparsely vegetated parts of the upper beach, which is usually beyond the reach of the waves, and can form a type of sand plain.

Sites are severely affected by wind, waves, and winter ice.

COMMENTS: *1, MCS*. Stands occur on narrow shoreline-sand beaches. Some are associated with large dune systems. The beach can include the sparsely vegetated parts of the upper beach, which is usually beyond the reach of the waves, and can form sand flats. In Wisconsin this type is only on Lake Michigan. The *Cakile edentula* subspecies is primarily *lacustris*. Minnesota may have only a minor occurrence in the Duluth area.

CONSERVATION RANK: *G3?.* There may be fewer than 100 occurrences of this community rangewide (depending on how the boundaries of one occurrence are defined). This community is reported from Michigan (where it is ranked S3), Wisconsin (S2), Ohio (S1), Indiana (SU), Ontario (S2S3) and New York (S?). Currently 14 occurrences have been documented from Wisconsin, Illinois, and Ohio. There are probably fewer than 5,000 acres rangewide, since this community occurs in a narrow zone along the shores of the Great Lakes. Currently over 75 acres have been documented (average of documented sizes is 25 acres). This community has fairly narrow habitat requirements; it is restricted to sandy beaches along the Great Lakes that have active movement of sand controlled by water currents and wave action.

DISTRIBUTION: This community occurs along unstable shorelines in the Great Lakes region of the United States and Canada, ranging from sandy shores of all states and Ontario that are associated with the Great Lakes.

USFS ECOREGIONS: 212Hd:CCC, 212He:CCC, 212Hi:CCP, 212Hj:CCC, 212Hw:CCP, 212Ia:CPP, 212Ja:CPP, 212Oa:CCC, 212Ob:CCC, 222Ia:CCC, 222If:CCC, 222Jj:CCC, 222Kg:CCC, 222Qa:CCC
CONSERVATION REGIONS: 48:C
STATES: IL IN MI NY OH WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	beach =
IN	sand flat +
MI	sand/gravel beach +
OH	beach-dune community +
WI	beach (great lakes subtype) =

OTHER SYNONYMY: Beach Community (Anderson 1996) =. Anderson provides an excellent review of species on the beach community in Ohio.

USNVC HIERARCHY: CAKILE EDENTULA SPARSE VEGETATION ALLIANCE (VII.C.2.N.a)

Ammophila breviligulata - (Schizachyrium scoparium) Herbaceous Vegetation

American Beachgrass - (Little Bluestem) Herbaceous Vegetation

Great Lakes Beachgrass Dune CEGL005098

DESCRIPTION: Component plant communities vary from sparsely vegetated, active dunes to communities dominated by grasses, shrubs, and trees, depending on the degree of sand deposition, sand erosion, and distance from the lake. Depositional areas, where Great Lakes beachgrass foredunes are found, are dominated by *Ammophila breviligulata (= Ammophila champlainensis*); erosional areas, such as slacks in blowouts and dune fields, by *Calamovilfa longifolia*; and stabilized areas by *Schizachyrium scoparium*. In dune fields and on the most stable dune ridges, especially around northern Lake Michigan and Huron, low evergreen shrubs (*Arctostaphylos uva-ursi, Juniperus communis, Juniperus horizontalis*) occupy dune crests and also the ground layer in the savanna edge of dunes; elsewhere, deciduous shrubs are dominant, including *Prunus pumila, Salix cordata* and *Salix myricoides (= Salix glaucophylloides)*. These two shrubby phases are separated from this open grassland type, but could be treated as phases of this type.

Environmental processes include sand deposition, sand erosion, and stabilization. They are affected by the distance from the lake. Three sets of environmental habitats can be identified: depositional areas, erosional areas such as slacks in blowouts, and stabilized dune fields.

Dynamic tension exists at the forest edge where trees invade dune fields, often creating wind-stressed savanna, typically oak pine in the south, pine-conifer in the north. When lake levels go down and beach and dune area increases lakeward, windspeed and sand abrasion decrease in the savanna edge, permitting forest development.

COMMENTS: *2, MCS*. Perhaps 25-35% of Great Lakes dune species grow in maritime dunes (e.g., *Cakile edentula, Ammophila breviligulata, Hudsonia tomentosa, Lathyrus japonicus var. maritimus (= Lathyrus maritimus)*), but the many western species (such as *Schizachyrium scoparium*) set Great Lakes dunes apart (as do its endemic plants, such as *Cirsium pitcheri*). In Vermont (Lake Champlain) and New York (eastern Lake Ontario) the dunes apparently contain *Ammophila champlainensis* instead of *Ammophila breviligulata*. This type is linked in complexes with *Juniperus horizontalis - Arctostaphylos uva-ursi - Juniperus communis* Dune Dwarf-shrubland (CEGL005064) and *Prunus pumila - (Ptelea trifoliata*) Dune Shrubland (CEGL005075), which could be treated together as a single association, or treated as a complex open dune type. The sparsely vegetated parts of the dune are included in this association (old CEGL005161).

CONSERVATION RANK: *G3G5.*

DISTRIBUTION: This community occurs along the Great Lakes shores of the United States and Canada on stabilized foredunes, ranging from Wisconsin to Ontario and New York in the Great Lakes, and in isolated occurrences along the shores of Lake Champlain, Vermont.

USFS ECOREGIONS: 212Hd:CCC, 212He:CCC, 212Hi:CCP, 212Hj:CCC, 212Hl:CCC, 212Hm:CCP, 212Hn:CCC, 212Ho:CCC, 212Hr:CCP, 212Hw:CCC, 212Hx:CCC, 212Ia:CCC, 212Ja:CCC, 212Oa:CCC, 212Ob:CCC, 212Pa:CCC, 221E:CC, 222Ja:CCC, 222Jj:CCC, 222Kg:CCC
CONSERVATION REGIONS: 48:C
STATES: IL IN MI NY VT WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	foredune +
IN	foredune +
MI	open dune +
WI	lake dune (beachgrass subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: AMMOPHILA BREVILIGULATA HERBACEOUS ALLIANCE (V.A.5.N.c)

* Nonstandard type (needs review)

Great Lakes Wooded Dune and Swale Complex*

Great Lakes Wooded Dune And Swale Complex

Great Lakes Wooded Dune And Swale Complex CECX002000

DESCRIPTION: As described by the MNFI (1999) summary description, the foredunes of most dune-and-swale complexes are commonly 1-2 m high, with *Ammophila breviligulata, Calamovilfa longifolia, Salix serissima, Salix cordata*, and *Populus balsamifera* most common. Within their ranges, federally threatened *Cirsium pitcheri* and state-threatened *Tanacetum bipinnatum ssp. huronense (= Tanacetum huronense)* are also found on the foredunes.

Immediately behind the foredune, where lake-influenced, calcareous sands are most common, a shallow swale often contains *Cladium mariscoides, Myrica gale, Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda), Calamagrostis canadensis, Lobelia kalmii, Triantha glutinosa (= Tofieldia glutinosa)*, and *Parnassia glauca*. Less commonly, in the Straits of Mackinac area, federally threatened *Solidago houghtonii* is found in the swales behind the foredune. The swale immediately behind the foredune is influenced by short-term variation in lake levels and can be partially or occasionally completely filled by dune sands following major storm events. Species common to this first swale include *Juncus balticus, Juncus pelocarpus, Juncus nodosus, Eleocharis acicularis*, and *Schoenoplectus americanus (= Scirpus americanus)*.

A low dune field with more advanced plant succession often follows the first open dunes and swales. *Pinus banksiana, Pinus strobus*, and *Pinus resinosa* often form a scattered overstory canopy, while *Juniperus communis, Juniperus horizontalis, Arctostaphylos uva-ursi*, and *Koeleria macrantha* form a scattered ground layer.

Following the dune-field zone, both dunes and swales are typically forested. Moist swales are often forested, and soil organic material has often begun to accumulate. *Thuja occidentalis, Alnus incana, Salix* spp., and *Acer rubrum* dominate the partial overstory canopy and understory. In northern Lake Michigan and Lake Huron, where these swales are better drained, and *Thuja occidentalis* forms the overstory, federally threatened *Iris lacustris* may be found in large non-flowering populations.

In contrast to the dry or moist swales, in those swales where standing water is present through most of the year, Carices, such as *Carex aquatilis* and *Carex stricta, Cladium mariscoides, Caltha palustris, Lysimachia terrestris*, and *Comarum palustre (= Potentilla palustris)*, commonly dominate the ground layer.

Forested beach ridges, with soils of medium to course sand, tend to be dominated by species common to dry-mesic and mesic northern forest (MNFI 1999). Soil moisture conditions appear to change dramatically with slight elevational changes and are reflected in the development of soil organic material and changing plant species. On higher, drier ridges, soils often have less than 3 cm of organic material. *Pinus resinosa, Pinus strobus*, and *Quercus rubra* are often codominant, while *Betula papyrifera, Populus grandidentata, Abies balsamea*, and *Acer rubrum* are subdominant or understory species. *Pteridium aquilinum, Gaylussacia baccata, Vaccinium myrtilloides, Cornus canadensis*, and *Gaultheria procumbens* occur in the shrub and ground layers.

On lower ridges, where soils are moister, soil organic material accumulation is greater (4-25 cm). *Pinus strobus* may still dominate the overstory, but often *Picea glauca, Picea mariana, Acer rubrum, Abies balsamea, Thuja occidentalis*, and occasionally *Larix laricina* are codominant. *Lonicera canadensis, Nemopanthus mucronatus, Linnaea borealis, Rubus pubescens, Maianthemum canadense*, and *Trientalis borealis* are common in the shrub and ground layers.

Complexes located in embayments protected from prevailing winds tend to be formed entirely of low, water-lain beach ridges. As a result, even the beach ridges within these complexes support wetland vegetation. An example is Ogontz Bay, in the eastern Upper Peninsula of Michigan. Here swales ranged from 1-30 m wide and 0.5-3.0 m deep. Narrow, shallow swales are forested with vegetation typical of rich *Thuja occidentalis* swamps. Wider, deeper swales are more often unforested, with *Photinia floribunda (= Aronia prunifolia), Cornus sericea, Betula pumila*, and *Alnus incana* forming a shrubby ecotone, while Carices (*Carex lasiocarpa, Carex oligosperma, Carex aquatilis, Carex stricta*), and *Scirpus cyperinus* form a mat within which *Thelypteris palustris* and *Utricularia cornuta* also occur. Where a sedge mat is not well-developed, *Sparganium natans (= Sparganium minimum), Nuphar lutea ssp. variegata (= Nuphar variegata), Potamogeton pusillus ssp. tenuissimus (= Potamogeton berchtoldii)*, and *Potamogeton natans* are commonly found.

Organic material gradually accumulates in the swales over time; organic material in swales reaches a depth of 30-75 cm within 300 m of the lake's edge. Vegetation in swales reflects the more acid conditions of the older thickets as peat accumulates. *Chamaedaphne calyculata, Andromeda polifolia, Ledum groenlandicum, Kalmia polifolia, Vaccinium macrocarpon, Eriophorum virginicum, Sarracenia purpurea*, and *Sphagnum* spp. (*Sphagnum centrale,*

Sphagnum wulfianum, Sphagnum warnstorfii, Sphagnum magellanicum, and *Sphagnum squarrosum*) are commonly found in the thick peat soils of the swale behind the shoreline (MNFI 1999).

As described by the MNFI (1999) summary description this complex, composed of upland and wetland features, is found in embayments and sand spits along the Great Lakes shoreline. Most were formed in two stages, with progressive dropping lake levels and post-glacial uplift beginning with the glacial Lake Algonquin levels (approx. 12,000 years ago), and again with the Lake Nipissing water levels 3000-4000 years ago. The receding lake levels deposited a series of sandy beach ridges ranging from 0.5 to 4 m high. From the air these ridges appear as a series of arcs, extending inland up to 2 miles, generally parallel to the present shoreline. In several examples, beach ridges were also built up and re-sorted by wind, creating a higher, somewhat irregular dune ridge.

These complexes are often best developed where post-glacial streams entered an embayment and provide a dependable sand source. The combination of along-shore currents, waves, and winds form foredunes along the shoreline. With gradual long-term drops in water level, combined with post-glacial uplifting of the earth's crust, these low dunes gradually rise above the direct influence of the lakes, and new foredunes replace them. Over several thousand years, a series of ridges and swales is created. For most complexes, the flow of surface streams and groundwater maintain the wet conditions in the swales. With time, plant succession has proceeded to the point where the beach ridges are now forested while the wet swales are either forested or open wetlands. Along the Lake Superior shoreline, where post-glacial uplift is greatest, many of the complexes consist primarily of dry, forested swales (Comer and Albert 1993). The number and size of the dune ridges and swales differs depending on fetch and the amount of sediment available.

Both swales and upland dune ridges have been studied (Comer and Albert 1993). Of the 17 sites where elevations were measured from the shoreline inland, only 3 sites contained swales where the sandy bottoms of all or most of the swales lay below the current Great Lakes water levels. This suggests that, except for a few examples, the influence of Great Lakes water-level fluctuations is probably limited to the first few swales inland from the shoreline. For most of the complexes, the water occupying the swales comes from streams flowing from the adjacent uplands or from groundwater seepage (MNFI 1999).

Classic ecological studies have identified distinctive successional zones within the sand dune portion of the complexes, determined on the basis of several factors, including distance from the lake, amount of soil development, and available light (Olson 1958,Cowles 1899). Lichter's (1998) recent study of dune-and-swale complexes at Wilderness State Park in northern Lower Michigan has identified similar successional trends. He found that, at the Lake Michigan shoreline, young dunes had (1) stronger winds, (2) more sand burial and erosion, (3) higher levels of sunlight, (4) higher rates of evaporation, and (5) lower available nitrogen and phosphorus than older beach ridges farther inland, resulting in an open herbaceous-dominated plant community along the shore. Farther inland, with greater protection from sun and wind and with greater soil development, there was succession from open dune, first to grassland, then to shrubs, and finally to forests, with mesic northern hardwoods increasing in dominance on beach ridges farther from the shoreline.

COMMENTS: *3, MCS*. Because they contain a unique assemblage of physiographic, soil, and vegetative components, and provide a high-quality habitat for numerous shoreline animal species, the Wooded Dune and Swale Complex is considered a distinct complex that groups together a number of different associations, some restricted to the complex, others more wide-ranging. The various zones of plant communities in each complex may include several of the following, depending on the complex subtype and local site: Great Lakes Foredune, Interdunal Wetland, Great Lakes Pine Barrens, Great Lakes Dune Pine Forest, Red Pine / Blueberry Dry Forest, White Pine - Red Oak Forest, Great Lakes White Pine - Hemlock Forest, White Cedar - (Hemlock) Mesic Forest, White Cedar - Mixed Hardwood Swamp, Black Ash - Mixed Hardwood Swamp, Speckled Alder Swamp, Bog Birch - Willow Rich Boreal Fen, Leatherleaf Bog, Northern Poor Fen, Tussock Sedge Wet Meadow.

The complex can be further subdivided into five complex subtypes, reflecting north-south trend in plant species distributions, from southern Lake Huron to western Lake Superior, along with the relative impact of wind-sorting versus water-lain processes that formed the beach ridges of each complex. The five subtypes include the southern Lake Huron subtype, the northern Lake Huron/Lake Michigan-Low Dune subtype, the Northern Lake Michigan-High Dune subtype, the Lake Superior-High Dune subtype, and the Lake Superior-Low Dune subtype. Southern Lake Michigan dune/swale complexes in Indiana and Illinois are currently very minor and not included here. It is possible that these dune/swale complexes have mostly dried out and blown away (P. Comer pers. comm. 2000). Northward in southern Michigan, the dunes are perched and complexes do not form. Rather, scattered Interdunal Wetlands occur. Possible complexes in Lake Erie (Pennsylvania) and elsewhere in shorelines in Ontario may require additional subtypes.

CONSERVATION RANK: *G3.* Wooded dune and swale complexes are restricted to the Great Lakes shoreline (Comer and Albert 1991, 1993, Homoya et al. 1985). Although there are features of similar geological origin along the shore-lines of most oceans and seas, the biota of the marine systems is distinctly different (Wiedemann 1984). Residential and recreational development has resulted in disrupted hydrological conditions and wetland destruction. Currently,

about 95 dune and swale complexes have been identified in the Great Lakes, with 70 located in Michigan. Michigan's 40 highest quality dune and swale complexes total about 70,926 acres (28,370 hectares) in area (MNFI 1999).

DISTRIBUTION: This complex of wetland swales and upland beach ridges or dunes is found along the shoreline of all of the Great Lakes in the United States and Canada. Its range includes Minnesota, Wisconsin, Michigan, Pennsylvania, and the province of Ontario, and perhaps (at least historically) Illinois, Indiana, and Ohio.

USFS ECOREGIONS: 212H:CC, 212I:CC, 212J:CC, 212O:CC, 222I:CC, 222J:CC, 222K:CC
CONSERVATION REGIONS:
STATES: IL IN MI MN OH PA WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	foredune +
IN	foredune +
MI	wooded dune and swale complex =
MN	lake beach (lake superior section) sand subtype -
OH	beach-dune community ?
WI	lake dune (dune-swale complex) ?

OTHER SYNONYMY:

USNVC HIERARCHY: N/A

Juniperus horizontalis - Arctostaphylos uva-ursi - Juniperus communis Dune Dwarf-shrubland

Creeping Juniper - Kinikinnick - Common Juniper Dune Dwarf-shrubland

Great Lakes Juniper Dune Shrubland CEGL005064

DESCRIPTION: The dwarf-shrubs form an open to closed mat layer. Dominant shrubs include *Arctostaphylos uva-ursi, Juniperus communis*, and *Juniperus horizontalis*. *Hudsonia tomentosa* may also be present, along with a variety of other deciduous shrubs. *Ammophila breviligulata* and *Schizachyrium scoparium* are among the herbaceous species found here (Curtis 1959, especially plates 61 and 62, White and Madany 1978, Bakowsky and Lee 1996).

Stands are found on flat-topped, wind-swept, stabilized dunes.

The open dunes are exposed to high winds that may prevent tree establishment. The dynamics driving the establishment of dwarf-shrubs in dunes is not entirely clear.

COMMENTS: *2, MCS*. Type is dominated by evergreen shrubs. Deciduous stands dominated by willows are placed in *Prunus pumila - (Ptelea trifoliata)* Dune Shrubland (CEGL005075). This type may be a minor component of other vegetation types, such as *Ammophila breviligulata - (Schizachyrium scoparium)* Herbaceous Vegetation (CEGL005098), or the Great Lakes Pine Barrens, *Pinus banksiana - (Pinus resinosa) - Pinus strobus / Juniperus horizontalis* Wooded Herbaceous Vegetation (CEGL005125), and it could conceivably be treated as a phase of CEGL005098.

CONSERVATION RANK: *G3G4.*

DISTRIBUTION: This dwarf-shrub dune community is found throughout dune areas of the western Great Lakes region of the United States and Canada, ranging from the shores of southern Michigan in Illinois, Indiana and Michigan northward to the shores of other Great Lakes, such as Lake Superior in Wisconsin.

USFS ECOREGIONS: 212H:CC, 212Ja:CCP, 222Kg:CCP
CONSERVATION REGIONS: 48:C
STATES: IL IN? MI WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	foredune +
IN?	foredune ?
MI	open dune +
WI	lake dune (juniper shrub subtype (not tracked)) ?

OTHER SYNONYMY:

USNVC HIERARCHY: JUNIPERUS HORIZONTALIS DWARF-SHRUBLAND ALLIANCE (IV.A.1.N.b)

Pinus banksiana - (Pinus resinosa) - Pinus strobus / Juniperus horizontalis Wooded Herbaceous Vegetation

Jack Pine - (Red Pine) - Eastern White Pine / Creeping Juniper Wooded Herbaceous Vegetation

Great Lakes Pine Barrens CEGL005125

DESCRIPTION: The vegetation forms a coniferous savanna of scattered and clumped trees. Patches of bare sand are common. In the tree layer, *Pinus banksiana* is usually the single most abundant tree, but several other species, including *Pinus resinosa* and *Pinus strobus* are typically present. Much of the shrub layer is composed of evergreen species, namely *Arctostaphylos uva-ursi, Hudsonia tomentosa, Juniperus horizontalis, Juniperus communis*, and *Vaccinium angustifolium*. The most abundant species of the ground layer include *Ammophila breviligulata, Agrostis hyemalis, Arabis lyrata, Calamovilfa longifolia, Danthonia spicata, Deschampsia flexuosa*, and *Toxicodendron radicans*. In dune-swale complexes, the swales between the dunes are often close enough to the water table to support more mesophytic, sometimes even semi-aquatic, plants. Along the shores of the Great Lakes there is often a dense low or creeping shrub layer (Chapman et al. 1989). Stunted individuals of *Quercus rubra* are present in stands in Keweenaw County, MI (Chapman et al 1989).

This community occurs on sandy former lake embayments and on some dune and swale complexes along the shores of the Great Lakes. Changes in the lake water levels periodically raises the water table. Soils are circumneutral (pH 6.6-7.3) dry sands (Chapman et al. 1989).

COMMENTS: *1, MCS*. In Wisconsin, this type occurs in Lake Superior on the Apostle Islands. The physiognomy of the understory is complex, containing patches of shrub, dwarf-shrub, herbaceous, and sparse vegetation. The ground layer vegetation is somewhat related to the Great Lakes Juniper Dune Shrubland type, *Juniperus horizontalis - Arctostaphylos uva-ursi - Juniperus communis* Dune Dwarf-shrubland (CEGL005064). Several stands on Lake Michigan contain a number of prairie disjuncts (E. Epstein pers. comm. 1999).

CONSERVATION RANK: *G2.* This community is restricted to the Great Lakes area and many sites have been degraded. Good occurrences are found on the Apostle Islands National Park, Wisconsin, and several others in Wisconsin could be restored (including several on Lake Michigan).

DISTRIBUTION: This pine barrens type is found along sandy areas of the Great Lakes shores in the United States and Canada, including areas in Wisconsin, Michigan, and Ontario.

USFS ECOREGIONS: 212Hj:CPP, 212Hw:CPP, 212Ia:CCC, 212Ja:CPP, 212Jb:CP?, 212Jc:CP?, 212Jl:CP?, 212Jn:CP?, 212Oa:CCC
CONSERVATION REGIONS: 47:?, 48:C
STATES: MI WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI great lakes barren +
WI pine barrens (great lakes mixed pine subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: PINUS BANKSIANA - (PINUS RESINOSA) WOODED HERBACEOUS ALLIANCE (V.A.6.N.f)

Pinus banksiana - Pinus resinosa - Pinus strobus Dune Forest

Jack Pine - Red Pine - Eastern White Pine Dune Forest

Great Lakes Dune Pine Forest CEGL002589

DESCRIPTION: The canopy is more-or-less closed, and is dominated by *Pinus banksiana, Pinus resinosa*, and *Pinus strobus*. This type has not been well described, and further characterization is needed.

Stands are found on dune systems along Lake Michigan and Lake Huron.

COMMENTS: *3, MCS*. Type is not described in Ontario by Lee (1998). Its extent in the United States may be limited, and a review of its concept is needed. Perhaps this type can be combined with Great Lakes Pine Barrens, *Pinus banksiana - (Pinus resinosa) - Pinus strobus / Juniperus horizontalis* Wooded Herbaceous Vegetation (CEGL005125), or can be dissolved into the respective *Pinus banksiana, Pinus resinosa* or *Pinus strobus* inland forests on sand. Type (whether as forest or barrens) has been eliminated in Illinois.

CONSERVATION RANK: *G3Q*.

DISTRIBUTION: This pine dune forest type is found on dune systems on Lake Michigan and Lake Huron in the United States and possibly in Canada, ranging from Michigan to Ontario, and, at least historically, in Indiana and Illinois.

USFS ECOREGIONS: 212Ha:CC?, 212Hb:CC?, 212He:CCC, 212Hh:CC?, 212Hi:CCP, 212Hj:CCC, 212Hk:CC?, 212Hl:CCC, 212Ho:CCC, 212Hr:CCP, 212Hw:CCC, 212Hx:CCC, 212Ja:CC?, 212Jn:CC?, 212Jr:CCC, 212Oa:CCC, 222Jj:CCC
CONSERVATION REGIONS: 48:C
STATES: IL IN? MI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	dry sand forest +
IN?	dry upland forest ?
MI	great lakes barren +

OTHER SYNONYMY:

USNVC HIERARCHY: PINUS BANKSIANA FOREST ALLIANCE (I.A.8.N.b)

Populus deltoides - (Juniperus virginiana) Dune Woodland

Eastern Cottonwood - (Eastern Red-cedar) Dune Woodland

Cottonwood Dune CEGL005119

DESCRIPTION: The canopy is typically open (25-80% cover) and may even be scrubby due to wind damage. The most common dominant is *Populus deltoides*, often in association with *Juniperus virginiana*. *Quercus* spp. (including *Quercus macrocarpa, Quercus rubra*, and *Quercus velutina*) may occur, particularly when there are adjacent oak forests. Shrub and vine species include *Cornus drummondii, Parthenocissus quinquefolia, Rhus typhina, Salix amygdaloides, Salix exigua, Salix fragilis*, and *Vitis riparia*. *Morella pensylvanica (= Myrica pensylvanica)* is common at Presque Isle in Pennsylvania. Herbaceous species are scattered, but include *Asclepias syriaca, Elymus virginicus, Rumex acetosella, Schizachyrium scoparium*, and *Strophostyles helvula* (Anderson 1996, Fike 1999).

This community occurs in dune fields and on the most stable dune ridges.

COMMENTS: *2, MCS*. *Juniperus virginiana* may form enough of a dominant without *Populus deltoides* that it may deserve its own type (Lee et al. 1998).

CONSERVATION RANK: *G1G2.* There are probably fewer than 60 occurrences rangewide. Occurrences tend to be small, averaging less than 20 acres, so there is probably less than 1000 acres rangewide. This community is restricted to shores of the eastern Great Lakes and Lake Champlain. There has been a significant decline in occurrences due to residential development along the shores of the eastern Great Lakes and Lake Champlain. The community requires stabilized sand dunes along these large lakes.

DISTRIBUTION: This community occurs in dune fields and on the most stable dune ridges in the southern Great Lakes region, especially around Lake Erie and Lake Ontario, ranging from Ohio and Ontario east to Pennsylvania, New York, and Vermont.

USFS ECOREGIONS: 212:C, 222Qa:CCC
CONSERVATION REGIONS: 48:C
STATES: NY OH PA VT **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: OH beach-dune community +

OTHER SYNONYMY:

USNVC HIERARCHY: POPULUS DELTOIDES WOODLAND ALLIANCE (II.B.2.N.a)

Prunus pumila - (Ptelea trifoliata) Dune Shrubland

Sand Cherry - (Hop-tree) Dune Shrubland

Sand Cherry Dune Shrubland CEGL005075

DESCRIPTION: Stands are dominated by deciduous shrubs, with a relatively open canopy. *Prunus pumila* is a characteristic dominant, but *Salix cordata, Salix myricoides, Physocarpus opulifolius*, and *Ptelea trifoliata* may also be present. The ground layer may consist of open sand with sparse herbaceous vegetation. Herbaceous species include *Ammophila breviligulata, Schizachyrium scoparium* and others (Chapman et al. 1989, Bakowsky and Lee 1996).

Stands occur on stabilized foredunes.

Disturbances caused by lake storms can bury stands in sand.

COMMENTS: *3, MCS*. Stands of this type are often intermingled with open grassland-dominated parts of the dune. This type may be of limited spatial extent, and there is some concern about the practicality of tracking it on a dynamic dune system. Inland dunes along the Illinois River may contain this type (B. McClain pers. comm. 1996). Lake dunes covered by *Juniperus horizontalis, Juniperus communis*, and/or *Arctostaphylos uva-ursi* are placed in *Juniperus horizontalis - Arctostaphylos uva-ursi - Juniperus communis* Dune Dwarf-shrubland (CEGL005064).

CONSERVATION RANK: *G2Q*. No occurrences have been documented, but the community is reported from Illinois, where it is ranked S1, Ontario (S?), and possibly Indiana (SP). It is found in 2 ecoregional sections. Stands are restricted to stabilized foredunes.

DISTRIBUTION: This shrub dune community is found on southern Great Lakes dunes or inland dune systems in the United States and Canada, ranging from Illinois to Ontario, and possibly Indiana, Michigan, and Ontario.

USFS ECOREGIONS: 222Ja:CCC, 222Jj:CCC, 222K:C?
CONSERVATION REGIONS: 48:C
STATES: IL? IN? MI? WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL?	foredune +
IN?	foredune ?
MI?	open dune
WI	lake dune (sand cherry subtype (not tracked)) ?

OTHER SYNONYMY:

USNVC HIERARCHY: PRUNUS PUMILA SHRUBLAND ALLIANCE (III.B.2.N.a)

Inland Freshwater Strand Beach Sparse Vegetation

Inland Freshwater Strand Beach Sparse Vegetation

Inland Freshwater Strand Beach CEGL002310

DESCRIPTION: The lower beach zone has submergent and floating-leaved aquatics tolerant of stranding (MNNHP 1993). The upper beach zone has both perennial graminoids tolerant of inundation and erosion and annual species. Species composition of this type needs to be described.

Stands may be most common on sandy outwash plains (MNNHP 1993), presumably where lakes are large enough to be affected by wave action or annual fluctuations in water level.

Wave action and annual fluctuations in water level disturb these sandy beaches.

COMMENTS: *3, MCS*. Extent of this type in the region is not well known. Many inland lakes in the region do not have sparsely vegetated beaches.

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This freshwater inland lake beach occurs locally throughout the upper midwestern and northeastern United States and adjacent Canada, ranging from Minnesota and Saskatchewan southeastward to Indiana and northeastward to Vermont and Ontario.

USFS ECOREGIONS: 212Ha:CPP, 212Hb:CPP, 212He:CPP, 212Hh:CPP, 212Hi:CPP, 212Hj:CPP, 212Hk:CPP, 212Hq:CPP, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jk:CPP, 212Jl:CPP, 212Jm:CPP, 212Jn:CPP, 212Jo:CPP, 212Jr:CPP, 212Ka:CCC, 212Mb:C??, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 222:?
CONSERVATION REGIONS: 47:C, 48:C
STATES: IN? MI MN NY VT WI **PROVINCES:** MB ON SK

MIDWEST HERITAGE SYNONYMY:

IN?	sand flat ?
MI	sand/gravel beach +
MN	lake beach (inland section) sand subtype =
WI	beach (inland subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: INLAND STRAND BEACH SPARSE VEGETATION ALLIANCE (VII.C.2.N.a)

Riverine Sand Flats - Bars Sparse Vegetation

Riverine Sand Flats - Bars Sparse Vegetation

Riverine Sand Flats CEGL002049

DESCRIPTION: Vegetation is very sparse, highly dynamic and irregular in structure because of constantly changing conditions on the river. Herbaceous species shared in Missouri and Nebraska include *Cyperus* spp. (*Cyperus erythrorhizos, Cyperus odoratus, Cyperus squarrosus), Eragrostis hypnoides, Eragrostis trichodes, Leptochloa fusca ssp. fascicularis (= Leptochloa fascicularis), Polygonum* spp. (including *Polygonum lapathifolium), Rorippa sinuata, Sporobolus cryptandrus*, and *Xanthium strumarium*. Other species listed for Nebraska and Missouri alone can be found in Nelson (1985) and Steinauer and Rolfsmeier (2000). Woody cover is generally absent in the first year of establishment but can increase if the site does not flood. A broader description including other Midwest and Great Plains sites is needed.

This community is a sparsely vegetated community that occurs along river shorelines, islands, pointbars, and flats. These sandbars form when receding floodwaters deposit sand and lesser amounts of clay, silt, gravel, and cobbles in the stream bed. Soils are often undeveloped due to the ephemeral nature of the stands. Drainage depends on depth above the water level (Nelson 1985, Steinauer and Rolfsmeier 2000).

This community can be very short-lived. For example, in Nebraska, it rarely persists for more than a single season before it is either destroyed by flooding or succeeds to other communities such as *Salix exigua* communities (Steinauer and Rolfsmeier 2000).

COMMENTS: *3, MCS*. This type will need to be separated into at least a Great Plains versus a Midwest type. The current description is based primarily on work available in Missouri (Nelson 1985) and Nebraska (Steinauer and Rolfsmeier 2000). See also the Riverine Gravel Flats Great Plains Sparse Vegetation (CEGL005223).

CONSERVATION RANK: *G4G5*.

DISTRIBUTION: This community is found from the western Great Plains to the eastern parts of the midwestern United States and Canada, ranging from Indiana northwest to Saskatchewan, and south to Kansas.

USFS ECOREGIONS: 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 222Ad:CC?, 222Ae:CC?, 222Af:CC?, 222Ak:CC?, 222Ap:CCC, 222Md:CCC, 251Cg:CCC, 251D:CC, 331:C, 332C:CC, 332E:CC
CONSERVATION REGIONS: 36:C, 37:C, 38:C, 46:C, 47:P, 48:C
STATES: IL IN KS MN MO NE WY? **PROVINCES:** MB? ON SK?

MIDWEST HERITAGE SYNONYMY:

IL	river shore type? ?
IN	sand flat +
MN	river beach sand subtype =
MO	sand bar =
NE	sandbar/mudflat =

OTHER SYNONYMY:

USNVC HIERARCHY: SAND FLATS TEMPORARILY FLOODED SPARSE VEGETATION ALLIANCE (VII.C.2.N.c)

Salix exigua - Salix lutea Sandbar Shrubland

Coyote Willow - Yellow Willow Sandbar Shrubland

Midwest Willow Sandbar Shrubland CEGL005078

DESCRIPTION: Shrubs form a discontinuous to continuous canopy cover that may be fairly battered by flooding and scouring. *Salix exigua* is the major dominant, sometimes the only shrub species present. Other vegetation characteristics of this type are not well-described.

Stands occur on sandbars along major rivers and streams, which river scouring and deposition creates newly exposed sandy substrates.

Flooding and ice scouring can create extensive damage to the structure of this type, and stands may be eliminated altogether for a period.

COMMENTS: *3, MCS*. This type is in need of further characterization to determine its rangewide character, and whether it is really needed in these states as a type. It may be of limited extent in the states in which it is found. Taxonomically *Salix exigua* is equivalent to *Salix interior*. *Salix lutea* has been treated as a variety of *Salix eriocephala* by some authors (Great Plains Flora Association 1986).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This sandbar willow type is found in the central and possibly northeastern United States, and adjacent Canada, ranging from Indiana and Ontario to possibly Illinois, Ohio, and Pennsylvania.

USFS ECOREGIONS: 221Ec:PPP, 221Ed:PPP, 221Ef:PPP, 222Df:???, 222Ek:???, 222Fc:???, 251:C
CONSERVATION REGIONS: 48:C
STATES: IL IN OH? PA? **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	river shore type? ?
IN	gravel wash +
OH?	no state equivalent

OTHER SYNONYMY:

USNVC HIERARCHY: SALIX EXIGUA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (III.B.2.N.d)

Lake Mud Flats Sparse Vegetation

Lake Mud Flats Sparse Vegetation

Lake Mud Flats CEGL002313

DESCRIPTION: The composition and structure of the vegetation is influenced by the flooding regime. In general, the vegetation is composed of dryland forms of aquatic plants and seedlings originating from seeds dormant in the sediment or washed in from other communities. These aquatics include *Heteranthera* spp., *Nuphar* spp., *Nymphaea* spp., *Polygonum amphibium*, and *Potamogeton* spp. As the vegetation matures over the summer and early fall, graminoids or forbs may dominant, including species of *Cyperus, Juncus, Polygonum*, and *Scirpus and/or Schoenoplectus* (MNNHP 1993). Lake mud flats in the Great Lakes are exposed when high waters recede. They are often quickly colonized by *Schoenoplectus tabernaemontani (= Scirpus tabernaemontani), Rorippa palustris, Bidens cernua*, and *Polygonum* spp. Over time these colonizing species decline and are replaced by wet meadow species, such as *Calamagrostis canadensis* or *Carex* spp. (Minc and Albert 1998).

Stands occur in shallow basins or lake margins that flood in the spring and draw down later in the season, exposing wet, muddy sediments on which plant species subsequently grow. Substrate includes silt and clay mixed with marl or sedimentary peats comprised of plant and animal residues precipitated from standing water (sometimes referred to as "gyttja") (MNNHP 1993).

COMMENTS: *3, MCS*. This description is based on information from lake mud flats in Minnesota (MNNHP 1993) and needs rangewide review and better circumscription. This type represents both the open, sparsely vegetated mud flats as well as the more vegetated phases. As such the type may overlap in concept with *Polygonum amphibium* Permanently Flooded Herbaceous Alliance (CEGL002002), *Polygonum* spp. - Mixed Forbs Herbaceous Vegetation (CEGL002430), and other herbaceous mud flat communities that occur on similar substrates, but are not regularly flooded. Lake mud flats are currently separated from riverine mud flats, River Mud Flats Sparse Vegetation (CEGL002314). Lake mudflats on Great Lakes shorelines may be distinct from inland lakes (Minc and Albert 1998).

CONSERVATION RANK: *G?.*

DISTRIBUTION: The lake mudflat community type is found throughout the upper midwestern Region of the United States and adjacent Canada. It ranges from Minnesota and Manitoba east to Michigan and Ontario, and south to Indiana.

USFS ECOREGIONS: 212Hj:CPP, 212Hl:CPP, 212Mb:C??, 212Na:CC?, 212Nb:CC?, 212Nc:CCC, 222Ha:PPP, 222Ji:PPP
CONSERVATION REGIONS: 47:C, 48:C
STATES: IN MI MN WI **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY:

IN	muck flat +
MI	cobble beach +
MN	lake beach (inland section) mud subtype =
WI	lake mud flats (not tracked) =

OTHER SYNONYMY:

USNVC HIERARCHY: NON-TIDAL MUD FLAT SEASONALLY/TEMPORARILY FLOODED SPARSE VEGETATION ALLIANCE (VII.C.4.N.c)

River Mud Flats Sparse Vegetation

River Mud Flats Sparse Vegetation

River Mud Flats CEGL002314

DESCRIPTION: Vegetation of this type has not been characterized. Stands in south-central Illinois and east-central Missouri contain the characteristic, and rare, *Boltonia decurrens* (Bill McClain pers. comm. 1996).

Stands occur in riverine areas that flood in the spring, but dry out later in the season, exposing wet, muddy sediments on which plant species subsequently grow. Substrate includes silt and clay. The composition and structure of the vegetation is influenced by the flooding regime.

Spring floods and subsequent draw down cause the exposure of mud flats.

COMMENTS: *3, MCS*. River mud flats are currently separated from lake mud flats, Lake Mud Flats Sparse Vegetation (CEGL002313). This type represents both the open, sparsely vegetated river mud flats as well as the more vegetated phases. As such the type may overlap in concept with *Polygonum amphibium* Permanently Flooded Herbaceous Alliance (CEGL002002), *Polygonum* spp. - Mixed Forbs Herbaceous Vegetation (CEGL002430), and other herbaceous mud flat communities that occur on similar substrates, but are not regularly flooded.

CONSERVATION RANK: *G?.*

DISTRIBUTION: The river mudflat community type is found throughout the upper and central midwestern region of the United States and adjacent Canada, and probably more widely. Currently, it ranges from Minnesota and Manitoba east to Michigan and Ontario, and south to Illinois and Indiana.

USFS ECOREGIONS: 212Jn:CPP, 212Mb:C??, 212Na:CP?, 212Nb:CPP, 212Nc:CP?, 222Ha:PPP, 222Ji:PPP, 251Aa:P??, 251Ba:P??
CONSERVATION REGIONS: 35:C, 36:C, 47:P, 48:C
STATES: IL IN MI MN WI **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY:

IL	river shore type? ?
IN	muck flat +
MI	cobble beach +
MN	river beach ?
WI	river mud flats (not tracked) =

OTHER SYNONYMY:

USNVC HIERARCHY: NON-TIDAL MUD FLAT SEASONALLY/TEMPORARILY FLOODED SPARSE VEGETATION ALLIANCE (VII.C.4.N.c)

Saline Spring Mud Flats Sparse Vegetation

Saline Spring Mud Flats Sparse Vegetation

Saline Spring Mud Flats CEGL002581

DESCRIPTION: The vegetation is generally sparse. Plant species tolerant of high concentrations of dissolved salts dominate the stands. *Puccinellia nuttalliana, Salicornia rubra* and *Schoenoplectus maritimus (= Scirpus maritimus)* are particularly characteristic (MNNHP 1993).

These mudflats are found in shallow basins that flood in the spring and draw down later in the season, exposing the wet sediments on which the plants grow. High concentrations of salts that were dissolved in the water accumulate on the surface. Submerged aquatic plants may be present during the flooding stage, leaving an organic debris on the surface (MNNHP 1993).

COMMENTS: *3, MCS*. This type is typified by a sparse vegetation with saline-tolerant species. Closely related saline flats with more vegetation cover include *Salicornia rubra* Herbaceous Vegetation (CEGL001999), a type that is also seasonally flooded (and may well be synonymous with this type, though it has a wide Great Plains distribution), and a saline prairie type that is drier and more extensively covered by vegetation, *Distichlis spicata - Hordeum jubatum - Puccinellia nuttalliana - Suaeda calceoliformis* Herbaceous Vegetation (CEGL002273).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This saline spring mud flat community type occurs in the northern tallgrass region of the United States and Canada, ranging from Minnesota into Manitoba.

USFS ECOREGIONS: 251Aa:PP?
CONSERVATION REGIONS: 35:C
STATES: MN **PROVINCES:** MB

MIDWEST HERITAGE SYNONYMY: MN mud flat saline subtype ?

OTHER SYNONYMY:

USNVC HIERARCHY: NON-TIDAL MUD FLAT SEASONALLY/TEMPORARILY FLOODED SPARSE VEGETATION ALLIANCE (VII.C.4.N.c)

Riverine Gravel Flats Great Plains Sparse Vegetation

Riverine Gravel Flats Great Plains Sparse Vegetation

Great Plains Riverine Gravel Flats CEGL005223

DESCRIPTION: Vegetation is sparse and often consists of nearly equal cover of annual grasses and annual or biennial forbs under 1 m tall. *Sporobolus cryptandrus* and *Artemisia campestris ssp. caudata* are conspicuous. In some sites, *Populus deltoides* may be scattered to woodland-like in structure. Shrubs are also scattered and uncommon, with *Amorpha fruticosa* the most frequent. Other herbaceous species that can occur include *Ambrosia artemisiifolia, Chamaesyce glyptosperma, Chamaesyce serpyllifolia, Froelichia gracilis, Helianthus petiolaris, Opuntia macrorhiza, Pectis angustifolia*, and *Triplasis purpurea* (Steinauer and Rolfsmeier 2000).

This community is found along major rivers where gravel has been deposited on the first terraces of rivers. The substrate consists of a mixture of gravel and some sand, and soils are poorly developed or absent. Sites can occasionally be flooded in spring (Steinauer and Rolfsmeier 2000).

Reduced river flows and decreased frequency of flooding may cause many of these sites to succeed to woodland (Steinauer and Rolfsmeier 2000).

COMMENTS: *3, MCS*. This community is poorly studied and may not be separable in Nebraska from their sand/gravel prairie, *Schizachyrium scoparium - Aristida basiramea - Sporobolus cryptandrus - Eragrostis trichodes* Herbaceous Vegetation (CEGL005221). This type has more woody vegetation, such as scattered *Populus deltoides*. This community is also on higher terraces than sandflat/mudbar communities, e.g., Riverine Sand Flats - Bars Sparse Vegetation (CEGL002049).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This riverine gravel flats community is found in the central Great Plains of the United States.

USFS ECOREGIONS: 331C:CC, 332C:CC
CONSERVATION REGIONS:
STATES: NE **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE riverine gravel flats =

OTHER SYNONYMY:

USNVC HIERARCHY: COBBLE/GRAVEL SHORE SPARSE VEGETATION ALLIANCE (VII.B.2.N.b)

2.2. Rocky Shores

Igneous - Metamorphic Bedrock Inland Lake Shore Sparse Vegetation

Igneous - Metamorphic Bedrock Inland Lake Shore Sparse Vegetation

Inland Lake Igneous - Metamorphic Bedrock Shore CEGL002301

DESCRIPTION: Vegetation is sparse, but little information is available to further characterize this type.

Stands are exposed bedrock along lakeshores. Substrate may be either granite/metamorphic or basalt/conglomerate. Presumably this type exists where wave action is sufficient to create a sparse vegetation zone along the lakeshore, or perhaps where rock outcrops occur adjacent to a lake shoreline.

A sufficiently sized lake with substantial wave action is needed to create a sparse, rocky vegetation zone along the lakeshore.

COMMENTS: *2, MCS*. This type may only occur on larger lakes where sufficient wave action exists to create a sparsely vegetated shoreline, or perhaps where rock outcrops occur adjacent to a lake shoreline. A separate sedimentary rock type may also be needed for some inland lakes. The type needs to be further studied and contrasted with Great Lakes types of either granite/metamorphic substrates, Granite - Metamorphic Bedrock Great Lakes Shore Sparse Vegetation (CEGL005216), or basalt/conglomerate substrates, Basalt - Conglomerate Bedrock Great Lakes Shore Sparse Vegetation (CEGL005215). In Michigan, this type may possibly occur in Presque Isle County, but this needs verification.

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This bedrock lakeshore community type is found on small lakes on the Canadian shield in the Upper Great Lakes region of the United States and Canada, including Minnesota, Wisconsin, Manitoba and Ontario, and perhaps more widely in Canada.

USFS ECOREGIONS: 212Ja:CCC, 212La:CPP
CONSERVATION REGIONS: 47:P, 48:C
STATES: MN WI **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY: MN lake beach (inland section) bedrock subtype =
WI inland lake pavement (not tracked) =

OTHER SYNONYMY:

USNVC HIERARCHY: OPEN PAVEMENT SPARSE VEGETATION ALLIANCE (VII.A.2.N.a)

Igneous - Metamorphic Cobble - Gravel Inland Lake Shore Sparse Vegetation

Igneous - Metamorphic Cobble - Gravel Inland Lake Shore Sparse Vegetation

Inland Lake Igneous - Metamorphic Cobble - Gravel Shore CEGL002303

DESCRIPTION: Vegetation is sparse, but little information is available to further characterize this type.

Stands are exposed bedrock along lakeshores. Cobble-gravel substrate may be either granite/metamorphic or basalt/conglomerate (?).

A sufficiently sized lake with substantial wave action is needed to create a sparse, rocky vegetation zone along the lakeshore.

COMMENTS: *2, MCS*. This type may only occur on larger inland lakes where sufficient wave action exists to create a sparsely vegetated shoreline. The type needs to be further studied, and contrasted with Great Lakes types of either granite/metamorphic substrates, Non-alkaline Cobble - Gravel Great Lakes Shore Sparse Vegetation (CEGL002508), or basalt/conglomerate substrates, Basalt - Diabase Cobble - Gravel Great Lakes Shore Sparse Vegetation (CEGL005250).

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This cobble-gravel lakeshore community type is possibly found on small lakes on the Canadian shield in the Upper Great Lakes region of the United States and Canada, and perhaps more widely in Canada, ranging from Michigan and Minnesota to Ontario and probably more widely across central Canada.

USFS ECOREGIONS: 212Ha:CPP, 212Hb:CPP, 212He:CPP, 212Hh:CPP, 212Hi:CPP, 212Hj:CPP, 212Hk:CPP, 212Ib:CPP, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jk:CPP, 212Jl:CPP, 212Jn:CPP, 212Jo:CPP, 212Jr:CPP, 212La:CPP, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 222Mb:CCC
CONSERVATION REGIONS: 46:C, 47:P, 48:C
STATES: MI MN **PROVINCES:** MB ON SK

MIDWEST HERITAGE SYNONYMY: MI cobble beach +
MN lake beach (inland section) gravel - cobble subtype =

OTHER SYNONYMY:

USNVC HIERARCHY: COBBLE/GRAVEL SHORE SPARSE VEGETATION ALLIANCE (VII.B.2.N.b)

Igneous - Metamorphic Cobble - Gravel River Shore Sparse Vegetation

Igneous - Metamorphic Cobble - Gravel River Shore Sparse Vegetation

Riverine Igneous - Metamorphic Cobble - Gravel Shore CEGL002304

DESCRIPTION: The vegetation of this type has not yet been characterized.

Stands are found on rivers where scouring by ice or flooding creates a sparsely vegetated zone along the river. Substrate is cobble-gravel, and may be composed of either basalt/diabase or granite/metamorphic rocks.

Scouring by ice or flooding is common.

COMMENTS: *3, MCS*. This type needs further characterization. Substrate may be either basalt/diabase or granite/metamorphic.

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This igneous/metamorphic cobble-gravel bedrock river shore community type is found in the upper Great Lakes region of the United States and Canada, and perhaps elsewhere, ranging from Minnesota to Michigan and north into central Canada, from Saskatchewan east to Quebec.

USFS ECOREGIONS: 212Ha:CPP, 212Hb:CPP, 212He:CPP, 212Hh:CPP, 212Hi:CPP, 212Hj:CPP, 212Hk:CPP, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jk:CPP, 212Jl:CPP, 212Jn:CPP, 212Jo:CPP, 212Jr:CPP, 212Kb:CCC, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP
CONSERVATION REGIONS: 47:C, 48:C
STATES: MI MN **PROVINCES:** MB ON SK

MIDWEST HERITAGE SYNONYMY: MI cobble beach +
MN river beach gravel - cobble subtype =

OTHER SYNONYMY:

USNVC HIERARCHY: COBBLE/GRAVEL SHORE SPARSE VEGETATION ALLIANCE (VII.B.2.N.b)

Sandstone Bedrock River Shore Sparse Vegetation

Sandstone Bedrock River Shore Sparse Vegetation

River Ledge Sandstone Pavement CEGL002302

DESCRIPTION: The vegetation of this type has not yet been characterized.

Stands are found on rivers where scouring by ice or flooding creates a sparsely vegetated zone along the river. Substrate is sandstone.

COMMENTS: *3, MCS*.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This sandstone bedrock river shore community type is found in the upper Great Lakes region of the United States and Canada, and perhaps elsewhere, ranging from Michigan, Wisconsin, and Minnesota to Ontario and Manitoba.

USFS ECOREGIONS: 212Hb:CCC, 212He:CCP, 212Ja:C??, 212Jb:C??, 212Jj:C??, 212Nb:CPP
CONSERVATION REGIONS: 47:P, 48:C
STATES: MI MN WI **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY:

MI	bedrock beach - sandstone cliff/lakeshore +
MN	river beach bedrock subtype =
WI	river pavement (sandstone subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: OPEN PAVEMENT SPARSE VEGETATION ALLIANCE (VII.A.2.N.a)

Dasiphora fruticosa ssp. floribunda / Clinopodium arkansanum - Argentina anserina - Primula mistassinica Sparse Vegetation

Shrubby-cinquefoil / Low Calamint - Silverweed - Bird's-eye Primrose Sparse Vegetation

Great Lakes Limestone - Dolostone Bedrock Shore CEGL002506

DESCRIPTION: These lakeshores are characterized by a zonal gradation of plant communities, changing in response to distance from the lake. Typical species found in protected bedrock cracks of the splash/scrape zone include *Juncus balticus, Argentina anserina (= Potentilla anserina)*, and *Populus balsamifera*. The more inland vegetated zone contains patchy vegetation. Common species include *Clinopodium arkansanum (= Calamintha arkansana), Deschampsia caespitosa, Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda), Dichanthelium acuminatum var. lindheimeri (= Panicum lindheimeri)*, and species from the previous zone. A variety of mosses, including *Campylium stellatum*, are common throughout this zone. In the most inland zone, on sand accumulations or cobble ridges on the bedrock, scattered trees and shrubs are common, including *Abies balsamea, Picea glauca, Populus balsamifera*, and *Thuja occidentalis* (Albert et al. 1995).

The width of the zone varies with fluctuations in the Great Lakes water level. The splash/scrape zone, which averages 10 m in width, is very sparsely vegetated, with small pools of standing water. Plant species are typically found in protected bedrock cracks. A vegetated zone occurs more inland as soil accumulates in and adjacent to bedrock cracks. Further inland, sand accumulations or cobble ridges on the bedrock surface provide a suitable substrate for the establishment of woody and herbaceous plants.

Wind, waves, and ice action disturb the various zones in this community.

COMMENTS: *2, MCS*. Note, in Michigan alvar-like communities may be included here. New York occurrences in Lake Champlain may fit this type. Michigan stands may be split into two types: limestone/dolomite (S3) and volcanic conglomerate (S3).

CONSERVATION RANK: *G3.*

DISTRIBUTION: This community occurs along Great Lakes shores in the United States and Canada, ranging from Michigan and Wisconsin to Ontario, and possibly to Minnesota and Ohio.

USFS ECOREGIONS: 212Ha:CC?, 212He:CCC, 212Hi:CC?, 212Hj:CCC, 212Hl:CCP, 212Ja:C??, 212Oa:CCC, 212Ob:CCC, 212Pa:CCC
CONSERVATION REGIONS: 48:C
STATES: MI MN OH? WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:
MI bedrock beach-limestone pavement lakeshore =
MN lake beach (lake superior section) bedrock subtype ?
OH? bedrock beach? ?
WI Great Lakes limestone-dolostone bedrock shore =

OTHER SYNONYMY:

USNVC HIERARCHY: OPEN PAVEMENT SPARSE VEGETATION ALLIANCE (VII.A.2.N.a)

Limestone Cobble - Gravel Great Lakes Shore Sparse Vegetation

Limestone Cobble - Gravel Great Lakes Shore Sparse Vegetation

Great Lakes Limestone Cobble - Gravel Shore CEGL005169

DESCRIPTION: Vegetation is typically sparse. Deep accumulations of large cobbles tend to be quite dry and nearly unvegetated. Shallow accumulations, especially when occurring over a moist, sandy substrate, tend to support denser, more diverse assemblages. The most frequently encountered species include *Campanula rotundifolia, Carex viridula, Juncus balticus, Juncus dudleyi, Populus balsamifera, Argentina anserina (= Potentilla anserina)*, and *Oligoneuron ohioense (= Solidago ohioensis)* (Albert et al. 1995).

Stands are most extensive in Lake Huron and Georgian Bay, including island shorelines. They often occur as an alternating pattern of limestone pavement interspersed with cobble-gravel. Deep accumulations of large cobbles tend to be quite dry and are nearly unvegetated, while shallow accumulations of small gravel and cobbles, especially when mixed with a moist sandy substrate, tend to support denser and more diverse plant cover (Albert et al. 1995).

COMMENTS: *2, MCS*. The alkaline cobble-gravel shorelines are split into two types, limestone (this type) and basalt/diabase conglomerates, Basalt - Diabase Cobble - Gravel Great Lakes Shore Sparse Vegetation (CEGL005250). See also the Graminoid Rich Shore Fen type, *Calamagrostis canadensis - Carex viridula - Cladium mariscoides - Lobelia kalmii* Herbaceous Vegetation (CEGL005115), which can be found in limestone cobble areas.

CONSERVATION RANK: *G3G4.*

DISTRIBUTION: The limestone cobble-gravel Great Lakes shore type is commonly found along the northern Great Lakes shores in the United States and Canada, ranging from Michigan and Wisconsin to Ontario.

USFS ECOREGIONS: 212Hi:CCP, 212Hj:CCC, 212Hl:CCC, 212Ib:C??, 212Ja:CPP, 212Oa:CCC, 212Ob:CCP, 212Pa:CCC, 212Pc:CCC
CONSERVATION REGIONS: 48:C
STATES: MI WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI cobble beach +
WI Great Lakes cobble beach (alkaline subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: COBBLE/GRAVEL SHORE SPARSE VEGETATION ALLIANCE (VII.B.2.N.b)

Basalt - Conglomerate Bedrock Great Lakes Shore Sparse Vegetation

Basalt - Conglomerate Bedrock Great Lakes Shore Sparse Vegetation

Great Lakes Basalt - Conglomerate Bedrock Shore CEGL005215

DESCRIPTION: Wave action and ice scour action are strongest near the shore, producing a wave-washed zone almost devoid of vegetation, except for scattered patches of mosses and lichens, and pockets of herbaceous species around bedrock pools. With increasing distance above the lake, herbaceous and nonvascular plant cover increases, though still very patchy, with lichens predominating, particularly on high, dry rocks. Herbaceous species include *Achillea millefolium, Campanula rotundifolia, Fragaria virginiana, Sibbaldiopsis tridentata (= Potentilla tridentata)*, and *Solidago simplex*. Perched meadows, dominated by tufted graminoids, are found at the edge of seasonal pools. The most common meadow species are *Calamagrostis canadensis, Carex buxbaumii, Carex castanea, Danthonia spicata, Deschampsia caespitosa, Trichophorum caespitosum (= Scirpus cespitosus)*, and *Trisetum spicatum*, as well as *Pinguicula vulgaris*. Lichens, mosses, and liverworts are prominent. Scattered, often stunted, woody trees and shrubs are found throughout, including *Abies balsamea, Amelanchier* spp., *Juniperus communis, Picea glauca, Populus tremuloides, Rubus pubescens, Shepherdia canadensis, Thuja occidentalis*, and *Vaccinium angustifolium* (Albert et al. 1995).

The bedrock consists of basalts, volcanic conglomerates, and localized rhyolites. Volcanic conglomerate shores may be more species rich than basalt shores due to the presence of cracks or small cavities in the former.

Wave action and ice scour action are the primary disturbances affecting the vegetation. Near the lakeshore a wave-washed zone is almost devoid of vegetation. A gradient of increasing vegetation occurs further above the lakeshore (Albert et al. 1995).

COMMENTS: *2, MCS*. This type grades into the Basalt Bedrock Glade, *Picea glauca - Abies balsamea* Basalt - Conglomerate Woodland (CEGL005214). This description is taken largely from Albert et al. (1995). In Michigan this type is predominantly nonvascular, with over 25% foliose and fruticose lichens.

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This basalt bedrock lakeshore is found along the Lake Superior shoreline of both the United States and Canada, ranging from Michigan to Minnesota and Ontario.

USFS ECOREGIONS: 212Ia:CCC, 212Jb:CCC, 212Jn:CCP
CONSERVATION REGIONS: 48:C
STATES: MI MN **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI bedrock beach - igneous/metamorphic lakeshore +
MN lake beach (lake superior section) bedrock subtype +

OTHER SYNONYMY:

USNVC HIERARCHY: OPEN PAVEMENT SPARSE VEGETATION ALLIANCE (VII.A.2.N.a)

Basalt - Diabase Cobble - Gravel Great Lakes Shore Sparse Vegetation

Basalt - Diabase Cobble - Gravel Great Lakes Shore Sparse Vegetation

Great Lakes Basalt - Diabase Cobble - Gravel Shore CEGL005250

DESCRIPTION: At Isle Royale National Park, this cobble-gravel lakeshore is a sparsely vegetated community on cobble or gravel beaches. This community occurs as a mosaic of sparse grassland with over 25% cover, and sparsely vegetated areas with less than 25% cover. The most abundant herbs are grasses, mostly *Elymus trachycaulus* (average 29% cover); other characteristic herbs are *Lathyrus palustris* and *Oenothera biennis*; characteristic shrubs are *Rubus idaeus, Cornus sericea*, and *Alnus viridis* (each with <5% cover). The shrub zone is dominated by low shrubs, which vary from 20-60% cover. The most abundant shrubs are *Rosa acicularis, Rubus idaeus, Diervilla lonicera, Physocarpus opulifolius, Ribes oxyacanthoides, Alnus incana*, and *Sorbus decora*. There may be scattered trees (0-5% cover) including *Picea glauca, Abies balsamea, Thuja occidentalis*, and *Betula papyrifera*. Cover of herbs varies from 10-40%; the most common herbs are *Lathyrus palustris, Oenothera biennis, Cornus canadensis, Calamagrostis canadensis*, and *Equisetum hyemale* (C. Reschke pers. comm. 1999). *Carex atratiformis, Polygonum viviparum*, and *Trisetum spicatum* have been reported at the inner margin of the island's cobble lakeshore, near the tree edge. Elsewhere, in Minnesota, *Lathyrus japonicus* is characteristic.

This community occupies cobble or gravel shores of Lake Superior. These shores occur in coves and gently curving bays between rocky points. These mostly non-vegetated shores may contain a shrub zone that occurs on the highest beach ridge, which is usually nearly level. There may be little or no soil; the plants are rooted in the cobble or gravel (C. Reschke pers. comm. 1999).

These are exposed shores that are regularly disturbed by wave action and winter ice movements from the lake. Most of the shore has little or no vegetation, probably due to regular disturbance by waves washing the shore. The high beach ridge is formed by the most severe storm waves, so the disturbance is irregular and infrequent (C. Reschke pers. comm. 1999).

COMMENTS: *2, MCS*. The alkaline cobble-gravel shorelines are split into two types, basalt /diabase (this type) and Limestone Cobble - Gravel Great Lakes Shore Sparse Vegetation (CEGL005169).

CONSERVATION RANK: *G4G5*. Type may be relatively localized, but threats are uncommon.

DISTRIBUTION: The basalt cobble-gravel Great Lakes shore type is commonly found in the northern Great Lakes region of the United States and Canada, ranging from Michigan to Minnesota and Ontario.

USFS ECOREGIONS: 212Ib:CCC, 212J:CC, 212Lb:CCC
CONSERVATION REGIONS: 48:C
STATES: MI MN **PROVINCES:** ON?

MIDWEST HERITAGE SYNONYMY: MI cobble beach +
MN lake beach (lake superior section) gravel - cobble subtype =

OTHER SYNONYMY:

USNVC HIERARCHY: COBBLE/GRAVEL SHORE SPARSE VEGETATION ALLIANCE (VII.B.2.N.b)

Granite - Metamorphic Bedrock Great Lakes Shore Sparse Vegetation

Granite - Metamorphic Bedrock Great Lakes Shore Sparse Vegetation

Great Lakes Granite - Metamorphic Bedrock Shore CEGL005216

DESCRIPTION: Vegetation cover varies with distance from the lakeshore. Wave action and ice scour are strongest near the shore, producing a wave-washed zone with little or no vegetation. Vegetation cover and height increases towards land. A zone of open, vegetated bedrock occurs first, where the dominant vegetation consists of mosses and lichens. Herbs and shrubs are restricted to bedrock cracks in the lower part of this zone, but increase farther inland. Above the zone of wave and ice influence, woody vegetation becomes dominant. Some of the more common vascular plants include *Agrostis hyemalis, Campanula rotundifolia, Danthonia spicata, Deschampsia caespitosa, Poa compressa, Vaccinium angustifolium, Betula papyrifera, Sibbaldiopsis tridentata (= Potentilla tridentata), Achillea millefolium, Chamerion angustifolium (= Epilobium angustifolium)*, and *Scirpus cyperinus*. Shrubs, farther inland, include *Arctostaphylos uva-ursi, Diervilla lonicera, Juniperus communis*, and *Physocarpus opulifolius*. The more common ferns include *Cystopteris fragilis, Woodsia ilvensis*, and *Polypodium virginianum*. Small pools may also occur containing *Calamagrostis canadensis, Deschampsia caespitosa, Lobelia kalmii*, and *Scirpus cyperinus* (Albert et al. 1995).

The bedrock is diverse in both age and origin, and includes an acidic group of granite and metamorphic rocks. Wave action and ice scour are strongest near the shore, producing a wave-washed zone with little or no vegetation (Albert et al. 1995).

Wave action and ice scour along the shore often prevents vegetation from establishing. Vegetation height and cover increases towards land.

COMMENTS: *3, MCS*. A Great Lakes granitic bedrock glade community, with similar ground layer species listed to those above, could be separated from this community (see Albert et al. 1995), as was done for the Basalt glade community, *Picea glauca - Abies balsamea* Basalt - Conglomerate Woodland (CEGL005214), but for now these Great Lakes near-shore granitic stands are treated as part of a more widespread type on rocky ridges, the *Pinus banksiana - Pinus strobus - (Quercus rubra) / Cladina* spp. Nonvascular Vegetation (CEGL002491). Typical tree species in the scattered canopy of the glade include *Pinus banksiana, Pinus resinosa, Pinus strobus, Quercus rubra*, and *Betula papyrifera*. Verification of granitic shores along the Minnesota North Shore is needed.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This sparsely vegetated granite (metamorphic) bedrock rocky shore community is found along Lake Superior shorelines of the United States and Canada, particularly in Michigan and Ontario.

USFS ECOREGIONS: 212Ja:CCC, 212Jb:CCC, 212Lb:CPP
CONSERVATION REGIONS: 48:C
STATES: MI **PROVINCES:** ON?

MIDWEST HERITAGE SYNONYMY: MI bedrock beach - igneous/metamorphic lakeshore +

OTHER SYNONYMY:

USNVC HIERARCHY: OPEN PAVEMENT SPARSE VEGETATION ALLIANCE (VII.A.2.N.a)

Non-alkaline Cobble - Gravel Great Lakes Shore Sparse Vegetation

Non-alkaline Cobble - Gravel Great Lakes Shore Sparse Vegetation

Great Lakes Non-alkaline Cobble - Gravel Shore CEGL002508

DESCRIPTION: Sites identified in Michigan are almost completely covered by a gravel and cobble beach and support no vegetation. Rangewide description is still needed (Albert et al. 1995).

Substrates currently identified include a combination of siltstones, shales, and sandstones (Albert et al. 1995).

These rock exposures are subject to much wave action that prevents the development of a distinctive plant community (Albert et al. 1995).

COMMENTS: *3, MCS*. This type may need to be separated into granite/metamorphic cobble/gravel shores and sandstone cobble/gravel shores, if such shores exist. But given the almost complete lack of vegetation on the cobble and gravel, no further subdivision may be warranted. The Michigan report (Albert et al. 1995) does not indicate a granite/metamorphic type and the sandstone type is of very limited extent on the Keweenaw Peninsula and within the Porcupine Mountains State Park. Rangewide review is still needed. In Minnesota, review is needed to determine if there are any granitic cobble shores (not basalt, which is tracked as Basalt - Diabase Cobble - Gravel Great Lakes Shore Sparse Vegetation (CEGL005250)).

CONSERVATION RANK: *G3G4.*

DISTRIBUTION: This non-alkaline cobble/gravel Great Lakes shore type is found along the shores of northern Great Lakes in the United States and Canada, ranging from Michigan and Wisconsin, north to Ontario and possibly Minnesota.

USFS ECOREGIONS: 212Hr:CPP, 212Ib:CCC, 212Ja:CPP, 212Jb:CPP, 212Lb:C??, 222:?
CONSERVATION REGIONS: 48:C
STATES: MI MN WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

MI	cobble beach +
MN	lake beach (lake superior section) gravel - cobble subtype ?
WI	Great Lakes cobble beach (non-alkaline subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: COBBLE/GRAVEL SHORE SPARSE VEGETATION ALLIANCE (VII.B.2.N.b)

Picea glauca - Abies balsamea Basalt - Conglomerate Woodland

White Spruce - Balsam Fir Basalt - Conglomerate Woodland

Great Lakes Spruce - Fir Basalt Bedrock Shore CEGL005214

DESCRIPTION: This community consists of scattered, open-grown trees, scattered shrubs or shrub thickets, and a partial layer of graminoids, mosses, and lichens. The scattered, and often stunted, tree layer contains *Abies balsamea, Betula papyrifera, Picea glauca, Pinus resinosa, Pinus strobus, Quercus rubra, Sorbus decora*, and *Thuja occidentalis*. The shrub layer is very sparse and may contain *Amelanchier* spp. and *Juniperus communis*. More prominent is the dwarf-shrub layer, which contains *Arctostaphylos uva-ursi, Epigaea repens, Juniperus horizontalis, Lonicera dioica, Rosa acicularis*, and *Vaccinium angustifolium*. The herbaceous layer is characterized by *Achillea millefolium, Calamagrostis canadensis, Danthonia spicata, Festuca saximontana var. saximontana (= Festuca ovina var. saximontana), Fragaria virginiana*, and *Sibbaldiopsis tridentata (= Potentilla tridentata)*. Mosses and lichens occur in localized patches throughout the stand (Albert et al. 1995).

Stands occur along the Great Lakes shorelines between the open basalt bedrock and the inland forests. Soils are thin and exposed areas of bedrock are common. The bedrock includes basalt, volcanic conglomerates, and localized rhyolites (Albert et al. 1995).

Exposures to wind and storms affect the structure of this community, with trees often somewhat stunted.

COMMENTS: *2, MCS*. This community occupies a zone between Basalt - Conglomerate Bedrock Great Lakes Shore Sparse Vegetation (CEGL005215) and adjacent boreal forests. The description is taken largely from Albert et al. (1995). The type overlaps in concept with *Picea glauca - (Betula papyrifera) / Danthonia spicata* Woodland (CEGL005196), described from Isle Royale (C. Reschke pers. comm. 1999), but that type is found at higher elevations away from the shoreline, along ridges.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This basalt bedrock shore community is found along the Lake Superior shorelines of the United States and Canada, ranging from Michigan to Minnesota and Ontario.

USFS ECOREGIONS: 212Jn:CPP, 212Lb:CCC
CONSERVATION REGIONS: 48:C
STATES: MI MN **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI bedrock beach - igneous/metamorphic lakeshore +
MN northern conifer woodland =

OTHER SYNONYMY:

USNVC HIERARCHY: PICEA GLAUCA WOODLAND ALLIANCE (II.A.4.N.b)

Sandstone Bedrock Great Lakes Shore Sparse Vegetation

Sandstone Bedrock Great Lakes Shore Sparse Vegetation

Great Lakes Sandstone Bedrock Shore CEGL002507

DESCRIPTION: This community is dominated by nonvascular species with open pavement. Mosses, liverworts, and scattered vascular plants may be found. Vascular plants on the pavement are concentrated in cracks in the rock, whereas mosses and liverworts are found where seepages flow across the rock. Some of the more common vascular plants include *Achillea millefolium, Chamerion angustifolium (= Epilobium angustifolium), Betula papyrifera, Campanula rotundifolia, Cystopteris fragilis, Deschampsia caespitosa, Phegopteris connectilis (= Thelypteris phegopteris), Alnus incana, Equisetum arvense*, and *Euthamia graminifolia*. Less common, and more restricted to cracks in the pavement, are *Sibbaldiopsis tridentata (= Potentilla tridentata), Lobelia kalmii, Packera indecora (= Senecio indecorus), Packera paupercula (= Senecio pauperculus), Physocarpus opulifolius, Primula mistassinica, Trisetum spicatum*, and *Rubus pubescens* (Albert et al. 1995).

In Michigan, these bedrock shorelines occur as small inclusions within areas of the larger sandstone cliff communities. Narrow areas of pavement occur at less than a meter above the lake levels and are generally moist (Albert et al. 1995).

COMMENTS: *2, MCS*. Distribution in Minnesota is uncertain.

CONSERVATION RANK: *G3G4.*

DISTRIBUTION: This sparsely vegetated sandstone bedrock rocky shore community is found in the United States and Canada on the Michigan, Wisconsin (Apostle Islands only), and Ontario shores of Lake Superior, and possibly in Minnesota.

USFS ECOREGIONS: 212Ha:CPP, 212Hi:CPP, 212Ia:CPP, 212Ja:CPP, 212Jb:CPP, 212Jn:CPP, 212Jr:CPP, 212Lb:C??
CONSERVATION REGIONS: 48:C
STATES: MI MN WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

MI	bedrock beach - sandstone cliff/lakeshore +
MN	lake beach (lake superior section) bedrock subtype ?
WI	Great Lakes sandstone bedrock shore =

OTHER SYNONYMY:

USNVC HIERARCHY: OPEN PAVEMENT SPARSE VEGETATION ALLIANCE (VII.A.2.N.a)

Justicia americana Herbaceous Vegetation

Common Water-willow Herbaceous Vegetation

Water-willow Wetland CEGL004286

DESCRIPTION: *Justicia americana* is the characteristic dominant. Other herbaceous species that may be present include *Diodia teres, Gratiola brevifolia, Leersia* sp., *Lemna minor, Orontium aquaticum, Podostemum ceratophyllum, Saururus cernuus*, and *Xyris difformis var. difformis*. In Ohio, *Justicia* usually grows in nearly pure patches, so that few other species are associated with it. *Bidens* spp., *Cuscuta gronovii, Mimulus ringens, Polygonum* spp., *Rumex* spp., and *Salix interior* can occur (Anderson 1982). A sparse canopy layer may be present, which can include *Carpinus caroliniana, Fagus grandifolia*, and *Fraxinus pennsylvanica*, among others. In the Cumberland Plateau of Alabama, *Justicia americana* is present in dense patches with some interspersion of other species including *Pilea pumila, Boehmeria cylindrica, Eclipta prostrata (= Eclipta alba), Juncus coriaceus, Mikania scandens, Ludwigia palustris, Leersia* sp. and *Bidens* sp.

This association occurs on the shoals or bars of rocky streams and riverbeds, or gravelly sands.

Stands in some situations may be obliterated by ongoing river channeling. Anderson (1982) describes some of the life-history characteristics of *Justicia americana* that allow it to persist in river channels.

COMMENTS: *2, SCS*. This type, in Ohio, often forms pure patches, but consistent identification may require a simple cutoff rule, such as at least 50% cover of *Justicia* (Anderson 1982). However, Anderson (1996) no longer recognizes this type.

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This type is found primarily in the Piedmont, Interior Low Plateau, Cumberland Plateau, Ozarks, Ouachita Mountains, and adjacent provinces. It ranges from Alabama, Georgia and the Carolinas west to Arkansas and Oklahoma and north to Ohio, Pennsylvania, and Delaware.

USFS ECOREGIONS: 221Ec:CCC, 221Ed:CCP, 221Ef:CCP, 221Ha:CCC, 221Hb:CCC, 221Hc:CCC, 221He:CCC, 222Eb:CCC, 222Ej:CCP, 222En:CCC, 222Eo:CCC, 222Ha:CCC, 231Af:CCC, 231B:CC, 231Cd:CCC, 231D:CC, M221Aa:CCC, M221Ac:CCC, M221Ad:CCC, M221Bb:CCC, M221Bd:CCC, M221Be:CCC, M221Bf:CCC, M221Cd:CCC, M221Da:CCC, M221Dc:CCC, M222A:CC, M231A:CC

CONSERVATION REGIONS: 38:C, 39:C, 43:C, 44:C, 45:C, 48:C, 49:C, 50:C, 51:C, 52:C, 59:C, 61:C

STATES: AL AR DE GA KY MD? NC OH OK PA SC? TN VA? WV **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: OH water-willow riverine community =

OTHER SYNONYMY: IIE3a. Riverside Shoal and Stream Bar Complex, in part (Allard 1990), Water-willow Aquatic Bed

USNVC HIERARCHY: JUSTICIA AMERICANA TEMPORARILY FLOODED HERBACEOUS ALLIANCE (V.B.2.N.d)

Andropogon gerardii - Panicum virgatum - Baptisia australis Herbaceous Vegetation

Big Bluestem - Switchgrass - Tall Blue Wild Indigo Herbaceous Vegetation

Riverwash Bedrock Prairie CEGL006283

DESCRIPTION: This community is characterized by a luxuriant growth of the robust grasses *Andropogon gerardii, Sorghastrum nutans, Panicum virgatum*, and *Spartina pectinata*, which resembles prairie vegetation. *Tripsacum dactyloides* may also occur. Many of the forbs are also typical of prairies. Characteristic species include *Baptisia australis, Toxicodendron radicans, Allium cernuum, Cerastium arvense, Clematis viorna, Coreopsis tripteris, Melica mutica, Phlox divaricata, Pycnanthemum virginianum, Silphium trifoliatum, Solidago erecta, Solidago rupestris, Solidago speciosa, Teucrium canadense, Veronicastrum virginicum, Vicia americana*, and *Zizia aurea*.

Stands occur only along high-gradient sections of major rivers, such as in gorges and along the Fall Line. They occur within the active channel shelf at an intermediate level above the low-water level and the bank-full level. Flood scouring and river ice may become a powerful and ecologically important abrasive force along the riverbanks. Soils are rapidly drained Psamments. Often, soil material is restricted to the narrow interstices of tightly packed boulders, or to small crevices in bedrock exposures.

Flash floods actively scour the floodplain, keeping the vegetation open.

COMMENTS: *2, ECS*. In the Central Appalachian region, the type is found predominantly on Western Allegheny Mountains (M221Be + M221Bd, Gauley M221Ca dammed).

CONSERVATION RANK: *G2G3*. There are probably fewer than 100 occurrences of this community rangewide, depending on how an occurrence is defined. It is known from Maryland, District of Columbia, and Virginia along the Potomac River, from the James River, Shenandoah River, and various tributaries in Virginia, and from about 50 miles along the Greenbrier River in West Virginia. It is also reported from Pennsylvania, and may also occur in Ohio. This community is threatened by invasion of exotic weeds, especially *Sorghum halepense* and *Lythrum salicaria*.

DISTRIBUTION: This riverwash grassland community is found in the east-central United States, from Pennsylvania, West Virginia, and Virginia, and possibly Ohio.

USFS ECOREGIONS: M221Aa:CCC, M221Ac:CCC, M221Ad:CCC, M221Bd:CCC, M221Be:CCC, M221C:C?, M221D:C?
CONSERVATION REGIONS: 59:C, 61:C
STATES: MD OH? PA VA WV **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: OH? no state equivalent

OTHER SYNONYMY: *Fraxinus pennsylvanica / Andropogon gerardii - Panicum virgatum - Baptisia australis* Wooded Herbaceous Vegetation (Lea 2000), Riverwash Grasslands (*Baptisia australis - Lespedeza violacea - Chasmanthium latifolium* Herbaceous Vegetation) (Grossman et al. 1994)

USNVC HIERARCHY: ANDROPOGON GERARDII - (SORGHASTRUM NUTANS) TEMPORARILY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.j)

Alnus serrulata - Amorpha fruticosa Shrubland

Smooth Alder - Tall Indigobush Shrubland

CEGL007807

DESCRIPTION: These shrublands are moderately tall (8-15 feet, 2-5 m) and often partially recumbent. *Alnus serrulata* is the dominant shrub. Associated shrubs include *Amorpha fruticosa, Amorpha nitens, Cephalanthus occidentalis, Cornus obliqua (= Cornus amomum ssp. obliqua), Cornus foemina, Hypericum prolificum, Ilex decidua, Itea virginica, Lyonia ligustrina, Styrax grandifolius, Vaccinium fuscatum, Viburnum nudum*, and others. Typical species in the herbaceous layer include *Amsonia hubrichtii, Dichanthelium dichotomum var. dichotomum (= Panicum microcarpon), Dichanthelium sphaerocarpon var. isophyllum (= Panicum polyanthes), Dulichium arundinaceum, Elymus virginicus var. virginicus, Gratiola brevifolia, Hypericum mutilum, Juncus effusus, Lysimachia lanceolata, Proserpinaca palustris, Ptilimnium nodosum* (restricted distribution), *Pycnanthemum tenuifolium, Rhynchospora capitellata, Solidago rugosa, Sium suave* (uncommon), and others.

Stands occur near slow-moving water among the cobble bar vegetation of mountain streams. This community is maintained by the flashy, high-velocity flows and flooding of upland (often intermittent) streams. Dense piles of debris around the bases of the shrubs and aerial leaf packs ("alps") are common. Soils are derived from alluvial deposition of eroded sandstone, shale, and chert substrates.

Flashy, high-velocity flows maintain these shrublands.

COMMENTS: *2, SCS.* High-quality examples are common on the Ouachita National Forest. The type location is in Garland County, Arkansas. Other sites include the North Fork of the Ouachita, Irons Fork, and Fourche LaFave rivers in Arkansas and Cedar Creek, Beech Creek, and Cucumber Creek in Oklahoma. Distribution of this type outside the Ouachita Mountains needs investigation with subsequent rank refinement.

CONSERVATION RANK: *G3?.* This association is known only from the Ouachita Mountains of Oklahoma and Arkansas where it is naturally restricted in range and environmental setting. It is found near slow-moving water among the cobble bar vegetation of mountain streams where it is maintained by flashy, high-velocity flows and flooding. The degree of uncertainty in the rank reflects the need for further inventory to assess the full distribution of this type.

DISTRIBUTION: These temporarily flooded riparian shrublands occur in the Ouachita Mountains of Oklahoma and Arkansas.

USFS ECOREGIONS: 222:P, 231:P, M222:P, M231:C
CONSERVATION REGIONS: 38:P, 39:C
STATES: AR MO OK **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO no state equivalent

OTHER SYNONYMY:

USNVC HIERARCHY: ALNUS SERRULATA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (III.B.2.N.d)

Hamamelis vernalis - Cornus obliqua - Hypericum prolificum Shrubland

Spring Witch-hazel - Pale Dogwood - Shrubby St. John's-wort Shrubland

Witch-hazel - Dogwood Gravel Wash CEGL003898

DESCRIPTION: *Hamamelis vernalis, Cornus obliqua (= Cornus amomum ssp. obliqua)*, and *Hypericum prolificum* are common and characteristic. Several other species may be locally abundant in the diverse microhabitats of this shrubland, including *Salix caroliniana* in more open streambeds, *Leptopus phyllanthoides (= Andrachne phyllanthoides)* in drier scour zones, *Juniperus virginiana var. virginiana* in upper scour zones, *Ilex vomitoria* on bedrock and boulders on larger streams, and *Alnus serrulata* and *Cephalanthus occidentalis* in low, wet areas. On more stable substrates *Platanus occidentalis, Acer rubrum*, and *Liquidambar styraciflua* may be locally abundant. Other shrub and tree species that may occur include *Amorpha fruticosa, Amorpha ouachitensis, Betula nigra, Crataegus* spp., *Diospyros virginiana, Ulmus alata, Hypericum prolificum, Ilex decidua, Styrax grandifolius*, and *Vaccinium virgatum*. Herbaceous species include *Amsonia illustris, Amsonia hubrichtii, Ambrosia* spp., *Apios americana, Boltonia diffusa, Chasmanthium latifolium, Commelina erecta, Diodia virginiana, Eupatorium fistulosum, Ludwigia decurrens, Polygonum pensylvanicum, Vernonia lettermannii, Panicum virgatum, Panicum anceps*, and *Perilla frutescens* (exotic). *Trachelospermum difforme* is a common vine of this community (J. Campbell pers. comm. 1994, D. Zollner pers. comm. 1994).

This shrubland occurs as narrow strips (1-10 m wide) in the upper scour zones of small to medium-sized streams. It is typically found in a substrate of loose cobble, but on larger streams and rivers may occur on bedrock shelves or alluvial silt, where it intergrades with other vegetation types (J. Campbell pers. comm. 1994, D. Zollner pers. comm. 1994).

COMMENTS: *2, SCS*. This association was defined from a TNC Arkansas Field Office survey in the Ouachita Mountains, Oklahoma and Arkansas, covering areas that are not part of the Ouachita National Forest (J. Campbell pers. comm. 1994, D. Zollner pers. comm. 1994). In Missouri it may be difficult to separate this type from *Salix caroliniana* Temporarily Flooded Shrubland (CEGL003899). See also *Juniperus virginiana var. virginiana - Leptopus phyllanthoides - (Quercus nigra, Ilex vomitoria)* Shrubland (CEGL003942), which may be a zone of this type.

CONSERVATION RANK: *G3.* This association is geographically restricted, occurring only in the Interior Highlands of Arkansas, Oklahoma, and Missouri. Degradation of streambanks due to grazing and other agricultural influences can have a detrimental impact on this community type.

DISTRIBUTION: This witch-hazel - dogwood gravel wash occurs in the Ozarks-Ouachita region of the United States, from Missouri to Arkansas and Oklahoma.

USFS ECOREGIONS: 222A:CC, 231Gb:CCC, M231A:CC
CONSERVATION REGIONS: 38:C, 39:C
STATES: AR MO OK **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO gravel wash +

OTHER SYNONYMY:

USNVC HIERARCHY: HAMAMELIS VERNALIS TEMPORARILY FLOODED SHRUBLAND ALLIANCE (III.B.2.N.d)

Salix spp. / Andropogon gerardii - Sorghastrum nutans Gravel Wash Herbaceous Vegetation

Willow Species / Big Bluestem - Yellow Indiangrass Gravel Wash Herbaceous Vegetation

Brush Prairie Gravel Wash CEGL005175

DESCRIPTION: Shrubs include *Salix caroliniana, Cornus obliqua*, and others. In Indiana, other species include *Baptisia australis, Coreopsis tripteris, Hypericum sphaerocarpum*, and *Panicum virgatum* (Homoya et al. 1985).

Stands may be found on both gravel and bedrock substrates that are scoured by spring floods.

COMMENTS: *3, MCS*. Type is poorly defined and needs further review. It may better fit under shrub class physiognomy, and may be related to associations in the III.B.2.N.d *Salix caroliniana* Temporarily Flooded Shrubland Alliance (A.946). The type is related to riverine gravel/cobble bar 'prairies' along the Cumberland River in Kentucky and Tennessee.

CONSERVATION RANK: *G2Q.* The number of occurrences is unknown. Two have been documented in Indiana, where the community is ranked S1. Although no other occurrences have been documented, the community is also reported in Iowa (S?) and may occur in Illinois, and West Virginia (all SP). It is found in three ecoregional subsections. Stands occur on gravel or bedrock substrates that are scoured by spring floods.

DISTRIBUTION: This riverine gravel/cobble bar herbaceous type is found in the central parts of the United States, ranging from Iowa east to West Virginia (?).

USFS ECOREGIONS: 222Db:CC?, 222Df:CCC, 222Ek:CCC, 222Fd:CC?, 222Fe:CCC
CONSERVATION REGIONS: 44:C
STATES: IA? IL IN WV? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL river shore type? ?
IN gravel wash +

OTHER SYNONYMY:

USNVC HIERARCHY: ANDROPOGON GERARDII - (SORGHASTRUM NUTANS) TEMPORARILY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.j)

2.3. Rocky Uplands (Glades, Rock Barrens, Outcrops and Alvars)

Thuja occidentalis Limestone Bedrock Woodland

Northern White-cedar Limestone Bedrock Woodland

White-cedar Limestone Bedrock Woodland CEGL005050

DESCRIPTION: Canopy cover ranges from open to >90%, and varies from pure evergreen to mixed evergreen-deciduous. *Picea glauca* and *Thuja occidentalis* dominate the overstory in the pure evergreen phase, but *Pinus strobus* (emergent) and *Tsuga canadensis* can also be found in the mixed phase, along with deciduous species, such as *Acer saccharum, Quercus rubra*, and *Ostrya virginiana*. The shrub layer is sparse. Herbaceous cover is generally sparse in the evergreen phase, containing wide-ranging forbs, such as *Maianthemum canadense*, but is more diverse in the mixed phase (Reschke 1990, Bakowsky and Lee 1996).

In alvar situations, type can occur on shallow soils over relatively flat, limestone bedrock. In non-alvar situations, type can occur on thin-soil cliff-rim situations, such as escarpments, or on steep, colluvial slopes.

COMMENTS: *2, MCS*. Some stands have closed canopy cover, others more open. This type currently contains two phases - the evergreen phase with more closed canopies (>75% evergreen and >90% canopy cover) and the mixed evergreen-deciduous phase (between 25 and 75% evergreen and deciduous species, with 70-80% canopy cover). Future work may split these phases apart, which should be done in consultation with Ontario ecologists. Mapping should consider the two phases as separate, where feasible.

CONSERVATION RANK: *G3.*

DISTRIBUTION: This white-cedar pavement woodland community type is found in the lower and central Great Lakes regions of the United States and Canada, ranging from Michigan east to Ontario and New York.

USFS ECOREGIONS: 212E:CP, 212Hj:CPP, 212Hl:CPP
CONSERVATION REGIONS: 48:C
STATES: MI NY **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI alvar-glade +

OTHER SYNONYMY:

USNVC HIERARCHY: THUJA OCCIDENTALIS WOODLAND ALLIANCE (II.A.4.N.b)

(Pinus strobus, Quercus rubra) / Danthonia spicata Acid Bedrock Wooded Herbaceous Vegetation

(Eastern White Pine, Northern Red Oak) / Poverty Oatgrass Acid Bedrock Wooded Herbaceous Vegetation

White Pine - Oak Acid Bedrock Glade CEGL005101

DESCRIPTION: Shrubs and scattered trees dominate the woody canopy layers. Trees include *Betula papyrifera, Pinus banksiana, Pinus resinosa, Pinus strobus*, and *Quercus rubra*. The shrub layer contains *Diervilla lonicera, Juniperus communis*, and, less frequently, *Physocarpus opulifolius*. The dwarf-shrub *Arctostaphylos uva-ursi* is also present. The herbaceous layer contains *Agrostis hyemalis, Campanula rotundifolia, Danthonia spicata, Deschampsia caespitosa, Chamerion angustifolium (= Epilobium angustifolium), Poa compressa, Sibbaldiopsis tridentata (= Potentilla tridentata)*, and *Vaccinium angustifolium*. Moss and lichen cover may be substantial. A plant of special interest in Michigan is *Trisetum spicatum* (Albert et al. 1995). In New England a similar composition is found, but *Deschampsia flexuosa* replaces *Deschampsia caespitosa*, and the common shrubs are *Arctostaphylos uva-ursi, Comptonia peregrina, Gaultheria procumbens, Gaylussacia baccata, Juniperus communis, Kalmia angustifolia*, and *Vaccinium angustifolium*. *Picea rubens* is occasionally present. Common herbaceous species include *Maianthemum canadense, Melampyrum lineare, Oryzopsis asperifolia, Pteridium aquilinum*, and *Trientalis borealis*.

In the Great Lakes, these glades occur on rocky outcrops and along upper areas above the granitic bedrock shorelines (Albert et al. 1995). They also occur on rocky openings in New England.

COMMENTS: *3, MCS*. This type bears a resemblance to the *Quercus ellipsoidalis - Quercus macrocarpa - (Pinus banksiana)* Rocky Woodland (CEGL005246), that also occurs on granitic shoreline outcrops in Minnesota, particularly at Voyageurs National Park. It is distinct from the basaltic/metamorphic glades, *Picea glauca - Abies balsamea* Basalt - Conglomerate Woodland (CEGL005214), which is more spruce-fir-dominated. Stands have also been observed on Isle Royale National Park. This type is probably found in the basalt outcrops along the St. Croix River in Wisconsin (and perhaps Minnesota), and possibly elsewhere in the Penokee Range of Wisconsin.

CONSERVATION RANK: *G3G4.*

DISTRIBUTION: This acid bedrock glade type occurs in the Upper Great Lakes region of the United States and Canada and in New England. The type ranges from northwestern Wisconsin and northern Ontario east through several Great Lakes states to New York and several New England states.

USFS ECOREGIONS: 212Cb:CCC, 212Hb:CPP, 212Ib:CCC, 212Jb:CCP, 212Jc:CCP, 212Jj:CCC, 212Jk:CCC, 212Jl:CCP, 212Jr:CCC, 212K:C?, 221A:C?, M212A:C?, M212D:CP
CONSERVATION REGIONS: 47:C, 48:C, 61:C, 63:C
STATES: MA ME MI NH NY WI **PROVINCES:** ON?

MIDWEST HERITAGE SYNONYMY: MI bedrock glade +
WI bedrock glade (white pine-oak subtype) =

OTHER SYNONYMY: Red oak-white pine woodlands (NAP)

USNVC HIERARCHY: DANTHONIA SPICATA HERBACEOUS ALLIANCE (V.A.5.N.e)

Corylus cornuta - Amelanchier spp. - Prunus virginiana Rocky Shrubland

Beaked Hazelnut - Serviceberry Species - Choke Cherry Rocky Shrubland

Boreal Hazelnut - Serviceberry Rocky Shrubland CEGL005197

DESCRIPTION: The vegetation is dominated by shrubs, with a strong graminoid layer. Dominant shrubs include *Amelanchier* spp., *Corylus cornuta*, and *Prunus virginiana*. Other shrubs include *Juniperus communis, Rosa acicularis*, and *Rhus typhina*. Associated herbs include *Danthonia spicata, Hieracium* spp., and *Poa compressa* (Reschke pers. comm. 1999).

Stands occur on rocky ridges, with thin, acidic soils (Reschke pers. comm. 1999).

COMMENTS: *3, MCS*. Type concept is taken from studies on Isle Royale and needs rangewide review. The associated herbaceous type is *Danthonia spicata - Poa compressa* Granite Herbaceous Vegetation (CEGL005157), which is dominated by *Danthonia spicata* and *Poa compressa*.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This rocky shrubland type is found in the northern Great Lakes region of the United States and Canada.

USFS ECOREGIONS: 212Ib:CCC
CONSERVATION REGIONS: 48:C
STATES: MI? **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI? boreal shrubland

OTHER SYNONYMY:

USNVC HIERARCHY: CORYLUS CORNUTA - AMELANCHIER SPP. SHRUBLAND ALLIANCE (III.B.2.N.a)

Danthonia spicata - Poa compressa Granite Herbaceous Vegetation

Poverty Grass - Canada Bluegrass Granite Herbaceous Vegetation

Poverty Grass Granite Barrens CEGL005157

DESCRIPTION: The vegetation is open and dominated by graminoids. Characteristic dominants include *Danthonia spicata* and *Poa compressa*. Other features of this type still need to be described (C. Reschke pers. comm. 1999).

Stands occur on granite or metamorphic rocks. Soils are thin and acidic (C. Reschke pers. comm. 1999).

This type may arise after clearing or burning of conifer-dominated stands on rocky sites.

COMMENTS: *3, MCS*. Type is found on Isle Royale, where it occurs on the upper ridges. It may be a semi-natural type, originating from human-caused burns of ridge-tops. Type is associated with the beaked hazelnut shrubland type, *Corylus cornuta - Amelanchier spp. - Prunus virginiana* Rocky Shrubland (CEGL005197). It may also overlap with *Danthonia spicata - Poa compressa* Granite Herbaceous Vegetation (CEGL005157).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This boreal rocky grassland type is found in the northern Great Lakes region of the United States and Canada.

USFS ECOREGIONS: 212Ib:CCC
CONSERVATION REGIONS: 48:C
STATES: MI? **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI? northern bald

OTHER SYNONYMY:

USNVC HIERARCHY: DANTHONIA SPICATA HERBACEOUS ALLIANCE (V.A.5.N.e)

Juniperus communis - (Quercus rubra) / Juniperus horizontalis - Arctostaphylos uva-ursi Shrubland

Common Juniper - (Northern Red Oak) / Creeping Juniper - Kinikinnick Shrubland

Common Juniper Rocky Krummholz CEGL005065

DESCRIPTION: The shrub/scrub canopy varies from open to closed. In Michigan the scrub layer includes stunted *Quercus rubra* and *Juniperus communis*. The dwarf-shrub layer contains *Juniperus horizontalis* and *Arctostaphylos uva-ursi*.

Stands are found on exposed, igneous bedrock substrates. In Michigan, stands are found at higher elevations in the Porcupine Mountains, where exposure to wind and cold has stunted the vegetation.

COMMENTS: *3, MCS*. It is not known whether the Ontario stands resemble the Michigan stands sufficiently to warrant keeping them in the same type (see Bakowsky and Lee 1996). This type needs further characterization. It probably occurs along the northern shore of Lake Superior in Ontario, and possibly along the northern shores of Lake Huron, in the north channel and Georgian Bay areas.

CONSERVATION RANK: *G3G4.* Fewer than 100 small occurrences are restricted to a narrow range in northwestern Michigan along Lake Superior shores; this community probably also occurs along the northern shore of Lake Superior, and possibly along northern shores of Lake Huron in Ontario, where it may be more common.

DISTRIBUTION: This juniper shrubland type is found in the Great Lakes region of the United States and Canada; in particular, Michigan and Ontario.

USFS ECOREGIONS: 212Hw:CPP, 212Ib:CCC, 212Ja:CCC, 212Jb:CCC, 212Jn:CC?, 212Jr:CCP
CONSERVATION REGIONS: 48:C
STATES: MI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI northern bald +

OTHER SYNONYMY:

USNVC HIERARCHY: JUNIPERUS COMMUNIS SHRUBLAND ALLIANCE (III.A.3.N.a)

Picea glauca - (Betula papyrifera) / Danthonia spicata Woodland

White Spruce - (Paper Birch) / Poverty Oatgrass Woodland

White Spruce Rocky Woodland CEGL005196

DESCRIPTION: At Isle Royale National Park, Michigan, white spruce woodland is an open-canopy evergreen woodland with variable physiognomy; canopy cover ranges from 10-60% cover. *Picea glauca* is the most abundant tree over 5 m tall, with 10-50% cover. *Betula papyrifera* and *Populus tremuloides* are the next most abundant trees, each with 1-5% cover. Shrub cover varies from about 5-50% cover of tall shrubs, from 5-60% cover of short shrubs, and from 0-60% cover of dwarf-shrubs. The most abundant tall shrubs are saplings (or browsed scrub) of *Picea glauca, Abies balsamea*, and *Sorbus decora*, as well as *Alnus incana* shrubs. The most abundant short shrubs are *Diervilla lonicera, Rubus parviflorus, Sambucus racemosa, Ribes glandulosum*, and *Rosa acicularis*. *Arctostaphylos uva-ursi* is the most abundant dwarf-shrub. Herb cover is variable, ranging from about 30-80% cover. The most abundant herbs are *Eurybia macrophylla (= Aster macrophyllus), Aralia nudicaulis, Pteridium aquilinum, Cornus canadensis, Poa* spp., *Calamagrostis canadensis*, and *Deschampsia flexuosa*. Nonvascular cover is variable, ranging from 0-60% cover; the most abundant lichens are *Cladina* spp. and foliose lichens; the most abundant moss is *Pleurozium schreberi* (C. Reschke pers. comm. 1999).

At Isle Royale National Park, this community occupies high rocky ridgelines, with flat areas to steep slopes at elevations usually ranging from 200 to 300 m (610 to 900 feet) (in one case at almost 400 m or 1250 feet). Stands sometimes occur on old beach flats or beach ridges. Soils are thin sandy, sandy loam, or organic, and well-drained to rapidly drained (C. Reschke pers. comm. 1999).

COMMENTS: *3, MCS*. Type varies from evergreen to mixed evergreen-deciduous. Rangewide review is still needed for this type. The type overlaps in concept with *Picea glauca - Abies balsamea* Basalt - Conglomerate Woodland (CEGL005214), described best from the Lake Superior Shores of Minnesota and Michigan, but that type is found at low elevations more directly along shorelines. It may also overlap with the *Pinus banksiana - (Picea mariana, Pinus strobus) / Vaccinium* spp. Rocky Woodland (CEGL002483), which can have a spruce-fir phase, such as occurs at Voyageurs National Park.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This white spruce rocky woodland occurs in localized areas of the Great Lakes region of the United States, and possibly Canada. It is best described from rocky ridges of Isle Royale, Michigan, but may occur in Ontario.

USFS ECOREGIONS: 212Ib:CCC
CONSERVATION REGIONS: 48:C
STATES: MI? MN **PROVINCES:** ON?

MIDWEST HERITAGE SYNONYMY: MI? bedrock glade
MN northern conifer woodland +

OTHER SYNONYMY:

USNVC HIERARCHY: PICEA GLAUCA WOODLAND ALLIANCE (II.A.4.N.b)

Pinus banksiana - (Picea mariana, Pinus strobus) / Vaccinium spp. Rocky Woodland

Jack Pine - (Black Spruce, Eastern White Pine) / Blueberry Species Rocky Woodland

Boreal Pine Rocky Woodland CEGL002483

DESCRIPTION: The tree canopy is open, with scattered *Pinus banksiana* and *Picea mariana*. The understory is quite open, with scattered clumps of shrubby *Picea mariana*. The dwarf-shrub layer contains *Vaccinium angustifolium* and *Vaccinium myrtilloides*. The herbaceous layer is sparse, containing *Cornus canadensis, Maianthemum canadense*, and *Melampyrum lineare*. The moss layer contains *Dicranum polysetum* and *Pleurozium schreberi*. Lichens include *Cladina rangiferina, Cladina mitis*, and *Cladina stellaris* (Sims et al. 1989, McCarthy et al. 1994).

Stands typically occur on shallow, sandy or rocky sites. Soils vary from talus slopes and bare bedrock to deep mineral soils of coarse to fine sand (Sims et al. 1989, McCarthy et al. 1994).

COMMENTS: *2, MCS*. In Michigan, this type is possible on Isle Royale and elsewhere in the Upper Peninsula, and in Minnesota this type is expected primarily in the Border Lakes region (212La), though it may occur elsewhere. The description in the MNNHP (1993) report has a richer shrub layer than is described in Ontario, and probably also includes the tall-shrub phase of *Pinus banksiana - Picea mariana / Vaccinium spp. / Pleurozium schreberi* Forest (CEGL002448).

In Minnesota, especially at Voyageurs National Park, this type may essentially be synonymous with *Pinus banksiana / (Quercus rubra, Quercus ellipsoidalis)* Forest (CEGL002440) in more open rocky stands, and that type could be characterized as the typical subassociation within this type where *Picea mariana* is minor and *Quercus ellipsoidalis* is more common. Farther north in Ontario, *Picea mariana* is more common.

CONSERVATION RANK: *G4?.*

DISTRIBUTION: This jack pine - black spruce rocky woodland type is found in central Canada and adjacent boreal forests of the Great Lakes in the United States.

USFS ECOREGIONS: 212Hb:CPP, 212Ib:CCC, 212Ja:CPP, 212Jj:CPP, 212Jm:CPP, 212Ka:CPP, 212La:CCP, 212Lc:CCC
CONSERVATION REGIONS: 47:P, 48:C
STATES: MI MN **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY: MI northern bald +
MN northern conifer woodland; northern conifer scrubland I

OTHER SYNONYMY: Jack Pine - Black Spruce / Blueberry / Lichen (V30) (Sims et al. 1989) =, Jack Pine - Black Spruce / Feathermoss (V16) (McCarthy et al. 1994) =. Uncertain if equivalent; stands appear to occur less often on shallow soils over bedrock.

USNVC HIERARCHY: PINUS (BANKSIANA, RESINOSA) WOODLAND ALLIANCE (II.A.4.N.a)

Pinus banksiana - Pinus strobus - (Quercus rubra) / Cladina spp. Nonvascular Vegetation

Jack Pine - Eastern White Pine - (Northern Red Oak) / Reindeer Lichen Species Nonvascular Vegetation

Mixed Pine - (Oak) Igneous - Metamorphic Rock Outcrop CEGL002491

DESCRIPTION: Occurrences are typically a mosaic of exposed bedrock with patches of low vegetation dominated by fruticose lichens and mosses (which cover about 40% of the area) and scattered trees and shrubs. Bare rock (with crustose lichens) covers about 30% of the area. Lichen species include *Cladina rangiferina* and *Cladonia mitis*. Mosses include *Dicranum* spp., *Pleurozium schreberi*, and *Polytrichum* spp. The vascular vegetation is typically sparse and variable from location to location. Scattered trees and shrubs, rarely exceeding 20% in cover, include *Amelanchier* spp., *Diervilla lonicera, Juniperus communis, Pinus banksiana, Pinus resinosa, Pinus strobus, Prunus pensylvanica, Quercus rubra, Salix bebbiana*, and *Vaccinium angustifolium*. The sparse herbaceous layer may include *Agrostis hyemalis, Aralia hispida, Campanula rotundifolia, Corydalis sempervirens, Danthonia spicata, Deschampsia caespitosa, Chamerion angustifolium (= Epilobium angustifolium), Poa compressa*, and *Sibbaldiopsis tridentata (= Potentilla tridentata)* (Ohmann and Ream 1971, Grigal and Ohmann 1975, MNNHP 1993).

Stands are typically comprised of granite or metamorphic rock, and possibly basalt. They occur on relatively level or rounded areas of exposed bedrock. Soil development is minimal, and pH is typically acid (Ohmann and Ream 1971, Grigal and Ohmann 1975, MNNHP 1993). In the Great Lakes, these rock outcrops (or glades) occupy upper portions above the granitic bedrock shorelines (Albert et al. 1995).

Fire appears to be important in maintaining this community. In the absence of fire, these rock outcrops are invaded by trees from surrounding forest types, especially *Pinus banksiana* and *Pinus strobus* and (in more southern examples) *Quercus rubra* (MNNHP 1993).

COMMENTS: *2, MCS*. This type is defined broadly to include a number of granitic and other igneous and metamorphic rock outcrop types. Further study may make clear where further divisions are needed. This type bears some strong resemblance to the Mixed Conifer-Hardwood woodland type, *Quercus ellipsoidalis - Quercus macrocarpa - (Pinus banksiana)* Rocky Woodland that also occurs on granitic shoreline outcrops in Minnesota, but that type contains a dominant woodland canopy. It is distinct from the more boreal Great Lakes Shore basaltic/metamorphic glades, *Picea glauca - Abies balsamea* Basalt - Conglomerate Woodland (CEGL005214), which is more spruce-fir-dominated. In Wisconsin, the type may be found in the Penokee Range, the Lake District of the Nicolet National Forest, Oconto County, and the Menominee Reservation but see also *(Pinus strobus, Quercus rubra) / Danthonia spicata Acid Bedrock Wooded Herbaceous Vegetation* (CEGL005101). See also *Juniperus communis - (Quercus rubra) / Juniperus horizontalis - Arctostaphylos uva-ursi* Shrubland (CEGL005065), which may be the shrubby equivalent of this type. A plant of special interest in Michigan is *Trisetum spicatum* (Albert et al. 1995).

CONSERVATION RANK: *G3G5.*

DISTRIBUTION: This lichen and moss dominated rock outcrop community type is found on and near the Canadian Shield in the northern Great Lakes region and in rocky openings of Northern New England in the United States and elsewhere in Canada.

USFS ECOREGIONS: 212H:CP, 212I:CC, 212J:CC, 212K:CC, 212La:CPP, 212Nc:C??, 222K:CC
CONSERVATION REGIONS: 46:C, 47:C, 48:C, 61:C, 63:C
STATES: MA ME MI MN NH NY WI **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY:
MI bedrock glade +
MN rock outcrop (northeast section) =
WI bedrock glade (boreal mixed pine-(oak) subtype) =

OTHER SYNONYMY: Lichen (Grigal and Ohmann 1975) =. Uncertain if equivalent, Lichen (Ohmann and Ream 1971) =. Uncertain if equivalent

USNVC HIERARCHY: PINUS BANKSIANA / CLADINA SPP. NONVASCULAR ALLIANCE (VI.B.1.N.c)

Pinus banksiana / (Quercus rubra, Quercus ellipsoidalis) Forest

Jack Pine / (Northern Red Oak, Northern Pin Oak) Forest

Jack Pine / Scrub Oak Forest CEGL002440

DESCRIPTION: The overstory is dominated almost exclusively by *Pinus banksiana*. There is a well-developed and diverse sapling/tall-shrub layer dominated by *Acer rubrum, Amelanchier alnifolia, Gaultheria procumbens, Juniperus communis, Prunus pensylvanica, Quercus ellipsoidalis, Quercus rubra*, and *Vaccinium* spp. The ground layer includes the dwarf-shrub *Arctostaphylos uva-ursi* and the forbs *Melampyrum lineare* and *Pteridium aquilinum*. Lichens, especially *Cladonia* spp., are an important ground cover.

This community is found on dry rocky outcrops, typically on ridges or hilltops (Grigal and Ohmann 1975). The soil is shallow, stony, well-drained sand to sandy loam with significant amounts of exposed rock (Kurmis et al. 1986). Soil moisture is low due to its shallow, coarse nature and presence on hillslopes.

COMMENTS: *2, MCS*. Type concept comes from the Minnesota state type: jack pine forest (NE) jack pine - oak subtype (MNNHP 1993). It may also be in Ontario on Canadian Shield near Peterborough. There is no *Quercus rubra* in this type in Michigan or Ontario. Type may have an open, woodland canopy. In Wisconsin, type is unclear and may be confounded with the more common Jack Pine - Northern Pin Oak Forest, *Pinus banksiana - (Pinus resinosa) - Quercus ellipsoidalis / Carex pensylvanica* Forest (CEGL002478), but that type is primarily on sandplains, whereas this type is on bedrock. In Minnesota, particularly in Voyageurs National Park this type may essentially be synonymous with the *Pinus banksiana - (Picea mariana, Pinus strobus) / Vaccinium* spp. Rocky Woodland (CEGL002483) in more open rocky stands, and this type could be characterized as an important subassociation where *Picea mariana* is minor and *Quercus ellipsoidalis* is more common.

CONSERVATION RANK: *G4?.*

DISTRIBUTION: This jack pine / oak forest type is found in the northern regions of the midwestern United States and in central Canada, ranging from northern Minnesota into northwestern Ontario, and possibly elsewhere in the Lake States.

USFS ECOREGIONS: 212Hb:CPP, 212Ja:CPP, 212Jm:CPP, 212Ka:CPP, 212La:CPP, 212Nc:C??
CONSERVATION REGIONS: 47:P, 48:C
STATES: MI? MN **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI? no state equivalent
MN jack pine forest (northeast section) jack pine - oak subtype =

OTHER SYNONYMY: Jack Pine-Oak (Grigal and Ohmann 1975) =, Jack Pine-Oak-*Arctostaphylos* Type (Kurmis et al. 1986) =, Jack Pine (Oak) (Ohmann and Ream 1971) =

USNVC HIERARCHY: PINUS BANKSIANA FOREST ALLIANCE (I.A.8.N.b)

Populus tremuloides - (Populus grandidentata) Rocky Woodland

Quaking Aspen - (Bigtooth Aspen) Rocky Woodland

Mixed Aspen Rocky Woodland CEGL002487

DESCRIPTION: The canopy of this type usually consists of a mix of *Populus tremuloides, Betula papyrifera* and, occasionally, *Populus grandidentata*. Percent cover ranges from 20-60%. There is often a subcanopy (usually about 30% cover) containing the species in the canopy as well as *Abies balsamea, Acer rubrum* and, less commonly, *Quercus ellipsoidalis*. In the patches of soil that exist between the bedrock outcrops, vegetation can be more forest-like. These areas contain a short-shrub layer of *Corylus cornuta* and *Populus* spp. with cover ranging from 20-90%. The herb layer in these patches consists of *Aralia nudicaulis, Pteridium aquilinum* and *Eurybia macrophylla (= Aster macrophyllus)* with cover typically in the 60-70% range. The bedrock outcrops often contain a low cover of *Vaccinium* spp. The herb layer associated with bedrock typically contains *Woodsia ilvensis, Schizachne purpurascens* and *Elymus trachycaulus (= Agropyron trachycaulum)*, with cover usually low (less than 25%). These bedrock areas may also contain a low cover of *Pleurozium schreberi* and *Cladina rangiferina, Cladina mitis*, and *Cladina stellaris* (M. Smith pers. comm. 1999).

This community occurs on bedrock ridges with shallow soils. Soils range from non-existent on bedrock openings to 8-12 cm loams or sandy loams in low areas where soil has developed. Slopes are generally gentle (1-10%) with variable aspects. Exposed bedrock ranges from 5-20%. These sites are rapidly drained (M. Smith pers. comm. 1999).

This type may originate after fires or logging, and many stands may not have a natural origin.

COMMENTS: *3, MCS*. This is found on Isle Royale, Michigan, but it may not be entirely natural. Type is expected on rocky soil in Manitoba, and in Ontario may contain *Prunus virginiana*. When canopy cover is greater than 60% and canopy closure is not prevented by the presence of exposed bedrock, stands are placed in the Aspen-Birch/Boreal Conifer Forest, *Populus tremuloides - Betula papyrifera / (Abies balsamea, Picea glauca)* Forest (CEGL002466). Some stands intermediate between these two communities exist. If woodland physiognomy is evident and the canopy is a mixture of aspen/birch and other conifers, this type can grade into Northern Pin Oak-Bur Oak-(Jack Pine) Rocky Woodland, *Quercus ellipsoidalis - Quercus macrocarpa - (Pinus banksiana)* Rocky Woodland (CEGL005246), but that type has at least 10% (?) oaks in the canopy. Type is not described from northern Ontario (Sims et al. 1989, but see V5).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This type is found in the rocky boreal regions of central Canada and adjacent United States, ranging from Minnesota and Manitoba east to Ontario and possibly Michigan.

USFS ECOREGIONS: 212Ib:CCC, 212La:CCC
CONSERVATION REGIONS: 47:C, 48:C
STATES: MI? MN **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY: MI? northern bald
MN aspen woodland +

OTHER SYNONYMY:

USNVC HIERARCHY: POPULUS TREMULOIDES WOODLAND ALLIANCE (II.B.2.N.a)

Quercus ellipsoidalis - Quercus macrocarpa - (Pinus banksiana) Rocky Woodland

Northern Pin Oak - Bur Oak - (Jack Pine) Rocky Woodland

Boreal Oak - (Pine) Rocky Woodland CEGL005246

DESCRIPTION: This type is characterized by either a canopy dominated by *Quercus ellipsoidalis*, with occasional *Quercus macrocarpa* or *Pinus banksiana*, or with large *Pinus banksiana, Pinus resinosa*, or *Pinus strobus* either forming an emergent canopy over the oak trees, or mixed with the oaks. These evergreen trees may have 25-75% cover. Thus the canopy of this type varies from pure deciduous to mixed evergreen-deciduous. Stands may also vary in canopy cover from 30% (woodland physiognomy) to 90% (forest physiognomy). It is common for open bedrock ridges with oak to be found in a mosaic with more closed oak stands. In both circumstances, *Corylus cornuta, Viburnum rafinesquianum, Quercus ellipsoidalis*, and *Amelanchier* spp. are the most abundant species in the shrub layers and usually cover 20-40% of the forest floor. *Vaccinium angustifolium* is the most common dwarf-shrub and is present at low (<25%) cover. In stands with much exposed bedrock, the dwarf-shrubs *Juniperus communis, Prunus pumila, Arctostaphylos uva-ursi*, and *Comptonia peregrina* may also be present. Cover of the herbaceous layer is highly variable, ranging from 20-80%, with the most abundant herbs being *Pteridium aquilinum, Eurybia macrophylla (= Aster macrophyllus)*, and *Aralia nudicaulis*. Species typical of bedrock outcrops and shallow soils can also be found and include *Danthonia spicata, Poa alsodes, Elymus trachycaulus (= Agropyron trachycaulum), Maianthemum canadense, Schizachne purpurascens*, and *Oryzopsis asperifolia*. The nonvascular layer can be absent or present with up to 30% cover. In the open bedrock areas this layer consists mainly of the lichens *Cladina rangiferina, Cladina mitis*, and *Cladina stellaris* and, to a lesser degree, the mosses *Polytrichum juniperinum, Polytrichum piliferum, Hedwigia ciliata*, and *Orthotrichum* spp. Under the canopy of oaks, the nonvascular strata consists primarily of *Pleurozium schreberi* and *Dicranum* spp. (M. Smith pers. comm. 1999).

This type occurs on ridgetops and high slopes, and some dry, flat, rocky areas. Slopes range from 0-20% with variable aspects. These sites are generally dry, well-drained sites with exposed bedrock typical in the more open stands and commonly covering 10-30% of the ground. In stands with more closed canopies exposed bedrock may be absent. In both cases, soils are fairly rocky, shallow loams, averaging 3-5 cm deep. Occasional cracks in the underlying bedrock results in pockets of relatively deep (15-20 cm) soil (M. Smith pers. comm. 1999).

COMMENTS: *2, MCS*. Diagnostic features of the type are a forest or woodland canopy consisting primarily of *Quercus ellipsoidalis*, with varying amounts of *Quercus macrocarpa, Pinus banksiana, Pinus resinosa* and *Pinus strobus*, and a rocky substrate, with dry herbaceous, moss, and lichen species. Though there are some differences, community analysis indicates that the floristic similarities between the woodland and forest stands warrant including them as open and closed version of this type. This type lacks *Abies balsamea*, and is not evergreen dominated, whereas the Boreal Pine Rocky Woodland, *Pinus banksiana - (Picea mariana, Pinus strobus) / Vaccinium* spp. Rocky Woodland (CEGL002483), almost always contains it, and is evergreen-dominated. Stands of this type on Dryweed Island in Voyageurs National Park are distinct from the stands that occur in the rest of the park, presumably because of the differences in underlying bedrock. In the case of *Quercus macrocarpa* being dominate in the canopy, this type includes only those stands with exposed bedrock and woodland physiognomy. Forested mesic situations with *Quercus macrocarpa* are included in the Northern Bur Oak Mesic Forest, *Quercus macrocarpa / (Amelanchier alnifolia, Cornus drummondii) / Aralia nudicaulis* Forest (CEGL002072).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This oak - (pine) rocky woodland community is found in the boreal regions of the Lake States of the United States, and in central Canada, ranging from northern Minnesota to adjacent northern Ontario, and possibly in Manitoba.

USFS ECOREGIONS: 212La:CCC
CONSERVATION REGIONS: 47:C
STATES: MN **PROVINCES:** MB? ON

MIDWEST HERITAGE SYNONYMY: MN oak woodland-brushland =

OTHER SYNONYMY: Upland Bur Oak (3.3) (Sims et al. 1997) =

USNVC HIERARCHY: QUERCUS MACROCARPA - QUERCUS (ALBA, ELLIPSOIDALIS, VELUTINA) WOODLAND ALLIANCE (II.B.2.N.a)

Pinus banksiana - Thuja occidentalis - Picea glauca / Juniperus communis Woodland

Jack Pine - Northern White-cedar - White Spruce / Common Juniper Woodland

Mixed Conifer / Common Juniper Alvar Woodland CEGL005126

DESCRIPTION: The trees form a partial canopy with 25-60% cover. The tree canopy consists of a variable mixture of *Picea glauca, Thuja occidentalis, Pinus banksiana, Abies balsamea*, and *Pinus strobus*. The understory of this woodland is a mosaic of shrubby patches, exposed pavement, and grassy patches. The most abundant shrub is *Juniperus communis*; other characteristic shrubs include *Juniperus horizontalis, Shepherdia canadensis*, and *Arctostaphylos uva-ursi*. Characteristic herbs include *Isanthus brachiatus (= Trichostema brachiatum), Carex crawei, Packera paupercula (= Senecio pauperculus), Carex eburnea, Carex richardsonii*, and *Sporobolus vaginiflorus*. Areas of exposed limestone or dolostone pavement are common, usually with a cover of mosses such as *Tortella* spp. and *Schistidium* spp., lichens such as *Cladonia rangiferina* and *Peltigera canina*, and rock surface algae such as *Gloeocapsa alpina* (Reschke et al 1998).

Stands occur on shallow soils over flat limestone or dolostone outcrops (pavements) (Reschke et al. 1998).

COMMENTS: *1, MCS*. This type is not as well documented as other alvars and its distribution may be broader than indicated here. This community is closely related to the Juniper Alvar Shrubland, *Juniperus communis - (Juniperus virginiana) - Rhus aromatica - Viburnum rafinesquianum / Oligoneuron album* Shrubland (CEGL005212), and may represent a later successional stage of that community. The main difference between this type and the Juniper Alvar Shrubland is the higher cover of trees (over 5 m tall) in this type (Reschke et al. 1998).

CONSERVATION RANK: *G2?.* This type probably occurs scattered through the Great Lakes region in southern Ontario, northern Michigan, and northern New York, but it has not been well-documented. Nine occurrences of this community have been documented, with a total of over 1334 acres (540 ha).

DISTRIBUTION: This mixed conifer / common juniper alvar woodland type is scattered throughout the Great Lakes region of the United States and Canada, from southern Ontario and northern Michigan to northern New York.

USFS ECOREGIONS: 212Ee:CCC, 212H:CC
CONSERVATION REGIONS: 48:C
STATES: MI NY **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI alvar-glade +

OTHER SYNONYMY:

USNVC HIERARCHY: THUJA OCCIDENTALIS WOODLAND ALLIANCE (II.A.4.N.b)

Thuja occidentalis - Pinus banksiana / Dasiphora fruticosa ssp. floribunda / Clinopodium arkansanum Wooded Herbaceous Vegetation

Northern White-cedar - Jack Pine / Shrubby-cinquefoil / Low Calamint Wooded Herbaceous Vegetation

White-cedar - Jack Pine /Shrubby-cinquefoil Alvar Savanna CEGL005132

DESCRIPTION: This is a savanna community with scattered trees forming an open canopy with 10-25% cover, and a variable understory with shrubby, grassy, and pavement patches. The most abundant trees are *Thuja occidentalis* and *Pinus banksiana*; *Larix laricina* is a common associate. This community has a fairly diverse shrub and herb layer. The most abundant shrubs are dwarf-shrubs (under 0.5 m tall), including *Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda)* and *Juniperus horizontalis*. Characteristic herbs include *Schizachyrium scoparium, Sporobolus heterolepis, Carex scirpoidea, Carex richardsonii, Carex eburnea*, and *Clinopodium arkansanum (= Calamintha arkansana)* (Reschke et al. 1998).

Stands occur on shallow soils over flat limestone outcrops (pavements). This is sometimes a near-shore alvar community, occurring along and near the southern shore of Manitoulin Island and the western shore of the Bruce Peninsula (Reschke et al. 1998).

COMMENTS: *1, MCS*. This type may have both an open canopy (woodland) and a scattered canopy (wooded herbaceous). Characteristic herbs are similar to Little Bluestem Alvar Grassland, *Sporobolus heterolepis - Schizachyrium scoparium - (Carex scirpoidea) / (Juniperus horizontalis)* Herbaceous Vegetation (CEGL005234).

CONSERVATION RANK: *G1G2.* This white cedar alvar savanna/woodland is found in the upper Great Lakes region, primarily in Ontario, Canada, on Manitoulin Island and the Bruce Peninsula. Currently 11 occurrences have been documented, with a total area of over 812 acres (330 ha). More surveys of this community are needed to map and determine acreage of occurrences.

DISTRIBUTION: The white-cedar - jack pine / shrubby-cinquefoil alvar savanna type is found in the upper Great Lakes region of the United States and Canada, primarily in Ontario, on Manitoulin Island and the Bruce Peninsula.

USFS ECOREGIONS: 212Pa:CCC, 212Pc:CCC
CONSERVATION REGIONS: 48:C
STATES: MI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI alvar-shrubland +

OTHER SYNONYMY:

USNVC HIERARCHY: THUJA OCCIDENTALIS WOODED HERBACEOUS ALLIANCE (V.A.6.N.f)

Juniperus communis - (Juniperus virginiana) - Rhus aromatica - Viburnum rafinesquianum / Oligoneuron album Shrubland

Common Juniper - (Eastern Red-cedar) - Fragrant Sumac - Downy Arrow-wood / Prairie Goldenrod Shrubland

Juniper Alvar Shrubland CEGL005212

DESCRIPTION: Shrubs dominate, with over 25% cover of tall, short, and dwarf-shrubs; the average is about 43% cover of shrubs, with less than 10% of that being tall shrubs. Characteristic tall shrubs (2-5 m tall) are scrub forms of trees such as *Juniperus virginiana, Thuja occidentalis*, and *Quercus macrocarpa*. Tree forms (>5 m tall) of these species may be present, but trees have less than 10% cover in the community. Other less common trees (>5 m tall) that may be present include *Carya ovata, Ulmus thomasii*, and *Fraxinus americana*. Characteristic short shrubs (0.5-2 m tall) include *Juniperus communis, Cornus racemosa (= Cornus foemina ssp. racemosa), Rhus aromatica, Prunus virginiana*, and *Viburnum rafinesquianum*. Some dwarf-shrubs (under 0.5 m tall) are usually present, including *Arctostaphylos uva-ursi* and *Symphoricarpos albus*. Characteristic vines include *Toxicodendron radicans* and *Vitis riparia*. The herb layer forms a dry, grassy meadow between the shrubs; average cover of herbs is about 23%. The most abundant herbs are *Danthonia spicata, Oligoneuron album (= Solidago ptarmicoides)*, and *Carex umbellata*. Less than 50% of the ground surface is exposed limestone bedrock, which is usually covered with lichens, mosses, and algae (Reschke et al. 1998).

Stands occur on very shallow soils (usually less than 30 cm deep) over flat limestone outcrops (pavements). Moisture varies over the season, but summer droughts are typical. Grikes (eroded cracks in the rock up to 2 m or more deep and extending 5 to 30 m in length) may occur, with shrubs and trees rooted in the cracks (Reschke et al. 1998).

Summer droughts are typical (Reschke et al. 1998).

COMMENTS: *1, MCS*. More northern stands may be more heavily dominated by *Juniperus communis*, and species such as *Abies balsamea, Aquilegia canadensis, Arctostaphylos uva-ursi*, and *Picea glauca* may be more common, and deciduous trees and shrubs are less common. Juniper Alvar Shrublands often occur in a patchy landscape mosaic with other alvar communities, including Tufted Hairgrass Wet Alvar Grassland, *Deschampsia caespitosa - (Sporobolus heterolepis, Schizachyrium scoparium) - Carex crawei - Packera paupercula* Herbaceous Vegetation (CEGL005110); Little Bluestem Alvar Grassland, *Sporobolus heterolepis - Schizachyrium scoparium - (Carex scirpoidea) / (Juniperus horizontalis)* Herbaceous Vegetation (CEGL005234); Annual Alvar Pavement-Grassland, *Sporobolus neglectus - Sporobolus vaginiflorus - Isanthus brachiatus - Panicum philadelphicum - (Poa compressa)* Herbaceous Vegetation (CEGL005235); Alvar Nonvascular Pavement, *Tortella tortuosa - Cladonia pocillum - Placynthium* spp. Sparse Vegetation (CEGL005192); and Poverty Grass Dry Alvar Grassland, *Danthonia spicata - Poa compressa - (Schizachyrium scoparium)* Herbaceous Vegetation (CEGL005100).

CONSERVATION RANK: *G3.* This community occurs throughout the Great Lakes basin in New York, Ontario, Ohio, Michigan, and Wisconsin. Thirty-five occurrences of this community were documented, with a total of about 7768 acres (3144 ha). Juniper alvar shrubland occurs in small to large patches; some of the larger patches form a small-scale matrix within which smaller openings of alvar grasslands and pavements may occur. Sizes of currently known occurrences range from under 10 acres to about 1600 acres (4 to about 650 ha). The global rank of this community (as compared to G2-ranked alvar grasslands with similar numbers of occurrences and acres) reflects our expectation that there are more examples of this community that we have not surveyed, including some sites too disturbed to be considered viable. The threats to this community do not seem to be as imminent as threats to the alvar grasslands, and since the soils are only briefly saturated (just after a rainfall), they are less vulnerable to disturbance by off-road vehicles.

DISTRIBUTION: This juniper alvar shrubland type occurs throughout the Great Lakes region of the United States and Canada, in northern New York, southern Ontario, northern Ohio, northern Michigan, and eastern Wisconsin.

USFS ECOREGIONS: 212Ee:CCC, 212H:CC, 222Qa:CCC
CONSERVATION REGIONS: 48:C
STATES: MI NY OH WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

MI	alvar-shrubland +
OH	shoreline alvar +
WI	alvar shrubland =

OTHER SYNONYMY:

USNVC HIERARCHY: JUNIPERUS COMMUNIS SHRUBLAND ALLIANCE (III.A.3.N.a)

Juniperus horizontalis - Dasiphora fruticosa ssp. floribunda / Schizachyrium scoparium - Carex richardsonii Dwarf-shrubland

Creeping Juniper - Shrubby-cinquefoil / Little Bluestem - Richardson's Sedge Dwarf-shrubland

Creeping Juniper - Shrubby-cinquefoil Alvar Pavement CEGL005236

DESCRIPTION: This community has at least 25% cover of dwarf-shrubs (under 0.5 m tall); the dominant shrubs are *Juniperus horizontalis*, and/or *Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda)*. Other characteristic species include *Schizachyrium scoparium, Carex richardsonii, Carex scirpoidea, Pinus banksiana, Thuja occidentalis, Danthonia spicata, Oligoneuron album (= Solidago ptarmicoides), Packera paupercula (= Senecio pauperculus), Clinopodium arkansanum (= Calamintha arkansana)*, and *Tetraneuris herbacea (= Hymenoxys herbacea)*. This community has less than 50% cover of herbaceous plants, and less than 10% cover of trees over 5 m tall. This community is closely related to little bluestem alvar grassland, and the two communities are frequently interspersed. The primary distinction is that the creeping juniper - shrubby cinquefoil alvar pavement community has dwarf-shrubs as the tallest vegetation layer covering at least 25% of the area; whereas little bluestem alvar grassland has grasses and sedges as a taller layer, with dwarf-shrubs, especially creeping juniper, growing primarily underneath the grasses and sedges. There is often a lot of exposed dolostone bedrock pavement, but exposed bedrock is always less than 50% of the ground surface area. Much of the exposed rock surface is covered with microscopic algae (e.g. *Gloeocapsa alpina*). Mosses and lichens are common, including *Tortella tortuosa, Schistidium rivulare, Placynthium nigrum* and *Cetraria arenaria* (Reschke et al. 1998).

Stands occur on very shallow soils (usually less than 10 cm deep) over flat dolostone outcrops (pavements). The surface of the dolostone pavement is often broken into small pieces (from 1 cm to 1 m in the longest dimension) by frost heaving, sometimes called rubble pavement. These pavements are typically very droughty in summer, except right after rainfall, when ephemeral shallow pools can form on the bedrock surface (Reschke et al. 1998).

COMMENTS: *1, MCS*. This community is closely related to Little Bluestem Alvar Grassland, *Sporobolus heterolepis - Schizachyrium scoparium - (Carex scirpoidea) / (Juniperus horizontalis)* Herbaceous Vegetation (CEGL005234), and the two communities are frequently interspersed. The primary distinction is that this type has dwarf shrubs as the tallest vegetation layer covering at least 25% of the area; whereas Little Bluestem Alvar Grassland has grasses and sedges as a taller layer, with dwarf shrubs, especially creeping juniper, growing primarily underneath the grasses and sedges. This type forms a more extensive patchy landscape mosaic with other alvar communities, most commonly with Little Bluestem Alvar Grassland (CEGL005234); Tufted Hairgrass Wet Alvar Grassland, *Deschampsia caespitosa - (Sporobolus heterolepis, Schizachyrium scoparium) - Carex crawei - Packera paupercula* Herbaceous Vegetation (CEGL005110); Juniper Alvar Shrubland, *Juniperus communis - (Juniperus virginiana) - Rhus aromatica - Viburnum rafinesquianum / Oligoneuron album* Shrubland (CEGL005212); and Alvar Nonvascular Pavement, *Tortella tortuosa - Cladonia pocillum - Placynthium* spp. Sparse Vegetation (CEGL005192).

CONSERVATION RANK: *G2.* This dwarf-shrubland community occurs in the Great Lakes basin in Ontario (primarily on the Bruce Peninsula, Manitoulin Island, the islands north of Manitoulin) and at 3 sites in northern Michigan. Twenty-four occurrences of this community were documented, with a total area of about 2700 acres (1093 ha). Creeping juniper - shrubby cinquefoil alvar pavement occurs in small to large patches. Sizes of currently known occurrences range from under 5 acres to about 550 acres (2 to about 220 ha). Some of the largest sites on and near Manitoulin Island (Ontario) are threatened with development of quarries, potential residential development, disturbance by cattle grazing, and collection of glacial erratic rocks (for landscape rocks) using heavy construction vehicles that cause extensive disturbances to shallow soils and hydrology.

DISTRIBUTION: The creeping juniper - shrubby-cinquefoil alvar pavement type occurs in the Great Lakes region of the United States and Canada, where it is found in Ontario (primarily on the Bruce Peninsula, Manitoulin Island, the islands north of Manitoulin) and in northern Michigan.

USFS ECOREGIONS: 212H:CC, 212Pc:CCC
CONSERVATION REGIONS: 48:C
STATES: MI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI alvar-shrubland +

OTHER SYNONYMY:

USNVC HIERARCHY: JUNIPERUS HORIZONTALIS DWARF-SHRUBLAND ALLIANCE (IV.A.1.N.b)

Picea glauca - Thuja occidentalis - Juniperus communis / Iris lacustris - Carex eburnea Shrubland

White Spruce - Northern White-cedar - Common Juniper / Dwarf Lake Iris - Bristleleaf Sedge Shrubland

Scrub Conifer / Dwarf Lake Iris Alvar Shrubland CEGL005211

DESCRIPTION: The vegetation contains over 25% cover of tall and short shrubs. The tall shrubs (2-5 m tall) in this shrubland are scrub forms of tree species such as *Picea glauca, Thuja occidentalis, Larix laricina*, and *Abies balsamea*. There is less than 10% cover of trees over 5 m tall. The typical short shrubs (0.5-2 m tall) are *Juniperus communis, Prunus virginiana, Diervilla lonicera, Shepherdia canadensis, Cornus sericea*, and *Rhamnus alnifolia*. Underneath and between the shrubs is a 'lawn' dominated by *Iris lacustris* and *Carex eburnea*. Other characteristic species are *Arctostaphylos uva-ursi, Carex richardsonii*, and *Danthonia spicata*. The herbaceous layer has an average of 82% cover. Less than 10% of the ground surface is exposed bedrock, including bedrock covered with lichens and mosses (Reschke et al. 1998).

Stands occur on very shallow organic soils (usually 20-30 cm deep) over flat limestone or dolostone outcrops (pavements). This community has a characteristic soil moisture regime of seasonal flooding or saturation in early spring and late fall, combined with summer dry periods in most years (except unusually wet years) (Reschke et al. 1998).

Extreme drought and perhaps very occasional fires (Reschke et al. 1998).

COMMENTS: *1, MCS*. This community often occurs as openings within a forested landscape; it is not always associated with other alvar communities. When it occurs in a landscape mosaic with other alvar communities, it typically occurs as small patches adjacent to Little Bluestem Alvar Grassland, *Sporobolus heterolepis - Schizachyrium scoparium - (Carex scirpoidea) / (Juniperus horizontalis)* Herbaceous Vegetation (CEGL005234); Creeping Juniper - Shrubby-cinquefoil Alvar Pavement, *Juniperus horizontalis - Dasiphora fruticosa ssp. floribunda / Schizachyrium scoparium - Carex richardsonii* Dwarf-shrubland (CEGL005236); and Tufted Hairgrass Wet Alvar Grassland, *Deschampsia caespitosa - (Sporobolus heterolepis, Schizachyrium scoparium) - Carex crawei - Packera paupercula* Herbaceous Vegetation (CEGL005110). Compare with *Thuja occidentalis* Limestone Bedrock Woodland (CEGL005050).

CONSERVATION RANK: *G1G2.* This shrubland community occurs in the central Great Lakes region in northern Michigan, and in Ontario on the southern shores of Manitoulin Island and the Bruce Peninsula. Ten occurrences of this community were documented, with a total area of 815 acres (330 ha). Scrub conifer / dwarf lake iris alvar shrublands usually occur in small to large patches. Sizes of currently known occurrences range from under 5 acres to about 300 acres (2 to 120 ha).

DISTRIBUTION: This alvar type is found in the central Great Lakes region of the United States and Canada, in northern Michigan, and in Ontario on the southern shores of Manitoulin Island and the Bruce Peninsula.

USFS ECOREGIONS: 212H:CC, 212Pc:CCC
CONSERVATION REGIONS: 48:P
STATES: MI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI alvar-shrubland +

OTHER SYNONYMY:

USNVC HIERARCHY: JUNIPERUS COMMUNIS SHRUBLAND ALLIANCE (III.A.3.N.a)

Danthonia spicata - Poa compressa - (Schizachyrium scoparium) Herbaceous Vegetation

Poverty Grass - Canada Bluegrass - (Little Bluestem) Herbaceous Vegetation

Poverty Grass Dry Alvar Grassland CEGL005100

DESCRIPTION: The vegetation contains a grassland cover dominated by *Danthonia spicata* and *Poa compressa*, and sometimes *Schizachyrium scoparium*. There is less than 10% cover of trees, and less than 25% cover of shrubs. There is usually about 50% cover of herbs, and up to about 50% cover of nonvascular plants (mosses, lichens, and algae) growing on exposed limestone or dolostone pavement areas that occur as patches within the grassland. These grasslands are sometimes disturbed by grazing, which introduces exotic species and pasture grasses such as *Phleum pratense* (Reschke et al. 1998).

Stands occur on shallow soils over flat limestone and dolostone outcrops (pavements). Soils of poverty grass dry alvar grasslands are very shallow loams (usually less than 10 cm deep). This community has a characteristic soil moisture regime of summer drought in most years. This grassland seems to occur on well-drained soils that are rarely, if ever, saturated or flooded; this interpretation is based on soil texture (Reschke et al. 1998).

COMMENTS: *1, MCS*. Name of this type needs review, as it lacks good diagnostic species to associate it with alvar. This community may occur in a patchy landscape mosaic with other alvar communities, most commonly Juniper Alvar Shrubland, *Juniperus communis - (Juniperus virginiana) - Rhus aromatica - Viburnum rafinesquianum / Oligoneuron album* Shrubland (CEGL005212); and Annual Alvar Pavement Grassland, *Sporobolus neglectus - Sporobolus vaginiflorus - Isanthus brachiatus - Panicum philadelphicum - (Poa compressa)* Herbaceous Vegetation (CEGL005235).

CONSERVATION RANK: *G2?*. Poverty grass dry alvar grassland occurs in the Great Lakes region in southern Ontario, northern New York, and northern Michigan, with 17 documented occurrences and a total area of over 467 acres (189 ha). There may be many more occurrences of this community, but many are very disturbed by grazing and dominated by exotic species. Poverty grass dry alvar grassland usually occurs in small to large patches. Sizes of currently known occurrences range from under 2 acres to about 100 acres (0.8 to 40 ha).

DISTRIBUTION: The poverty grass dry alvar grassland type occurs in the Great Lakes region of the United States and Canada, being found in southern Ontario, northern New York, and northern Michigan.

USFS ECOREGIONS: 212Ee:CCC, 212H:CC, 212Pc:CCC
CONSERVATION REGIONS: 48:C
STATES: MI NY **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI alvar-grassland +

OTHER SYNONYMY:

USNVC HIERARCHY: DANTHONIA SPICATA HERBACEOUS ALLIANCE (V.A.5.N.e)

Deschampsia caespitosa - (Sporobolus heterolepis, Schizachyrium scoparium) - Carex crawei - Packera paupercula Herbaceous Vegetation

Tufted Hairgrass - (Prairie Dropseed, Little Bluestem) - Crawe's Sedge - Balsam Ragwort Herbaceous Vegetation

Tufted Hairgrass Wet Alvar Grassland CEGL005110

DESCRIPTION: The dominant grasses and sedges are *Deschampsia caespitosa, Carex crawei, Sporobolus heterolepis*, and *Eleocharis compressa*. Other characteristic grasses and herbs include *Packera paupercula (= Senecio pauperculus), Sporobolus neglectus, Sporobolus vaginiflorus, Isanthus brachiatus (= Trichostema brachiatum)*, and *Allium schoenoprasum*. Typically there are several turf and weft mosses forming a patchy mat at the base of grasses and forbs; typical mosses are *Bryum pseudotriquetrum, Abietinella abietina, Tortella tortuosa*, and *Drepanocladus* spp. There are very few shrubs in this grassland community (usually less than 1% cover). The community often includes small patches of exposed bedrock pavement (patches are less than 1.25 acres or 0.5 ha) (Reschke et al. 1998).

Stands occur on very shallow, organic soils that cover flat limestone and dolostone outcrops (pavements). Average soil depths in this grassland community are less than 10 cm. This community has a characteristic soil moisture regime of alternating wet and dry seasons; many of them have flooded or saturated soils in early spring and late fall, combined with summer drought in most years. They usually occur in a patchy landscape mosaic with other alvar communities; in these landscape mosaics, this type usually occupies the lowest, wettest positions; the actual elevation differences may be very subtle, with differences of less than 10 or 15 cm (Reschke et al. 1998).

Windthrow is common in alvar probably because of the thin soils and proximity to major streams (which often funnel windstorms) and the Great Lakes. The thin soils are also droughty, giving the potential for tree-killing drought or ground fires. Thus, the plant community is maintained as primarily herbs and shrubs. Flooding after spring snow melt may also limit tree growth by creating anaerobic conditions for a few weeks (Reschke et al. 1998).

COMMENTS: *1, MCS*. This type usually occur in a patchy landscape mosaic with other alvar communities, including Annual Alvar Pavement Grassland, *Sporobolus neglectus - Sporobolus vaginiflorus - Isanthus brachiatus - Panicum philadelphicum - (Poa compressa)* Herbaceous Vegetation (CEGL005235); Little Bluestem Alvar Grassland, *Sporobolus heterolepis - Schizachyrium scoparium - (Carex scirpoidea) / (Juniperus horizontalis)* Herbaceous Vegetation (CEGL005234); Alvar Nonvascular Pavement, *Tortella tortuosa - Cladonia pocillum - Placynthium* spp. Sparse Vegetation (CEGL005192); and Juniper Alvar Shrubland, *Juniperus communis - (Juniperus virginiana) - Rhus aromatica - Viburnum rafinesquianum / Oligoneuron album* Shrubland (CEGL005212).

CONSERVATION RANK: *G2.* Tufted hairgrass wet alvar grasslands have a very restricted natural distribution; they occur in the Great Lakes region in northern Michigan, southern Ontario, and northern New York. Thirty-six occurrences of this community have been documented, with a total of about 3440 acres (1392 ha). These grasslands occur in small to large patches ranging from under 2 acres to about 100 acres (0.8 to 40 ha). Some of the largest sites on and near Manitoulin Island (Ontario) and in the Carden Plain (Ontario) are threatened with development of quarries, potential residential development, disturbance by cattle grazing, and collection of glacial erratic rocks (for landscape rocks) using heavy construction vehicles that cause extensive disturbances to shallow soils and hydrology. The number of occurrences is a little higher than the usual range of 6 to 20 occurrences for a rank of G2, but the low total acreage and significant threats resulted in the G2 rank.

DISTRIBUTION: The tufted hairgrass wet alvar grassland occurs in the Great Lakes region of the United States and Canada, ranging from northern Michigan and southern Ontario to northern New York .

USFS ECOREGIONS: 212Ee:CCC, 212Hb:CCC, 212Hj:CCC, 212Pa:CCC, 222If:C??
CONSERVATION REGIONS: 48:C
STATES: MI NY **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI alvar-grassland +

OTHER SYNONYMY:

USNVC HIERARCHY: SPOROBOLUS HETEROLEPIS - (DESCHAMPSIA CAESPITOSA, SCHIZACHYRIUM SCOPARIUM) HERBACEOUS ALLIANCE (V.A.5.N.c)

Spartina pectinata - Muhlenbergia richardsonis - Sporobolus heterolepis - Oligoneuron album - Euthamia graminifolia Herbaceous Vegetation

Prairie Cordgrass - Mat Muhly - Prairie Dropseed - Prairie Goldenrod - Flat-top Goldentop Herbaceous Vegetation

River Ledge Limestone Pavement CEGL005233

DESCRIPTION: Typically, the community has an open canopy with less than 10% cover of trees or shrubs. The ground layer is dominated by grasses and sedges, or a mosaic of pavement patches and grassy patches. Cover of herbs is variable, with some areas having nearly 100% cover, and other areas having a lot of exposed rock pavement, with as little as 15% cover of herbs, and these confined to linear rock crevices. Characteristic species include *Euthamia graminifolia, Muhlenbergia richardsonis, Oligoneuron album (= Solidago ptarmicoides), Spartina pectinata*, and *Sporobolus heterolepis* (Reschke et al. 1998).

Stands occur as small patches on limestone ledges along river shores (Reschke et al. 1998).

Ice scour by river water and ice occur during periods of peak water flow (Reschke et al. 1998).

COMMENTS: *2, MCS*. This community type is not considered alvar because the river shoreline processes (including annual flooding and ice-scouring) seem to be more important influences of plant species composition and structure than the processes characteristic of alvar communities (such as alternating wet and dry soil moisture regimes and infrequent fire). This community also seems distinct from alvar types because of the dominance of *Spartina pectinata* and *Muhlenbergia richardsonis*, which are not found in other alvar types (Reschke et al. 1998).

CONSERVATION RANK: *G1*. This pavement community is known from four sites, two in northern Michigan along the Escanaba River, one in Ontario along the Maitland River, and one in New York along the Black River. Type is present in Wisconsin, but is extremely rare and no good EOs are known. A few occurrences may yet be found elsewhere. Only preliminary surveys have been conducted at the Ontario and New York sites, and their sizes are unknown. The Michigan sites have a total of 45 acres (15 ha).

DISTRIBUTION: This river ledge pavement community is found in the United States and Canada, ranging from northern Michigan, northern Wisconsin and southern Ontario to northern New York.

USFS ECOREGIONS: 212Ee:CCC, 212H:CC
CONSERVATION REGIONS: 48:C
STATES: MI NY WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI alvar-pavement +
WI river pavement (limestone subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: OPEN PAVEMENT SPARSE VEGETATION ALLIANCE (VII.A.2.N.a)

Sporobolus heterolepis - Schizachyrium scoparium - (Carex scirpoidea) / (Juniperus horizontalis) Herbaceous Vegetation

Prairie Dropseed - Little Bluestem - (Scirpus-like Sedge) / (Creeping Juniper) Herbaceous Vegetation

Little Bluestem Alvar Grassland CEGL005234

DESCRIPTION: The vegetation is dominated by grasses and sedges, which usually have at least 50% cover. Characteristic species of the grassland are *Sporobolus heterolepis, Schizachyrium scoparium, Juniperus horizontalis, Carex scirpoidea, Deschampsia caespitosa, Packera paupercula (= Senecio pauperculus)*, and *Carex crawei*. There is usually less than 10% cover of shrubs over 0.5 m tall; however there may be as much as 50% cover of dwarf-shrubs (under 0.5 m tall) especially *Juniperus horizontalis*. This dwarf-shrub is shorter than the dominant grasses, and usually is found under the canopy of grasses, so the physiognomic type here is considered a grassland (in spite of relatively high cover of dwarf-shrubs). Less than 50% of the ground surface is exposed bedrock (including bedrock covered with nonvascular plants: lichens, mosses, algae).

These grasslands occur on very shallow, patchy soils (usually less than 20 cm deep, average is about 6 cm deep) on flat limestone and dolostone outcrops (pavements). Soils are loams high in organic matter. This community often has a characteristic soil moisture regime of alternating wet and dry periods; they can have wet, saturated soils in spring and fall, combined with summer drought in most years (except unusually wet years). In large patches over 50 acres (20 ha) this grassland often occurs as a small-scale matrix, with smaller patches of other alvar communities occurring within the larger patch of little bluestem alvar grassland, forming a landscape mosaic (Reschke et al. 1998).

COMMENTS: *1, MCS*. The most commonly associated alvar communities that occur with this community in a landscape mosaic are Creeping Juniper - Shrubby-cinquefoil Alvar Pavement Shrubland, *Juniperus horizontalis - Dasiphora fruticosa ssp. floribunda / Schizachyrium scoparium - Carex richardsonii* Dwarf-shrubland (CEGL005236); Tufted Hairgrass Wet Alvar Grassland, *Deschampsia caespitosa - (Sporobolus heterolepis, Schizachyrium scoparium) - Carex crawei - Packera paupercula* Herbaceous Vegetation (CEGL005110); Alvar Nonvascular Pavement, *Tortella tortuosa - Cladonia pocillum - Placynthium* spp. Sparse Vegetation (CEGL005192); and White-cedar - Jack Pine / Shrubby-cinquefoil Alvar Savanna, *Thuja occidentalis - Pinus banksiana / Dasiphora fruticosa ssp. floribunda / Clinopodium arkansanum* Wooded Herbaceous Vegetation (CEGL005132) (Reschke et al. 1998).

CONSERVATION RANK: *G2.* Little bluestem alvar grasslands are found primarily in the upper Great Lakes region of northern Michigan, and in Ontario on Manitoulin Island and vicinity, on the Bruce Peninsula, and at a few sites further east in the Carden Plain and Burnt Lands. Thirty-six occurrences of this community have been documented, with a total of about 7074 acres (2860 ha). Little bluestem alvar grasslands occur in small to large patches, ranging in size from less than 5 acres to over 3000 acres (<2 to >1214 ha). Some of the largest sites on and near Manitoulin Island (Ontario), and in the Carden Plain (Ontario) are threatened with development of quarries, potential residential development, disturbance by cattle grazing, and collection of glacial erratic rocks (for landscape rocks) using heavy construction vehicles that cause extensive disturbances to shallow soils and hydrology. Although this community has twice the acreage as Tufted Hairgrass Wet Alvar Grassland (CEGL005110), it has the same global rank due to imminent threats to the single largest occurrence, which makes up nearly half the total acreage.

DISTRIBUTION: The little bluestem alvar grassland type is found primarily in the upper Great Lakes region of the United States and Canada, in northern Michigan, and in Ontario on Manitoulin Island and vicinity, on the Bruce Peninsula, and at a few sites further east in the Carden Plain and Burnt Lands.

USFS ECOREGIONS: 212H:CC, 212Pc:CCC
CONSERVATION REGIONS: 48:C
STATES: MI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI alvar-grassland +

OTHER SYNONYMY:

USNVC HIERARCHY: SPOROBOLUS HETEROLEPIS - (DESCHAMPSIA CAESPITOSA, SCHIZACHYRIUM SCOPARIUM) HERBACEOUS ALLIANCE (V.A.5.N.c)

Tortella tortuosa - Cladonia pocillum - Placynthium spp. Sparse Vegetation

Twisted Moss - Cup Lichen - Crustose Lichen Species Sparse Vegetation

Alvar Nonvascular Pavement CEGL005192

DESCRIPTION: Alvar nonvascular pavement consists of exposed, flat limestone or dolostone pavement that is sparsely vegetated with a mosaic of mossy patches and exposed bedrock that is covered with crustose and foliose lichens. In the mossy patches, characteristic mosses are *Tortella tortuosa*, other *Tortella* spp., and *Tortula ruralis*; a characteristic lichen is *Cladonia pocillum*. On exposed pavement patches, characteristic lichens are *Placynthium nigrum* and *Dermatocarpon cf. miniatum*. Very small herbs (under 15 cm (6 inches) tall), grow in the mossy patches, including *Saxifraga virginiensis, Penstemon hirsutus, Potentilla norvegica, Isanthus brachiatus (= Trichostema brachiatum), Fragaria virginiana, Minuartia michauxii var. michauxii*, and *Houstonia longifolia*. Some taller herbs and low shrubs grow primarily in slightly deeper soils of rock crevices that crisscross the pavement, including *Solidago nemoralis, Symphoricarpos albus, Vitis riparia, Aquilegia canadensis*, and *Hieracium piloselloides*. There is usually less than 15% cover of herbs. Usually a few trees and shrubs are rooted in deep crevices of the pavement; characteristic trees and shrubs that occur sparsely include *Thuja occidentalis, Juniperus communis, Betula papyrifera, Juniperus virginiana, Juglans cinerea*, and *Picea glauca*. There is less than 10% total cover of trees, and less than 10% total cover of shrubs. There is a lot of exposed bedrock, and much of it is covered with lichens and mosses (average cover of lichens and mosses is about 55%) (Reschke et al. 1998).

Stands occur on flat limestone and dolostone outcrops (pavements). Soils of alvar nonvascular pavement are either lacking or very shallow (usually less than 10 cm deep). This community typically has a soil moisture regime characterized by severe summer drought, as well as high summer temperatures (Reschke et al. 1998).

COMMENTS: *1, MCS*. Alvar nonvascular pavements usually occur in a patchy landscape mosaic with other alvar communities, including Annual Alvar Pavement Grassland, *Sporobolus neglectus - Sporobolus vaginiflorus - Isanthus brachiatus - Panicum philadelphicum - (Poa compressa)* Herbaceous Vegetation (CEGL005235); Creeping Juniper - Shrubby-cinquefoil Alvar Pavement, *Juniperus horizontalis - Dasiphora fruticosa ssp. floribunda / Schizachyrium scoparium - Carex richardsonii* Dwarf-shrubland (CEGL005236); Little Bluestem Alvar Grassland, *Sporobolus heterolepis - Schizachyrium scoparium - (Carex scirpoidea) / (Juniperus horizontalis)* Herbaceous Vegetation (CEGL005234); Tufted Hairgrass Wet Alvar Grassland, *Deschampsia caespitosa - (Sporobolus heterolepis, Schizachyrium scoparium) - Carex crawei - Packera paupercula* Herbaceous Vegetation (CEGL005110); and Juniper Alvar Shrubland, *Juniperus communis - (Juniperus virginiana) - Rhus aromatica - Viburnum rafinesquianum / Oligoneuron album* Shrubland (CEGL005212).

CONSERVATION RANK: *G2.* Alvar nonvascular pavement is a rock outcrop community that occurs throughout the Great Lakes region on flat outcrops of limestone and dolostone. The largest examples are in Ontario, Canada near Lake Huron on the southern shore of Manitoulin Island and the western shore of the Bruce Peninsula; smaller examples are found in other parts of southern Ontario, northern Michigan, northern Ohio (Kelley's Island), and northern New York. Alvar nonvascular pavements usually occur in small to large patches; sizes of currently documented patches range from under 1.25 acres to over 200 acres (<0.5 to >80 ha). Nineteen occurrences of this community that met the minimum mapping criterion of at least 1.25 acres (0.5 ha) have been documented, with a total area of about 1424 acres (576 ha). This community is frequently observed in small patches (often smaller than 1.25 acres) within other alvar communities.

DISTRIBUTION: Alvar nonvascular pavement is a rock outcrop community that occurs throughout the Great Lakes region of the United States and Canada, from central and southern Ontario to northern parts of Michigan, Ohio, and New York. Stands occur in Ontario, near Lake Huron on the southern shore of Manitoulin Island and the western shore of the Bruce Peninsula, as well as in other parts of southern Ontario, northern Michigan, northern Ohio, and northern New York.

USFS ECOREGIONS: 212Ee:CCC, 212Hj:CCC, 212Pc:CCC, 222Qa:CCC
CONSERVATION REGIONS: 48:C
STATES: MI NY OH **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI alvar-pavement +
OH shoreline alvar +

OTHER SYNONYMY:

USNVC HIERARCHY: OPEN PAVEMENT SPARSE VEGETATION ALLIANCE (VII.A.2.N.a)

Quartzite - Granite Rock Outcrop Sparse Vegetation

Quartzite - Granite Rock Outcrop Sparse Vegetation

Northern Tallgrass Quartzite - Granite Rock Outcrop CEGL002298

DESCRIPTION: This community, in Minnesota and South Dakota contains a sparse vegetation layer, with scattered succulents and many annuals. Vegetation growing in the patchy soils include *Opuntia fragilis, Opuntia macrorhiza, Escobaria vivipara (= Coryphantha vivipara)*, and *Lomatium orientale*, as well as *Selaginella rupestris, Talinum parviflorum, Woodsia ilvensis*, and a variety of spring and summer blooming annuals (MNNHP 1993).

There is little soil development, and most plant species present grow in shallow, dry soil that collects in small depressions on sloping rock faces. The outcrops are composed primarily of Sioux quartzite, granite and gneiss. The species that persist in the community must survive extreme drought and great fluctuations in the temperature of the ground surface (MNNHP 1993).

Fire appears to be important in maintaining this community. Trees and shrubs invade in the absence of fire. *Juniperus virginiana* is an invader throughout the range of this type, displacing the herbs, lichens, and mosses that characterize the community (MNNHP 1993).

COMMENTS: *2, MCS*. Type is not well characterized in South Dakota.

CONSERVATION RANK: *G3?.* This type has a restricted distribution, and may always have been relatively scarce. At least 4 A-B ranked EOs are known in western Minnesota and none are known from eastern South Dakota.

DISTRIBUTION: This quartzite-granite rock outcrop community type is found on rocky, relatively level or hilly regions in the northern tallgrass region of the upper midwestern United States. In particular it is found in Minnesota in the Minnesota River Valley between New Ulm and Ortonville and in Cottonwood, Pipestone, and Rock counties, and in eastern South Dakota it is found east and west of Sioux Falls, and, at least historically, around Millbank. It may be found in Manitoba, but verification is needed.

USFS ECOREGIONS: 251Ba:CCC
CONSERVATION REGIONS: 35:C
STATES: MN SD **PROVINCES:** MB

MIDWEST HERITAGE SYNONYMY: MN rock outcrop (southwest section) =

OTHER SYNONYMY:

USNVC HIERARCHY: ROCK OUTCROP SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

Quercus alba - Carya ovata / Carex pensylvanica - Heuchera richardsonii Quartzite Glade Woodland

White Oak - Shagbark Hickory / Pennsylvania Sedge - Prairie Alumroot Quartzite Glade Woodland

Midwestern Oak Woodland - Quartzite Glade CEGL005276

DESCRIPTION: These glades represent forest openings dominated by relatively even-spaced, small-statured trees and a sparse shrub and sapling layer. The tree canopy is fairly closed, averaging about 75% (range of 57-82%). Either *Quercus alba* or *Carya ovata* dominate the canopy. *Quercus velutina* and *Quercus rubra* are much less common. Shrubs are nearly absent from all glades, with *Ribes* spp. and *Viburnum rafinesquianum* the more common species. The most abundant saplings are *Fraxinus pennsylvanica, Ostrya virginiana*, and *Quercus rubra*. Excluding tree seedlings, the ten most common understory species found in these glades are *Carex pensylvanica, Antennaria plantaginifolia, Poa compressa, Anemone quinquefolia, Solidago ulmifolia, Maianthemum racemosum (= Smilacina racemosa), Heuchera richardsonii, Dodecatheon meadia, Geranium maculatum*, and *Helianthus strumosus*. No vascular plant species were restricted in distribution to the glades, but several may be modal within the context of Wisconsin, including *Carex pensylvanica, Heuchera richardsonii, Antennaria plantaginifolia, Solidago ulmifolia, Lespedeza virginica, Lespedeza violacea*, and *Agalinis gattingeri* (West and Welsh 1998). The flora is complicated by the fact that the glades likely served as refugia for prairie plants historically, and now serve as refugia for woodland and savanna plants (P. West pers. comm. 2000).

Stands occur on the brow of steep slopes that overlay quartzite, rhyolite or sandstone bedrock that contains some fractures. Exposed bedrock may average about 15%. The stands themselves have gentle slopes (2-11%), mostly with a southwestern aspect, but ranging from due east to due west. Glade soils are thin (10-30 cm deep) silt loams, acidic (pH of 4.5-5.0), fertile, and rich in organic matter (10-15% organic matter). The high organic matter content could be a function of low pH and droughtiness that inhibit decomposition of organic matter (West and Welsh 1998).

Droughts and deer browse may currently interact to keep these glades open. The low light levels that reduce ground layer biomass and fuel loads would appear to also reduce the likelihood of fires in this system, coupled with fire suppression in the surrounding matrix of dry oak forests. Historically, the surrounding matrix may have been more likely to burn, and those fires could have spread into the glades (West and Welsh 1998). Nevertheless, these glades are thought to be more environmentally controlled, by shallow soils, than fire-controlled because average soil depth (depth to big stones or bedrock) was similar between the glade and the transition area (to forest), but there were significant differences between transition-forest and forest-glade. These differences suggest that soil depth and the historic extent of the glade community may be positively correlated (P. West pers. comm. 2000). *Juniperus virginiana* was present on some of the glades, but in small numbers (P. West pers. comm. 2000).

COMMENTS: *3, MCS*. There may be important differences in quartzite, rhyolite, quartzite conglomerate, and sandstone glades in the Baraboo Hills, but further analyses are required. This type should perhaps be placed in the more typical glade formation (V.A.6.N.q.) based on historic conditions. The best fit currently is woodlands, although photos from the 1930s show that they used to be much more open. The flora is complicated by the fact that the glades likely served as refugia for prairie plants historically, and now serve as refugia for woodland and savanna plants (P. West pers. comm. 2000). Unglaciated acidic glades further south, e.g., in Missouri, show no floristic relationships to this type. The only other large quartzite area is in the Blue Hills of Northern Wisconsin, and those stands probably would fit in with the *Pinus banksiana - Pinus strobus - (Quercus rubra) / Cladina* spp. Nonvascular Vegetation (CEGL002491). Elsewhere there is an extensive 5 to 6 mile long quartzite ridge straddling the Oconto-Marinette countyline with small glade-like openings.

CONSERVATION RANK: *G2?*. This type is only known from the Baraboo Hills region, where over 10 occurrences have been documented, but over 50 have been mapped. These occurrences are typically less than 2 ha (5 ac) in size (P. West, Jim Welsh pers. comm. 2000).

DISTRIBUTION: This quartzite rock outcrop community type is found on rocky, relatively level or hilly regions in the upper midwestern United States, particularly in the Baraboo Hills of Wisconsin.

USFS ECOREGIONS: 222K:CC, 222M:CC
CONSERVATION REGIONS: 46:C
STATES: WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: WI quartzite bedrock glade =

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS ALBA - (QUERCUS VELUTINA) WOODLAND ALLIANCE (II.B.2.N.a)

Juniperus ashei / Cotinus obovatus / Carex eburnea - Rudbeckia missouriensis Woodland

Ashe's Juniper / American Smoketree / Bristleleaf Sedge - Missouri Coneflower Woodland

Ozark Ashe's Juniper Glade Woodland CEGL007833

DESCRIPTION: The canopy is open to closed (>25% cover), stunted (4-10 m tall), and dominated by *Juniperus ashei*. Other species which form a minor component of the canopy are *Quercus muehlenbergii, Juniperus virginiana var. virginiana, Fraxinus americana, Fraxinus quadrangulata, Quercus stellata, Sideroxylon lanuginosum (= Bumelia lanuginosa)*. The understory consists of *Cotinus obovatus, Cercis canadensis var. canadensis*, and canopy species. *Rhus aromatica var. serotina, Ilex decidua, Hypericum prolificum, Diospyros virginiana, Frangula caroliniana, Celtis tenuifolia, Chionanthus virginicus, Berchemia scandens, Smilax bona-nox*, and *Smilax rotundifolia* are common shrubs. The dominant herb is *Carex eburnea*, which forms dense mats. Other herbs, especially present in small openings, include *Rudbeckia missouriensis, Allium cernuum, Arabis canadensis, Croton capitatus, Croton monanthogynus, Croton willdenowii (= Crotonopsis elliptica), Hedyotis nigricans var. nigricans, Heliotropium tenellum, Liatris cylindracea, Liatris scariosa var. nieuwlandii, Palafoxia callosa, Panicum virgatum, Parietaria pensylvanica, Pellaea glabella, Ruellia humilis*, and *Salvia azurea var. grandiflora (= Salvia pitcheri)*. Mosses and lichens may have high coverage. The most typical dominant moss is *Pleurochaete squarrosa* (Nelson 1985).

Stands occur on gently to steeply sloping exposures of dolomite (or possibly sometimes limestone). Soils are very rapidly drained and very shallow (0-40 cm) (Nelson 1985).

Droughts and infrequent fire may disturb these stands (Nelson 1985).

COMMENTS: *1, SCS*. Excellent examples of this community are known from the White River Balds Natural Area (Mark Twain National Forest, Missouri).

CONSERVATION RANK: *G2?*. This association is naturally rare, being restricted to specialized edaphic conditions (thin soil over dolomite) on the Springfield Plateau and possibly elsewhere in the Ozark Mountains of Arkansas and Missouri. The fire dynamics of this community are not well understood. Where it occurs on private land, it is subject to clearing and grazing.

DISTRIBUTION: This community is found in the Ozarks region of the United States.

USFS ECOREGIONS: 222Ag:CC?, 222An:CCC
CONSERVATION REGIONS: 38:C
STATES: AR MO OK? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO xeric limestone/dolomite forest +

OTHER SYNONYMY:

USNVC HIERARCHY: JUNIPERUS ASHEI WOODLAND ALLIANCE (II.A.4.N.a)

Juniperus virginiana Alkaline Bluff Woodland

Eastern Red-cedar Alkaline Bluff Woodland

Red Cedar Alkaline Bluff Woodland CEGL002426

DESCRIPTION: The vegetation contains an open-tree canopy, sometimes clumped or irregular due to the exposed bedrock. The shrubby or viney layer may or may not be present. Along bluffs, the herbaceous layer is variable. Tree dominants include *Juniperus virginiana*, with occasional hardwoods, such as *Quercus muehlenbergii* or *Fraxinus americana*. Ground layer dominants include *Schizachyrium scoparium, Sorghastrum nutans*, and *Bouteloua curtipendula* (Nelson 1985).

Stands may have been of minimal extent on blufftops of the White River region in southwestern Missouri. Soils are rapidly drained, very shallow (0-40 cm), and occur over cherty limestone or dolomite, or with bedrock partially exposed at the surface (Nelson 1985).

COMMENTS: *3, MCS*. The concept of the type is taken in part from the Missouri state classification - xeric limestone/dolomite forest (Nelson 1985). However, as described here, the type is restricted to blufftops, hence the understory description provided in Nelson may not entirely apply. The stands may have been of minimal extent on blufftops of the White River region in southwestern Missouri (T. Nigh. pers. comm. 2000). Otherwise, on flatter or gently sloping thin soil habitats, they were more commonly mixed with hardwoods, and can be treated as part of the *Quercus muehlenbergii - Fraxinus (quadrangulata, americana) / Schizachyrium scoparium* Woodland (CEGL002143) or, if more closed canopied, *Quercus muehlenbergii - Juniperus virginiana - Acer saccharum / Frangula caroliniana* Forest (CEGL002108).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This type occurs in the Ozarks region of the United States. Stands may have been of minimal extent on blufftops of the White River region in southwestern Missouri.

USFS ECOREGIONS: 222A:CC, 231Gb:CCC
CONSERVATION REGIONS: 38:C, 39:C
STATES: AR MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO xeric limestone/dolomite forest; limestone/dolomite savanna? I;?

OTHER SYNONYMY:

USNVC HIERARCHY: JUNIPERUS VIRGINIANA WOODLAND ALLIANCE (II.A.4.N.b)

Quercus muehlenbergii - Juniperus virginiana / Schizachyrium scoparium - Manfreda virginica Wooded Herbaceous Vegetation

Chinquapin Oak - Eastern Red-cedar / Little Bluestem - Eastern Agave Wooded Herbaceous Vegetation

Central Limestone Glade CEGL005131

DESCRIPTION: Herbaceous cover is very uneven, ranging from very dense in some areas to absent in others. Some dominant or characteristic grasses include *Schizachyrium scoparium, Sorghastrum nutans, Aristida* spp., and *Sporobolus compositus*. In deeper soil areas *Andropogon gerardii* may be present. At some sites *Bouteloua curtipendula* is present, but it may be rare or absent at others. Forbs vary in dominance by site and include *Asclepias verticillata, Comandra umbellata, Coreopsis tripteris, Croton monanthogynus, Echinacea simulata, Galactia regularis, Hexalectris spicata, Helianthus divaricatus, Helianthus hirsutus, Hypericum dolabriforme, Hypericum sphaerocarpum, Euphorbia corollata, Gaura* spp., *Lespedeza hirta, Lespedeza virginica, Liatris aspera, Liatris cylindracea, Liatris squarrosa, Lithospermum canescens, Lobelia spicata var. leptostachys, Manfreda virginica, Matelea obliqua, Ophioglossum engelmannii, Physostegia virginiana, Ratibida pinnata, Rudbeckia hirta, Ruellia humilis, Sabatia angularis, Scutellaria parvula, Silphium trifoliatum, Solidago nemoralis, Verbesina helianthoides, Verbesina virginica*, and *Zizia aptera*. *Quercus muehlenbergii* and *Juniperus virginiana var. virginiana* can form a sparse canopy. *Quercus stellata* may be common in parts of the range. Other scattered trees which may be present include *Cercis canadensis, Fraxinus quadrangulata, Quercus velutina, Quercus alba, Quercus marilandica*, and *Liriodendron tulipifera*. The subcanopy is absent or very sparse. Commonly encountered shrubs include *Celtis tenuifolia, Cornus florida, Ulmus alata, Rhus aromatica, Rhus copallinum*, and *Symphoricarpos orbiculatus*. This vegetation may exist as more extensive areas, or in some southeastern cases, it may be limited to a more narrow zone between vegetation dominated by woody plants and that dominated by annual grasses (TNC 1995a, Dave Minney pers. comm. 2000).

This community occurs on gentle to steep slopes of hills, knobs, ridges, bluffs along streams, and broad terraces. Aspect is variable, but the community is generally best developed on southern and western exposures. Parent material is limestone, cherty limestone, dolomite, or calcareous shale which is exposed at the surface, resulting in a very shallow, well-drained substrate. Soils are neutral to alkaline, shallow to moderately deep, and contain a homogenous mixture of rock fragments of various sizes. They can erode easily, partly due to freeze-thaw and subsequent mass wasting (TNC 1995a).

There is evidence that prior to their disappearance, bison and elk grazing helped maintain this natural community (Hall 1970). Fire also periodically swept through these barrens, killing woody vegetation and encouraging herbaceous growth. Drought stress is prevalent, and openings are occasionally enlarged when trees are removed by wind or lightning.

COMMENTS: *2, MCS*. In Indiana, *Quercus stellata* is typical, *Bouteloua curtipendula* is rare, and *Sorghastrum nutans* is common. In Illinois, *Sorghastrum nutans* is more common than *Bouteloua curtipendula*. This type was developed in the Midwest and attributed to various southeastern states. Its relation to other eastern and southeastern alkaline glades needs further investigation. In Tennessee, this community might be called a limestone barren, as the term "glade" is restricted to bedrock-defined openings that are mostly flat, pavement-like, and dominated by annual grasses rather than perennial ones. In Indiana, this community is commonly called a cedar glade because stands of *Juniperus virginiana* border many of the sites of the community. *Juniperus virginiana*, which occurs with *Quercus stellata*, was probably rare in this community before the time of European settlement and consequent fire suppression. *Quercus muehlenbergii - Quercus (alba, velutina)* Bluff Woodland (CEGL002144) is the more northern equivalent of this type. In southeastern Ohio, this type also contains a distinctive zone tracked as a separate type, the *Juniperus virginiana / Schizachyrium scoparium - Silphium terebinthinaceum var. luciae-brauniae - Carex juniperorum - Castilleja coccinea* Wooded Herbaceous Vegetation (CEGL004464).

CONSERVATION RANK: *G2G3.* There are probably over 100 occurrences rangewide. Eighty-three have been documented: 32 in Illinois (S2), 48 in Indiana (S2S3), and 3 in Ohio (S2). Although no other occurrences are documented, the community is also reported in Alabama, Georgia, Kentucky, Tennessee, West Virginia, and Virginia (all S?). It is found in 15 ecoregional subsections. The present range of this community is probably very close to its presettlement range, but lack of fire permits increased dominance by woody species.

DISTRIBUTION: This limestone glade or barrens community is found in the central and eastern United States, ranging from southern Illinois, Kentucky, Tennessee and Alabama, east to Georgia, western Virginia, West Virginia, and Ohio.

USFS ECOREGIONS: 222Aq:CCC, 222De:CCC, 222Df:CCC, 222Dh:CCC, 222Di:CCC, 222Ei:CCC, 222Ek:CCC, 222El:CCC, 222Fc:CCC, 222Fd:CCC, 222Fe:CCC, 251Cf:CCC, 251Ci:CCC
CONSERVATION REGIONS: 36:C, 38:C, 43:?, 44:C, 49:?, 50:C, 59:?
STATES: AL GA IL IN KY OH TN VA WV **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	limestone glade =
IN	limestone glade =
OH	little bluestem prairie +

OTHER SYNONYMY: Xeric Limestone Prairie (Baskin et al. 1994), Barrens type (Hutchison et al. 1986). is sometimes treated broadly as a barrens type, Barrens type (Hutchison 1994). is sometimes treated broadly as a barrens type

USNVC HIERARCHY: (JUNIPERUS VIRGINIANA) / SCHIZACHYRIUM SCOPARIUM - (BOUTELOUA CURTIPENDULA) WOODED HERBACEOUS ALLIANCE (V.A.6.N.q)

Schizachyrium scoparium - Bouteloua curtipendula - Rudbeckia missouriensis - Mentzelia oligosperma Wooded Herbaceous Vegetation

Little Bluestem - Sideoats Grama - Missouri Coneflower - Plains Mentzelia Wooded Herbaceous Vegetation

Ozark Limestone Glade CEGL002251

DESCRIPTION: The vegetation is dominated by medium-tall grasses and forbs, occasionally with stunted trees and shrubs. Stands are dominated by the grasses *Schizachyrium scoparium* and *Bouteloua curtipendula*. Typical forbs and ferns include *Rudbeckia missouriensis* (typically absent in Kansas stands), *Draba reptans, Draba cuneifolia, Heliotropium tenellum, Isoetes butleri, Ophioglossum engelmannii, Psoralidium tenuiflorum (= Psoralea tenuiflora), Sedum pulchellum, Glandularia canadensis (= Verbena canadensis), Agalinis aspera (= Gerardia aspera), Mentzelia oligosperma, Physalis pumila, Chamaesyce missurica (= Euphorbia missurica), Astragalus distortus, Erysimum capitatum, Castilleja purpurea, Lesquerella filiformis* (endemic to the Ozarks), *Talinum parviflorum, Thelesperma filifolium var. filifolium (= Thelesperma trifidum), Nothocalais cuspidata (= Agoseris cuspidata)*, and lichens *Lecanora muralis, Dermatocarpon arnoldianum (= Dermatocarpon lachneum)*, and *Psora russellii* (Nelson 1985, Lauver et at. 1999).

Stands occur on moderate to steep slopes of dissected hills, steep valley slopes above large rivers and streams. Aspect is typically south and west. Soils are very rapidly drained (seasonally saturated in winter and spring) and shallow (0-40 cm). Texture may be clayey. The parent material is limestone bedrock (Burlington, Keokuk, Plattin-Kimmswick formations) interspersed with abundant rock fragments and often dissected by horizontal layers of exposed limestone bedrock (Nelson 1985).

Dry summer conditions can lead to occasional fires. Seasonal winter and spring saturation can lead to frost heaving (Nelson 1985).

COMMENTS: *2, MCS*. Comparison of this association with other limestone glades in the Southeast needs to be completed.

CONSERVATION RANK: *G2.* There are probably fewer than 60 occurrences rangewide; currently 20 occurrences are documented from Missouri, where it is ranked S2. This community is also reported from Kansas, where it is ranked S1S2?; it may also occur in Arkansas. There are probably fewer than 400 acres rangewide; currently there are about 130 acres documented, and most are less than 10 acres each. Although historical acreage and trends are unknown, this was probably always a small and uncommon community restricted to limestone outcrops in the Ozarks. This community is reported from 11 subsections of two provinces in southern Missouri, eastern Kansas, and possibly northern Arkansas. More than half the currently documented occurrences are in good condition.

DISTRIBUTION: This bluestem graminoid limestone glade community is found in the Ozarks of Missouri and southeastern Kansas in the United States.

USFS ECOREGIONS: 222Ab:CC?, 222Ac:CCC, 222Ag:CCC, 222Ah:CCP, 222Ak:CCC, 222Am:CCC, 222An:CC?, 251Cd:CCP, 251Ce:CCP, 251Ea:CCP
CONSERVATION REGIONS: 36:C, 37:C, 38:C
STATES: KS MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO limestone glade =

OTHER SYNONYMY: Limestone Glade (Nelson 1987)

USNVC HIERARCHY: (JUNIPERUS VIRGINIANA) / SCHIZACHYRIUM SCOPARIUM - (BOUTELOUA CURTIPENDULA) WOODED HERBACEOUS ALLIANCE (V.A.6.N.q)

Schizachyrium scoparium - Sorghastrum nutans - Bouteloua curtipendula - Rudbeckia missouriensis - Hedyotis nigricans Wooded Herbaceous Vegetation

Little Bluestem - Yellow Indiangrass - Sideoats Grama - Missouri Coneflower - Narrowleaf Summer Bluets Wooded Herbaceous Vegetation

Ozark Dolomite Glade CEGL002398

DESCRIPTION: The vegetation is dominated by medium-tall grasses and forbs, occasionally with stunted trees and shrubs. Stands are dominated by *Schizachyrium scoparium, Bouteloua curtipendula, Sporobolus heterolepis*, occurring with *Andropogon gerardii, Rudbeckia missouriensis, Symphyotrichum sericeum (= Aster sericeus), Buchnera americana, Oenothera macrocarpa (= Oenothera missouriensis), Clinopodium arkansanum (= Satureja arkansana), Sporobolus neglectus, Echinacea paradoxa, Evolvulus nuttallianus, Leavenworthia uniflora, Clematis fremontii (= Clematis fremontii var. riehlii), Centaurea americana, Valerianella ozarkana, Yucca glauca, Eriogonum longifolium, Acacia angustissima, Phyllanthus polygonoides, Cotinus obovatus, Stenosiphon linifolius, Palafoxia callosa, Centaurium texense, Scutellaria bushii, Penstemon cobaea (= Penstemon cobaea var. purpureus), Marshallia caespitosa var. signata, Thelesperma filifolium var. filifolium (= Thelesperma trifidum), Juniperus ashei, Toxicodendron pubescens (= Rhus toxicodendron)*, and lichens (*Lecanora muralis, Caloplaca saxicola, Dermatocarpon arnoldianum (= Dermatocarpon lachneum), Psora russellii, Placynthium nigrum*) (Nelson 1985). Some additional forbs and grasses from Arkansas occurrences include *Asclepias amplexicaulis, Asclepias viridiflora, Coreopsis lanceolata, Croton capitatus, Desmanthus illinoensis, Grindelia lanceolata, Hedyotis nigricans, Liatris cylindracea, Minuartia patula, Mirabilis albida, Onosmodium molle ssp. subsetosum, Rhynchosia latifolia*, and *Ruellia humilis*.

Stands occur on moderate to steep slopes of dissected hills, steep valley slopes above large rivers and streams. Aspect is variable, but typically southern and western. Soils are rapidly drained (seasonally saturated in winter and spring) and shallow (0-40 cm). The parent material is dolomitic (dolostone) bedrock interspersed with abundant rock fragments and often dissected by horizontal layers of exposed dolomite bedrock (Nelson 1985).

Dry summer conditions can lead to occasional fires, and fires may have been more frequent in regions where glades were extensive. Seasonal winter and spring saturation can lead to frost heaving (Nelson 1985).

COMMENTS: *2, MCS*. Concept of this type is based on the Missouri state type - dolomite glade (Nelson 1985). Missouri may split this type into three subtypes: (1) White River section: large glades (>10 acres) on Cotter Dolomite. Several endemics are present, including *Penstemon cobaea*. (2) Upper/Lower Ozark section: small to medium glades (1-5 acres) on Gasconade and Eminence Dolomite. Indicator species include *Scutellaria bushii*. (3) Ozark Border Section along the Missouri River: medium glades (5-20 acres) on Jefferson City-Cotter Dolomite. Indicator species include *Clematis fremontii*. (M. Leahy pers. comm. 1999)

CONSERVATION RANK: *G3.*

DISTRIBUTION: This bluestem graminoid dolomite glade community is found in the United States in the Ozarks region of Missouri and Arkansas.

USFS ECOREGIONS: 222Aa:CCC, 222Ab:CCC, 222Ac:CCC, 222Ad:CCC, 222Ae:CCC, 222Af:CCC, 222Ag:CCC, 222Aj:CCC, 222Ak:CCC, 222Al:CCC, 222Am:CCC, 222An:CC?, 251:?
CONSERVATION REGIONS: 38:C
STATES: AR MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO dolomite glade =

OTHER SYNONYMY: Dolomite Glade (Nelson 1987), Ozark Dolomite Glade (MCS)

USNVC HIERARCHY: (JUNIPERUS VIRGINIANA) / SCHIZACHYRIUM SCOPARIUM - (BOUTELOUA CURTIPENDULA) WOODED HERBACEOUS ALLIANCE (V.A.6.N.q)

Quercus marilandica - Juniperus virginiana var. virginiana / Schizachyrium scoparium - Hypericum gentianoides Wooded Herbaceous Vegetation

Blackjack Oak - Eastern Red-cedar / Little Bluestem - Pineweed Wooded Herbaceous Vegetation

Shawnee Sandstone Glade CEGL004062

DESCRIPTION: This community is dominated by graminoid species with scattered *Quercus marilandica* and *Juniperus virginiana*. The patchiness and uneven distribution of trees, shrubs, and herbaceous vegetation is a response to thin infertile soils and droughty conditions. *Quercus stellata, Quercus marilandica*, and *Juniperus virginiana* are the dominant trees, which can be found scattered or in patches throughout the occurrence. These trees are generally small, stunted, and limby. The overstory cover seldom exceeds 50%, and the subcanopy is conspicuously thin or absent. Scattered individual and patches of shrubs occur here, with *Vaccinium arboreum* and *Ulmus alata* the most commonly encountered. *Schizachyrium scoparium, Danthonia spicata, Andropogon virginicus*, and *Dichanthelium* spp. dominate the herbaceous layer, along with a diverse mixture of forbs. *Toxicodendron radicans* is present, but *Smilax bona-nox* is more indicative of conditions found in this sparse woodland community. Lichens and mosses are common on exposed bedrock surfaces and on soils not covered with organic debris (leaf litter, wood) (TNC 1995a).

This community occurs primarily in the droughty environment of south- and southwest-facing slopes with thin, acidic soils which can erode easily. The southern aspect results in frequent periods of freeze and thaw and consequent erosion and mass wasting. Aspect also contributes to summer temperatures well in excess of cooler and wetter north- and east-facing slopes.

There is evidence that prior to their disappearance, the browsing and grazing by herds of buffalo, elk, and deer helped maintain this natural community (Hall 1970). Fire also periodically swept through, killing woody vegetation and encouraging herbaceous growth. Drought stress is prevalent, and openings are occasionally enlarged when trees are removed by wind or lightning.

COMMENTS: *2, MCS*. Concept of the type is that of a sandstone glade. Broadly speaking, this community is often referred to as a barrens (Hutchison 1994).

CONSERVATION RANK: *G3?.* There are probably fewer than 100 occurrences rangewide. Fifteen have been documented in Illinois, where the community is ranked S3, and 6 in Indiana (S1). Although no other occurrences have been documented, the community is also reported in Kentucky (S?). There are probably fewer than 1000 acres rangewide. Sizes of 19 occurrences total 182 acres. The present range of this community is probably very close to its presettlement range. Lack of fire may permit increased dominance by woody species. The community occurs on thin, acidic soils on south- or southwest-facing slopes.

DISTRIBUTION: This glade community is found in the Interior Low Plateau region of the midwestern United States, particularly in the Shawnee Hills and Highland Rim sections of southern Illinois, western Kentucky, and southern Indiana.

USFS ECOREGIONS: 222Aq:CCC, 222C:CP, 222De:CCC, 222Df:CCP, 222Dh:CCC, 222Di:CCC, 222E:CP
CONSERVATION REGIONS: 38:C, 44:C, 50:?
STATES: IL IN KY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL sandstone glade =
IN sandstone glade =

OTHER SYNONYMY: Cedar Glade B, Barrens, barrens type (Hutchison et al. 1986). The terms “barrens” is sometimes broadly used to include “glade” types.

USNVC HIERARCHY: (QUERCUS STELLATA, QUERCUS MARILANDICA) / SCHIZACHYRIUM SCOPARIUM WOODED HERBACEOUS ALLIANCE (V.A.6.N.q)

Schizachyrium scoparium - Aristida dichotoma - Croton willdenowii / Lichens Wooded Herbaceous Vegetation

Little Bluestem - Forktip Three-awn - Broadleaf Rushfoil / Lichens Wooded Herbaceous Vegetation

Ozark Sandstone Glade CEGL002242

DESCRIPTION: The vegetation is dominated by mid grasses and forbs; mosses and lichens are very abundant on areas of exposed rock. Scattered stunted xerophytic trees and shrubs are also present, in particular *Quercus stellata, Quercus marilandica, Pinus echinata, Juniperus virginiana*, and *Vaccinium arboreum*. Common herbaceous plants include *Aristida dichotoma, Coreopsis grandiflora* (in Arkansas), *Croton willdenowii*, and *Schizachyrium scoparium*. Other characteristic herbs include *Asclepias hirtella, Chaetopappa asteroides, Croton capitatus, Diodia teres, Eragrostis spectabilis, Isoetes butleri, Lechea mucronata (= Lechea villosa), Plantago pusilla, Hypericum gentianoides, Hypericum drummondii, Saxifraga texana, Sedum pulchellum, Sedum nuttallianum, Talinum calycinum*, and *Talinum parviflorum* (Nelson and Ladd 1983, Jeffries 1985, Nelson 1987).

Stands occur as outcrops along narrow ridges, on bluff escarpments, on rolling upland exposures, or on broad conical knobs. The aspect is somewhat neutral, with best development of the type occurring on south- and west-facing slopes. Soils are very shallow (0-40 cm), with occasional vernal pools. Stands occur on a variety of Pennsylvanian sandstone formations, including the St. Peter, Lamotte, Gasconade, Channel Sands, Roubidoux, and Gunter (Nelson and Ladd 1983, Jeffries 1985, Nelson 1987). Even thought these sites are generally thought of as acidic, at one Arkansas example cited by Jeffries (1985) soil pH varied from 4.7 to 8.8, perhaps due to influences from adjoining forests.

COMMENTS: *2, MCS*. Concept of the type is taken from Missouri and Kansas state classifications - sandstone glade (Nelson 1985, Lauver et al. 1999). Type may be in Oklahoma, but needs further review. This sandstone glade community is uncommon, but several high-quality sites remain. The estimated extent in Missouri (Nelson and Ladd 1983) was 810 hectares. This community is affected by extreme drought and infrequent fires. This association is related to, but distinct from, southeastern sandstone glade or outcrop communities east of the Mississippi River. There may be an Ozark Channel Sands subtype characterized by *Schizachyrium scoparium, Selenia aurea*, and *Geocarpon minimum*. *Croton willdenowii* has also been known as *Crotonopsis elliptica*.

CONSERVATION RANK: *G3.*

DISTRIBUTION: This sandstone glade community is found in the Ozark region of the south-central United States, particularly Arkansas, Kansas, Missouri and possibly Oklahoma.

USFS ECOREGIONS: 222Aa:CCC, 222Ab:CCC, 222Ac:CCC, 222Ad:CCC, 222Ae:CCC, 222Aj:CCC, 222Ak:CCC, 222Am:CCC, 251Ce:CCC, 251Eb:CCC
CONSERVATION REGIONS: 36:C, 37:C, 38:C, 39:?
STATES: AR KS MO OK? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO sandstone glade +

OTHER SYNONYMY: Sandstone Glade (Nelson 1987), Sandstone Glade (Nelson and Ladd 1983)

USNVC HIERARCHY: (QUERCUS STELLATA, QUERCUS MARILANDICA) / SCHIZACHYRIUM SCOPARIUM WOODED HERBACEOUS ALLIANCE (V.A.6.N.q)

Schizachyrium scoparium - Sedum nuttallianum - Selaginella rupestris - Portulaca pilosa / Lichens Wooded Herbaceous Vegetation

Little Bluestem - Nuttall's Stonecrop - Rock Spikemoss - Kiss-me-quick / Lichens Wooded Herbaceous Vegetation

Ozark Chert Glade CEGL002244

DESCRIPTION: This community is dominated by mid grasses, although forbs, mosses, and lichens are very common. *Coreopsis lanceolata, Schizachyrium scoparium, Selaginella rupestris*, and *Sporobolus neglectus* are the most common herbaceous plants. *Marshallia caespitosa, Portulaca pilosa, Portulaca oleracea (= Portulaca retusa)*, and *Dracopis amplexicaulis* are also characteristic. In Arkansas additional common species include *Sedum pulchellum, Talinum calycinum, Croton willdenowii, Plantago aristata, Agrostis elliottiana, Danthonia spicata, Hordeum pusillum, Oenothera linifolia, Astragalus distortus*, and *Ruellia humilis* (Nelson 1985). Stunted *Quercus marilandica* are the most likely trees to occur on the thin soils of this type. Nelson and Ladd (1983) reported that the vernal pools support certain (unnamed) ephemeral species not adapted to the droughty conditions that prevail in the community.

This community occurs on level to moderately steep slopes with any aspect or on the valley walls of tributaries of larger streams and rivers. The soil is absent to shallow (0-40 cm) and very rapidly drained. The nearly impervious parent material is massive brecciated chert of the Elsey Formation. Stratified bedrock, scattered chert fragments, fine-flaking shale, or boulders are present. Small depressions fill with water in the spring (Nelson 1985).

This community is affected by extreme drought, ephemeral vernal pools, and infrequent fires.

COMMENTS: *2, MCS*. Concept of the type is taken from Missouri state classification - chert glade (Nelson 1985). In Arkansas, this association, or one similar, occurs over hard, fine-flaking shale outcrops near the North Fork of the Ouachita River, on gentle, mostly south- and southwest-facing slopes (see Campbell et al. 1996).

CONSERVATION RANK: *G1G2.* There are probably under 50 occurrences rangewide. Seventeen have been documented in Missouri, where the community is ranked S1. Although no other occurrences are documented, the community is also reported in Arkansas and Oklahoma (both S?). There are probably fewer than 1000 acres rangewide. Approximately 80 hectares have been described in Missouri (Nelson 1985), of which 60 acres (about 24 hectares) are included in 13 known Element Occurrences. These occurrences range in size from 6.8 to 13 acres. Five of 17 ranked occurrences are A or B. The community occurs on level to moderately steep slopes with any aspect or on the valley walls of tributaries of larger streams and rivers. The soil is absent to shallow (0-40 cm) and very rapidly drained, often containing many rock fragments.

DISTRIBUTION: This chert glade community is found in the United States in the Ozarks region of Missouri, Arkansas, and Oklahoma.

USFS ECOREGIONS: 222Am:CCC, M231Ac:CCC
CONSERVATION REGIONS: 38:C, 39:?
STATES: AR? MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO chert glade =

OTHER SYNONYMY: Chert Glade (Nelson 1987), Chert Glade (Nelson and Ladd 1983)

USNVC HIERARCHY: (QUERCUS STELLATA, QUERCUS MARILANDICA) / SCHIZACHYRIUM SCOPARIUM WOODED HERBACEOUS ALLIANCE (V.A.6.N.q)

Quercus marilandica - (Juniperus virginiana) / Schizachyrium scoparium - Danthonia spicata Wooded Herbaceous Vegetation

Blackjack Oak - (Eastern Red-cedar) / Little Bluestem - Poverty Oatgrass Wooded Herbaceous Vegetation

Central Shale Glade CEGL002428

DESCRIPTION: Trees can be found scattered or in isolated clumps and patches throughout the occurrence, along with a few saplings and shrubs. *Quercus marilandica* and *Quercus stellata* are the dominant trees (*Quercus prinus* is dominant in Indiana examples), and *Pinus virginiana* or other *Quercus* spp. may also be found in some examples. *Vaccinium arboreum, Rhus aromatica* and *Ulmus alata* are common shrubs. *Vaccinium pallidum* and *Gaylussacia baccata* are common in Indiana examples. Ohio stands also contain *Cercis canadensis, Amelanchier arborea, Frangula caroliniana (= Rhamnus caroliniana), Rosa carolina*, and *Vaccinium stamineum*. *Schizachyrium scoparium* and *Danthonia spicata* dominate the herbaceous layer, along with a diverse assemblage of forbs. Missouri examples, where the shales are fairly 'limey,' contain *Astragalus distortus, Dalea purpurea, Porteranthus stipulatus*, and *Psoralidium tenuiflorum*. The herbaceous flora of Indiana Interior Low Plateau examples (Siltstone Glades) includes *Agalinis* sp., *Symphyotrichum patens (= Aster patens), Symphyotrichum shortii (= Aster shortii), Brickellia eupatorioides (= Kuhnia eupatorioides), Cunila origanoides, Dichanthelium depauperatum, Euphorbia corollata, Helianthus* sp., *Hypericum crux-andreae, Hypericum hypericoides, Liatris squarrosa, Manfreda virginica, Porteranthus stipulatus, Schizachyrium scoparium*, and *Tephrosia virginiana*. Some woody plants recorded at these sites include *Pinus virginiana, Quercus prinus, Quercus stellata, Quercus marilandica*, and *Juniperus virginiana*. In Ohio, *Carex hirsutella, Agrostis perennans, Allium cernuum, Sericocarpus asteroides (= Aster paternus), Agalinis tenuifolia (= Gerardia tenuifolia), Houstonia canadensis (= Hedyotis canadensis),* and *Lithospermum canescens*, among others, may occur. Some grasses and forbs from the Ouachita Mountain examples include *Agrostis elliottiana, Oenothera linifolia, Astragalus distortus*, and *Ruellia humilis*. Lichens and mosses occur in profusion on exposed bedrock surfaces and on soils not covered with organic debris (leaf litter, wood) (White and Madany 1978, Nelson 1985, Homoya 1994, TNC 1995a, D. Minney pers. comm. 2000).

In Missouri, this community occurs on moderate to steep slopes of dissected drainages along major streams and mounds, and shales have a strong limestone component, making them less acid. In several square km of Illinois, a series of steep ridges occurs in thick shale outcrops. Shale glades occur there on exposed slopes. The soil of these communities is absent to thin (0-40 cm) and somewhat rapidly to very rapidly drained. The parent material is shale, with siltstone present in Indiana occurrences. Shale fragments and exposed bedrock are common on the surface. In Ohio, sites occur sparingly on estill shales with extreme southwestern exposures (White and Madany 1978, Nelson 1985, Homoya 1994, D. Minney pers. comm. 2000).

Rapid weathering and erosion on steep slopes appear to be necessary for shale glades to persist. Fires may have been very occasional (Nelson 1985).

COMMENTS: *2, MCS*. This community has a restricted distribution and occurrences are small. In Indiana, *Quercus prinus* is the major dominant. Similar communities occur in West Virginia, and also with *Quercus prinus* as the primary scattered tree. In the Knobs region of Kentucky this community is threatened by strip mining. Total vegetative cover may sometimes be less than 10%. Shale glades in Missouri are so lime-rich that they may be treated as a variant of limestone glade (M. Leahy pers. comm. 1999). In Ohio, areas of shale that have been plowed have come back as "cedar barrens" but are typically dominated by a variety of annuals (though most of these are present at some level in the natural shale glades as well), and these areas may resemble the more annual grassland type, *Sporobolus (vaginiflorus, neglectus, ozarkanus) - Aristida longispica - Panicum flexile - Panicum capillare* Herbaceous Vegetation (CEGL004340) described for Tennessee glades. These shale glades may be so depauperate at this time that they could simply be combined with *Quercus stellata - Quercus marilandica / Schizachyrium scoparium - Silphium terebinthinaceum* Wooded Herbaceous Vegetation (CEGL005134) (D. Minney pers. comm. 2000).

CONSERVATION RANK: *G2.* The shale glade community has a very restricted distribution and occurrences are small. In Kentucky, where it is most abundant, particularly in the Knobs Region, threats are primarily from strip-mining, since oil shales may be strip-mined depending on the market. Sites in Ohio have been disturbed by agriculture through pasturing (but no clearing), severe erosion, or fire suppression.

DISTRIBUTION: This graminoid shale glade community is found in the central United States, particularly in the Interior Low Plateau region. Stands range from the Shawnee Hills of southern Illinois and western Kentucky, the Western Knobs of Kentucky, the Edge of Appalachia area in southern Ohio, and the Knobstone Escarpment and Brown County Hills of Southern Indiana to scattered sites in central Missouri. This type also tentatively includes some areas in West Virginia.

USFS ECOREGIONS: 222Ah:CCC, 222Aq:CCC, 222Dh:CCC, 222Ei:CCC, 222El:CCC, 222Em:CCP, 222Ff:CCC, 251Ce:CCC
CONSERVATION REGIONS: 36:C, 38:C, 44:C, 45:C
STATES: AR IL IN KY MO OH? OK WV? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	shale glade =
IN	siltstone glade =
MO	shale glade =
OH?	shale glade, post oak opening ?

OTHER SYNONYMY: IE6b. Interior Upland Shale Barren, in part (Allard 1990)

USNVC HIERARCHY: (QUERCUS STELLATA, QUERCUS MARILANDICA) / SCHIZACHYRIUM SCOPARIUM WOODED HERBACEOUS ALLIANCE (V.A.6.N.q)

Schizachyrium scoparium - Sorghastrum nutans - Coreopsis lanceolata - Croton willdenowii Wooded Herbaceous Vegetation

Little Bluestem - Yellow Indiangrass - Longstalk Tickseed - Broadleaf Rushfoil Wooded Herbaceous Vegetation

Ozark Igneous Glade CEGL002243

DESCRIPTION: The vegetation is dominated by medium-tall herbaceous vegetation, with scattered, stunted and gnarled trees and shrubs typically less than 10% cover. Mosses and lichen are abundant on the exposed rock. Trees and shrubs include *Quercus stellata, Quercus marilandica* and *Rhus copallinum*. Dominant grasses include *Sorghastrum nutans, Schizachyrium scoparium* and *Sporobolus clandestinus*. Dominant forbs include *Ambrosia bidentata* and *Diodia teres*. Other characteristic species include *Aristida dichotoma, Coreopsis lanceolata, Croton willdenowii (= Crotonopsis elliptica), Dichanthelium acuminatum, Hypericum gentianoides, Lespedeza capitata, Oenothera linifolia, Polygala sanguinea, Polygonum tenue, Talinum calycinum*, and *Trichostema dichotomum*. Lichens include *Pleopsidium chlorophanum (= Acarospora chlorophana), Cladina* spp., *Cladonia caroliniana, Cladonia strepsilis, Catapyrenium lachneum (= Dermatocarpon lachneum), Punctelia hypoleucites (= Parmelia hypoleucites)*, and *Xanthoparmelia* spp. (Nelson 1985).

Stands occur on gentle to moderately steep slopes of hills and broad mountain domes, upland ridges, and along drainages. Aspect is variable, but is best developed on south- and west-facing slopes. Soils are very rapidly drained, with seasonal saturation in winter or spring, and very shallow (0-40 cm). The parent material is igneous (felsite, rhyolite, dellenite, granite), with highly irregular exposed bedrock, often interspersed with massive outcrops of boulders and scattered rock fragments (Nelson 1985).

Disturbances include extreme drought, frost-heave from winter-saturated soils, and infrequent fires (Nelson 1985).

COMMENTS: *2, MCS*. The concept of the type is taken from the Missouri state classification - igneous glade (Nelson 1985). Actual glade openings range from 0.5-4 ha (1-10 acres) in size, but are usually embedded in a complex matrix of igneous woodland, including *Quercus marilandica / Vaccinium arboreum / Danthonia spicata* Scrub Woodland (CEGL002425) and *Quercus stellata - Quercus marilandica - Quercus velutina - Carya texana / Schizachyrium scoparium* Woodland (CEGL002149). Certain herbs tend to be associated with these glades, including *Hypericum gentianoides, Talinum calycinum* and *Trichostema dichotomum*. The largest known population of *Asclepias meadii* in Missouri occurs on an igneous glade.

CONSERVATION RANK: *G4?*. Fire suppression has caused many of these glades to be closed in by *Juniperus virginiana*.

DISTRIBUTION: This igneous glade type is found in the Missouri Ozarks region of the United States, where it is restricted primarily to the igneous core of the St. Francois Mountains.

USFS ECOREGIONS: 222Aa:CCC, 222Af:CCC
CONSERVATION REGIONS: 38:C
STATES: MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO igneous glade I

OTHER SYNONYMY:

USNVC HIERARCHY: (QUERCUS STELLATA, QUERCUS MARILANDICA) / SCHIZACHYRIUM SCOPARIUM WOODED HERBACEOUS ALLIANCE (V.A.6.N.q)

Redbeds (Siltstone, Sandstone, Gypsum) Sparse Vegetation

Redbeds (Siltstone, Sandstone, Gypsum) Sparse Vegetation

Redbeds (Siltstone) Rock Outcrop CEGL005261

DESCRIPTION: This is a sparse vegetation type with total vegetative cover usually less than 10% (BHCI 1999). Graminoids and forbs typically are equally represented. On moderate and steeper slopes, plants are often slightly elevated above the surrounding, easily eroded redbeds. Frequently found species include *Artemisia frigida, Hesperostipa comata (= Stipa comata), Schizachyrium scoparium, Achnatherum hymenoides (= Oryzopsis hymenoides), Tetraneuris acaulis (= Hymenoxys acaulis), Oxytropis lambertii, Heterotheca villosa, Paronychia depressa, Eriogonum pauciflorum, Hymenopappus filifolius*, and many other prairie forbs. Lichens and cryptogammic soils may be present (Marriott 1985, Salas et al. 1998, Cogan et al. 1999, Marriott et al. 1999, BHCI 1999, Marriott and Faber-Langendoen 2000).

This sparse vegetation type occurs on outcrops of the Permo-Triassic Spearfish Formation, which is composed of red siltstones and shales (BHCI 1999). Gypsum lenses are common and often cap the slopes, small hills and buttes where redbeds are exposed. Due to the softness of the parent rock material, exposures are often eroded to produce badlands-like topography. Occasionally, small cliff-like outcrops develop where strata are more resistant to erosion. Redbeds generally are restricted to lower elevations in the Black Hills, below 5000 feet. However, in the southwestern part of the range in the vicinity of Four Corners, WY, the Spearfish Formation crops out at elevations as high as 5900 feet (Love and Christiansen 1985).

The red siltstones and shales of the Spearfish Formation are relatively soft, and the soils that are derived are poor, loose and easily eroded. Poor soils and natural erosion prevent the development of substantial vegetative cover (Marriott and Faber-Langendoen 2000).

COMMENTS: *3, MCS*. This sparse vegetation type is developed on exposures of the Spearfish Formation of the Black Hills. It may be related to redbed types elsewhere, as this formation is equivalent to the Permo-Triassic redbeds of the Chugwater and Gooseegg formations, which extend west into central Wyoming (Love and Christiansen 1985).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This type is found in the Black Hills region of the western United States. It occurs in areas underlain by red siltstones and shales of the Spearfish Formation. The Red Valley or Racetrack that encircles the higher Black Hills gets its name from these red outcrops. There also are extensive exposures in the northwestern Black Hills in the valley of the Belle Fourche River in the vicinity of Devils Tower, WY.

USFS ECOREGIONS: M334A:CC
CONSERVATION REGIONS: 25:C
STATES: SD WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: ROCK OUTCROP SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

Shale Barren Slopes Sparse Vegetation

Shale Barren Slopes Sparse Vegetation

Shale Barren Slopes CEGL002294

DESCRIPTION: This is a sparse vegetation type with total vegetative cover usually less than 10%. No information is available as to species composition (Marriott and Faber-Langendoen 2000).

Stands are reported on the Mowry Shale outcrops around the Black Hills and the Pierre Shale outcrops of central and western South Dakota. In the Black Hills, stands ocur on sparsely vegetated exposures of the Cretaceous Mowry Formation, made up of siliceous shales, clays and bentonite. Slopes are flat to moderate and of variable aspect. Soils are poor, loose and easily eroded. The Mowry Formation occurs on the periphery of the Black Hills, at elevations ranging from 3000 to 4250 feet (Marriott and Faber-Langendoen 2000).

Poor soils and natural erosion prevent the development of substantial vegetative cover.

COMMENTS: *3, MCS*. More information is needed to determine the characteristics of this type. Type includes the Mowry Shale outcrops around the Black Hills and the Pierre Shale outcrops of central and western South Dakota. A few stands are reported in areas near Badlands National Park (Von Loh et al. 1999). The Mowry Shale outcrops can grade into *Quercus macrocarpa / Carex inops ssp. heliophila* Woodland (CEGL000554) or *Pinus ponderosa* woodlands, both with relatively sparse ground cover. See also *Quercus macrocarpa* / Mixedgrass Shale Wooded Herbaceous Vegetation (CEGL002164). The relationship of the vegetation to that found on shale outcrops elsewhere in the Great Plains is not known.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This shale barrens slopes sparse vegetation is found in the western Great Plains and Black Hills region of the United States.

USFS ECOREGIONS: 251Aa:CCC, 331:P, 332:P, M334A:CC
CONSERVATION REGIONS: 25:C, 34:C, 35:C
STATES: ND SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: ROCK OUTCROP SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

Siltstone - Sandstone Rock Outcrop Sparse Vegetation

Siltstone - Sandstone Rock Outcrop Sparse Vegetation

Siltstone - Clay Rock Outcrop CEGL002047

DESCRIPTION: The vegetation is sparse, with a mixture of short shrubs (<1 m tall) and mid and short grasses and forbs. In Nebraska, the short shrubs include widely scattered individuals of *Rhus trilobata*, though *Ericameria parryi var. howardii (= Chrysothamnus parryi ssp. howardii)* or *Cercocarpus montanus* are common in some stands. Forbs are usually more abundant than grasses in sites where soil development is minimal. *Eriogonum pauciflorum* and *Phlox hoodii* are among the more abundant. Where a shallow layer of soil has developed, grasses include *Bouteloua gracilis* and *Elymus lanceolatus*. Other species present can include *Arenaria hookeri, Astragalus laxmannii var. robustior, Astragalus spatulatus, Bouteloua curtipendula, Cryptantha cana, Gutierrezia sarothrae, Mentzelia decapetala, Muhlenbergia cuspidata, Muhlenbergia pungens, Paronychia depressa, Psoralidium lanceolatum*, and *Tetraneuris acaulis* (Steinauer and Rolfsmeier 2000).

Stands occur on nearly level to moderately steep slopes (less than 60% grade) on irregularly eroded sandstone and siltstone escarpments, ravines, and ridgecrests. Soils are poorly developed to absent, and consist of very shallow sandy loams or silty loams (Steinauer and Rolfsmeier 2000).

COMMENTS: *3, MCS*. Concept of the type is taken from the Nebraska state classification - rock outcrop (Steinauer and Rolfsmeier 2000). It applies to outcroppings in the Cross Timbers-Chautauqua Hills area of southeast Kansas, and to those in extreme northwest Kansas adjacent to Colorado (and probably then to scattered occurrences elsewhere).

CONSERVATION RANK: *G4?*. This type has a restricted distribution, but it has always been so, and is little impacted by negative human disturbances.

DISTRIBUTION: This siltstone-clay rock outcrop sparsely vegetated community is found in the central Great Plains, particularly Nebraska.

USFS ECOREGIONS: 251E:CC, 331F:CC, 332:?, M334A:CC
CONSERVATION REGIONS: 26:C
STATES: KS? NE **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE rock outcrop =

OTHER SYNONYMY:

USNVC HIERARCHY: ROCK OUTCROP SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

Granite - Metamorphic Black Hills Rock Outcrop Sparse Vegetation

Granite - Metamorphic Black Hills Rock Outcrop Sparse Vegetation

Black Hills Granite - Metamorphic Rock Outcrop CEGL002295

DESCRIPTION: Few vascular plants grow in this community, although lichens are common. Widely scattered *Pinus ponderosa* grow where there is enough soil to support their roots. Dwarf-shrubs and herbaceous species, such as *Arctostaphylos uva-ursi, Juniperus communis*, and *Carex inops ssp. heliophila* can be found in soil pockets as well.

This community is found where granite or schist bedrock is exposed in the higher elevations of the Black Hills. Slopes range from none (flat) to steep. There is little soil development; what soil there is can be found in cracks and depressions in the rock surface.

COMMENTS: *3, MCS*. Type includes igneous and metamorphic rock types (e.g., granites, slates, phonolite porphyry).

CONSERVATION RANK: *G4.*

DISTRIBUTION: This granitic/metamorphic rock outcrop community is found in the Black Hills of the United States and may be related to rock outcrop types in the Rocky Mountains.

USFS ECOREGIONS: M334A:CC
CONSERVATION REGIONS: 25:C
STATES: SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: ROCK OUTCROP SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

2.4. Cliffs, Talus, Buttes and Badlands

2.4.5. Rocky Mountains Cliffs, Buttes and Talus

Maderate Cliff Sparse Vegetation

Maderate Cliff Sparse Vegetation

Maderate Cliff CEGL002293

DESCRIPTION: The vegetation on the cliffs is sparse, but typical herbaceous and shrub species include *Cystopteris bulbifera, Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda), Zigadenus elegans, Cornus canadensis, Galium triflorum, Campanula rotundifolia, Aquilegia canadensis, Solidago sciaphila, Physocarpus opulifolius*, and *Arabis lyrata*. Tree and shrub species in close proximity to maderate cliffs (at the base or overhanging the top) characteristically include *Pinus strobus, Abies balsamea, Betula alleghaniensis (= Betula lutea), Betula papyrifera, Taxus canadensis, Acer saccharum*, and *Tilia americana*. Ferns, mosses and liverworts have been poorly characterized. Both maderate cliffs and the closely related algific talus slopes share some relict species that arrived shortly after the glaciers moved farther north and the climate gradually ameliorated; both, however, contain their own unique suite of relict species. Among the relict and disjunct plants, *Rhodiola integrifolia ssp. leedyi (= Sedum integrifolium ssp. leedyi)* and *Draba arabisans* occur in the Paleozoic Plateau region only on the maderate cliffs. (Frest 1991, MNNHP 1993, USFWS 1998, W. Ostlie pers. comm. 1999).

Stands occur on vertical or near-vertical bedrock exposures, with a northern to northeastern aspect. Maderate Cliffs can be up to 60 m in height, and may extend up to 0.6 km in length These cliffs can form through stream undercutting. Stream erosion caused massive blocks of dolostone to shift forward along horizontal planes, which created upland sinkholes and resulted in a miniature cave system with internal airflow feeding cool subsurface air to the cliff face. Under the present climate, the fissures retain ice and cold air well into summer, creating a cool cliff face. The yearly temperatures range only between about -10 and +10 degrees Celsius. Humidity is fairly high, generally 80% at ground surface. Generally, the dissected (eroded) fissure and sink system is small; fissures extend only 0.06 km or so into the rock, and the surface feeder sinks are usually cryptic. The habitat patches on the cliff face are very strongly developed along certain bedding planes, formed by bands of bentonite and limestone. Bentonite, a clay impervious to water, causes consistent groundwater discharge at the contact point, which creates horizontal bands on the cliff face. The bands are generally quite narrow, and they may form a loosely anastomosing system. Individual patches may be as large as 25 m2 or more. Where river erosion is less pronounced, the cool air can flow over talus (unlike true algific talus, where the cool air emerges through the talus) (Frest 1991, USFWS 1998).

COMMENTS: *2, MCS*. The vascular and nonvascular vegetation of this type needs to be better characterized, and this type may not technically fit the definition of sparse vegetation. This type shares a similar composition, climate, geographic distribution and geologic history with that of Algific Talus Slopes, *Impatiens pallida - Cystopteris bulbifera - Adoxa moschatellina - (Chrysosplenium iowense, Aconitum noveboracense)* Herbaceous Vegetation (CEGL002387). Type can be associated with *Pinus strobus - Abies balsamea - Betula alleghaniensis* Driftless Forest (CEGL002111).

CONSERVATION RANK: *G3?.*

DISTRIBUTION: This moist maderate cliff community type is found in the Driftless Area of the upper midwestern United States, particularly in southeast Minnesota and northeast Iowa.

USFS ECOREGIONS: 222Lc:CCC, 222Lf:CCC
CONSERVATION REGIONS: 46:C
STATES: IA MN **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MN moist cliff (southeast section) maderate subtype =

OTHER SYNONYMY:

USNVC HIERARCHY: OPEN CLIFF SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

Thuja occidentalis Cliff Woodland

Northern White-cedar Cliff Woodland

White-cedar Cliff Woodland CEGL002451

DESCRIPTION: The vegetation is an open-canopied woodland. The major tree dominant is *Thuja occidentalis*. Further information is needed to describe this type. See Kelley and Larson (1997) for a description of the old-growth structure of some of these cliffs along the Great Lakes.

Stands occur on steep, alkaline cliffs, typically of limestone or dolostone.

COMMENTS: *2, MCS*. This type is perhaps redundant, overlapping in concept with either moist Limestone - Dolostone Midwest Moist Cliff Sparse Vegetation (CEGL002292) or Limestone - Dolostone Great Lakes Shore Cliff Sparse Vegetation (CEGL002504). Moist cliffs may typically contain woody vegetation, but it is not known whether this *Thuja occidentalis* woodland description adequately represents the woody vegetation. In Wisconsin, this is a very minor type, perhaps less than 100 acres. Some cliffs in Wisconsin and further east may contain a *Thuja occidentalis - Pinus resinosa* community. In Wisconsin, there is a single occurrence of a white cedar-dominated dripping dolomite cliff community on a north-facing exposure above Bear Creek, a tributary of the lower Chippewa River in Pepin County. This is near the northern edge of the driftless area, but in "old" drift. The site is dramatically disjunct from other white cedar populations, and was in poor condition. There are stands of white cedar along the lower St. Croix River on both the Minnesota and Wisconsin side that can perhaps be characterized as outliers of the widespread cedar cliff populations occurring just to the north (E. Epstein pers. comm. 2000). The few stands in SE Minnesota are small and marginal (H. Dunevitz pers. comm. 2000). See comparisons of northern Midwest stands to stands in Ohio by Kangas (1989). See Kelly et al. (1997) for a striking presentation of the old-growth structure of white cedar woodlands on cliff-faces.

CONSERVATION RANK: *G3.* This type is naturally restricted to small areas on bluffs. It is unclear whether this type is an outlier population of northern *Thuja* communities, a variant of other moist cliffs, or a distinct community. In SE Minnesota only a few occurrences are known. In Wisconsin, this is a very minor type, perhaps less than 100 acres.

DISTRIBUTION: This white-cedar cliff woodland community is found in the upper Great Lakes region of the United States and Canada, ranging from Ontario and Michigan west to Wisconsin and southeastern Minnesota.

USFS ECOREGIONS: 212Ha:PPP, 212Ja:PP?, 212Jb:PP?, 212Jc:PP?, 212Jl:PPP, 212Jn:PPP, 212Jo:PPP, 212Jr:PPP, 222Lc:CCC
CONSERVATION REGIONS: 46:C, 47:?, 48:C
STATES: MI MN WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

MI	cedar bluff +
MN	upland white cedar forest (southeast section) =
WI	white cedar cliff woodland =

OTHER SYNONYMY:

USNVC HIERARCHY: THUJA OCCIDENTALIS WOODLAND ALLIANCE (II.A.4.N.b)

Acer spicatum - Thuja occidentalis - Betula papyrifera / Taxus canadensis Shrubland

Mountain Maple - Northern White-cedar - Paper Birch / Canada Yew Shrubland

Northern (Laurentian) Igneous - Metamorphic Moist Cliff Scrub CEGL005251

DESCRIPTION: At Isle Royale National Park in Michigan, the vegetation forms a closed canopy forested scrub, with about 80% canopy cover. *Acer spicatum* is dominant in the canopy, with over 50% cover; other tree species present include *Thuja occidentalis, Betula papyrifera*, and *Picea glauca*. There is about 30% cover of short shrubs; *Taxus canadensis* and *Rubus parviflorus* are the most abundant shrubs. Cover of herbs is about 30%; the most abundant herbs are *Gymnocarpium dryopteris* and *Mitella nuda*. Cover of nonvascular plants is about 20%; *Pleurozium schreberi* is a common moss (C. Reschke pers. comm. 1999). In Wisconsin, similar woody species occur, and herbs include *Cystopteris fragilis* and *Campanula rotundifolia* (E. Epstein pers. comm. 1999).

At Isle Royale National Park in Michigan, stands occupy sites in the northeast part of the park on very steep talus slopes or cliffs, typically facing northwest, and thus are relatively moist (C. Reschke pers. comm. 1999). Bedrock is igneous/metamorphic and may be either granite or basalt/diabase.

COMMENTS: *3, MCS*. Type may be either shrubland or forest. Physiognomy needs to be resolved. See also Ontario type Mountain Maple Carbonate Talus Shrubland, *Acer spicatum* Carbonate Talus Shrubland (CEGL005067). The substrate characteristics need review. Should both granite and basalt/diabase cliffs be placed here? Northern (Laurentian) Igneous/Metamorphic Dry Cliff, *Acer spicatum - Thuja occidentalis - Betula papyrifera / Taxus canadensis* Shrubland (CEGL005251), is the dry counterpart to this type. This type may overlap with the Basalt - Diabase Great Lakes Shore Cliff Sparse Vegetation (CEGL005191), and the Granite - Metamorphic Great Lakes Shore Cliff Sparse Vegetation (CEGL005244), but those types are restricted to the Great Lakes shore. Type may also overlap with White Cedar Cliff Woodland, *Thuja occidentalis* Cliff Woodland (CEGL002451), but that type is not expected to have the boreal species present in this type. In Wisconsin, the type may occur in northeast Wisconsin (Menominee River) and northwest Wisconsin (Apostle Islands, Penokee Range), as well as on the Door Peninsula (E. Epstein pers. comm. 1999).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This boreal cliff forest is found in the boreal regions of the midwestern United States and in adjacent Canada, ranging from the boreal regions of Michigan and Wisconsin to Ontario and perhaps elsewhere in central Canada.

USFS ECOREGIONS: 212H:CP, 212Ib:CCC, 212J:CP
CONSERVATION REGIONS: 48:C
STATES: MI MN WI? **PROVINCES:** ON?

MIDWEST HERITAGE SYNONYMY:

MI	moist non-acid cliff +
MN	moist cliff (northeast section) ?
WI?	boreal forest (boreal cliff scrub?) ?

OTHER SYNONYMY:

USNVC HIERARCHY: ACER SPICATUM SHRUBLAND ALLIANCE (III.B.2.N.a)

Igneous - Metamorphic Northern Dry Cliff Sparse Vegetation

Igneous - Metamorphic Northern Dry Cliff Sparse Vegetation

Northern (Laurentian) Igneous - Metamorphic Dry Cliff CEGL002300

DESCRIPTION: At this time little is known of the vegetational characteristics of this type. These dry cliffs may have <25% total plant cover, excluding crustose lichens (MNNHP 1993).

At this time little is known of the environmental characteristics of this type. Stands do include inland basalt/diabase cliffs away from the Great Lakes shoreline. Other igneous or metamorphic rock types may also be included.

COMMENTS: *3, MCS*. More study is needed to characterize this type. The igneous/metamorphic rock type category may be too broad, and perhaps more alkaline rocks such as basalt/diabase should be separated from granite and other more acidic rocks. The Northern (Laurentian) Igneous/Metamorphic Moist Cliff Scrub, *Acer spicatum - Thuja occidentalis - Betula papyrifera / Taxus canadensis* Shrubland (CEGL005251), is the moist counterpart to this type. In Wisconsin, basalt/diabase examples of this type occur along the St. Croix River and at a few other locations in the northwest. Other igneous or metamorphic rock types would also be placed here.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This dry igneous/metamorphic cliff community is found in the northern Great Lakes region of the United States and Canada, ranging from Minnesota, Wisconsin, and Michigan into Ontario.

USFS ECOREGIONS: 212Hb:CPP, 212He:CP?, 212Ja:CP?, 212Jb:CPP, 212Jc:CPP, 212Jf:CPP, 212Jj:CPP, 212Jl:CPP, 212Jn:CPP, 212Jo:CPP, 212Jr:CPP, 212L:CC
CONSERVATION REGIONS: 47:P, 48:C
STATES: MI? MN WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

	MI?	dry acid cliff
	MN	dry cliff (northeast section) +
	WI	open cliff (Basalt/Diabase Subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: OPEN CLIFF SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

Impatiens pallida - Cystopteris bulbifera - Adoxa moschatellina - (Chrysosplenium iowense, Aconitum noveboracense) Herbaceous Vegetation

Yellow Jewelweed - Bulblet Bladderfern - Moschatel - (Iowa Golden-saxifrage, Northern Monkshood) Herbaceous Vegetation

Algific Talus Slope CEGL002387

DESCRIPTION: The vegetation is dominated by forbs, ferns, and mosses, which cover much of the talus. The most abundant species are *Adoxa moschatellina, Circaea alpina, Cornus canadensis, Cystopteris bulbifera, Impatiens pallida, Maianthemum canadense, Mertensia paniculata*, and *Mitella nuda*. Other characteristic species include *Aconitum noveboracense* and *Chrysosplenium iowense* (a boreal disjunct). *Carex norvegica* is reported in Wisconsin (E. Epstein pers. comm. 1999). Associated shrub and tree species include *Abies balsamea, Acer spicatum, Betula papyrifera, Fraxinus nigra*, and *Rhamnus alnifolia*. Relict and disjunct vascular plants found only on algific talus slopes include *Aconitum noveboracense* and *Chrysosplenium iowense*, though in Wisconsin *Aconitum* is also found on moist sandstone ledges elsewhere in the Driftless Area (Frest 1991, MNNHP 1993, E. Epstein pers. comm. 1999).

Stands occur at the base of steep, north-facing dolostone talus slopes. They formed in carbonate units exposed along major drainages at the edge of concentric, cliffy cuestas found in the region. Generally they formed as a result of periglacial frost and ice wedging on north-facing slopes with 7 m or more of rock exposure. Common features of the bedrock where these talus slopes are formed include their formation as mechanical karst, i.e. karst formed from frost action and ice wedging when the system originated during the Wisconsin glacial period. Continuous cold air drainage from fissures and ice caves in the talus creates a cool, moist microclimate that keeps summer temperatures from rarely exceeding 16 degrees Celsius, and winter temperatures rarely below - 10 degrees Celsius. Exposed talus and boulders may be common, and the talus size varies depending on the geologic formation of the talus. Stands vary in size from a few meters square to narrow linear complexes that extend up to 1.5 km, depending on their geology (Frest 1991).

COMMENTS: *1, MCS*. This type is related in species composition, geographic distribution, and climate to Maderate Cliff Sparse Vegetation (CEGL002293). The type can be adjacent to stands of *Pinus strobus - Abies balsamea - Betula alleghaniensis* Driftless Forest (CEGL002111).

CONSERVATION RANK: *G2.* Most occurrences are very small (less than 1 acre). The community is ranked S1 in three states (Iowa, Illinois, Wisconsin) and S2 in Minnesota. There are 70 small occurrences documented in a fairly restricted range (eight counties in four states). Many occurrences are disturbed.

DISTRIBUTION: The algific talus slope community type is found in the Driftless Area of the upper midwestern United States ranging from northeastern Iowa, southeastern Minnesota, southwestern Wisconsin, and northwestern Illinois.

USFS ECOREGIONS: 222Lc:CCC, 222Lf:CCC
CONSERVATION REGIONS: 46:C
STATES: IA IL MN WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:
IL algific talus slope =
MN talus slope algific subtype =
WI algific talus slope =

OTHER SYNONYMY:

USNVC HIERARCHY: IMPATIENS PALLIDA - CYSTOPTERIS BULBIFERA - ADOXA MOSCHATELLINA HERBACEOUS ALLIANCE (V.B.2.N.a)

Thuja occidentalis Carbonate Talus Woodland

Northern White-cedar Carbonate Talus Woodland

White-cedar Limestone Talus Woodland CEGL005172

DESCRIPTION: Stand structure varies from patchy and barren (20-40%) to more closed (40-70%) tree canopy. The dominant species is *Thuja occidentalis*, with typical associates including *Acer saccharum, Betula alleghaniensis, Betula papyrifera, Fraxinus americana, Ostrya virginiana, Picea glauca*, and *Tsuga canadensis*. Tall shrubs include *Acer spicatum, Cornus rugosa*, and *Sambucus racemosa*. Herbaceous species include *Asplenium trichomanes, Cystopteris bulbifera, Dryopteris marginalis, Geranium robertianum*, and *Polypodium virginianum* (Bakowsky and Lee 1996).

Stands are found on limestone or dolostone (carbonate) talus.

COMMENTS: *2, MCS*. This description is derived from species lists from Bakowsky and Lee (1996) and needs rangewide review. However, this type may be part of a broader northern (Laurentian) Talus types. See also Limestone - Dolostone Talus Sparse Vegetation (CEGL002308), a broadly defined Midwestern talus type.

CONSERVATION RANK: *G3G4.* No occurrences have been documented, but the community is reported in southern Ontario, where it is ranked S?, and it may occur in Michigan (SP). Stands are found on limestone or dolostone (carbonate) talus.

DISTRIBUTION: This white-cedar evergreen woodland type is found on talus in the upper midwestern United States and Canada, including limited areas of Michigan and southern Ontario.

USFS ECOREGIONS: 212Hj:PPP
CONSERVATION REGIONS: 48:C
STATES: MI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI cedar bluff +

OTHER SYNONYMY:

USNVC HIERARCHY: THUJA OCCIDENTALIS WOODLAND ALLIANCE (II.A.4.N.b)

Basalt - Diabase Northern Open Talus Sparse Vegetation

Basalt - Diabase Northern Open Talus Sparse Vegetation

Northern Basalt - Diabase Open Talus CEGL005247

DESCRIPTION: This open basalt-diabase talus type occurs in the northern parts of the midwestern United States and into Canada. The type is in need of further characterization.

COMMENTS: *2, MCS*. In Wisconsin, basalt talus occurs along the St. Croix River.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This open basalt/diabase talus type occurs in the northern parts of the midwestern United States and into Canada, ranging from Wisconsin and Ontario to possibly Minnesota and Michigan.

USFS ECOREGIONS: 212J:CC, 212Lb:CC?
CONSERVATION REGIONS:
STATES: MI? MN WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

MI?	moist non-acid cliff
MN	talus slope +
WI	basalt talus =

OTHER SYNONYMY:

USNVC HIERARCHY: LOWLAND TALUS SPARSE VEGETATION ALLIANCE (VII.B.1.N.a)

Betula papyrifera - Picea glauca / Acer spicatum - Alnus viridis / Polypodium virginianum Talus Shrubland [Provisional]

Paper Birch - White Spruce / Mountain Maple - Green Alder / Rock Polypody Talus Shrubland

Northern Basalt - Diabase Scrub Talus CEGL005252

DESCRIPTION: At Isle Royale National Park in Michigan, this paper birch - white spruce talus scrub woodland is an open canopy, mixed evergreen and deciduous woodland. Stands occur on steep to very steep talus slopes at the base of basalt cliffs facing northwest. Canopy cover of trees over 5 m tall is typically 30-50% cover. The most abundant trees are *Betula papyrifera* and *Picea glauca*. Cover of tall shrubs varies from 10-70% cover; the most abundant tall shrubs are *Acer spicatum* and *Alnus viridis*. Cover of short shrubs (including dwarf-shrubs) varies from 5-40%; the most abundant low shrubs are *Taxus canadensis* and *Rubus pubescens*. Herbs usually have about 30-40% cover; the most abundant herbs are *Polypodium virginianum* and *Dryopteris expansa*. Cover of nonvascular plants is usually about 30-40%; mosses, such as *Pleurozium schreberi*, and foliose lichens are common in the ground layer (C. Reschke pers. comm. 1999).

At Isle Royale National Park, this community occupies steep to very steep talus slopes at the base of basalt cliffs facing northwest (C. Reschke pers. comm. 1999).

COMMENTS: *3, MCS*. This type has a mixed evergreen-deciduous physiognomy on Isle Royale, but rangewide review with Ontario's Paper Birch Talus type is needed (Dry-Fresh White Birch Carbonate Treed Talus Type) (Lee et al. 1998). Distinctions between this type and the Granite-Metamorphic Talus Northern Sparse Vegetation (CEGL002409), need review, as well as with the Basalt-Diabase Northern Open Talus Sparse Vegetation (CEGL005247).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This talus scrub type is found in the northern Great Lakes region of the United States and Canada.

USFS ECOREGIONS: 212Ib:CCC
CONSERVATION REGIONS: 48:C
STATES: MI? **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI? moist non-acid cliff

OTHER SYNONYMY:

USNVC HIERARCHY: ACER SPICATUM SHRUBLAND ALLIANCE (III.B.2.N.a)

Boreal Glaciere Talus Sparse Vegetation

Boreal Glaciere Talus Sparse Vegetation

Glaciere Talus CEGL005243

DESCRIPTION: The vegetation is physiognomically complex, tending to be shrubby with scattered trees and patches of ferns, mosses, and lichens. At the Wisconsin sites, scattered soil pockets may occur that support scattered pines (*Pinus strobus* and *Pinus resinosa*). These are often associated with mossy beds of *Polypodium virginianum*. At the base of the talus slope, cold air upwells during the summer among the jumbled boulders along a narrow (3- to 20-m wide) front. Here, among the talus blocks, a shrubland forms, dominated by *Acer spicatum, Ribes glandulosum*, and *Cornus rugosa*, under which is a dense carpet of ferns (mostly *Polypodium virginianum*), and rare and disjunct mosses and lichens. Scattered trees of *Betula papyrifera, Acer saccharum, Acer rubrum*, and *Abies balsamea* may also be present. A 'pro-talus rampart' - a low windrow-like ridge a short distance from the base of the main slope caused by rubble sliding down ice faces - may be present in some sites (Devils Lake and Blue Hills, Wisconsin). Rare plants present may include species disjunct from slightly to much farther north, such as *Viburnum edule, Ribes oxyacanthoides, Clematis occidentalis, Ledum groenlandicum*, and *Abies balsamea* (E. Judziewicz and E. Epstein pers. comm. 1999).

In Ontario (Ouimet Canyon and Cavern Lake), slow-melting ice is present throughout the summer among the talus blocks and arctic disjunct plants, such as *Arenaria humifusa, Pyrola grandiflora, Carex atratiformis, Arnica lonchophylla ssp. lonchophylla (= Arnica chionopappa), Salix myrtillifolia, Saxifraga paniculata*, and *Polygonum viviparum*. The moss *Aulacomnium acuminatum* is dominant and may comprise 90% of the ground cover. Scattered 'layering' of small trees of *Picea mariana* and *Betula papyrifera* may occur in the cold upwelling zone, and *Ledum groenlandicum* is locally frequent (Soper and Given 1981, Frest 1991, Bakowsky 1997).

Stands contain quartzite or other metamorphic or igneous rock talus slope or "felsenmeer" communities that are characterized by all-summer upwellings of cool, moist air near or at their bases. It is not certain whether year-round ice deposits are responsible for the upwelling. Glaciere talus forms as the result of periglacial frost and ice-wedging; quartzite, in particular, is a brittle rock that is susceptible to frost-wedging. The talus slopes themselves consist of lichen-covered boulders ranging from 0.25-1 m in diameter. Nearly all sites (except the one at Devils Lake, Wisconsin) occur in areas that were glaciated during the Pleistocene (Bakowsky 1997, E. Judziewicz and E. Epstein pers. comm. 1999).

COMMENTS: *2, MCS*. A proposed name for this type is *Polypodium virginianum - Acer spicatum - Ribes* spp. - Lichen species - Moss species Herbaceous Vegetation (E. Judziewicz and E. Epstein pers. comm. 1999). This type is related in geomorphological characteristics and (to a lesser degree) in floristic composition to Algific Talus Slope, *Impatiens pallida - Cystopteris bulbifera - Adoxa moschatellina - (Chrysosplenium iowense, Aconitum noveboracense)* Herbaceous Vegetation (CEGL002387), which, however, is found on dolostone and strictly in unglaciated territory. The type may occur in extreme northeastern Minnesota, as many rare plants occur on the diabase and gabbro cliffs and talus there. But, apparently at these sites, the plants occur on the slopes, ledges, and tops of the talus slopes (Coffin and Pfannmuller 1988), and no cold air upwellings are reported from the base.

CONSERVATION RANK: *G2G3*. Occurrences range from small (under 1 acre in Wisconsin sites) to tens of acres (the Ontario sites). The community will be tentatively ranked S1 in Wisconsin. It is best developed in the Blue Hills in the northwestern part of the state, where there are three high-quality (Blue Hills, Rock Creek, and Spring Creek felsenmeers) and several more lower quality, incompletely surveyed occurrences. These communities, hitherto designated as "felsenmeers", have been designated as State Natural Areas.

DISTRIBUTION: This talus community is found in the upper midwestern United States and adjacent Canada in northern Ontario. It ranges from southwestern Wisconsin to northern Ontario, and possibly in northern Michigan and northeastern Minnesota.

USFS ECOREGIONS: 212J:CC, 212L:C?
CONSERVATION REGIONS: 47:C, 48:C
STATES: MI? MN? WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI? moist acid cliff
MN? talus slope +
WI Glaciere talus =

OTHER SYNONYMY: WI, "Felsenmeer" (= "sea of rocks") (Mack-Olson 1998). also possibly used as far back as the 1969 by W.E. Tans and/or R.H. Read to characterize the Blue Hills sites., ON, "*Pyrola* Talus Herbfield" (Given and Soper 1981)

USNVC HIERARCHY: LOWLAND TALUS SPARSE VEGETATION ALLIANCE (VII.B.1.N.a)

Granite - Metamorphic Talus Northern Sparse Vegetation

Granite - Metamorphic Talus Northern Sparse Vegetation

Northern Granite - Metamorphic Talus CEGL002409

DESCRIPTION: The vegetation on these talus slopes varies from very sparse to pockets of shrubs and trees. Species composition needs to be described.

Stands occur as unconsolidated rocks at the base of steep slopes or cliffs. Soils are absent. The parent material is either granite or metamorphic, and rock fragments are often angular and large.

COMMENTS: *2, MCS*. Type may need to be split into open versus wooded types. In Wisconsin, this type may possibly occur in the Penokee Range (granite). Stands along the St. Croix River are basalt/diabase and are treated with the Basalt-Diabase Northern Open Talus Sparse Vegetation (CEGL005247). Devil's Lake has a quartzite, metamorphic talus which is included here for now.

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This granite/metamorphic talus type is found in the northern parts of the Great Lakes region in both the United States and Canada, ranging from Minnesota and Ontario east to Wisconsin and Michigan.

USFS ECOREGIONS: 212Ja:CPP, 212Jb:CPP, 212Jf:CP?, 212Jj:CPP, 212Jn:CP?, 222:C
CONSERVATION REGIONS: 47:P, 48:C
STATES: MI MN WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

MI	dry acid cliff +
MN	talus slope +
WI	igneous talus =

OTHER SYNONYMY:

USNVC HIERARCHY: LOWLAND TALUS SPARSE VEGETATION ALLIANCE (VII.B.1.N.a)

Sandstone Talus Northern Sparse Vegetation

Sandstone Talus Northern Sparse Vegetation

Northern Sandstone Talus CEGL005202

DESCRIPTION: The vegetation is generally sparse, but may vary depending on degree of slope, exposure (open vs. shaded) and rock type. The composition of the type may be heavily influenced by adjacent forested stands. The vegetation of this type has not been characterized.

Stands occur at the bases of steep cliffs along larger streams or rivers, or strongly dissected valleys. Aspect is variable, and moisture could be moist or dry. Soils are generally absent. Parent material is sandstone.

COMMENTS: *3, MCS*. Further work is needed to characterize this type. As currently defined, both open and wooded talus are included here. The distribution in central parts of the Midwest needs further review.

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This sandstone talus community is found in the upper Great Lakes region of the United States and Canada, ranging from Ontario into Minnesota, though it may also occur farther south into the midwestern United States.

USFS ECOREGIONS: 212:C, 222Ga:CCC, 222Gb:CCC, 222Hf:CCC, 222Kh:CCC, 222Lc:CCC, 251Cf:P??, 251Cj:P??, 251De:PPP
CONSERVATION REGIONS: 36:?, 45:?, 46:P, 48:?
STATES: MN **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MN talus slope +

OTHER SYNONYMY:

USNVC HIERARCHY: LOWLAND TALUS SPARSE VEGETATION ALLIANCE (VII.B.1.N.a)

Basalt - Diabase Great Lakes Shore Cliff Sparse Vegetation

Basalt - Diabase Great Lakes Shore Cliff Sparse Vegetation

Great Lakes Shore Basalt - Diabase Cliff CEGL005191

DESCRIPTION: Vegetation is often sparse, due to severe wave action. Mosses, lichens, ferns, and liverworts may be found, with occasional graminoids in crevices or shelves that trap soil. In Minnesota, arctic-alpine disjunct plant species (e.g., *Moehringia macrophylla (= Arenaria macrophylla), Draba norvegica*) and more temperate plant species may be found (MNNHP 1993, Albert et al. 1995).

This community occurs on vertical or near-vertical, south- to west-facing aspects of basalt or diabase bedrock. In Michigan cliffs range from only 3-6 m to over 60 m tall (Albert et al. 1995). Moisture is derived from precipitation.

Cliffs along the Great Lakes shore are exposed to severe wave action, preventing establishment of vegetation.

COMMENTS: *2, MCS*. A cliff may be defined as a vertical or near-vertical rock face at least 3 m high (MNNHP 1993). It is not clear whether a dry versus moist cliff distinction is needed along the Great Lakes shores, where lake moistures may keep the cliffs moist regardless of exposures. Inland basalt/diabase cliffs that are heavily wooded are tracked as Northern (Laurentian) Igneous - Metamorphic Moist Cliff Scrub (= *Acer spicatum - Thuja occidentalis - Betula papyrifera / Taxus canadensis* Shrubland (CEGL005251)), and Inland basalt/diabase cliffs that are open or dry are tracked as Northern (Laurentian) Igneous - Metamorphic Dry Cliff (= Igneous - Metamorphic Northern Dry Cliff Sparse Vegetation (CEGL002300)).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This basalt/diabase cliff community is found along the Great Lakes shorelines and inland areas in the sub-boreal regions of the Great Lakes in the United States and central Canada, including Michigan, Minnesota, and Ontario.

USFS ECOREGIONS: 212Hb:CPP, 212Ib:CCC, 212Ja:CCP, 212Jb:CCP, 212Jj:CCP, 212Lb:CCC
CONSERVATION REGIONS: 47:P, 48:C
STATES: MI MN **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI moist non-acid cliff +
MN dry cliff (northeast section) +

OTHER SYNONYMY:

USNVC HIERARCHY: OPEN CLIFF SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

Limestone - Dolostone Great Lakes Shore Cliff Sparse Vegetation

Limestone - Dolostone Great Lakes Shore Cliff Sparse Vegetation

Great Lakes Shore Limestone - Dolostone Cliff CEGL002504

DESCRIPTION: Exposed cliff faces are often wind-swept and experience extreme temperature fluctuations, with little vegetation. Plants growing in crevices include *Deschampsia caespitosa, Pellaea glabella, Physocarpus opulifolius, Polypodium virginianum*, and *Thuja occidentalis*. *Thuja occidentalis* can attain very old ages elsewhere on limestone cliffs, often exceeding 300 years of age (Kelly and Larson 1997). Where cliffs are largely concealed by a forest canopy, their climatic conditions are moderated, and many other herbaceous species are found, including *Aralia nudicaulis, Cystopteris bulbifera, Cystopteris fragilis, Geranium robertianum*, and *Trientalis borealis*. Mosses may also be common. Other woody species present include *Tilia americana, Acer spicatum*, and *Taxus canadensis* (Albert et al. 1995).

Stands occur both as open exposed cliff faces and as low exposures concealed by forest cover. Exposed cliff faces are often wind-swept and experience extreme temperature fluctuations, with little vegetation. Where cliffs are largely concealed by a forest canopy, their climatic conditions are moderated (Albert et al. 1995).

COMMENTS: *2, MCS*. This type varies from dry cliff (exposed) to moist (shaded) cliff, but along the Great Lakes shoreline this distinction has not been made. Albert et al. (1995) do not indicate what the forest canopy composition is for the shaded limestone cliffs. The shaded cliff may fit in part into a White Cedar Limestone Cliff Woodland type, *Thuja occidentalis* Cliff Woodland (CEGL002451; see Bakowsky and Lee 1996). On Lake Superior, a Precambrian limestone cliff type occurs, with arctic-alpine disjunct floristic elements. There may be less than 5 occurrences of this variant, each less than <20 m in width and between 5 and 10 m in height (Bakowsky pers. comm. 1998). This Great Lakes cliff is distinct from inland examples, Limestone - Dolostone Midwest Dry Cliff Sparse Vegetation (CEGL002291) and Limestone - Dolostone Midwest Moist Cliff Sparse Vegetation (CEGL002292).

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This limestone/dolostone cliff community is found along the northern Great Lakes shorelines in the United States and Canada, ranging from Michigan and Wisconsin (Door Peninsula only) to Ontario.

USFS ECOREGIONS: 212Ha:CCC, 212He:CCC, 212Hj:CC?, 212Ja:CCP, 212Jb:CCC, 212Jr:CCC, 212Ob:CCC
CONSERVATION REGIONS: 48:C
STATES: MI WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI moist non-acid cliff +
WI Great Lakes bedrock cliff (lake michigan subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: OPEN CLIFF SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

Granite - Metamorphic Great Lakes Shore Cliff Sparse Vegetation

Granite - Metamorphic Great Lakes Shore Cliff Sparse Vegetation

Great Lakes Shore Granite - Metamorphic Cliff CEGL005244

DESCRIPTION: The vegetation is very sparse. Further information describing this type is needed.

Stands occur along the lake shore and are exposed to wind, wave, and ice action. Bedrock is composed of granite or metamorphic rock.

COMMENTS: *2, MCS*. This type may closely resemble either Basalt - Diabase Great Lakes Shore Cliff Sparse Vegetation (CEGL005191) or Sandstone Great Lakes Shore Cliff Sparse Vegetation (CEGL002503). Albert et al. (1995) do not describe a granite cliff type in Michigan. The type is expected in Ontario, but review is needed (W. Bakowsky pers. comm. 1999).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This granite - metamorphic cliff community type is found along the Great Lakes shoreline of the United States and Canada, possibly in Minnesota, Michigan, and Ontario.

USFS ECOREGIONS: 212Lb:CP?
CONSERVATION REGIONS: 48:?
STATES: MI MN **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI moist acid cliff +
MN moist cliff (northeast section) +

OTHER SYNONYMY:

USNVC HIERARCHY: OPEN CLIFF SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

Sandstone Great Lakes Shore Cliff Sparse Vegetation

Sandstone Great Lakes Shore Cliff Sparse Vegetation

Great Lakes Shore Sandstone Cliff CEGL002503

DESCRIPTION: Species composition varies somewhat, depending on sandstone type, but sandstone cliffs are very low in botanical diversity for a variety of reasons, including lack of soil for rooting, droughtiness on much of the rock surface, exposure to waves and ice, and in some places, unstable surface prone to wave erosion. Some portions of the cliff are moist from small streams or seepages. Jacobsville Sandstone has cliff faces that are largely unvegetated, with mosses, lichens, and herbs concentrated in seeps and streams. Two common herbs are *Sagina procumbens* and *Stellaria calycantha*. *Pinguicula vulgaris* also grows on moist cliffs (Albert et al. 1995).

The substrate is Precambrian sandstone, which in Michigan is exposed along the southern shoreline of Lake Superior. Cliffs rise up over 50 m in places. Fog and wavespray are important environmental influences (Albert et al. 1995).

Disturbances include exposure to waves and ice, and in some places, unstable surfaces prone to wave erosion (Albert et al. 1995).

COMMENTS: *2, MCS*. Categories of moist vs. dry are difficult to apply due to variability on the rock surface and the Great Lakes shoreline context. Instead, substrate type is used, with the granite - metamorphic cliffs placed in the Granite - Metamorphic Great Lakes Shore Cliff Sparse Vegetation (CEGL005244).

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This sandstone cliff community type is found in the northern Great Lakes shorelines of the United States and Canada, from Michigan and Wisconsin (Apostle Islands, northern Bayfield County along Lake Superior) to Ontario, possibly eastward to Pennsylvania.

USFS ECOREGIONS: 212Ha:CCC, 212He:CCP, 212Hi:CCP, 212Hl:CCC, 212Ia:CCC, 212Ib:CCC, 212Ja:CCC, 212Jb:CCP, 212Jn:CCC, 212Jr:CCC, 212Lb:C??, 222:?
CONSERVATION REGIONS: 48:C
STATES: MI PA? WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI moist acid cliff +
WI Great Lakes bedrock cliff (lake superior subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: OPEN CLIFF SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

Juniperus ashei Ozark Clifftop Woodland

Ashe's Juniper Ozark Clifftop Woodland

Ozark Ashe's Juniper Clifftop Woodland CEGL004672

DESCRIPTION: These woodlands generally have a pure *Juniperus ashei* canopy with little other associated vascular flora. Lichens may be abundant on rocks and covering the ground.

Stands occur on rimrock bluffs and cliffs composed of dolomite (or possibly limestone) in the Ozark Highlands of the United States.

COMMENTS: *1, SCS*. Excellent examples of this community are known from the Ashe Juniper Natural Area (Mark Twain National Forest, Missouri). The type is also reported from Mayes County, Oklahoma. The distinction between this type, which is found in cliff habitats, and *Juniperus ashei / Cotinus obovatus / Carex eburnea - Rudbeckia missouriensis* Woodland (CEGL007833), which is found in glade habitats, was agreed upon at an Ozarks-Ouachita Mountains region meeting (February 1997). These woodlands are less diverse than the mixed *Juniperus ashei* woodlands that occur as glade complexes on less extreme sites in the Ozarks. Field data and example locations are still needed to clarify their patterns, particularly in Missouri, where the need for this type is still under discussion (M. Leahy pers. comm. 1999, T. Nigh pers. comm. 1999). Very open examples of this type may also overlap with the sparse vegetation type Limestone - Dolostone Midwest Dry Cliff Sparse Vegetation (CEGL002291).

CONSERVATION RANK: *G2?.* This association is restricted to rimrock bluffs and cliffs in the Ozark Highlands of the United States, ranging from Missouri to Arkansas and Oklahoma. This association is distinct from related woodlands which occur at part of a glade complex (e.g., *Juniperus ashei / Cotinus obovatus / Carex eburnea - Rudbeckia missouriensis* Woodland (CEGL007833)), as well as from extremely open dry cliffs on limestone and dolostone (Limestone - Dolostone Midwest Dry Cliff Sparse Vegetation (CEGL002291)). Field data and example locations are still needed to clarify the relationships among these types. This community is restricted to scattered, isolated sites which are probably not vulnerable to logging. Sites on private land could be subjected to quarrying for dolomite or limestone. Some examples are protected in the Mark Twain National Forest of Missouri.

DISTRIBUTION: This association includes *Juniperus ashei* woodlands occurring on rimrock bluffs and cliffs composed of dolmite (or possibly limestone) in the Ozark Highlands of the United States, ranging from Missouri to Arkansas and Oklahoma.

USFS ECOREGIONS: 222Ab:CCC, 222Ag:CCC, 222An:CCC
CONSERVATION REGIONS: 38:C
STATES: AR MO OK **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO xeric limestone/dolomite forest +

OTHER SYNONYMY:

USNVC HIERARCHY: JUNIPERUS ASHEI WOODLAND ALLIANCE (II.A.4.N.a)

Limestone - Dolostone Midwest Dry Cliff Sparse Vegetation

Limestone - Dolostone Midwest Dry Cliff Sparse Vegetation

Midwest Dry Limestone - Dolostone Cliff CEGL002291

DESCRIPTION: Vegetation is restricted to shelves, cracks and crevices in the rock, generally averaging less than 20%, and typically consisting of vines and ferns. In the Ozarks and Interior Plateau region, ferns include *Cheilanthes feei, Argyrochosma dealbata (= Notholaena dealbata), Pellaea atropurpurea*, and *Pellaea glabella*. Herbaceous forbs and graminoids include *Aquilegia canadensis, Hedyotis nigricans (= Houstonia nigricans), Mentzelia oligosperma, Muhlenbergia cuspidata, Sedum pulchellum*, and *Solidago rugosa ssp. aspera (= Solidago drummondii)*. Lichens include *Dermatocarpon lachneum, Lecanora muralis* and *Psora russellii*. In Ohio, stands contain the ferns *Pellaea atropurpurea* and *Pellaea glabella*, and the forbs *Aquilegia canadensis, Arabis laevigata, Heuchera americana, Hydrangea arborescens*, and *Sedum ternatum*. Scattered woody plants across the range include *Celastrus scandens, Juniperus virginiana, Parthenocissus quinquefolia, Physocarpus opulifolius, Quercus prinus* (southward), and *Toxicodendron radicans (= Rhus radicans)*, and farther north, *Taxus canadensis, Thuja occidentalis*, and *Tsuga canadensis* (Curtis 1959, Nelson 1985, MNNHP 1993, Anderson 1996).

Stands occur as steep to vertical rock exposures of limestone bedrock. Aspect is variable, but stands are best developed on south- and west-facing slopes. Soils are either absent or, along ledges and shelves, very shallow. The cliffs drain very rapidly, and can become very dry in summer (Nelson 1985).

Natural disturbances include drought stress, wind and storm damage, and disturbances from cliff-dwelling animals, particularly in the crevices, ledges and rock shelters (Nelson 1985).

COMMENTS: *2, MCS*. Definitions of cliff types remain problematic. A minimum height of 3 m may be practical. Curtis (1959) in Wisconsin suggested that substrate was of secondary importance compared to moisture (shading vs. open) in determining floristic patterns. Furthermore some cliffs are a combination of layers of sandstone, shale and limestone or dolostone, making classification problematic. The combination of moisture and substrate is retained here, but a more systematic rangewide comparison of cliff floras is needed. Tim Nigh (pers. comm. 1996) has suggested that the Missouri type could be named "*Aquilegia canadensis - Solidago rugosa ssp. aspera (= Solidago drummondii) - Pellaea atropurpurea* Cliff." Ozark, southern Illinois and Indiana cliffs may be better placed into a Southeastern/Interior Low Plateau type, separate from an upper Midwest type. Limestone cliffs along the Niagara Escarpment in central Ontario/Bruce Peninsula may be different from those in southern Ontario (Wasyl Bakowsky pers. comm. 1998) and from other Great Lakes Limestone cliffs. A series of studies in Ontario's cliffs have led to surprising biological discoveries, including a rich snail fauna, unusual cyanobacteria, and old growth *Thuja occidentalis* stands on the cliffs (Larson and Kelly 1991, Larson, Matthes and Kelly 1999, Larson et al. 1999). Chalk breaks in west-central Kansas along the Smoky Hill River and associated terrain are cliff-like and probably need to be separated from the eastern cliffs (Lauver pers. comm. 1998).

CONSERVATION RANK: *G4G5*. In Missouri many sites have been quarried (M. Leahy pers. comm. 1999). This issue should be examined range-wide. Other sites lack adequate buffers above and below the cliffs. Finally, rock-climbing can be disruptive to vegetation (Larson et al. 1999).

DISTRIBUTION: This limestone/dolostone cliff community type is found throughout the midwestern United States and adjacent Canada, from Ohio and Ontario, west to Minnesota, south to Kansas, and possibly Arkansas, and east to Indiana.

USFS ECOREGIONS: 212Jn:CCC, 222Ac:CCC, 222Ad:CCC, 222Ae:CCC, 222Af:CCC, 222Ag:CCC, 222Ah:CCC, 222Ak:CCC, 222Am:CCC, 222Ap:CCC, 222Aq:CCC, 222Df:CCC, 222Di:CCP, 222Ek:CCC, 222Fd:CCC, 222Fe:CCC, 222Hc:CCC, 222Hf:CCP, 222Lc:CCC, 222Lf:CCC, 222Md:CCC, 251Ce:CCC
CONSERVATION REGIONS: 36:C, 37:C, 38:C, 44:C, 45:C, 46:C, 48:C
STATES: IA IL IN KS MI MN MO OH **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	limestone cliff community; dolomite cliff community I
IN	limestone cliff +
MI	dry non-acid cliff +
MN	dry cliff (southeast section) +
MO	dry limestone/dolomite cliff =
OH	calcareous cliff community +

OTHER SYNONYMY: Exposed Rock Cliffs (Curtis 1959) B, Cliff Communities (Anderson 1996) B

USNVC HIERARCHY: OPEN CLIFF SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

Thuja occidentalis / Carex eburnea - Pellaea atropurpurea Woodland

Northern White-cedar / Bristleleaf Sedge - Purple Cliffbrake Woodland

Appalachian Cliff White-cedar Woodland CEGL002596

DESCRIPTION: Stands are dominated by coniferous trees, but with a significant amount of deciduous species. The most abundant tree species are *Thuja occidentalis, Acer saccharum, Tsuga canadensis, Juniperus virginiana, Quercus alba, Quercus muehlenbergii*, and *Quercus rubra*. Other associates include *Quercus coccinea* and *Liriodendron tulipifera* in more southern stands, and *Celtis occidentalis* and *Ulmus rubra* in more northern stands. Shrub and small tree species include *Cercis canadensis, Cornus florida, Hydrangea arborescens, Ostrya virginiana*, and *Rhus aromatica*. Closed-canopy stands have very few vascular species in the lower strata, while stands with broken canopies contain scattered shrubs and a substantial number of herbaceous species. Composition is quite variable, but some of the most constant herbaceous plants include *Asarum canadense, Carex eburnea, Cystopteris bulbifera*, and *Hepatica nobilis var. acuta (= Hepatica acutiloba)* (Anderson 1996). In Kentucky, *Thuja occidentalis* occurs within the Cumberland River drainage in the southeastern Highland Rim region. These woodlands are associated with steep, rocky, limestone, mostly north- and east-facing slopes along permanent streams. Some stands are associated with cold-air drainages. These sites are small (0.1-1 acre), with scattered *Thuja occidentalis* codominating with *Acer saccharum, Fraxinus americana, Ostrya virginiana*, and *Philadelphus hirsutus*. Other associated species include *Juniperus virginiana var. virginiana, Cercis canadensis var. canadensis, Pachysandra procumbens, Hamamelis virginiana, Parthenocissus quinquefolia, Solidago flexicaulis, Solidago sphacelata, Symphyotrichum cordifolium (= Aster cordifolius)*, and *Dioscorea quaternata*.

This community is found primarily on steep calcareous cliffs, as well as on the uplands above the cliffs. The bedrock is typically limestone or dolomite (Braun 1928a, Anderson 1996). Soils are shallow, dry, and calcareous, and plants often root in crevices or on narrow ledges, or adjacent clifftops and talus. In Ohio this woodland community occurs as pure, isolated patches on steep calcareous cliffs. It is also found as mixed stands on the uplands above the cliffs. The site of a glacial relict stand in Ohio is maintained by seepage springs from underground limestone formations (Kangas 1989). In Kentucky, *Thuja occidentalis* occurs within the Cumberland River drainage in the southeastern Highland Rim region. These woodlands are associated with steep, rocky, limestone, mostly north- and east-facing slopes along permanent streams. Some stands are associated with cold-air drainages.

COMMENTS: *2, MCS*. This type is simply defined by the presence of white-cedar or mixed white-cedar - hardwoods, and either forest or woodland canopy; hence all four physiognomic categories fall under this one type. Small-scale occurrences are worth documenting. The relationship between this type and *Thuja occidentalis / Carex eburnea* Forest (CEGL006021) should be examined and clarified. Stands on lower slopes often grade into swamps, especially those dominated by *Thuja occidentalis*. There are also many similarities between this vegetation and that in the I.C.3.N.a *Thuja occidentalis - Betula alleghaniensis* Forest Alliance (A.417). In the Ridge and Valley of Virginia, *Thuja occidentalis* communities occur in two situations: on rocky bluffs with admixtures of hardwood species and on mesic slopes with *Tsuga canadensis* and *Pinus strobus* (G. Fleming pers. comm. 1999). Southern *Thuja* stands are more genetically diverse than northern populations (Walker 1987). One Tennessee site is a proposed State Natural Area, Window Cliffs. This association is peripheral in the Southern Blue Ridge of Tennessee.

CONSERVATION RANK: *G2G3.* There are probably fewer than 50 occurrences of this community rangewide. It is restricted to north-facing calcareous bedrock cliffs and summits in the Ridge and Valley section of the central Appalachians. About 10 occurrences are known in Virginia and West Virginia, with a total acreage of about 120 acres. It is also known from Pennsylvania, Tennessee, and Maryland. Due to their location on small ledges of steep cliffs, these communities are difficult to survey, and few field surveys have been conducted. This community has probably always been rare, and there are no imminent threats. In Ohio, the type has apparently always been restricted to a few stands.

DISTRIBUTION: This white-cedar cliff woodland type is found in the Appalachian and Allegheny Plateau region of the United States.

USFS ECOREGIONS: 222Ea:CCC, 222Eb:CCC, 222Ej:CCC, 222Fd:CCC, 222Ha:CCC, 222Hb:CCC, 222Hc:CCP, 231Ak:CCC, M221Aa:CCC, M221Ab:CCC, M221Bd:CC?, M221Be:CCC, M221Dd:CCC
CONSERVATION REGIONS: 44:C, 45:C, 50:C, 51:C, 52:C, 59:C
STATES: KY MD OH PA TN VA WV **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: OH arbor vitae-mixedwood forest =

OTHER SYNONYMY: Arbor vitae forest (Braun 1928a) =

USNVC HIERARCHY: THUJA OCCIDENTALIS WOODLAND ALLIANCE (II.A.4.N.b)

Limestone - Dolostone Midwest Moist Cliff Sparse Vegetation

Limestone - Dolostone Midwest Moist Cliff Sparse Vegetation

Midwest Moist Limestone - Dolostone Cliff CEGL002292

DESCRIPTION: The vegetation is generally quite sparse (<25% cover). Trees, when present, are scattered. Shrubs, herbs, and nonvascular species are more often present. Characteristic trees include *Acer saccharum*. Characteristic shrubs include *Hydrangea arborescens* and *Staphylea trifolia*. Common ferns include *Adiantum pedatum, Asplenium rhizophyllum (= Camptosorus rhizophyllus)*, and *Cystopteris bulbifera*, as well as *Asplenium ruta-muraria* and *Asplenium resiliens* in the southern part of the range. Other herbs include *Aquilegia canadensis, Chenopodium simplex, Lysimachia quadriflora, Parnassia grandifolia, Pilea pumila, Selaginella apoda, Solidago caesia*, and *Solidago flexicaulis*. Mosses, liverworts and lichens are also present (Curtis 1959, White and Madany 1978, Homoya et al. 1985, Nelson 1985). In Wisconsin, seepage areas include *Primula mistassinica* and *Campanula rotundifolia*.

The cliffs are often very steep and found along rivers and strongly dissected hills. The aspect is typically north and east, but is variable. Soils are generally absent, except on ledges or shelves. The cliff is moist due to seepage or shading due to aspect (Nelson 1985).

Disturbances include wind and ice storm damage (Nelson 1985).

COMMENTS: *2, MCS*. This moist cliff type is apparently less common across the region than the Limestone - Dolostone Midwest Dry Cliff Sparse Vegetation (CEGL002291). Definitions of cliff types remain problematic. Curtis (1959) in Wisconsin suggested that substrate was of secondary importance compared to moisture (shading versus open) in determining floristic patterns. Furthermore some cliffs are a combination of layers of sandstone, shale and limestone or dolostone, making classification problematic. Tim Nigh (pers. comm. 1996) has suggested that the Missouri type could be named "*Hydrangea arborescens - Adiantum capillus-veneris - Cystopteris bulbifera - Parnassia grandifolia* Alkaline Cliff". This type should also be compared with *Cystopteris bulbifera* Sparse Vegetation [Placeholder] (CEGL004394) in the Southeast. Ozark and southern Illinois and Indiana cliffs may be better placed into a Southeastern/Interior Low Plateau type, separate from a Midwest type, based on such species as *Asplenium ruta-muraria* and *Asplenium resiliens*. In southeastern Indiana, other rare calciphitic species include *Carex eburnea, Heuchera villosa, Phlox bifida ssp. stellaria, Hylotelephium telephioides (= Sedum telephioides)*, and *Sullivantia sullivantii*. Limestone cliffs along the Niagara Escarpment in central Ontario/Bruce Peninsula may be different from those in southern Ontario (Wasyl Bakowsky pers. comm. 1998) and from other Great Lakes Limestone cliffs. More northern examples of these cliffs in the Great Lakes region may also contain the *Thuja occidentalis* Cliff Woodland (CEGL002451), which may overlap in concept with this type.

CONSERVATION RANK: *G4G5*. In Missouri many sites have been quarried (M. Leahy pers. comm. 1999). This issue should be examined range-wide. Other sites lack adequate buffers above and below the cliffs. Finally, rock-climbing can be disruptive to vegetation (Larson et al. 1999).

DISTRIBUTION: This limestone/dolostone cliff community occurs in localized areas throughout the midwestern United States and southern Ontario, Canada, ranging from Ohio and southern Ontario west to Iowa, south to Kansas and possibly Arkansas, and east to Tennessee.

USFS ECOREGIONS: 212Ha:CCC, 212Hb:CCC, 212Hh:CCC, 212Hj:CCC, 212Hl:CCC, 212Pa:CCC, 222Ac:CCC, 222Ae:CCC, 222Af:CCC, 222Ag:CCC, 222Ak:CCC, 222Aq:CCC, 222Df:CCC, 222Di:CCP, 222Ek:CCC, 222Fc:CCC, 222Fe:CCC, 222Hb:CCC, 222Hc:CCC, 222Hf:CCC, 222Kf:CCC, 222Kg:CCC, 251Ci:CCC, 251Dd:CCC
CONSERVATION REGIONS: 36:C, 37:C, 38:C, 44:C, 45:C, 46:C, 48:C
STATES: IA IL IN KS KY MI MO OH TN **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	limestone cliff community; dolomite cliff community I
IN	limestone cliff +
MI	moist non-acid cliff +
MO	moist limestone/dolomite cliff =
OH	calcareous cliff community +

OTHER SYNONYMY: Shaded Cliff (Curtis 1959) B

USNVC HIERARCHY: OPEN CLIFF SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

Chert Ozark Dry Cliff Sparse Vegetation

Chert Ozark Dry Cliff Sparse Vegetation

Ozark Dry Chert Cliff CEGL002285

DESCRIPTION: The vegetation contains few, if any, trees, and these are limby, gnarled, open-grown, and stunted. Herbaceous cover is less than 20%, consisting of spring ephemerals and grasses on ledges, and lichens on the open rock. Characteristic woody plants include *Quercus marilandica*. Herbaceous species include *Asplenium bradleyi, Cheilanthes lanosa, Coreopsis lanceolata, Danthonia spicata, Lechea tenuifolia, Opuntia humifusa (= Opuntia compressa)*, and *Polygonum tenue*. Lichens include *Pleopsidium chlorophanum (= Acarospora chlorophana), Cladonia caroliniana*, and *Xanthoparmelia* spp. (Nelson 1985).

Stands occur on extremely steep to vertical rock exposures along bluffs or rock ledges in valleys. Aspect is variable, but best developed south and west. Soils are generally absent, except on ledges, where they are shallow, very rapidly drained and dry (they can be ephemerally wet). Parent material is chert or cherty conglomerate (Nelson 1985).

Disturbances include drought stress, wind and storm damage (Nelson 1985).

COMMENTS: *2, MCS*. The concept of the type is taken from the Missouri state classification - dry chert cliff (Nelson 1985).

CONSERVATION RANK: *G3?*. There may be more than 20 occurrences of this community rangewide. Currently there is only one occurrence documented from Missouri, where the community is ranked S2, but others are not yet recorded in the database. This community is reported from two ecoregion sections in southeastern Missouri: the Ozark Highlands section and the Upper Gulf Coastal Plain section. The community has restricted habitat requirements and may have always been rare.

DISTRIBUTION: This dry chert cliff type is found in the Missouri Ozarks region of the United States.

USFS ECOREGIONS: 222Ak:CCC
CONSERVATION REGIONS: 38:C
STATES: MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO dry chert cliff =

OTHER SYNONYMY:

USNVC HIERARCHY: OPEN CLIFF SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

Igneous Ozark Dry Cliff Sparse Vegetation

Igneous Ozark Dry Cliff Sparse Vegetation

Ozark Dry Igneous Cliff CEGL002286

DESCRIPTION: This igneous dry cliff type is found in the Missouri Ozarks of the United States. Stands occur on extremely steep to vertical rock exposures along bluffs and mountain domes, often occurring in a series of irregular rock terraces and ledges or as highly weathered massive outcrops. Aspect is variable, but sites are best developed south and west. Soils are generally absent, except on ledges, where they are shallow, ephemerally wet, but very rapidly drained. Parent material is igneous (dellenite, felsite, granite or rhyolite). The vegetation contains few, if any, tree species, but if present they are stunted, limby, and gnarled. Herbaceous cover is sparse (less than 20%) consisting of spring ephemerals and grasses on ledges. Lichens are common on the rock face. Sites are disturbed by droughts, wind and storm damage. Woody plants include *Juniperus virginiana* and *Ulmus alata*. Characteristic herbaceous species include *Symphyotrichum oblongifolium (= Aster oblongifolius), Cheilanthes lanosa, Coreopsis lanceolata, Danthonia spicata, Opuntia humifusa (= Opuntia compressa), Polypodium virginianum (= Polypodium vulgare var. virginianum)*, and *Sporobolus clandestinus*. Lichens include *Acarospora chlorophana, Cladonia caroliniana, Cladonia strepsilis, Catapyrenium lachneum (= Dermatocarpon lachneum)* and *Punctelia hypoleucites (= Parmelia hypoleucites)*.

COMMENTS: *2, MCS*. The concept of the type is taken from the Missouri state classification - dry igneous cliff (Nelson 1985).

CONSERVATION RANK: *G4.*

DISTRIBUTION: This igneous dry cliff type is found in the Missouri Ozarks region of the United States.

USFS ECOREGIONS: 222Aa:CCP, 222Af:CCC
CONSERVATION REGIONS: 38:C
STATES: MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO dry igneous cliff =

OTHER SYNONYMY:

USNVC HIERARCHY: OPEN CLIFF SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

Sandstone Dry Cliff Sparse Vegetation

Sandstone Dry Cliff Sparse Vegetation

Midwest Dry Sandstone Cliff CEGL002045

DESCRIPTION: Vegetation is restricted to shelves, cracks and crevices in the rock, generally averaging less than 20%. In the Ozarks and Interior Low Plateau, scattered occurrences of woody species, such as *Juniperus virginiana, Quercus stellata, Vaccinium arboreum*, and *Vaccinium pallidum (= Vaccinium vacillans)*, are found; farther east in Ohio, woody species include *Tsuga canadensis, Betula alleghaniensis (= Betula lutea), Kalmia latifolia*, and *Hydrangea arborescens*. In the Ozarks and Interior Low Plateau, the herbaceous layer contains the ferns *Asplenium bradleyi, Asplenium pinnatifidum, Cheilanthes lanosa, Dennstaedtia punctilobula*, and *Dryopteris marginalis*. In the Allegheny region of Ohio, the sandstone cliffs contain the forbs *Agrostis perennans, Aquilegia canadensis, Mitchella repens*, and *Viola blanda*, and the ferns *Asplenium montanum, Asplenium pinnatifidum, Asplenium rhizophyllum, Asplenium trichomanes, Cystopteris fragilis, Dennstaedtia punctilobula, Dryopteris intermedia, Dryopteris marginalis, Polypodium virginianum*, and the rare *Asplenium bradleyi* (some of these species in Ohio may be more common in moist sandstone cliffs). In Minnesota and Wisconsin the dry cliffs include forbs, such as *Aquilegia canadensis, Campanula rotundifolia, Solidago hispida, Solidago sciaphila* (Driftless Area endemic), *Toxicodendron radicans, Selaginella rupestris, Silene antirrhina*, and *Tradescantia ohiensis*, and the ferns *Asplenium trichomanes, Pellaea atropurpurea, Pellaea glabella, Polypodium virginianum (= Polypodium vulgare)*, and *Woodsia* spp. The nonvascular layer in Missouri includes the mosses *Brothera leana, Polytrichum* spp., and *Rhodobryum roseum*, and the lichens *Pleopsidium chlorophanum (= Acarospora chlorophana), Cladonia mateocyatha, Cladonia strepsilis*, and *Dermatocarpon miniatum* (White and Madany 1978, Homoya et al. 1985, Nelson 1985, MNNHP 1993, Anderson 1996). On some Driftless Area cliffs along major rivers, odd groupings of species can occur, e.g., *Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda), Ledum groenlandicum*, and *Photinia melanocarpa (= Aronia melanocarpa)*. Also, the endemic *Pseudognaphalium obtusifolium ssp. saxicola (= Gnaphalium saxicola)* occurs exclusively on dry sandstone cliffs in the Driftless Area (E. Epstein pers. comm. 1999).

Stands occur as steep to vertical rock exposures of sandstone bedrock, occasionally with dolostone interbedded. Aspect is variable, but stands are best developed on south- and west-facing slopes (Nelson 1985, MNNHP 1993). The geologic formations in Missouri include Channel Sands, St. Peter, Lamotte, Roubidoux, and Gunter Formations (M. Leahy pers. comm. 1999).

Natural disturbances include drought stress, wind and storm damage, and disturbances from cliff-dwelling animals, particularly in the crevices, ledges and rock shelters (Nelson 1985).

COMMENTS: *2, MCS*. This type could be split into an Ozark/Interior Low Plateau sandstone cliff type and a more northern Midwest sandstone cliff type. Relation of this type to stands in the southeast needs to be resolved. Cliffs are defined as vertical exposures of rock at least 3 m tall. The distinction between open (dry) vs. shaded (moist) may be more important that bedrock type, at least on a local or state level. Curtis (1959) comments that in an effort to group the Wisconsin cliff data into meaningful categories, sites were separated by rock type (dolomite, sandstone, igneous) and exposure (shaded, exposed). He found that type of rock was far less important than exposure.

CONSERVATION RANK: *G4G5.* Although the cliffs may be relatively common, sites may lack adequate buffers above and below the cliffs.

DISTRIBUTION: This community is found throughout the central and upper midwestern United States and adjacent Canada, ranging from Ohio and Ontario west to Minnesota, south to Kansas, and east to Indiana.

USFS ECOREGIONS: 212Hi:CPP, 212Ja:CPP, 212Jn:CPP, 212Jr:CPP, 221Ea:CCC, 221Ec:CCC, 221Ed:CCP, 221Ee:CCP, 221Ef:CCC, 221Eg:CCC, 221Fa:CCC, 222Aa:CCC, 222Ac:CCC, 222Aj:CCC, 222Ak:CCC, 222Aq:CCC, 222Dc:CCP, 222De:CCC, 222Df:CCC, 222Dh:CCP, 222Di:CCP, 222Ga:CCC, 222Gb:CCC, 222Gc:CCC, 222Hf:C??, 222Ka:CCC, 222Lc:CCC, 251Cj:CCC, 251Dd:CCC, M221:?

CONSERVATION REGIONS: 26:C, 36:C, 37:C, 38:C, 44:C, 46:C, 48:C, 49:C

STATES: AR? IA IL IN KS MI MN MO OH WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	sandstone cliff community =
IN	sandstone cliff =
MI	dry acid cliff +
MN	dry cliff (southeast section) +
MO	dry sandstone cliff =
OH	non-calcareous cliff community +
WI	open cliff (sandstone subtype) =

OTHER SYNONYMY: Cliff Communities (Anderson 1996) B, Exposed Rock Cliffs (Curtis 1959) B

USNVC HIERARCHY: OPEN CLIFF SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

Chert Ozark Moist Cliff Sparse Vegetation

Chert Ozark Moist Cliff Sparse Vegetation

Ozark Moist Chert Cliff CEGL002288

DESCRIPTION: Overall vegetation is sparse, with the herbaceous layer less than 20%. Trees, when present, are scattered and limby. The herbaceous layer is dominated by ferns and spring ephemerals. Ferns include *Asplenium trichomanes, Dryopteris marginalis*, and *Polypodium virginianum*, and possibly *Dryopteris goldiana* (Nelson 1985). Forbs may include *Mitella diphylla* and *Mitchella repens* (Tim Nigh pers. comm. 1996).

Stands occur on extremely steep to vertical rock exposures in crevices along bluffs or rock ledges in valleys. Aspect is north and east. Soils are generally absent, except in crevices or on ledges. Moisture drains rapidly, but conditions may remain moist because of shading or extensive moss and lichen mats. Bedrock is chert or chert conglomerates (Nelson 1985).

COMMENTS: *2, MCS*. Concept of the type is taken from Missouri state classification - moist chert cliff (Nelson 1985). Tim Nigh (pers. comm. 1996) has indicated that the name "*Mitella diphylla - Mitchella repens - Dryopteris goldiana* Chert Cliff" may well describe this type.

CONSERVATION RANK: *G2G3*. There are probably fewer than 100 occurrences rangewide; it is reported from Minnesota (where it is ranked S3?), Missouri (S2), and Kansas (SU). Only one occurrence has been documented, from Missouri, but other occurrences do exist (M. Leahy pers. comm. 1999). Most bluffs and cliffs are probably small (under 100 acres); there may have been minimal disturbance to these habitats. This community has very specific environmental requirements, and therefore has probably always been rare.

DISTRIBUTION: This moist chert cliff community is found in the Ozarks region of the south-central United States, particularly Missouri and Kansas.

USFS ECOREGIONS: 222Ak:CCC
CONSERVATION REGIONS: 38:C
STATES: KS MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO moist chert cliff =

OTHER SYNONYMY:

USNVC HIERARCHY: OPEN CLIFF SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

Igneous Ozark Moist Cliff Sparse Vegetation

Igneous Ozark Moist Cliff Sparse Vegetation

Ozark Moist Igneous Cliff CEGL002289

DESCRIPTION: Trees, when present, are scattered and short (8-20 m). *Pinus echinata* may be present, along with a variety of *Quercus* spp. Herbaceous cover is sparse (<20%), consisting of spring ephemerals and ferns. These include *Arisaema triphyllum (= Arisaema atrorubens), Arabis missouriensis, Asplenium trichomanes, Dryopteris goldiana, Dryopteris marginalis, Mitchella repens, Mitella diphylla*, and *Chasmanthium latifolium (= Uniola latifolia)*. A nonvascular layer of mosses and lichens is usually present, including *Polytrichum* spp. and *Thuidium* spp. (Nelson 1985).

Stands are found on extremely steep to vertical rock exposures, often occurring in a series of irregular rock terraces and ledges, with a north or east aspect. The igneous parent material includes rhyolite, felsite, dellenite or granite. Soils are generally absent, except on ledges and rock terraces. These cliffs are rapidly drained, but are kept moist or wet for significant periods because of seepage, dense shading, or thick mats of mosses and lichens (Nelson 1985).

COMMENTS: *3, MCS*. Description and type concept are from Nelson (1985). The northern igneous (granite/metamorphic) cliffs are separated from Ozark igneous cliff as Granite-Metamorphic Great Lakes Shore Cliff Sparse Vegetation (CEGL005244). In Missouri, Tim Nigh (pers. comm. 1996) suggested that the following descriptive name for this type "*Mitella diphylla - Mitchella repens - Dryopteris goldiana* Igneous Cliff".

CONSERVATION RANK: *G4Q*.

DISTRIBUTION: This moist igneous cliff type is restricted to parts of the Ozarks in the south-central United States, particularly Missouri and Kansas.

USFS ECOREGIONS: 212Ia:CCC, 212Ja:CC?, 212Jb:CCP, 212Jc:CCP, 212Jn:CCC, 212Jo:CCP, 222Aa:CCC
CONSERVATION REGIONS: 38:C
STATES: KS? MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO moist igneous cliff =

OTHER SYNONYMY:

USNVC HIERARCHY: OPEN CLIFF SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

Sandstone Midwest Moist Cliff Sparse Vegetation

Sandstone Midwest Moist Cliff Sparse Vegetation

Midwest Moist Sandstone Cliff CEGL002287

DESCRIPTION: Vegetation is restricted to shelves, cracks and crevices in the rock, generally averaging less than 20%. In the Ozarks and Interior Low Plateau, the herbaceous layer contains the forbs *Dicentra canadensis, Dodecatheon frenchii, Heuchera parviflora, Triadenum walteri (= Hypericum walteri), Mitchella repens, Mitella diphylla*, among others, and the ferns *Athyrium filix-femina, Cystopteris bulbifera, Osmunda cinnamomea, Osmunda regalis*, and *Trichomanes boschianum*. In the Allegheny region of Ohio, the sandstone cliffs include the forbs *Agrostis perennans, Aquilegia canadensis, Mitchella repens*, and *Viola blanda*, and the ferns *Asplenium montanum, Asplenium pinnatifidum, Asplenium rhizophyllum, Asplenium trichomanes, Cystopteris fragilis, Dennstaedtia punctilobula, Dryopteris intermedia, Dryopteris marginalis, Polypodium virginianum*, and the rare *Asplenium bradleyi*. In Minnesota and Wisconsin the moist cliffs include forbs, such as *Aralia nudicaulis, Asarum canadense* and *Mitella diphylla*, and the ferns *Cystopteris bulbifera* and *Cystopteris fragilis*. Missouri sites often harbor glacial relicts. The nonvascular layer is poorly described. Seepage areas in Minnesota include *Sullivantia sullivantii (= Sullivantia renifolia)* (also found in Missouri) and *Crytogramma stelleri* (White and Madany 1978, Homoya et al. 1985, Nelson 1985, MNNHP 1993, Anderson 1996).

Stands occur as steep to vertical rock exposures of sandstone bedrock. Aspect is variable, but stands are best developed on north- and east-facing slopes, or under sandstone overhangs (Nelson 1985, MNNHP 1993). The sandstone overhangs are amphitheatre-like cuts in sandstone cliffs. They may recede deeply enough into the cliff face that light levels are very low in the interior of the overhang. The soils beneath the overhang are typically sandy and with little vegetation. Seepage areas may also occur (Homoya et al. 1985). In Missouri, geologic formations include the St. Peter and Lamotte formations.

Natural disturbances include wind and storm damage, activity by cliff-dwelling animals in the crevices, ledges and rock shelters, and the build up and collapse of ice (Nelson 1985).

COMMENTS: *2, MCS*. In Missouri, a descriptive name for this type could be "*Mitella diphylla - Mitchella repens - Dryopteris goldiana* Cliff" (Tim Nigh pers. comm. 1996), but the name would not work in Wisconsin (E. Epstein pers. comm. 1999). Also present are polypodium ferns and mosses. Differences between sandstone overhang and sandstone cliff need review. In Ontario this type is found as very small occurrences and is very rare. This type could be split into an Ozark/Interior Low Plateau sandstone cliff type and more northern Midwest sandstone cliff type. Cliffs are defined as vertical exposures of rock at least 3 m tall. The distinction between open (dry) versus shaded (moist) may be more important that bedrock type, at least on a local or state level. Curtis (1959) comments that in an effort to group the Wisconsin cliff data into meaningful categories, sites were separated by rock type (dolomite, sandstone, igneous) and exposure (shaded, exposed).

CONSERVATION RANK: *G4G5.* Although the cliffs may be relatively common, sites may lack adequate buffers above and below the cliffs.

DISTRIBUTION: This moist sandstone cliff community is found throughout the central and upper midwestern United States and adjacent Canada, from Ohio and Ontario west to Minnesota, south to Kansas and east to Indiana.

USFS ECOREGIONS: 212Hi:CPP, 212Ja:CPP, 212Jn:CPP, 212Kb:CCC, 221Ea:CCC, 221Ec:CCP, 221Ed:CCP, 221Ef:CCC, 221Fa:CCC, 222Aa:CCC, 222Ag:CCC, 222Ak:CCC, 222Ap:CCC, 222Aq:CCC, 222Dc:CCP, 222De:CCC, 222Dh:CCC, 222Di:CCP, 222Hf:CCC, 222Jc:CCC, 222Ka:CCC, 222Lc:CCC, 222Ld:CCC, 222Lf:CCC, 222Md:CCC, 222Me:CCC, 251Cc:CCC, 251Ce:CCC, M221:?

CONSERVATION REGIONS: 36:C, 37:C, 38:C, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C

STATES: AR? IA IL IN KS MI MN MO OH WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	sandstone overhang community =
IN	sandstone overhang =
MI	moist acid cliff +
MN	moist cliff (southeast section) +
MO	moist sandstone cliff =
OH	non-calcareous cliff community +
WI	shaded cliff (sandstone subtype) =

OTHER SYNONYMY: Cliff Communities (Anderson 1996) B. Anderson also notes the sandstone overhang type., Shaded Rock Cliffs (Curtis 1959) B

USNVC HIERARCHY: OPEN CLIFF SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

Limestone - Dolostone Talus Sparse Vegetation

Limestone - Dolostone Talus Sparse Vegetation

Midwest Limestone - Dolostone Talus CEGL002308

DESCRIPTION: The vegetation is generally sparse, but may vary depending on degree of slope, exposure (open versus shaded) and rock type. The composition of the type may be heavily influenced by adjacent forested stands. In Missouri, characteristic species include the ferns *Adiantum pedatum, Diplazium pycnocarpon (= Athyrium pycnocarpon), Asplenium rhizophyllum (= Camptosorus rhizophyllus)*, and *Cystopteris bulbifera*. Other herbaceous species include *Aralia nudicaulis, Impatiens capensis, Pilea pumila, Polymnia canadensis*, and *Physalis missouriensis*. Scattered woody plants include *Hydrangea arborescens* and *Staphylea trifolia* (Nelson 1985). In Ontario open talus stands contain *Adiantum pedatum, Ageratina altissima (= Eupatorium rugosum), Geranium robertianum, Impatiens capensis, Poa pratensis*, and *Toxicodendron radicans* (Lee et al. 1998).

Stands occur at the bases of steep cliffs along larger streams or rivers, or strongly dissected valleys. Aspect is variable, and moisture could be moist or dry. Soils are generally absent. Parent material could be limestone or dolostone with a mixture of rock fragments and large boulders. The vegetation is generally sparse, but may vary depending on degree of slope, exposure (open versus shaded) and rock type (Nelson 1985).

Cliff weathering causes rock debris to fall and accumulate at the base of the cliff.

COMMENTS: *2, MCS*. This type has not been described across its range, with the exception of Missouri (Nelson 1985) and somewhat in Ontario (Lee et al. 1998). Further study is needed to characterize the type. It may be very localized. Rare snails may also be found. The type is especially notable at the base of limestone and dolostone cliffs of the Niagara Escarpment, e.g. in eastern Wisconsin on the Door Peninsula (E. Epstein pers. comm. 1999).

CONSERVATION RANK: *G4G5*. Many sites may not lack proper buffers along the cliff tops or lower slopes.

DISTRIBUTION: This limestone-dolostone talus community is found throughout the central/upper midwestern United States, including the Ozark region, and adjacent Canada, extending from Ontario west to Minnesota, south to Arkansas, and east to possibly Illinois.

USFS ECOREGIONS: 222Ac:CCC, 222Ae:CCC, 222Ag:CCC, 222Lc:CCC, 222Lf:CCC, 251Ce:CCC, 251Ch:CCC
CONSERVATION REGIONS: 36:C, 38:C, 46:C, 48:C
STATES: AR IA IL? MI MN MO WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL?	limestone cliff community I
MI	dry non-acid cliff +
MN	talus slope +
MO	limestone/dolomite talus =
WI	limestone talus =

OTHER SYNONYMY:

USNVC HIERARCHY: LOWLAND TALUS SPARSE VEGETATION ALLIANCE (VII.B.1.N.a)

Igneous Ozark Talus Sparse Vegetation

Igneous Ozark Talus Sparse Vegetation

Ozark Igneous Talus CEGL005203

DESCRIPTION: The vegetation is sparse, consisting of herbaceous plants, vines, mosses and lichens. Characteristic vines include *Celastrus scandens, Lonicera flava, Rhus aromatica, Smilax bona-nox, Toxicodendron radicans*, and *Vitis aestivalis*. Other characteristic species include the forb *Polymnia canadensis*, the moss *Dicranum scoparium*, and the lichens include *Pleopsidium chlorophanum (= Acarospora chlorophana), Cladonia caroliniana, Cladonia strepsilis, Catapyrenium lachneum (= Dermatocarpon lachneum), Punctelia hypoleucites (= Parmelia hypoleucites)*, and *Xanthoparmelia* spp. (Nelson 1985).

Stands occur on moderately steep to extremely steep slopes at the bases of bluffs, cliffs, and steep valleys or sideslopes of mountain domes, especially along shut-ins. Aspect is in all directions. Soils are absent, slope is dry. The parent material is igneous, with a large mass of accumulated angular rock fragments and boulders forming large (4 ha or 10 acres) rocky areas (Nelson 1985).

Disturbances include falling rock fragments from adjacent cliffs and slumping of rock material (Nelson 1985).

COMMENTS: *2, MCS*. The concept of the type is taken from the Missouri state type - igneous talus (Nelson 1985).

CONSERVATION RANK: *G4.*

DISTRIBUTION: This igneous talus type is found in the Missouri Ozarks of the United States.

USFS ECOREGIONS: 222A:CC
CONSERVATION REGIONS:
STATES: MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO igneous talus =

OTHER SYNONYMY:

USNVC HIERARCHY: LOWLAND TALUS SPARSE VEGETATION ALLIANCE (VII.B.1.N.a)

Sandstone Interior Highlands Talus Sparse Vegetation

Sandstone Interior Highlands Talus Sparse Vegetation

Interior Highlands Sandstone Talus CEGL002309

DESCRIPTION: The vegetation is generally sparse but may vary depending on degree of slope, exposure (open versus shaded) and rock type. The composition of the type may be heavily influenced by adjacent forested stands. Vascular plants are generally very sparse, absent, or limited to marginal areas. Vines and viney shrubs are characteristic of this community (at least its margins), because their habit allows them to exploit the combination of abundant available light and scarce rooting opportunities. Characteristic vines and shrubs can include *Ribes* spp., *Toxicodendron radicans, Parthenocissus quinquefolia*, and *Philadelphus pubescens*. Characteristic herbaceous species can include the annual composite *Polymnia canadensis* and the ferns *Dryopteris marginalis* and *Polypodium virginianum*. *Sassafras albidum* seems to be a particularly characteristic tree species of the margins of this community; *Cornus alternifolia* is also reported from Missouri occurrences. Foliose, crustose, and umbilicate lichens are common. (Nelson 1985, M. Pyne pers. comm. 1998)

Stands occur at the bases of steep cliffs along larger streams or rivers, or strongly dissected valleys. Aspect is variable, and they can be relatively moist or relatively dry. Soils are generally absent. Parent material is sandstone with a mixture of rock fragments and large boulders (Nelson 1985).

Disturbances include falling rock fragments from adjacent cliffs and slumping of rock material (Nelson 1985).

COMMENTS: *2, MCS*. The concept of the type is taken from the Missouri state type - sandstone talus (Nelson 1985); however, Missouri sandstone talus is so uncommon and small that the type may be dropped (M. Leahy pers. comm. 2000). Occurrences at relatively high elevations and in more mountainous terrain of the Ozarks and Ouachitas should be further assessed for their similarity to Missouri Ozarks stands. In Arkansas excellent examples of the blocky sandstone type occur at Mount Magazine State Park and along Talamena Drive, near the Oklahoma border. The possible occurrence of this community in the Interior Low Plateau should be checked. Related vegetation with substantial tree cover and better soil development (such as mesic sandstone forests) is classified elsewhere.

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This sandstone talus community is found in the Ozark and Ouachita regions of the United States, particularly in Arkansas, Oklahoma and Missouri.

USFS ECOREGIONS: 222Ac:CCC
CONSERVATION REGIONS: 38:C
STATES: AR MO OK **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO sandstone talus =

OTHER SYNONYMY:

USNVC HIERARCHY: LOWLAND TALUS SPARSE VEGETATION ALLIANCE (VII.B.1.N.a)

Eroding Clay Bank Sparse Vegetation

Eroding Clay Bank Sparse Vegetation

Eroding Clay Bank CEGL002584

DESCRIPTION: The vegetation is typically sparse to absent. Little information is available on species that persist in this habitat.

This eroding clay bank type is found localized along banks of rivers and lakes in the midwestern United States and adjacent Canada. Stands occur on active steep and near-vertical exposures of unconsolidated clays that are at least 3 m in height. They are typically found along lakes and rivers. Moisture and temperature fluctuations can be extreme (Lee et al. 1998).

Stands are subject to active erosional processes (Lee et al. 1998).

COMMENTS: *3, MCS*. This type is found along lakes and rivers, but much more rangewide information is needed to characterize this type. Its status as a natural ecological community is considered by some to be rather dubious.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This eroding clay bank type is found localized along banks of rivers and lakes in the midwestern United States and adjacent Canada.

USFS ECOREGIONS: 212Ia:PPP, 222:?
CONSERVATION REGIONS: 48:C
STATES: IN? **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY: IN? eroding cliff ?

OTHER SYNONYMY:

USNVC HIERARCHY: SMALL ERODING BLUFFS SPARSE VEGETATION ALLIANCE (VII.C.3.N.b)

Small Eroding Bluffs Midwestern Sparse Vegetation

Small Eroding Bluffs Midwestern Sparse Vegetation

Midwestern Small Eroding Bluffs CEGL002315

DESCRIPTION: The vegetation is sparse. Species composition is quite variable, and there may be little floristic coherence to the type. Species include, in Indiana, *Danthonia spicata, Heuchera* spp., *Hydrangea arborescens, Solidago nemoralis*; in Illinois, *Danthonia spicata, Solidago nemoralis, Taenidia integerrima*; and in Missouri (at least in seepage areas at the toeslope), *Adiantum pedatum, Arisaema triphyllum (= Arisaema atrorubens), Equisetum arvense, Equisetum hyemale*, and *Impatiens capensis* (White and Madany 1978, Homoya et al. 1985, Nelson 1985).

Sites are found in deeply cut ravines or valleys, especially adjacent to streams or rivers. Stands consist of vertical exposures of eroded unconsolidated material (glacial drift, loess), or weak rock (shale). Soils are absent or confined to the crests of the bluff. Moisture is variable, but may be high in seepage areas (White and Madany 1978, Homoya et al. 1985, Nelson 1985).

COMMENTS: *3, MCS*. The term bluff, as opposed to cliff, is used to refer to unconsolidated or poorly consolidated material. This type may need to be sampled more carefully based on substrate, since species composition on slopes comprised of eroding shales may be expected to be quite different from loess. In Missouri the type is really a slumpage feature and many of the plants occur at the toeslope in seepage areas. Its status as a natural ecological community is questionable (M. Leahy pers. comm. 1999).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This sparsely vegetated bluff community is found in restricted places throughout the midwestern United States and adjacent Canada, ranging from Ontario and possibly Ohio westward to Illinois and Missouri.

USFS ECOREGIONS: 212Oa:CCC, 222Em:CCC, 222Fe:CCC, 222Hb:CCC, 222Hf:CCC, 222Kg:CCC, 251Cd:CC?, 251Cj:CCC, 251Ea:CCC

CONSERVATION REGIONS: 36:C, 37:C, 44:C, 45:C, 48:C

STATES: IL IN MI? MO OH? **PROVINCES:** ON?

MIDWEST HERITAGE SYNONYMY:

IL	eroding bluff =
IN	eroding cliff =
MI?	no state equivalent
MO	eroding cliff =
OH?	no state equivalent

OTHER SYNONYMY:

USNVC HIERARCHY: SMALL ERODING BLUFFS SPARSE VEGETATION ALLIANCE (VII.C.3.N.b)

Limestone Butte Sparse Vegetation

Limestone Butte Sparse Vegetation

Great Plains Limestone Butte CEGL002296

DESCRIPTION: Characteristics of this type are not yet available.

COMMENTS: *3, MCS*. This type is based on the Kansas state type, "limestone caprock," though that name will be modified to be limestone butte (Lauver et al. 1999). This type needs to be reviewed rangewide.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This limestone butte type may be found sporadically in the western Great Plains region of the United States, from Kansas to North Dakota.

USFS ECOREGIONS: 331C:C?
CONSERVATION REGIONS: 27:?
STATES: KS ND **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: OPEN CLIFF SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

Limestone - Dolostone Great Plains Xeric Cliff Sparse Vegetation

Limestone - Dolostone Great Plains Xeric Cliff Sparse Vegetation

Great Plains Xeric Limestone - Dolostone Cliff CEGL002046

DESCRIPTION: No information is available on the vegetation of these cliffs.

There are exposures of Niobrara Chalk along the Missouri River at the South Dakota - Nebraska border. There are numerous exposures along Lewis & Clark Lake, most of them located in Nebraska (D. Ode pers. comm. 2000).

COMMENTS: *3, MCS*. Little is known about this type.

CONSERVATION RANK: *G?.*

DISTRIBUTION: The limestone/dolostone cliff type is found in the central Great Plains of the United States, possibly in South Dakota and Nebraska.

USFS ECOREGIONS: 331F:CC, 332:?
CONSERVATION REGIONS:
STATES: NE? SD? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE? no state equivalent

OTHER SYNONYMY:

USNVC HIERARCHY: OPEN CLIFF SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

Sandstone Butte Sparse Vegetation

Sandstone Butte Sparse Vegetation

Great Plains Sandstone Butte CEGL002297

DESCRIPTION: Characteristics of this type are not yet available.

COMMENTS: *3, MCS*. This type is based on the Kansas state type, "sandstone caprock.", to be renamed sandstone butte (Lauver et al. 1999). This type needs to be reviewed rangewide. It may be identical to the Siltstone - Sandstone Rock Outcrop Sparse Vegetation (CEGL002047) or the the Sandstone Great Plains Xeric Butte - Bluff Sparse Vegetation (CEGL002290).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This sandstone caprock type may be found sporadically in the western Great Plains region of the United States.

USFS ECOREGIONS: 331:C
CONSERVATION REGIONS:
STATES: KS ND **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: OPEN CLIFF SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

Sandstone Great Plains Dry Cliff Sparse Vegetation

Sandstone Great Plains Dry Cliff Sparse Vegetation

Great Plains Dry Sandstone Cliff CEGL005257

DESCRIPTION: The vascular layer varies from sparse to absent, particularly on siltstone. The nonvascular layer is not well described. Plants include scattered forbs, such as *Mentzelia decapetala* and *Penstemon glaber* (Steinauer and Rolfsmeier 2000).

Stands occur on steep (>60%) slopes of sandstone or siltstone bedrock. Cliffs may exceed 100 m. Soils are not developed (Steinauer and Rolfsmeier 2000).

COMMENTS: *3, MCS*. Distribution of this type is not clear. In Nebraska, the type is found at Scotts Bluff, Wildcat Hills, and along the Niobrara River. The cliff flora may be fairly different from site to site (G. Steinauer pers. comm. 1999).

CONSERVATION RANK: *G4G5.* Although the cliffs may be relatively common, sites may lack adequate buffers above and below the cliffs.

DISTRIBUTION: This dry sandstone cliff community is found in the central-western Great Plains of the United States.

USFS ECOREGIONS: 331F:CC
CONSERVATION REGIONS: 25:C
STATES: CO? NE WY? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE dry cliff =

OTHER SYNONYMY:

USNVC HIERARCHY: OPEN CLIFF SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

Sandstone Great Plains Xeric Butte - Bluff Sparse Vegetation

Sandstone Great Plains Xeric Butte - Bluff Sparse Vegetation

Great Plains Xeric Sandstone Butte CEGL002290

DESCRIPTION: There is no information available on the vegetation of the sandstone buttes.

Sandstone materials are the dominant rock of these buttes or bluffs. The Fox Hills sandstone is a fairly widespread exposure in northwestern South Dakota. Exposures at the Slim Buttes include a lot of volcanic ash that texturally may be more like siltstones, but there are also exposures of rather coarse sand/gravel stones. (D. Ode pers. comm. 2000).

COMMENTS: *3, MCS*. More information is needed to determine the characteristics of this type. There are a variety of sandstone outcrops in northwestern South Dakota and most certainly in southeastern Montana (D. Ode pers. comm. 2000). Whether these need to be split from other sedimentary outcrops is unclear. See also Sandstone Butte Sparse Vegetation (CEGL002297).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This sandstone butte type occurs in the United States in northwestern South Dakota, and possibly elsewhere in the Great Plains.

USFS ECOREGIONS: 331F:CC
CONSERVATION REGIONS: 26:C
STATES: MT? SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: OPEN CLIFF SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

Artemisia longifolia Badlands Sparse Vegetation

Longleaf Wormwood Badlands Sparse Vegetation

Badlands Longleaf Sage Sparse Vegetation CEGL002195

DESCRIPTION: The vegetation is sparse, often much less than 10% cover, and species richness is very low. Short shrubs are the most conspicuous. *Artemisia longifolia* is the most frequent, and it may be associated with *Atriplex nuttallii, Eriogonum pauciflorum*, or *Gutierrezia sarothrae* (Von Loh et al. 1999).

Stands, which may be less than 0.1 ha in size (at least in Badlands National Park, South Dakota), are found on sparsely vegetated eroding slopes or flat clay ridges. Some slopes may be acidic, others more alkaline. Soils are poorly consolidated clays and silts. Stands may be particularly common on bentonite clay bands found on the ridges and slopes of the badlands (Von Loh et al. 1999).

COMMENTS: *3, MCS*. Bare soil may be extensive. See also Eroding Great Plains Badlands Sparse Vegetation (CEGL002050).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This badlands longleaf wormwood type is found in the Badlands regions of the northern Great Plains of the United States, particularly in the western Dakotas.

USFS ECOREGIONS: 331F:CC
CONSERVATION REGIONS:
STATES: ND SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: ARTEMISIA LONGIFOLIA SPARSELY VEGETATED ALLIANCE (VII.C.3.N.b)

Eriogonum pauciflorum - Gutierrezia sarothrae Badlands Sparse Vegetation

Small-flower Wild Buckwheat - Snakeweed Badlands Sparse Vegetation

Wild Buckwheat- Snakeweed Badlands Sparse Vegetation CEGL005270

DESCRIPTION: This badlands community type rarely exceeds 10% vegetative cover and is often less than 5%. On level terrain, the vegetation is relatively evenly distributed, but on steeper slopes and cliffs the vegetation may grow in patches and in rows or seams. In Badlands National Park, plant species that are nearly always present include the dwarf-shrubs *Eriogonum pauciflorum, Gutierrezia sarothrae, Opuntia polyacantha, Atriplex argentea*, and *Cryptantha thyrsiflora*, and the forb *Grindelia squarrosa*. *Atriplex canescens* dwarf-shrubs were observed throughout the type, but were typically short-statured and scattered in distribution (Von Loh et al. 1999).

In Badlands National Park, South Dakota, this type is typically found on silty/sandy outwash fans newly deposited by eroding badlands formations. These formations include Cretaceous Pierre shale, Oligocene Brule siltstone and Chadron clayey mudstone and shale, and Miocene Arickaree sandstone. Soils are undeveloped, poor, loose, and easily eroded. The topography is typically flat, and stands occur on erosional outwash fans. One stand, comprised of four-wing saltbush, occupies a large badlands flat and erosion fan (Von Loh et al. 1999).

COMMENTS: *3, MCS*.

CONSERVATION RANK: *G4G5.* In Badlands National Park, South Dakota, this community type occupies badland formations, which cover approximately 45% of the park (Von Loh et al. 1999). It is probably found in other badlands habitats in the Northern Great Plains.

DISTRIBUTION: This badlands type is found in the northwestern Great Plains in badlands topography.

USFS ECOREGIONS: 331F:CC
CONSERVATION REGIONS:
STATES: MT? ND SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: ERIOGONUM PAUCIFLORUM SPARSE VEGETATION ALLIANCE (VII.C.4.N.a)

Eroding Great Plains Badlands Sparse Vegetation

Eroding Great Plains Badlands Sparse Vegetation

Eroding Great Plains Badlands CEGL002050

DESCRIPTION: The clay soils of the badland eroding slopes and walls are almost devoid of vegetation. Widely scattered individuals of *Grindelia squarrosa, Gutierrezia sarothrae*, or *Eriogonum pauciflorum* may be present. *Eriogonum visheri*, a spring annual, is a rare plant found primarily in badlands in the Dakotas. *Astragalus barrii* is another uncommon Great Plains species that is associated with these badlands habitats (Froiland 1990).

Badlands eroding slopes are produced by a combination of factors, including elevation, type of rainfall, carving action of streams, and a particular material. Badlands are basically a type of mature dissection with a finely textured drainage pattern and steep slopes. They form where the land lies well above its local base level. The land must also be easily erodible, or vegetation cover will stabilize the surface. An arid climate will also discourage vegetation growth and will tend to have infrequent, but torrential, rains with great eroding action. In the Great Plains, the geologic formations where eroding slope are found include Cretaceous shales, Oligocene siltstones, sandstones, and clayey mudstones (Von Loh et al. 1999). The soils of the eroding slopes are generally poorly consolidated clays with bands of sandstone or isolated conglomerates (Froiland 1990).

COMMENTS: *3, MCS*. This type is essentially devoid of any vegetation and is typically restricted to highly eroded slopes and badland walls. Areas in South Dakota where vegetation is still sparse and widely scattered, but is more consistently present, are classified as either *Eriogonum pauciflorum - Gutierrezia sarothrae* Badlands Sparse Vegetation (CEGL005270), which occurs on flat, erosional outwash fans in the badlands, or *Artemisia longifolia* Badlands Sparse Vegetation (CEGL002195).

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This badlands eroding slope type is found in the badlands formations of the western Great Plains of the United States and Canada.

USFS ECOREGIONS: 331F:CC, 332:?
CONSERVATION REGIONS: 26:C, 34:C
STATES: ND NE SD **PROVINCES:** SK?

MIDWEST HERITAGE SYNONYMY: NE badlands =

OTHER SYNONYMY:

USNVC HIERARCHY: LARGE ERODING BLUFFS SPARSE VEGETATION ALLIANCE (VII.C.3.N.b)

* Nonstandard type (needs review)

Great Plains Badlands Sparse Vegetation Complex*

Great Plains Badlands Sparse Vegetation Complex

Great Plains Badlands Complex CECX002004

DESCRIPTION: This badlands community complex varies from stands with virtually no vegetation (eroding slopes and badland walls) to stands that may exceed 10% vegetative cover, but more often are less than 5%. On level terrain, the vegetation is relatively evenly distributed, but on steeper slopes and cliffs the vegetation may grow in patches and in rows or seams. Plant species that are nearly always present include the dwarf-shrubs *Eriogonum pauciflorum, Gutierrezia sarothrae, Opuntia polyacantha, Atriplex argentea*, and *Cryptantha thyrsiflora*, and the forb *Grindelia squarrosa*. *Atriplex canescens* dwarf-shrubs were observed throughout the type, but were typically short-statured and scattered in distribution (Von Loh et al. 1999). *Eriogonum visheri*, a spring annual, is a rare plant found primarily in badlands in the Dakotas (Froiland 1990). *Astragalus barrii* is another uncommon Great Plains species that is associated with these badlands habitats (Froiland 1990).

Badlands are produced by a combination of factors, including elevation, type of rainfall, carving action of streams, and a particular material. Badlands are basically a type of mature dissection with a finely textured drainage pattern and steep slopes. Badlands can only form where the land lies well above its local base level. The land must also be easily erodible, or vegetation cover will stabilize the surface. An arid climate will also discourage vegetation growth and will tend to have infrequent, but torrential, rains with great eroding action. In the Great Plains, the geologic formations forming the badlands complex include Cretaceous shales, Oligocene siltstones, sandstones, and clayey mudstones (Von Loh et al. 1999). The soils in the Great Plains badlands complex are generally poorly consolidated clays with bands of sandstone or isolated conglomerates (Froiland 1990).

COMMENTS: *2, MCS*. This type represents a combination of at least four associations, but more associations may be listed as further investigations are completed.

CONSERVATION RANK: *G5.* This badlands complex is somewhat restricted in distribution, occurring in selected localities where geologic conditions are right for its formation, but it is a rugged, persistent type, with extensive areas protected.

DISTRIBUTION: The badlands complex is found in the northern Great Plains region of the United States and Canada, ranging from the western Dakotas to Alberta.

USFS ECOREGIONS: 331D:CP, 331F:CC
CONSERVATION REGIONS: 26:C
STATES: MT ND SD **PROVINCES:** AB

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: N/A

Sarcobatus vermiculatus / Pseudoroegneria spicata Shrubland

Black Greasewood / Bluebunch Wheatgrass Shrubland

Greasewood / Bluebunch Wheatgrass Shrubland CEGL001367

DESCRIPTION: Stands have a sparse to moderate woody layer (15-40% cover) dominated by the deciduous, facultative halophytic shrub *Sarcobatus vermiculatus*. Other characteristic shrubs and dwarf-shrubs may include *Artemisia tridentata, Atriplex canescens, Ericameria nauseosa (= Chrysothamnus nauseosus)*, and *Gutierrezia sarothrae*. The herbaceous layer ranges from absent to moderately sparse cover (<25%) of scattered tall and medium-tall bunch grasses, such as *Pseudoroegneria spicata, Achnatherum hymenoides (= Oryzopsis hymenoides)*, and the sod grass *Bouteloua gracilis*. Annual grasses, especially the exotic *Bromus tectorum* and *Bromus japonicus* may be present. Forbs are sparse, except on disturbed, weedy sites. Forb species may include *Eriogonum pauciflorum, Suaeda calceoliformis*, or *Sphaeralcea coccinea*. Occasionally, cacti, such as *Opuntia fragilis* or *Opuntia polyacantha*, may also be present (Brown 1971, Hansen and Hoffman 1988).

Stands occur in the badlands regions of the northwestern Great Plains, where they are found on weakly consolidated sedimentary rocks. The badland topography is composed of outcrops of parallel beds of clay and silt shales, interspersed in some regions with lignite (coal) seams of varying thickness, massive outcroppings of sandstone strata, and colluvial talus of clay, silt and fragments of sandstone (Brown 1971). This community is found on the interbedded clay and silt shales. Slopes range from 0 to 80%, and average about 35-40%, with a southwest- to southeast-facing aspect. On steeper slopes, this community is found on residual interbedded clays and silts, with occasional bands of lignite that are from several centimeters to over a meter in thickness, and stands are usually 0.5 ha in size. On more gentle slopes, they are found on alluvial materials of stream terraces and may range in size up to 4 ha or more. A thin crust of highly saline salt 1 to 5 cm in depth may form on the surface. These crusts form in places where substantial movement of subsurface water accumulates high concentrations of salts and sodium near the surface through high evaporation rates (Brown 1971). The porous lignite seams may cause subsurface water to move horizontally to the surface on the hillsides (Hansen and Hoffman 1988). The upper and lower soil horizons contain concentrations of sodium salt of 9.1 to 12.00 me/100 g (Brown 1971). Soil pH is around 8.0.

Natural disturbances include ongoing erosion of badlands topography, and, where stands are near streams, occasional flash floods.

COMMENTS: *1, WCS*.

CONSERVATION RANK: *G3.* This type is restricted to Badlands topography in the northern Great Plains, rarely exceeding 4-5 ha in size. Sites are not particularly threatened, but site requirements are very specialized (highly salty subsurface soils) and localized.

DISTRIBUTION: This community is found in the badlands regions of southeastern Montana and western South Dakota, and possibly in northeastern Wyoming and western North Dakota.

USFS ECOREGIONS: 331B:C?, 331D:CC, 331G:CC, 342A:CC
CONSERVATION REGIONS: 10:C, 26:C
STATES: MT ND SD WY? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: SARCOBATUS VERMICULATUS SHRUBLAND ALLIANCE (III.B.3.N.a)

Pinus ponderosa Limestone Cliff Sparse Vegetation

Ponderosa Pine Limestone Cliff Sparse Vegetation

Ponderosa Pine Limestone Cliff CEGL002055

DESCRIPTION: At Wind Cave National Park in South Dakota, cliffs of limestone have very sparse vegetative cover at most. Where smaller outcrops occur, they often are surrounded by some type of ponderosa pine forest or woodland. Several shrub species are often found associated with limestone rock outcrops, including *Prunus virginiana, Rhus trilobata* and *Toxicodendron pubescens* (H. Marriott pers. comm. 1999).

At Wind Cave National Park in South Dakota, stands are found around large exposures of Pahasapa and Minnekahta limestones. These cliffs occur on ridgetops, slopes and in drainage bottoms (H. Marriott pers. comm. 1999).

COMMENTS: *2, MCS*. Cliffs may be defined as containing at least 3 m vertical height. At Wind Cave, South Dakota, some of the cliffs are more like rock outcrops.

CONSERVATION RANK: *G4?.*

DISTRIBUTION: This type is found in ponderosa-pine dominated areas of the Black Hills and possibly the western mountain regions of the United States.

USFS ECOREGIONS: 331:C, M334A:C□C
CONSERVATION REGIONS: 25:C, 26:C
STATES: SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: OPEN CLIFF SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

Igneous - Metamorphic Black Hills Butte Sparse Vegetation

Igneous - Metamorphic Black Hills Butte Sparse Vegetation

Black Hills Igneous - Metamorphic Butte CEGL005283

DESCRIPTION: Vascular plant cover typically is low in this community; lichens are often abundant. Vascular plants are found in cracks and other pockets of soil. Common species include *Pinus ponderosa, Juniperus scopulorum, Rhus trilobata, Ribes cereum, Campanula rotundifolia, Achillea millefolium*, and *Woodsia oregana* (Marriott 1985, BHCI 1999, Marriott and Faber-Langendoen 2000). Small stands of other community types often are found on the summits and less steep slopes of these buttes and hills.

This community is found where rock formations form buttes - isolated flat-topped or craggy hills with steep slopes or cliffs, often capped with a resistant rock layer or formed from old volcanic cones. Included are igneous and metamorphic rock types, particularly extrusive igneous rocks (e.g., trachytes, pyroxenites, and latites). In the Black Hills, this community is found on resistant igneous and metamophic rocks in the zone of Tertiary igneous features that crosses the northern part of the uplift in the vicinity of Interstate 90. This zone includes one volcanic cone (Bear Butte), and numerous intrusive features that have been exposed with erosion of the surrounding sedimentary strata: buttes, large rock outcrops (greater than 20 m vertical relief) and plug-shaped hills or small mountains with large rock exposures on multiple sides. Rocks include a variety of subvolcanic to volcanic igneous types, mainly of the phonolite-trachyte-quartz latite association (Lisenbee et al. 1981). Rhyolite is occasional. Precambrian granitic inclusions are exposed in some areas. These granites are not related to the Harney Peak granite of the Central Core region of the Black Hills to the south, and probably are significantly older (Darton 1905).

This community occurs on rock exposures ranging from flat to overhanging. There may be as much as 100 m vertical relief (e.g., Devils Tower), but most exposures are less, in the 20-50 m range. There is little soil development except in cracks and depressions. This type occurs at elevations generally in the 4000 to 6000 feet range. The summit of Warren Peaks in the Bear Lodge Mountains, at 6700 feet elevation, includes exposures of Tertiary igneous rocks and granitic inclusions, but none of sufficient vertical relief to support this community (Marriott and Faber-Langendoen 2000).

The igneous buttes and outcrops in the northern Black Hills are known to be Tertiary in age and predominantly intrusive, but their origin and classification otherwise remain controversial. One of the more thorough discussions is found in Lisenbee et al. (1981).

COMMENTS: *3, MCS*. This igneous-metamorphic butte community is expected to be related to butte and rock outcrop types in the Rocky Mountains. A good example is reported from Devils Tower, a volcanic neck with remnants of magma from inside an ancient volcanic cone. Others include Little Missouri Buttes, Sundance Mountain, and Inyan Kara Mountain. More information is needed to determine if the vegetation on buttes is distinctive enough from rock outcrops on similar rock types to justify splitting the types. Elevation of the buttes and rock outcrops may be a critical factor.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This igneous/metamorphic rock butte community is found in the Black Hills region and adjacent areas of the United States.

USFS ECOREGIONS: M334A:CC
CONSERVATION REGIONS: 25:C
STATES: SD WY? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: OPEN CLIFF SPARSE VEGETATION ALLIANCE (VII.A.1.N.a)

Pinus ponderosa Scree Woodland

Ponderosa Pine Scree Woodland

Ponderosa Pine Scree Woodland CEGL000878

DESCRIPTION: This type applies to stands with greater than 20% tree canopy cover dominated by *Pinus ponderosa*. The understory is thought to be generally sparse. Little information is currently available as to species composition and structure of this type. Two stands surveyed during the Black Hills Community Inventory were classified as scree woodland, but overall pine cover was less than 5% (Marriott et al. 1999, Marriott and Faber-Langendoen 2000).

Talus and scree slopes are found scattered throughout the Black Hills at elevations in the range of 3600 to 6500 feet. They are best developed in association with metamorphic rock outcrops (schist, slate) in the Central Core, sandstone cliffs and canyons in the Hogback Rim, and Tertiary igneous features in the northern Black Hills (e.g., Devils Tower, Sundance Mountain, Bear Butte). Soils generally are poor, and restricted to small accumulations among talus and scree (Marriott and Faber-Langendoen 2000).

COMMENTS: *2, WCS*. This type may be related to talus/scree types in the Rocky Mountains. In the Black Hills, it perhaps should be combined with the Scree - Talus Black Hills Sparse Vegetation (CEGL002307), but there currently is insufficient information to do so. The Ponderosa Pine Scree Woodland community is characterized by greater tree cover than the talus type (usually greater than 20%), but with a sparse understory. There may not be enough examples of scree woodland in the Black Hills to justify recognizing two scree types.

CONSERVATION RANK: *G4.*

DISTRIBUTION: This type is found in the Black Hills and Rocky Mountains of the western United States. Talus and scree slopes are found scattered throughout the Black Hills, and are best developed in association with metamorphic rock outcrops (schist, slate) in the Central Core, sandstone cliffs and canyons in the Hogback Rim, and Tertiary igneous features in the northern Black Hills (e.g., Devils Tower, Sundance Mountain, Bear Butte).

USFS ECOREGIONS: M332B:CC, M332D:CC, M333B:CC, M333C:CC, M333D:CC, M334A:CC
CONSERVATION REGIONS: 25:C
STATES: MT SD WY? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: PINUS PONDEROSA WOODLAND ALLIANCE (II.A.4.N.a)

Scree - Talus Black Hills Sparse Vegetation

Scree - Talus Black Hills Sparse Vegetation

Black Hills Talus CEGL002307

DESCRIPTION: This is a sparse vegetation type with total vegetative cover usually less than 10%. Lichens may be common, especially on igneous and metamorphic rocks. Little information is currently available as to species composition of this type. Because it occurs on a variety of rock types and includes a wide range of elevations, this type may be quite variable floristically (Marriott and Faber-Langendoen 2000).

Substrate includes igneous and metamorphic rocks, but more information is needed on what kinds of rock formations produce the scree or talus habitat. In the Black Hills region, talus and scree slopes are scattered at elevations in the range of 3600 to 6500 feet. Soils generally are poor and restricted to small accumulations among talus and scree. Talus and scree slopes are derived from a variety of rock types, but the most sizeable ones are restricted to three major rock types. Talus and scree composed of Precambrian schists and slate occur in the Central Core region. Accumulations of large sandstone boulders are found in narrow canyon bottoms in the Hogback Rim and occasionally below sandstone rimrock. Talus and scree slopes are common on igneous landforms in the zone of Tertiary igneous activity in the northern Black Hills (e.g., Devils Tower, Sundance Mountain, Bear Butte). Small slopes of limestone talus are occasionally found, for example, below the extensive exposures of limestone cliffs in Spearfish Canyon (Marriott and Faber-Langendoen 2000).

COMMENTS: *3, MCS*. This sparsely vegetated talus/scree type may be related to talus/scree types in the Rocky Mountains. It may be best to expand this type to include *Pinus ponderosa* Scree Woodland (CEGL000878) in the Black Hills, but there currently is insufficient information to do so. The latter community is characterized by greater tree cover (usually greater than 20%), but with a sparse understory. There may not be enough examples of the scree woodland type in the Black Hills to justify recognizing two scree types. Because this type occurs on a variety of rock types and includes a wide range of elevations, it may be quite variable floristically.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This type has been reported from the Black Hills region of the United States, and may occur elsewhere in the Rocky Mountains.

USFS ECOREGIONS: M334A:CC
CONSERVATION REGIONS: 25:C
STATES: SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: LOWLAND TALUS SPARSE VEGETATION ALLIANCE (VII.B.1.N.a)

2.5. Forests and Woodlands

2.5.5. Great Plains Forests and Woodlands

2.5.5.1. Northern Great Plains Juniper and Pine Forests and Woodlands

2.5.5.2. Northern Great Plains Bur Oak Forests and Woodlands

2.5.5.3. Northern Great Plains Ash-Elm Forests and Woodlands

2.5.5.4. Northern Great Plains Aspen-Birch Forests and Woodlands

2.5.5.5. Cross Timbers Upland Oak Forests and Woodlands

2.5.6. Rocky Mountains Forests and Woodlands

2.5.6.1. Rocky Mountains Dry Ponderosa Pine Forests and Woodlands

2.5.6.2. Rocky Mountains Mesic Ponderosa Pine Forests and Woodlands

2.5.6.3. Rocky Mountains White Spruce Forests

2.5.6.4. Rocky Mountains Aspen Forests

Pinus banksiana - (Pinus resinosa) - Quercus ellipsoidalis / Carex pensylvanica Forest

Jack Pine - (Red Pine) - Northern Pin Oak / Pennsylvania Sedge Forest

Jack Pine - Northern Pin Oak Forest CEGL002478

DESCRIPTION: *Vaccinium angustifolium* is very common, but *Corylus americana, Corylus cornuta, Rosa* spp., and *Rubus* spp. are other common constituents. *Gaylussacia baccata* is common in central Michigan and Wisconsin. The herbaceous layer contains species such as *Carex pensylvanica, Fragaria virginiana, Lysimachia quadrifolia, Maianthemum canadense, Maianthemum racemosum*, and *Pteridium aquilinum* (Curtis 1959, MNNHP 1993).

This community is found on well-drained, sandy, infertile soils (Curtis 1959). Sites are typically relatively flat and occur on outwash plains or glaciolacustrine beds (MNNHP 1993).

Fires were common in this forest before European settlement (Curtis 1959, MNNHP 1993).

COMMENTS: *2, MCS*. *Pinus strobus, Quercus rubra, Quercus macrocarpa* and *Quercus velutina* may also occur in this type. The distinction between this type and *Pinus banksiana / (Quercus rubra, Quercus ellipsoidalis)* Forest (CEGL002440) is that the latter is primarily found on bedrock, with oaks occurring primarily as grubs and only rarely are in the canopy. This type also overlaps with *Pinus banksiana / Vaccinium spp. / Pleurozium schreberi* Forest (CEGL002441), especially in Wisconsin, where timber management can cause a lot of variation in the proportion of oak and pine (E. Epstein pers. comm. 2000).

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This community is found in northern Minnesota, northern and central Wisconsin, northern Michigan, and Ontario.

USFS ECOREGIONS: 212Hb:CCP, 212He:CCP, 212Hi:CCP, 212Hm:CCP, 212Hp:CCC, 212Hq:CCP, 212Hr:CCP, 212Hs:CCP, 212Ht:CCP, 212Hu:CCP, 212Hv:CCP, 212Hw:CCP, 212Hy:CCP, 212Ja:CPP, 212Jb:CP?, 212Jc:CPP, 212Jj:CPP, 212Jl:CPP, 212Jm:CPP, 212Jn:CPP, 212Jo:CPP, 212Jr:CPP, 212Ka:CPP, 212Na:CCP, 212Nb:CCP, 212Nc:CCC, 222Ka:CCC
CONSERVATION REGIONS: 46:C, 47:C, 48:C
STATES: MI MN WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

	MI	dry northern forest - red pine-jack pine (oak) +
	MN	mixed pine - hardwood forest +
	WI	northern dry forest (jack pine-oak subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: PINUS BANKSIANA - QUERCUS (ELLIPSOIDALIS, VELUTINA) FOREST ALLIANCE (I.C.3.N.a)

Pinus banksiana - (Pinus resinosa) / Corylus cornuta Forest

Jack Pine - (Red Pine) / Beaked Hazelnut Forest

Jack Pine / Hazel Forest CEGL002442

DESCRIPTION: The overstory of this forest community is dominated by moderately to densely spaced conifers with a scattering of deciduous trees. The trees in this community are typically 15-20 m tall. *Pinus banksiana* is often the sole dominant. *Pinus resinosa* and *Betula papyrifera* are canopy or subcanopy associates. The shrub layer contains abundant *Corylus cornuta*, along with *Amelanchier* spp. and *Viburnum rafinesquianum* (MNNHP 1993).

This community is found on flat to rolling topography, such as glaciofluvial and lacustrine deposits, moraines, and other glacial features. The soils are sandy loams, fine sands, and loamy sands, shallow to deep, and with low organic content. Soils generally have greater than 2.5% organic matter (MNNHP 1993).

Stands in this type occur on fire-prone sites. Jack pine on these outwash plains may contain the open-cone ecotype, whereby some cones open with age or during hot weather. In these stands, most pine regeneration still occurs immediately following a fire. If pine regeneration is poor following a fire, aspens and birches may seed in for several years, but will eventually be replaced by jack pine. Stands of these jack pine stands often have cohorts of seedlings and saplings that presumably are the offspring of parent trees that survived minor disturbances, such as ground fires (MNNHP 1993).

COMMENTS: *2, MCS*. This type may closely resemble *Pinus banksiana / Vaccinium spp. / Pleurozium schreberi* Forest (CEGL002441). Type can grade into *Pinus resinosa / Vaccinium spp*. Forest (CEGL002443). Additional papers on this type by J. Almendinger should be used to improve this description.

CONSERVATION RANK: *G4?.*

DISTRIBUTION: This jack pine forest community type is found in the upper midwestern United States and possibly adjacent Canada, ranging from central Minnesota into possibly Ontario.

USFS ECOREGIONS: 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP
CONSERVATION REGIONS: 47:P, 48:C
STATES: MN **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MN jack pine forest (central outwash plain section) hazel subtype =

OTHER SYNONYMY:

USNVC HIERARCHY: PINUS BANKSIANA FOREST ALLIANCE (I.A.8.N.b)

Pinus banksiana / Arctostaphylos uva-ursi Forest

Jack Pine / Kinikinnick Forest

Jack Pine / Bearberry Forest CEGL002438

DESCRIPTION: The overstory is dominated by a single species, *Pinus banksiana*. There may be scattered *Pinus resinosa, Populus tremuloides*, and, in stands adjacent to low areas, *Picea mariana*. The canopy is typically 15-20 m tall. The more mesic sites tend to have denser shrub layers. Usual components include *Amelanchier alnifolia, Arctostaphylos uva-ursi, Diervilla lonicera, Hudsonia tomentosa,* and *Vaccinium* spp. Common herbaceous species are *Symphyotrichum laeve (= Aster laevis), Cornus canadensis, Maianthemum canadense, Oryzopsis asperifolia*, and *Solidago* spp. (Zoladeski et al. 1995).

This community occurs on flat to rolling topography on eolian, glaciofluvial, lacustrine, and morainal deposits. These deposits produce relatively infertile sand, loamy sand, sandy loam, and sometimes silt soils. There is a shallow but largely continuous layer of humus (Mueller-Dombois 1964, Zoladeski et al. 1995).

This community develops following fire. Without periodic fires, later successional species, such as *Abies balsamea* and *Picea* spp., invade. Drier sites have more open understories and depauperate flora (MNNHP 1993). Mosses are common, especially on more mesic sites.

COMMENTS: *2, MCS*. *Pinus banksiana / Vaccinium spp. / Pleurozium schreberi* Forest (CEGL002441) is a related community but is somewhat less even-aged and may be on slightly more fertile soils.

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This jack pine / kinikinnick forest type is found in the northern parts of the midwestern United States and in central Canada, particularly in northwestern Minnesota and southeastern Manitoba.

USFS ECOREGIONS: 212Mb:CCC
CONSERVATION REGIONS: 47:C
STATES: MN **PROVINCES:** MB

MIDWEST HERITAGE SYNONYMY: MN jack pine forest (northwest section) =

OTHER SYNONYMY: Dry *Arctostaphylos-Cladonia* Type on Minimal Podzols (Mueller-Dombois 1964) =, Jack Pine Conifer (Zoladeski et al. 1995) =, Jack pine / Ericaceous Shrub / Feathermoss (V29) (Sims et al. 1989) B

USNVC HIERARCHY: PINUS BANKSIANA FOREST ALLIANCE (I.A.8.N.b)

Pinus banksiana / Vaccinium spp. / Pleurozium schreberi Forest

Jack Pine / Blueberry Species / Feathermoss Forest

Jack Pine / Blueberry / Feathermoss Forest CEGL002441

DESCRIPTION: The overstory of this forest community is dominated by moderately to densely spaced conifers with a scattering of deciduous trees. The trees in this community are typically 15-20 m tall (Mueller-Dombois 1964). *Pinus banksiana* is often the only tree of significance in the overstory (Mueller-Dombois 1964, MNNHP 1993). In some stands, smaller amounts of *Betula papyrifera, Picea mariana, Pinus resinosa*, and *Populus tremuloides* may be found. Tall shrubs are uncommon, but may occur in patches (Sims et al. 1989). The most common of these are *Alnus viridis* and *Amelanchier alnifolia*. Occasional grubs of *Quercus ellipsoidalis* and *Quercus macrocarpa* may be present. Low shrubs are abundant. These include *Arctostaphylos uva-ursi, Diervilla lonicera, Juniperus communis, Linnaea borealis, Rosa acicularis*, and *Vaccinium* spp. The herbaceous layer contains many species typical of northern coniferous forests, such as *Aralia nudicaulis, Anemone quinquefolia, Cornus canadensis, Fragaria virginiana, Maianthemum canadense*, and *Trientalis borealis*. Mosses, especially *Pleurozium schreberi*, form a nearly continuous carpet (Eyre 1980, Sims et al. 1989).

This community is found on flat to rolling topography, such as glaciofluvial and lacustrine deposits, moraines, and other glacial features. The soils are sandy loams, fine sands, and loamy sands, shallow to deep, and with low organic content (Sims et al. 1989, MNNHP 1993). In Wisconsin, stands may be found on the "sandscapes" of the Apostle Islands (E. Epstein pers. comm. 1999).

This community often originates following fire.

COMMENTS: *2, MCS*. *Pinus banksiana / Arctostaphylos uva-ursi* Forest (CEGL002438) in northwestern Minnesota and southeastern Manitoba appears to be similar to this community, but is on deeper sands. This type also overlaps with *Pinus banksiana - (Pinus resinosa) - Quercus ellipsoidalis / Carex pensylvanica* Forest (CEGL002478), especially in Wisconsin, where timber management can cause a lot of variation in the proportion of oak and pine (E. Epstein pers. comm. 2000).

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This jack pine forest community is found in the northern parts of the midwestern United States and in central Canada, ranging from northern Michigan and northern Wisconsin west and north to Minnesota, southeastern Manitoba, and northwestern Ontario.

USFS ECOREGIONS: 212Ha:CC?, 212Hb:CCP, 212He:CC?, 212Hh:CC?, 212Hi:CC?, 212Hj:CC?, 212Hk:CC?, 212Hl:CCC, 212Hm:CCP, 212Hp:CCP, 212Hq:CCP, 212Hr:CCP, 212Hs:CCP, 212Ht:CCP, 212Hv:CCP, 212Hw:CCP, 212Hy:CCC, 212Ia:CCC, 212Ib:CCP, 212Ja:CCP, 212Jc:CCP, 212Jl:CCP, 212Jm:CCC, 212Jn:CCP, 212Jo:CC?, 212Ka:CCC, 212Na:CCC, 212Nb:CCP, 212Nc:CCC

CONSERVATION REGIONS: 47:C, 48:C

STATES: MI MN WI **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY:
MI dry northern forest - jack pine (northern pin oak) =
MN jack pine forest (central outwash plain section) blueberry subtype =
WI northern dry forest (jack pine / blueberry subtype) =

OTHER SYNONYMY: Oligotrophic Fresh Arctostaphylos-Linnaea Type on Low Beta- and Gamma-gley Podzols (Mueller-Dombois 1964) =. uncertain if equivalent, Jack Pine-Feather Moss subtype (Eyre 1980) B. is broader, Jack Pine / Ericaceous Shrub / Feathermoss (V29) (Sims et al. 1989) B. V29 may be a more northern type; it also keys to 2438, Jack Pine - Feathermoss (Zoladeski et al. 1995) =

USNVC HIERARCHY: PINUS BANKSIANA FOREST ALLIANCE (I.A.8.N.b)

Pinus strobus - Quercus alba / (Corylus americana, Gaylussacia baccata) Forest

Eastern White Pine - White Oak - / (American Hazelnut, Black Huckleberry) Forest

White Pine - White Oak Sand Forest CEGL002481

DESCRIPTION: *Pinus strobus* dominates the canopy, or may form a supercanopy over a hardwood canopy. Typical canopy associates include *Pinus resinosa* (in parts of its range), *Quercus alba, Quercus rubra*, and *Acer rubrum*. Where soils are more sandy, *Populus grandidentata* and *Quercus ellipsoidalis* may be important. Shrub species include *Corylus americana* and *Gaylussacia baccata* (rare in Minnesota). The herbaceous layer can contain *Aquilegia canadensis, Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Symphyotrichum cordifolium (= Aster sagittifolius), Carex pensylvanica, Gaultheria procumbens, Lysimachia quadrifolia, Polygala paucifolia*, and *Pteridium aquilinum* (MNNHP 1993, Eric Epstein pers. comm. 1994).

Soils are often fine sands, and in central Minnesota, Wisconsin, and Michigan, are typically formed on sandy outwash plains or lakeplains.

A long-interval fire regime (100-200 years) may be the source disturbance of these stands (Eric Epstein pers. comm. 1994).

COMMENTS: *2, MCS*. The concept of the type is a mature pine - oak forest type on sand plains. It may be that Minnesota White Pine Hardwood Forest SE, Dry Subtype is not a good crosswalk to this type if it is found on dry bluffs. Compare this type to *Pinus strobus - (Pinus resinosa) - Quercus rubra* Forest (CEGL002480) (where Minnesota White Pine Hardwood NC type is crosswalked). Indiana and Illinois stands, if not on sand, may best fit with *Pinus strobus - (Pinus resinosa) - Quercus rubra* Forest (CEGL002480).

CONSERVATION RANK: *G3.*

DISTRIBUTION: This white pine-oak forest community is found in the upper midwestern United States on dry typically sandy sites. It ranges from east-central Minnesota, central Wisconsin and central Michigan, south to northern Illinois and possibly northern Indiana.

USFS ECOREGIONS: 212Hl:CCP, 212Hp:CCP, 212Hr:CCP, 212Ht:CCP, 212Hu:CCC, 212Hv:CCP, 212Hw:CCP, 212Hx:CCP, 212Hy:CCC, 222Ja:CCC, 222Jc:CCC, 222Jj:CCC, 222Ka:CCC, 222Kh:CCC, 222Lc:CCC, 222Lf:CCC, 222Md:CCC, 222Me:CCC
CONSERVATION REGIONS: 46:C, 47:, 48:C
STATES: IL? IN? MI MN WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL?	dry upland forest (N) ?
IN?	dry-mesic upland forest ?
MI	dry-mesic northern forest - white pine-white oak =
MN	white pine - hardwood forest (southeast section) dry subtype =
WI	northern dry-mesic forest (white pine-white oak sand subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: PINUS STROBUS - QUERCUS (ALBA, RUBRA, VELUTINA) FOREST ALLIANCE (I.C.3.N.a)

Picea mariana - Populus tremuloides / Mixed Herbs Forest

Black Spruce - Quaking Aspen / Mixed Herbs Forest

Black Spruce - Aspen Rich Forest CEGL002516

DESCRIPTION: The tree layer is dominated by a moderately closed to closed canopy of mixed coniferous and deciduous species. *Populus tremuloides* is the only common deciduous tree, but scattered *Betula papyrifera* and *Populus balsamifera* are also found. *Picea mariana* is the most abundant coniferous species, and often the most abundant canopy species. *Abies balsamea, Picea glauca*, and *Pinus banksiana* are typical associated conifers. The shrub layer ranges from open to dense. Species found in this layer include *Diervilla lonicera, Ledum groenlandicum, Linnaea borealis, Rosa acicularis, Rubus pubescens, Vaccinium angustifolium*, and *Vaccinium myrtilloides*. The herbaceous layer has great diversity. *Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Cornus canadensis, Coptis trifolia, Maianthemum canadense, Petasites frigidus, Trientalis borealis*, and *Viola renifolia* are common herbaceous species. Mosses also cover a substantial portion of the forest floor (Sims et al. 1989).

This community is found on flat to gently sloping sites with fresh to moist mineral soils (Sims et al. 1989, Zoladeski et al. 1995). Soil texture is most often coarse loam, but can be clay, silt, or sand. Fine-textured soils tend to be on lacustrine substrates, while coarse-textured soils result from morainal or glaciofluvial substrates. In Ontario, this community often occurs on calcareous soil (Sims et al. 1989).

COMMENTS: *2, MCS*. Concept of the type is taken from V19 of Sims et al. (1989). This type may or may not be in the United States, though localized occurrences were noted in Voyageurs National Park, Minnesota.

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This black spruce - aspen forest community type is found in the boreal regions of the upper midwestern United States and widely in central Canada, ranging from Minnesota (where only localized occurrences are known) northward to Manitoba and east to possibly Quebec.

USFS ECOREGIONS: 212L:CP
CONSERVATION REGIONS: 48:C
STATES: MN **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY: MN boreal hardwood - conifer forest +

OTHER SYNONYMY: Black Spruce Mixedwood / Herb Rich (V19) (Sims et al. 1989) =, Black Spruce Mixedwood / Shrub and Herb Rich (V17) (Zoladeski et al. 1995) =

USNVC HIERARCHY: PICEA MARIANA - POPULUS TREMULOIDES FOREST ALLIANCE (I.C.3.N.a)

Picea mariana / Pleurozium schreberi Forest

Black Spruce / Feathermoss Forest

Black Spruce / Feathermoss Forest CEGL002447

DESCRIPTION: The canopy of this community is closed and strongly dominated by *Picea mariana* with small amounts of *Abies balsamea, Betula papyrifera, Picea glauca, Pinus banksiana*, and *Populus tremuloides*. The shrub and herb layers are poorly developed (Grigal and Ohmann 1975). Species that are most abundant in these layers include the shrubs *Corylus cornuta, Gaultheria procumbens, Ledum groenlandicum, Rosa acicularis, Vaccinium angustifolium*, and *Vaccinium myrtilloides*, and the herbs *Eurybia macrophylla (= Aster macrophyllus), Cornus canadensis, Equisetum arvense*, and *Maianthemum canadense*. Feathermosses, particularly *Pleurozium schreberi*, are very abundant. Mosses may cover from 23% (Grigal and Ohmann 1975) to over 85% (Sims et al. 1989) of the forest floor. Stands in the northeastern United States differ somewhat in composition, where stands contain *Picea mariana* and *Picea rubens* with associates of *Betula alleghaniensis, Abies balsamea, Tsuga canadensis, Acer rubrum*, or *Fagus grandifolia*. Characteristic shrubs include *Ledum groenlandicum, Kalmia angustifolia, Amelanchier bartramiana, Vaccinium angustifolium*, and *Vaccinium myrtilloides*. Characteristic herbs include *Osmunda cinnamomea, Osmunda claytoniana, Gaultheria hispidula, Maianthemum canadense, Cornus canadensis, Coptis trifolia (= Coptis groenlandica), Clintonia borealis*, and *Dalibarda repens*. The ground layer consists of a luxuriant mossy carpet of *Pleurozium schreberi, Hylocomium splendens, Ptilium crista-castrensis, Dicranum* spp., and *Bazzania trilobata*. (Northern Appalachian Ecoregional Planning Team pers. comm. 1998)

This community is found on level to gently sloping ground. Soils are typically moderately well-drained, coarse loams, sands, and silts (Sims et al. 1989). In the northeastern United States, stands occur on moist, poorly drained, mid-elevation sites along the borders of swamps, low flats along lakes, streams or boreal heathlands. Soils are sandy and imperfectly drained but not saturated or peaty. Like the lowland spruce-fir flats, sites may be situated where cold-air drainage accumulates, but these forests are moister and have a different understory composition (Northern Appalachian Ecoregional Planning Team pers. comm. 1998).

COMMENTS: *1, MCS*. Portions of this type (as described by Sims et al. 1989, V34) can be somewhat poorly drained, bordering on wetland types, such as *Picea mariana - (Larix laricina) / Ledum groenlandicum / Sphagnum* spp. Forest (CEGL005271) (Sims et al. 1989, V35 or V37). There is a sparse vascular cover and few shrubs. The distribution of the type may be more fire-related in the southern part of range and less fire-dependent further north. These forests are not well understood in the northeastern United States. The abundance of black spruce and the often small stature of the canopy trees suggest that hydrological and soil conditions may be limiting for many "upland" species. However, these stands in the northeast appear to describe well the transitional stands between the black spruce poor swamp type *Picea mariana - (Larix laricina) / Ledum groenlandicum / Sphagnum* spp. Forest (CEGL005271) and the drier stands more typical of this type.

CONSERVATION RANK: *G5.*

DISTRIBUTION: This black spruce / feathermoss forest type is found widely throughout the boreal regions of Canada, and into adjacent areas of the midwestern and northeastern United States.

USFS ECOREGIONS: 212Ib:CCC, 212J:CC, 212La:CCC, 212M:CC
CONSERVATION REGIONS: 47:C, 48:C, 63:C
STATES: ME MN NH NY VT? **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY: MN black spruce - feathermoss forest =

OTHER SYNONYMY: Black Spruce - Feathermoss Forest (Grigal and Ohmann 1975) =, Black Spruce / Feathermoss Forest (V33) (Sims et al. 1989) =, Black Spruce / Feathermoss Forest (Zoladeski et al. 1995) =, Black Spruce / Labrador Tea / Feathermoss (Sphagnum) (V34) (Sims et al. 1989) F, Black spruce-red spruce flats (NAP)

USNVC HIERARCHY: PICEA MARIANA FOREST ALLIANCE (I.A.8.N.c)

Pinus banksiana - Picea mariana / Vaccinium spp. / Pleurozium schreberi Forest

Jack Pine - Black Spruce / Blueberry Species / Feathermoss Forest

Jack Pine - Black Spruce / Feathermoss Forest CEGL002448

DESCRIPTION: *Pinus banksiana* is usually the dominant canopy species but has little successful reproduction. *Picea mariana* is of secondary importance in the canopy but often the most abundant tree species in the lower strata (Grigal and Ohmann 1975). Other trees found in this community include *Abies balsamea, Acer rubrum, Picea glauca*, and *Populus tremuloides*. Tall and low shrubs are moderately common, while herbaceous species are infrequent. Mosses, especially *Pleurozium schreberi*, are abundant. Common shrubs are the tall shrubs *Alnus viridis, Amelanchier* spp., and *Corylus cornuta*, and the low shrubs *Diervilla lonicera, Gaultheria procumbens, Vaccinium angustifolium*, and *Vaccinium myrtilloides*. Herbaceous species include *Eurybia macrophylla (= Aster macrophyllus), Clintonia borealis, Cornus canadensis*, and *Maianthemum canadense*. Grigal and Ohmann (1975) found that *Pleurozium schreberi* had 41% ground cover in 10 stands in northeastern Minnesota, while all herbaceous species had 11% coverage.

This community is found on flat areas and gentle upper and lower slopes but not on ridges or valley floors (Ohmann and Ream 1971). Soils are moderately deep (60-80 cm) sands, coarse loams, or silts with boulders often present at or near the surface (Ohmann and Ream 1971, Sims et al. 1989).

COMMENTS: *2, MCS*. The canopy of this community is usually dominated by *Pinus banksiana*, but the overall ecological and floristic relationships appear to be closer to other communities in the *Picea mariana* Forest Alliance (A.149) (Grigal and Ohmann 1975, Sims et al. 1989). Further work on this classification is needed to provide support for this placement or to support moving the community to the *Pinus banksiana* Forest Alliance (A.116). This type is most similar to V32, but may also overlap that of V31 in Sims et al. (1989).

CONSERVATION RANK: *G5.*

DISTRIBUTION: This community is found in northeastern Minnesota, northwestern Ontario, and southeastern Manitoba.

USFS ECOREGIONS: 212Ia:CCC, 212Jn:CCC, 212La:CCP, 212Lb:CCC, 212Ld:CCC
CONSERVATION REGIONS: 47:P, 48:C
STATES: MN **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY: MN jack pine forest (northeast section) jack pine - black spruce subtype =

OTHER SYNONYMY: Jack Pine - Black Spruce Forest (Ohmann and Ream 1971) F, Black Spruce - Jack Pine Forest (Ohmann and Ream 1971) I, Jack Pine - Black Spruce Forest (Grigal and Ohmann 1975) =, Jack Pine - Black Spruce / Ericaceous Shrub / Feathermoss Forest (V32) (Sims et al. 1989) =

USNVC HIERARCHY: PICEA MARIANA FOREST ALLIANCE (I.A.8.N.c)

Pinus banksiana - Populus tremuloides / Diervilla lonicera Forest

Jack Pine - Quaking Aspen / Bush-honeysuckle Forest

Jack Pine - Aspen / Bush Honeysuckle Forest CEGL002518

DESCRIPTION: The canopy layer is a mix of coniferous and deciduous trees, with the conifers tending to be more abundant in the north (Sims et al. 1989, Zoladeski et al. 1995). The canopy is typically dominated by *Pinus banksiana* and *Populus tremuloides* with lesser amounts of *Abies balsamea, Betula papyrifera, Picea glauca*, and *Picea mariana*. Tree density and crown spacing may be moderately dense to dense, but sufficient light penetrates to permit the growth of a vigorous shrub layer. Most shrubs are less than 1 m tall. The most common among these are *Corylus cornuta, Diervilla lonicera, Linnaea borealis, Rosa acicularis, Rubus pubescens*, and *Vaccinium* spp. The herbaceous layer is also typically quite rich with species such as *Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Cornus canadensis, Clintonia borealis, Streptopus lanceolatus (= Streptopus roseus), Trientalis borealis*, and *Viola* spp.

This community is found on generally level sandy outwash plains or moderately sloping moraines (Sims et al. 1989, MNNHP 1993). The soils are fresh to dry, deep, sandy loams, loams, and fine sands (Sims et al. 1989). In Manitoba, the soils tend to be somewhat more moist and fine (Zoladeski et al. 1995).

COMMENTS: *3, MCS*. In Voyageurs National Park, this type is on thin soil, rocky substrate, but on the scale of 1-10 hectares, it tends to be a mosaic of pure *Pinus banksiana* and pure *Populus tremuloides* stands. Type needs rangewide review.

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This jack pine - aspen forest community type is found in the northern parts of the midwestern United States and into central Canada, ranging from northeastern Minnesota to Manitoba and Ontario.

USFS ECOREGIONS: 212La:CCC
CONSERVATION REGIONS: 47:C, 48:C
STATES: MN **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY: MN mixed pine - hardwood forest +

OTHER SYNONYMY: Jack Pine Mixedwood / Shrub Rich (V17) (Sims et al. 1989) =, Jack Pine Mixedwood / Shrub Rich (V15) (Zoladeski et al. 1995) =

USNVC HIERARCHY: PINUS BANKSIANA - POPULUS TREMULOIDES FOREST ALLIANCE (I.C.3.N.a)

Pinus banksiana / Abies balsamea Forest

Jack Pine / Balsam Fir Forest

Jack Pine / Balsam Fir Forest CEGL002437

DESCRIPTION: The tree layer of this community is dominated by *Pinus banksiana*, often to the exclusion of other species. *Abies balsamea, Betula papyrifera, Picea mariana*, and *Populus tremuloides* dominate the sapling and seedling layers and sometimes occur in the canopy. There is a well-developed shrub layer containing species such as *Acer spicatum, Amelanchier alnifolia, Corylus cornuta, Lonicera canadensis*, and *Vaccinium* spp. The herbaceous layer is dominated by dry-mesic forest species including *Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Clintonia borealis, Coptis trifolia*, and *Galium boreale*. Mosses and lichens are common on the forest floor (Grigal and Ohmann 1975, Sims et al. 1989).

This community is found on moderately deep (50-100 cm), usually sandy soils (Grigal and Ohmann 1975). The sites are often on north- to northeast-facing slopes.

This community often originates following fires.

COMMENTS: *2, MCS*. This type represents a relatively more moist jack pine type in areas of the Canadian Shield, whereas *Pinus banksiana / (Quercus rubra, Quercus ellipsoidalis)* Forest (CEGL002440) is the drier type.

CONSERVATION RANK: *G5.*

DISTRIBUTION: This jack pine / fir forest type is found in the northern parts of the midwestern United States and in central Canada, ranging from northeastern Minnesota to northwestern Ontario and probably elsewhere.

USFS ECOREGIONS: 212La:CCC, 212Nc:C??
CONSERVATION REGIONS: 47:C, 48:C
STATES: MN **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MN jack pine forest (northeast section) jack pine - fir subtype =

OTHER SYNONYMY: Jack Pine-Fir (Grigal and Ohmann 1975) =, Jack Pine / Low Shrub (V28) (Sims et al. 1989) B. The Jack Pine / Low Shrub type may be equal to this type; needs further review., Jack Pine (Fir) (Ohmann and Ream 1971) =

USNVC HIERARCHY: PINUS BANKSIANA FOREST ALLIANCE (I.A.8.N.b)

Pinus resinosa - Populus tremuloides / Diervilla lonicera - Vaccinium spp. Forest

Red Pine - Quaking Aspen / Bush-honeysuckle - Blueberry Species Forest

Red Pine - Aspen - Birch Forest CEGL002520

DESCRIPTION: Stands contain a mix of deciduous and evergreen trees, comprising mainly *Pinus resinosa* as the conifer, with some *Pinus banksiana, Pinus strobus*, and *Abies balsamea*. Less frequent associates include *Picea glauca* and *Picea mariana*. Hardwoods include *Betula papyrifera, Populus grandidentata* and *Populus tremuloides*. The shrub and herb layer varies from dense to open. Tall and dwarf-shrubs include *Abies balsamea, Acer spicatum, Amelanchier* spp., *Corylus cornuta, Diervilla lonicera, Linnaea borealis, Lonicera canadensis, Vaccinium angustifolium*, and *Vaccinium myrtilloides*. Herbs include *Eurybia macrophylla (= Aster macrophyllus), Aralia nudicaulis, Clintonia borealis, Cornus canadensis*, and *Maianthemum canadense*. Large patches of feathermoss can develop on the forest floor. Moss species include *Dicranum polysetum* and *Pleurozium schreberi* (Sims et al. 1989, McCarthy et al. 1994).

Stands are found on well-drained upland sites on a variety of landforms. Soils are coarse sandy, and shallow to deep (Sims et al. 1989, McCarthy et al. 1994).

COMMENTS: *2, MCS*. This type overlaps floristically with *Pinus resinosa / Vaccinium spp*. Forest (CEGL002443), the pure evergreen red pine forest, but is somewhat more diverse in the shrub and herb layers.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This red pine-hardwood mixed forest community type is found in the boreal regions of the midwestern United States and in central and possibly eastern Canada, ranging from Minnesota north and east to Manitoba, Ontario and possibly elsewhere in eastern Canada.

USFS ECOREGIONS: 212Ja:CCC, 212Kb:CCC, 212La:CCP, 212Lb:CCC, 212Ld:CCC
CONSERVATION REGIONS: 47:P, 48:C
STATES: MN **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY: MN mixed pine - hardwood forest +

OTHER SYNONYMY: Red Pine Mixedwood (V13) (Sims et al. 1989) =, Red Pine Mixedwood (V5) (McCarthy et al. 1994) =

USNVC HIERARCHY: PINUS STROBUS - (PINUS RESINOSA) - POPULUS TREMULOIDES FOREST ALLIANCE (I.C.3.N.a)

Pinus resinosa / Vaccinium spp. Forest

Red Pine / Blueberry Species Forest

Red Pine / Blueberry Dry Forest CEGL002443

DESCRIPTION: This community is characterized by a pine overstory and a poorly developed understory. *Pinus resinosa* is present in the canopy at a higher cover and basal area than other conifers (typically 80% or more). *Pinus strobus* can be common in the canopy. Mesic sites tend to include not only *Pinus resinosa* in the canopy, but also *Picea mariana, Picea glauca*, and *Abies balsamea*, whereas on dry sites, *Pinus banksiana* is found (MNNHP 1993). Beneath the canopy, northern hardwoods such as *Acer rubrum* and *Betula papyrifera* sometimes form a subcanopy. The understory ranges from moderately herb and shrub rich to extremely poor. In the tall shrub class, the important species are *Amelanchier* spp. and *Corylus cornuta*. The short-shrub layer includes *Gaultheria procumbens, Linnaea borealis, Vaccinium angustifolium*, and *Vaccinium myrtilloides*, particularly where gaps in the canopy occur (Ohmann and Ream 1971). The herb layer is very poorly represented in most parts of this community's range, and includes *Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Cornus canadensis, Maianthemum canadense, Pteridium aquilinum*, and *Trientalis borealis*. Mosses can have very high cover, and typically include *Dicranum* spp. (including *Dicranum polysetum*) and *Pleurozium schreberi*. The average coverage of feathermoss was greater in the northwest region of Ontario than in the north-central region Sims et al. (1989).

This community occurs on Precambrian bedrock, overlaid with medium deep (>60 cm), coarse sand or coarse loam soils. Moisture varies from dry to dry-mesic, and stands are on mid to upper gentle slopes. The climate is highly variable, with temperature extremes between -46 C and 38 C, and anywhere from 58-91 cm of precipitation.

Fire is an important natural disturbance in this community. *P. resinosa* has adaptations that make it well suited to frequent ground fires and occasional crown fires. Reconstructions of the fire regime (Heinselman 1973, Frelich 1992) in red and white pine stands indicate that a combination of ground fires every 20 to 30 years, and severe crown fires every 100-150 years maintained presettlement *P. resinosa* communities. The thick, corky bark of older *P. resinosa* make them more resistant to fire than any other type of pine. The stems of older *P. resinosa* are likely to have better survival rates than *P. strobus* and *P. banksiana* when no crown damage results (Ahlgren 1974). In addition *P. resinosa* seedling establishment is favored by exposed mineral soils and high sunlight. Therefore, relatively frequent fires makes the continued regeneration of *P. resinosa* possible, as they are only moderately shade tolerant. Fire suppression over much of the *P. resinosa* range appears to be leading towards the gradual succession from *P. resinosa* forests to forests of mesic hardwoods or *P. strobus*, species that, with a frequent fire regime, are confined to the understory (MNNHP 1993).

COMMENTS: *1, MCS*. Stands are dominated by *Pinus resinosa*, with at least 60% cover, and typically 80% or more. Stands can intergrade with white pine, and these mixed stands are placed with the white pine types, either White Pine-Mountain Maple Mesic Forest, *Pinus strobus / Acer spicatum - Corylus cornuta* Forest (CEGL002445), or White Pine/Blueberry Dry-mesic Forest, *Pinus strobus / Vaccinium spp*. Forest (CEGL002444). Red pine stands in the central Great Lakes region, often on sandy outwash, are treated with more boreal stands as one type, since the ericaceous component is similar. It remains to be seen whether the central stands lack enough of the more common boreal elements of the northern stands to warrant a separate type.

A survey of vegetation of the dunes of Lake Michigan in Manistee National Forest in Michigan (Hazlett 1986) found a community very similar to *Pinus resinosa / Vaccinium spp*. Forest. This pine forest would appear to belong with the Great Lakes Dune Pine Forest, *Pinus banksiana - Pinus resinosa - Pinus strobus* Dune Forest (CEGL002589).

CONSERVATION RANK: *G3.* There are probably over 100 occurrences of this community rangewide. Currently there are 77 occurrences documented from Michigan (where it is ranked S3), Minnesota (S3), and Wisconsin (S3); it is also reported from Manitoba (S3) and Ontario (S?). There are probably over 10,000 acres of this community rangewide. Currently 5545 acres have been documented from 45 occurrences in Michigan, Minnesota, and Wisconsin. Many sites have been degraded by logging, but there are also many mature to old-growth stands remaining.

DISTRIBUTION: This upland red pine community type is found in the boreal regions of the midwestern United States and in central and possibly eastern Canada, ranging from Minnesota and southwestern Manitoba east to Michigan, Ontario, and possibly further east.

USFS ECOREGIONS: 212Ha:CCC, 212Hb:CCP, 212He:CC?, 212Hh:CCC, 212Hi:CCP, 212Hj:CCC, 212Hk:CC?, 212Hl:CCC, 212Hm:CCP, 212Hp:CCP, 212Hq:CCC, 212Hr:CCP, 212Hs:CCP, 212Ht:CCP, 212Hu:CCP, 212Hv:CCP, 212Hw:CCP, 212Hx:CCP, 212Hy:CCP, 212Ia:CCC, 212Ja:CCC, 212Jb:CCP, 212Jc:CCC, 212Jf:CCP, 212Jj:CCP, 212Jl:CCC, 212Jm:CCC, 212Jn:CCP, 212Jo:CC?, 212Ka:CCC, 212Kb:CCC, 212La:CCC, 212Lb:CCP, 212Lc:CCC, 212Mb:CCC, 212Na:CCC, 212Nb:CCC, 212Nc:CCC, 222Mc:CCC

CONSERVATION REGIONS: 46:C, 47:C, 48:C

STATES: MI MN WI **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY:

MI	dry northern forest - red pine-jack pine (oak) +
MN	red pine forest =
WI	northern dry forest (red pine subtype) =

OTHER SYNONYMY: Red Pine Conifer (V27) (Sims et al. 1989), Red Pine-White Pine-Jack Pine-Blueberry-Feathermoss (V30) (Chambers et al. 1997) F, Red Pine-White Pine-Jack Pine-Largetooth Aspen-White Pine Shrub-Wintergreen (V31) (Chambers et al. 1997) F, Red Pine (Ohmann and Ream 1971) =

USNVC HIERARCHY: PINUS RESINOSA FOREST ALLIANCE (I.A.8.N.b)

Pinus strobus - (Pinus resinosa) - Quercus rubra Forest

Eastern White Pine - (Red Pine) - Northern Red Oak Forest

White Pine - Red Oak Forest CEGL002480

DESCRIPTION: *Pinus strobus* is the dominant component of the overstory, often forming a supercanopy above the hardwood canopy. *Quercus rubra* is an important canopy species, along with *Acer saccharum* and *Quercus alba* in central Minnesota, and, farther eastward, *Fraxinus americana, Quercus velutina*, and occasional *Fagus grandifolia*. Northern stands may contain *Acer rubrum, Betula papyrifera, Pinus resinosa, Pinus strobus, Populus grandidentata*, and *Populus tremuloides*, along with *Abies balsamea* in the understory. The shrub and vine layer in the southern part of the range contains *Cornus foemina, Corylus americana, Parthenocissus quinquefolia*, and *Vaccinium angustifolium*, and, farther north, *Corylus cornuta, Diervilla lonicera, Gaultheria procumbens, Vaccinium angustifolium*, and *Viburnum acerifolium*. Typical herbs in the southern part of the range include *Amphicarpaea bracteata, Aralia nudicaulis, Carex pensylvanica*, and *Geranium maculatum*; farther north, they include *Eurybia macrophylla (= Aster macrophyllus), Maianthemum canadense, Oryzopsis asperifolia, Polygala paucifolia, Polygonatum pubescens, Pteridium aquilinum*, and *Trientalis borealis*. Mosses include *Ptilidium pulcherrimum*, among others (Eyre 1980, MNNHP 1993, Chambers et al. 1997).

Sites are found on dry-mesic to mesic sites with well-drained sandy loams or coarser soils, typically on morainal slopes and ridges.

COMMENTS: *2, MCS*. Distinction between this type and *Pinus strobus - Quercus alba* / (*Corylus americana, Gaylussacia baccata*) Forest (CEGL002481), which is found on sands, needs clarification. Compare also with *Pinus strobus - Quercus (rubra, velutina) - Fagus grandifolia* Forest (CEGL006293) in the East. Type may have a boreal variant (see Voyageurs NP and descriptions from central Ontario (Chambers et al. 1997). If Minnesota White Pine-Hardwood Forest (especially north-central subtype) is primarily a sandplain type, all of it should be placed with CEGL002481. In Wisconsin, this type grades into the pure evergreen white pine type, *Pinus strobus / Acer spicatum - Corylus cornuta* Forest (CEGL002445).

CONSERVATION RANK: *G3.*

DISTRIBUTION: This white pine - oak forest community occurs in the central Great Lakes region of the United States and Canada, where it occurs on dry to dry-mesic sites. Stands range from Minnesota east to Michigan and Ontario.

USFS ECOREGIONS: 212Hb:CCP, 212He:CCC, 212Hi:CCP, 212Hj:CCC, 212Hl:CCC, 212Hm:CCP, 212Ho:CCC, 212Hp:CCP, 212Hq:CCP, 212Hr:CCP, 212Ht:CCP, 212Hu:CCP, 212Hv:CCC, 212Hw:CCC, 212Ja:CCP, 212Jb:CCC, 212Jc:CCP, 212Jf:CCP, 212Jj:CCP, 212Jl:CCP, 212Jm:CCC, 212Jn:CCP, 212Jr:CCC, 212Ka:CCP, 212Kb:CCC, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 212Oa:CCC, 212Oc:CCC, 222Jd:CCC, 222Je:CCC, 222Jg:CCC, 222Lc:CCC, 222Lf:CCC, 222Mc:CCC, 222Md:CCC

CONSERVATION REGIONS: 46:C, 47:C, 48:C

STATES: MI MN WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI dry-mesic northern forest - white pine (red pine)-oak =
MN white pine - hardwood forest (southeast section) mesic subtype; white pine - hardwood forest (north-central section) -
WI northern dry-mesic forest (white pine-red oak subtype) =

OTHER SYNONYMY: White Pine-White Birch-Red Oak-Largetooth Aspen-Bracken Fern (Chambers et al. 1997) =. Uncertain if equivalent; Type overlaps with both CEGL002479 and CEGL002480, White Pine - Northern Red Oak - Red Maple: 20 (Eyre 1980). may be equivalent

USNVC HIERARCHY: PINUS STROBUS - QUERCUS (ALBA, RUBRA, VELUTINA) FOREST ALLIANCE (I.C.3.N.a)

Pinus strobus - (Pinus resinosa) Driftless Bluff Forest

Eastern White Pine - (Red Pine) Driftless Bluff Forest

White Pine - (Red Pine) Driftless Bluff Forest CEGL002378

DESCRIPTION: The vegetation is a closed to open canopy of conifer or mixed conifer-hardwood trees. The canopy is typically dominated by *Pinus strobus*. Occasionally *Tsuga canadensis* is mixed with the pine, or may dominate in certain areas, typically the most steep areas. Some of the stands examined by McIntosh (1950) had pine seedlings and saplings in the understory, while others were dominated by young hardwoods, such as *Betula papyrifera, Populus tremuloides, Quercus alba, Quercus velutina, Ostrya virginiana*, or *Tilia americana*. Less common conifer associates include *Juniperus virginiana* and *Pinus banksiana*. Many of the herbs and shrubs of the northern pine forests are present in these forests. Typical shrub associates include *Diervilla lonicera* and *Vaccinium myrtilloides*. Less common shrubs include *Acer spicatum, Cornus canadensis, Corylus cornuta, Prunus pensylvanica*, and *Prunus virginiana*. Typical herbs include *Maianthemum canadense*. Less common herb and dwarf-shrub associates may include *Eurybia macrophylla (= Aster macrophyllus), Chimaphila umbellata, Gaultheria procumbens, Lycopodium obscurum, Mitchella repens, Pyrola americana (= Pyrola rotundifolia)*, and *Trientalis borealis*. Other members of the understory are found more commonly on prairies, including *Amorpha canescens, Coreopsis palmata*, and *Dodecatheon meadia*. Species typical of more southern hardwood stands include *Arisaema triphyllum* and *Sanguinaria canadensis*. There is little chance of exchange of species between sites, and the makeup of adjacent communities can have a significant impact on understory composition. When a population of a species becomes extirpated in one site it is unlikely to reinvade due to the distance to another site (McIntosh 1950).

This community occurs on sloping or level sandstone or, rarely, on quartzite bluffs. The sandstone is either St. Peter or Franconia. McIntosh (1950) studied 22 stands of this type and found them on all aspects except SE. Soils are sandy, shallow, usually acidic, and excessively drained. The most common site is a waterworn cliff with the undercutting stream still present at the cliff base. Considerable light penetrates to the forest floor even though the trees are close together.

Treefall is relatively common in this community due to the steep slopes and shallow soils.

COMMENTS: *2, MCS*. This type should be compared to the more moist *Pinus strobus - Abies balsamea - Betula alleghaniensis* Driftless Forest (CEGL002111).

CONSERVATION RANK: *G2G3.* This type has a naturally restricted distribution. McIntosh (1950) mentioned that some of the more accessible stands in his study had been logged.

DISTRIBUTION: This community occurs in many places in the Driftless Area of southwestern Wisconsin, and also in a few places in the area of Farmdale glaciation. It is also found in southeastern Minnesota and in very small occurrences in northeastern Iowa.

USFS ECOREGIONS: 222Lc:CCC, 222Ld:CCC, 222Le:CCC, 222Lf:CCC
CONSERVATION REGIONS: 46:C
STATES: IA MN WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MN white pine forest (southeast section) =
WI northern dry-mesic forest (white pine-red pine relict) =

OTHER SYNONYMY:

USNVC HIERARCHY: PINUS STROBUS FOREST ALLIANCE (I.A.8.N.b)

Pinus strobus - Abies balsamea - Betula alleghaniensis Driftless Forest

Eastern White Pine - Balsam Fir - Yellow Birch Driftless Forest

Driftless White Pine - Northern Hardwoods Forest CEGL002111

DESCRIPTION: The tree canopy includes any combination of *Abies balsamea, Betula alleghaniensis*, and *Pinus strobus*. The shrub layer contains *Acer spicatum, Taxus canadensis*, and *Viburnum opulus var. americanum (= Viburnum trilobum)*. Characteristic herbaceous species include *Allium cernuum, Equisetum scirpoides, Streptopus lanceolatus (= Streptopus roseus)*, and, more rarely, *Cornus canadensis* (MNNHP 1993).

Stands occur on moist, steep north-facing slopes with thin soils, and are usually associated with cliffs, talus slopes, and bedrock outcrops (MNNHP 1993).

COMMENTS: *2, MCS*. This type is similar in some respects to *Tsuga canadensis - Acer saccharum / (Hepatica nobilis var. acuta)* Driftless Forest (CEGL002597) in Wisconsin, but in Wisconsin, *Abies balsamea* is not present (except on two cliffs in old drift of west-central Wisconsin), and *Tsuga canadensis* is common. *Tsuga canadensis* does not occur in southeastern Minnesota, and *Abies balsamea* is absent from some stands. Information in Minnesota is partly taken from Minnesota County Biological Survey information from Fillmore County. It is also very similar in some ways to *Pinus strobus - (Pinus resinosa)* Driftless Bluff Forest (CEGL002378), yet based on the floristic information available, the types appear to contain different suites of species. But this may simply reflect the isolated nature of stands in all of these types.

CONSERVATION RANK: *G2?.* There are probably fewer than 20 occurrences from a restricted range. Four occurrences have been documented in two states (Minnesota and Wisconsin). Most occurrences are small, and total rangewide acreage is probably less than 1000 acres. Stands occur on cool and often steep slopes in the Driftless Area of Minnesota and Wisconsin. Stands are relatively inaccessible, but some may have been degraded by logging.

DISTRIBUTION: This pine-hardwoods community is found in the "Driftless Region" of southeastern Minnesota, United States.

USFS ECOREGIONS: 222Lc:CCC, 222Lf:CCC, 222Md:CCC
CONSERVATION REGIONS: 46:C
STATES: MN **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MN northern hardwood forest (southeast section); northern hardwood - conifer forest (southeast section) -

OTHER SYNONYMY:

USNVC HIERARCHY: PINUS STROBUS - (PINUS RESINOSA) - POPULUS TREMULOIDES FOREST ALLIANCE (I.C.3.N.a)

Pinus strobus - Populus tremuloides / Corylus cornuta Forest

Eastern White Pine - Quaking Aspen / Beaked Hazelnut Forest

White Pine - Aspen - Birch Forest CEGL002479

DESCRIPTION: The tree canopy is mixed evergreen-deciduous. *Pinus strobus* may form a supercanopy over a mixture of other species, including *Betula papyrifera, Populus tremuloides, Picea glauca*, and *Abies balsamea*. Less frequent are *Pinus resinosa, Populus grandidentata*, and *Thuja occidentalis*. The subcanopy can include *Acer rubrum* and *Acer saccharum*, as well as a mixture of canopy species. Tall shrubs and saplings include *Abies balsamea, Acer spicatum, Amelanchier* spp., and *Corylus cornuta*. Short shrubs include *Diervilla lonicera, Linnaea borealis, Lonicera canadensis*, and *Vaccinium myrtilloides*. *Viburnum nudum var. cassinoides (= Viburnum cassinoides)* may be present in the eastern part of the range. Herbs include *Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Clintonia borealis, Cornus canadensis, Maianthemum canadense, Oryzopsis asperifolia, Pteridium aquilinum, Streptopus lanceolatus (= Streptopus roseus)*, and *Trientalis borealis*. Typical mosses include *Pleurozium schreberi, Dicranum polysetum* and *Dicranum flagellare* (Sims et al. 1989, MNNHP 1993, Chambers et al. 1997).

Stands are found on a variety of slope positions on deep (>60 cm), dry-mesic to mesic, rapidly drained soils, with fine sandy to loamy soil textures (Sims et al. 1989, MNNHP 1993, Chambers et al. 1997).

This community typically develop as a successional stage after fire, but may also originate after logging.

COMMENTS: *2, MCS*. In Wisconsin and Michigan this type can originate as a result of forestry management and natural examples may be rare. In Wisconsin, this type did apparently occur prior to European settlement, but was more variable than what is described here (E. Epstein pers. comm. 1999). An aspen-birch-white pine type has also been recognized by Grigal and Ohmann (1975) (see also Heinselman 1996), which consists of two subtypes, stands currently with a white pine overstory, and stands formerly with white pine but currently dominated by aspen-birch because of past logging and fire. Thus this type may be a relatively trivial split between pure evergreen white pine forest and pure deciduous aspen-birch types.

CONSERVATION RANK: *G4?.*

DISTRIBUTION: This white pine - hardwood forest community type is found in the Great Lakes region of the United States and Canada.

USFS ECOREGIONS: 212Ha:CCP, 212Hb:CCP, 212He:CCP, 212Hh:CCP, 212Hi:CCP, 212Hj:CCP, 212Hk:CCP, 212Hl:CCP, 212Hm:CCP, 212Hn:CCP, 212Ho:CCP, 212Hp:CCP, 212Hq:CCP, 212Hr:CCC, 212Hs:CCP, 212Ht:CCP, 212Hu:CCP, 212Hv:CCP, 212Hw:CCP, 212Hx:CC?, 212Hy:CCP, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jk:CPP, 212Jl:CPP, 212Jn:CPP, 212Jo:CPP, 212Jr:CPP, 212La:CCC, 212Lb:CCC, 212Lc:CCP, 212Ld:CCP, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP
CONSERVATION REGIONS: 47:C, 48:C
STATES: MI MN WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:
MI dry-mesic northern forest - red pine-white pine +
MN northern hardwood - conifer forest (northern section) =
WI northern dry-mesic forest (white pine-aspen subtype) =

OTHER SYNONYMY: White Pine Mixedwood (Sims et al. 1989) =, White Birch-White Pine-Trembling Aspen-Beaked Hazel-Mountain Maple (V23) (Chambers et al. 1997) =

USNVC HIERARCHY: PINUS STROBUS - (PINUS RESINOSA) - POPULUS TREMULOIDES FOREST ALLIANCE (I.C.3.N.a)

Pinus strobus / Acer spicatum - Corylus cornuta Forest

Eastern White Pine / Mountain Maple - Beaked Hazelnut Forest

White Pine / Mountain Maple Mesic Forest CEGL002445

DESCRIPTION: This community is dominated by *Pinus strobus*. It is often distinguished by a supercanopy of large, old *Pinus strobus* and scattered *Pinus resinosa*. The lower layer of the canopy consists mainly of *Abies balsamea* trees and saplings (Ohmann and Ream 1971). Other trees that may be found in this layer include *Betula alleghaniensis, Picea glauca, Thuja occidentalis, Acer rubrum, Acer spicatum*, and other trees common to boreal forest landscapes. The tall-shrub layer is moderately to well-developed and consists of *Abies balsamea, Acer spicatum, Corylus cornuta*, and, less frequently, *Amelanchier* spp. (Ohmann and Ream 1971, Sims et al. 1989). The low-shrub layer is not well-developed and dominated by *Diervilla lonicera, Linnaea borealis, Vaccinium myrtilloides*, and *Vaccinium angustifolium*. The herb stratum is also not well-developed. The deep layer of undecomposed needles that formed the mor humus are not conducive to herb growth (Martin 1959). Prevalent herbs include *Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Cornus canadensis, Maianthemum canadense, Polypodium virginianum (= Polypodium vulgare)*, and *Pteridium aquilinum*. Moss species include *Dicranum polysetum* and *Pleurozium schreberi*.

This community is found on Precambrian Shield bedrock, overlaid with sandy loam soils that are moderately well-drained and deep (>60 cm). In northeastern Minnesota it occurs on northeast- and south-facing slopes, that are moderate to steep (slope ranges between 4-45%) (Ohmann and Ream 1971). The climate is highly variable, with temperature extremes between -46.7 degrees C and 38.7 degrees C and 58-91 cm precipitation.

Fire is an important natural disturbance in this community. Although *Pinus strobus* does not have the more sophisticated adaptations to fire that *Pinus resinosa* and *Pinus banksiana* do, *Pinus strobus* seedling establishment is favored by post-fire conditions, such as exposed mineral soil, and high sunlight. Once established, mature *Pinus strobus* are able to survive surface fires, and have moderate tolerance to shade. Frelich (1992), in an overview of research done on various *Pinus strobus* communities, found that it is most abundant in forests with a catastrophic fire rotation period of 150-300 years. This coincides with the fire rotation cycle found in the BCWA in northeastern Minnesota, where Heinselman found that *Pinus strobus* stands remained largely intact for 150-350 years.

Fire plays an important part in the longevity of the stand. Where there is a frequent ground fire regime the understory is eliminated by fire, establishing a pine seed bed that allows for pine regeneration (Ohmann and Ream 1971). It was suggested by Ohmann and Ream (1971) that the fire suppression in the BCWA had allowed an extremely well-developed *Abies balsamea* undercanopy to become established, thus hastening the successional trend towards an *Abies balsamea* forest.

COMMENTS: *1, MCS*. The type allows for *Pinus strobus*-dominated stands or mixed *Pinus strobus*-conifers, including *Pinus resinosa*. The type concept is not well-developed in Wisconsin, where it complexes with *Pinus strobus - (Pinus resinosa) - Quercus rubra* Forest (CEGL002480). The limits of the type farther eastward, where it overlaps with *Pinus strobus - Pinus resinosa / Cornus canadensis* Forest (CEGL006253), are also not clear. In some stands *Juniperus communis* may be present.

CONSERVATION RANK: *G3G4.* There are fewer than 100 occurrences of this community rangewide, but Ontario ranks are unknown. Currently there are 45 occurrences documented from Minnesota (where it is ranked S3), Michigan (S?), and Wisconsin (S?); it is also reported from Ontario (S?). There are probably fewer than 10,000 acres of this community rangewide. Currently 2075 acres have been documented from 32 occurrences in Minnesota, Michigan, and Wisconsin. Many stands are reported to be of post-fire origin; infrequent catastrophic fires may be important for maintenance of this community. Many, perhaps, most sites have been degraded by logging. Some sites may be disturbed by fire suppression, and they may be succeeding to other forest types.

DISTRIBUTION: This white pine forest type is found in the northern parts of the midwestern United States and in adjacent parts of Canada, ranging from Minnesota and Ontario east to Wisconsin and Michigan.

USFS ECOREGIONS: 212Ha:CCC, 212Ia:CCC, 212Ja:CCP, 212Jb:CCC, 212Jc:CCC, 212Je:CCC, 212Jl:CCC, 212Jm:CCC, 212Ka:CCC, 212La:CCC, 212Lb:CCC, 212Lc:CCC, 212Ld:CC?, 212Ma:CCC, 212Mb:CCC, 212Nb:CCC
CONSERVATION REGIONS: 47:C, 48:C
STATES: MI? MN WI? **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:
MI? no state equivalent
MN white pine forest (northeast section) =
WI? northern dry-mesic forest (white pine / mountain maple subtype?) ?

OTHER SYNONYMY: White Pine Conifer (V26) (Sims et al. 1989) =, White Pine (Ohmann and Ream 1971) =, White Pine-Red Pine-Beaked Hazel-Bracken Fern-Bush Honeysuckle (V29) (Chambers et al. 1997) =

USNVC HIERARCHY: PINUS STROBUS FOREST ALLIANCE (I.A.8.N.b)

Pinus strobus / Vaccinium spp. Forest

Eastern White Pine / Blueberry Species Forest

White Pine / Blueberry Dry-mesic Forest CEGL002444

DESCRIPTION: Conifers dominate the overstory. *Pinus strobus* is the most abundant mature tree species, often found with small to substantial amounts of *Pinus resinosa*. Scattered *Acer rubrum, Betula papyrifera*, and *Populus tremuloides* can be found as subcanopy or small canopy trees. The understory contains species such as *Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Maianthemum canadense, Pteridium aquilinum*, and *Vaccinium* spp. (MNNHP 1993). An inland dune ridge variant occurs in Michigan; the overstory contains *Pinus strobus* and *Pinus resinosa*, the shrub layers contain *Vaccinium angustifolium* and *Arctostaphylos uva-ursi*, and *Pteridium aquilinum* is common in the understory (P. Comer and D. Albert pers. comm. 1996).

This community is found on sandy soils. It occurs most often on glaciated landscapes, such as moraines and till, where sandy pockets occur, and may be on flat to moderately sloping topography (MNNHP 1993). It is also found on somewhat poorly drained sand and clay lakeplains. The inland dune variant occurs on dune ridges.

COMMENTS: *1, MCS*. This type is similar to *Pinus resinosa / Vaccinium* spp. Forest (CEGL002443). It occurs on droughty soils, influenced by adjacent moraines. The inland dune variant, found in Saginaw Bay and in Luce County (Two-hearted River), Upper Peninsula, could also be treated as a variant of the Great Lakes Dune Pine Forest, *Pinus banksiana - Pinus resinosa - Pinus strobus* Dune Forest (CEGL002589).

CONSERVATION RANK: *G3G4.* There are well over 100 occurrences rangewide, but the occurrences tend to be fairly small stands (under 100 acres) because of the somewhat restricted environmental requirements. Few old-growth remnants remain, but several are protected. This community may be dependent on occasional catastrophic fires (with a very long fire-return interval) to allow regeneration of pines instead of gradual succession to other forest types. Fire suppression, grazing, and logging in the last 100 years have substantially reduced the acreage of this forest type.

DISTRIBUTION: This dry white pine forest community is found in the western Great Lakes region of the United States and Canada and eastward into the northeastern United States and eastern Canada. It ranges from northern Minnesota and northwestern Ontario east to possibly New Hampshire and Maine, and possibly into Quebec and the Maritime Provinces.

USFS ECOREGIONS: 212Hb:CCP, 212He:CCP, 212Hh:CCC, 212Hi:CCP, 212Hj:CCC, 212Hl:CCC, 212Hm:CCC, 212Ho:CCC, 212Hp:CCC, 212Hq:CCP, 212Hr:CCC, 212Hs:CCP, 212Ht:CCP, 212Hu:CCP, 212Hv:CCP, 212Hw:CCP, 212Hy:CCP, 212Ja:CCP, 212Jb:CCP, 212Jc:CCP, 212Jl:CCP, 212Jm:CCP, 212Jn:CCP, 212Jr:CCC, 212Ka:CCP, 212Kb:CCC, 212Na:CCC, 212Nb:CCP, 212Nc:CCC, 222Ma:CCC, 222Mc:CCC, M212:P

CONSERVATION REGIONS: 46:C, 47:C, 48:C

STATES: ME MI MN NH WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:
MI dry-mesic northern forest - red pine-white pine +
MN white pine forest (central section) =
WI northern dry-mesic forest (white pine / blueberry subtype) =

OTHER SYNONYMY: Northern Dry Forest (Curtis 1959) B

USNVC HIERARCHY: PINUS STROBUS FOREST ALLIANCE (I.A.8.N.b)

Abies balsamea - Betula papyrifera / Diervilla lonicera Forest

Balsam Fir - Paper Birch / Bush-honeysuckle Forest

Balsam Fir - Paper Birch Forest CEGL002474

DESCRIPTION: The tree canopy is either pure evergreen or mixed evergreen-deciduous. The overstory is usually dominated by *Abies balsamea* and *Betula papyrifera*, but some stands may have large amounts of *Populus tremuloides*. Other common trees include *Picea glauca, Picea mariana, Pinus strobus*, and *Thuja occidentalis*. Canopy trees may typically be 15-25 m tall (Hansen et al. 1973). *Abies balsamea* is also abundant in the sapling/shrub stratum, along with *Acer spicatum, Betula papyrifera, Diervilla lonicera, Corylus cornuta, Linnaea borealis, Rubus pubescens, Sorbus americana*, and *Taxus canadensis* (especially on Isle Royale and in northern Wisconsin). Herbaceous species found in this community include *Anemone quinquefolia, Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Clintonia borealis, Coptis trifolia, Cornus canadensis, Maianthemum canadense, Mitella nuda, Streptopus lanceolatus (= Streptopus roseus)*, and *Trientalis borealis*. Mosses include *Hylocomium splendens, Plagiomnium cuspidatum, Pleurozium schreberi*, and *Ptilium crista-castrensis* (Sims et al. 1989).

This community is found on deep, moist to mesic, mineral soils, usually loams (Sims et al. 1989). It can be on flat to moderate slopes (5-30%) and, in northern Minnesota, tends to be near water (Ohmann and Ream 1971).

COMMENTS: *2, MCS*. This type does not always have a pure evergreen canopy; it can grade into mixed evergreen-deciduous canopy in northern and central Ontario. It intergrades heavily with spruce-fir evergreen types, *Picea glauca - Abies balsamea / Acer spicatum / Rubus pubescens* Forest (CEGL002446), and spruce-fir-hardwood mixed evergreen-deciduous types, *Picea glauca - Abies balsamea - Populus tremuloides* / Mixed Herbs Forest (CEGL002475), and could perhaps be lumped with either of these two types. Sims et al. (1989) note that this type (their V14) is often uneven-aged with relatively closed canopies, and occurs less frequently on calcareous soils. In Manitoba this type can be common following insect infestation by spruce budworm or tree harvesting without replanting (J. Greenall, pers. comm. 1999).

CONSERVATION RANK: *G5.*

DISTRIBUTION: This balsam fir - birch sub-boreal forest type is found in the northern Great Lakes region of the United States and Canada and elsewhere in central Canada, ranging from northern Minnesota and Manitoba east to Ontario.

USFS ECOREGIONS: 212Ib:C??, 212JI:C??, 212La:CCP, 212Lb:CC?, 212Lc:CCP, 212Ld:CC?, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP
CONSERVATION REGIONS: 47:P, 48:C
STATES: MN **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY: MN spruce - fir forest fir - birch subtype =

OTHER SYNONYMY: Fir - Birch (Ohmann and Ream 1971) =, Balsam Fir - Yellow Birch - Paper Birch - White Spruce (Hansen et al. 1973) I, Fir - Birch - *Mitella* (Kurmis et al. 1986) B. Kurmis et al. (1986) Fir - Birch - Mitella type appears to closely match this community. However, the stands in their type were classified using a habitat type approach, placing stands with dissimilar vegetation into groups based on their presumably similar climax states. This makes it difficult to compare their classification with one based on existing vegetation., Balsam Fir Mixedwood (V14) (Sims et al. 1989) =

USNVC HIERARCHY: PICEA GLAUCA - ABIES BALSAMEA FOREST ALLIANCE (I.A.8.N.c)

Picea glauca - Abies balsamea - Populus tremuloides / Mixed Herbs Forest

White Spruce - Balsam Fir - Quaking Aspen / Mixed Herbs Forest

Spruce - Fir - Aspen Forest CEGL002475

DESCRIPTION: The overstory composition is varied. The most abundant tree species typically are *Abies balsamea, Acer rubrum, Picea glauca, Pinus strobus, Populus tremuloides*, and *Populus balsamifera*. The sapling/shrub layer is usually moderately well-developed. *Acer spicatum, Corylus cornuta, Rosa acicularis, Rubus pubescens*, and saplings of *Abies balsamea* are the most commonly encountered in this stratum. Herb diversity is usually high. *Aralia nudicaulis, Symphyotrichum ciliolatum (= Aster ciliolatus), Eurybia macrophylla (= Aster macrophyllus), Clintonia borealis, Cornus canadensis, Galium triflorum, Maianthemum canadense, Mitella nuda*, and *Trientalis borealis* are typical of this community (Sims et al. 1989, MNNHP 1993). A Lake Superior clayplain variant may occur in northern Wisconsin. Leading canopy dominants include *Picea glauca, Pinus strobus*, and *Betula papyrifera*. Common associates include *Abies balsamea, Populus tremuloides, Populus balsamifera, Thuja occidentalis*, and *Acer rubrum*. Shrubs include *Cornus sericea, Corylus cornuta, Diervilla lonicera, Lonicera hirsuta, Rubus parviflorus, Rubus pubescens, Sorbus decora*, and *Viburnum opulus var. americanum (= Viburnum trilobum)*. Typical herbaceous species include *Anemone quinquefolia, Eurybia macrophylla, Aralia nudicaulis, Calamagrostis canadensis, Carex arctata, Fragaria virginiana, Luzula acuminata, Maianthemum canadense, Petasites frigidus*, and *Pteridium aquilinum* (E. Epstein pers. comm. 1999).

This upland community is found on deep, well-drained to rapidly drained, moist, fine-textured mineral soils. Loams are the most common, but silts and clays are not rare (Sims et al. 1989, Zoladeski et al. 1995).

COMMENTS: *2, MCS*. This type overlaps in concept with *Abies balsamea - Betula papyrifera / Diervilla lonicera* Forest (CEGL002474). A red maple variant may occur in the Great Lake states (Michigan, Minnesota, Wisconsin). The Lake Superior clayplain variant should be reviewed range-wide to see if it may represent a distinct association.

CONSERVATION RANK: *G5.* No old-growth stands are known for the Lake Superior clayplain variant.

DISTRIBUTION: This spruce - fir - aspen forest type is found in the western Great Lakes area of the United States and Canada and elsewhere in parts of central Canada, ranging from northern Minnesota and Manitoba east to Michigan and possibly Quebec.

USFS ECOREGIONS: 212He:CP?, 212Hi:CPP, 212Hl:CPP, 212Hm:CPP, 212Hn:CPP, 212Ho:CPP, 212Hp:CPP, 212Hq:CPP, 212Hr:CPP, 212Hs:CPP, 212Hv:CPP, 212Hw:CPP, 212Ia:CCP, 212Ib:CCC, 212Ja:CCP, 212Jb:CCP, 212Jc:CCP, 212Jl:CCP, 212Jm:CCC, 212Jn:CCP, 212Jo:CCP, 212La:CCC, 212Lc:CCC, 212Mb:CCC, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 212Ob:C??, 222Ma:CCC, 222Na:CCC

CONSERVATION REGIONS: 35:C, 46:C, 47:C, 48:C

STATES: MI MN WI **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY:

	MI	boreal forest +
	MN	boreal hardwood - conifer forest +
	WI	boreal forest (spruce-fir-hardwoods subtype) =

OTHER SYNONYMY: White Spruce Mixedwood (V15) (Sims et al. 1989) =, White Spruce Mixedwood (V13) (Zoladeski et al. 1995) =

USNVC HIERARCHY: PICEA GLAUCA - ABIES BALSAMEA - POPULUS SPP. FOREST ALLIANCE (I.C.3.N.a)

Picea glauca - Abies balsamea / Acer spicatum / Rubus pubescens Forest

White Spruce - Balsam Fir / Mountain Maple / Dewberry Forest

Spruce - Fir / Mountain Maple Forest CEGL002446

DESCRIPTION: This community is a closed-canopy forest dominated by a combination of *Picea glauca* and *Abies balsamea*. Some stands have a preponderance of one of these species and the other may then be an important associate. In these situations it is typically *Picea glauca* that is the most abundant (Maycock and Curtis 1960, MNNHP 1993). Common associates include *Acer rubrum, Betula papyrifera, Picea mariana, Pinus banksiana, Populus tremuloides*, and *Populus balsamifera*. There is usually a prominent shrub/sapling layer containing *Abies balsamea, Acer spicatum, Corylus cornuta, Diervilla lonicera, Lonicera canadensis, Picea glauca, Rosa acicularis, Rubus pubescens, Sorbus americana, Vaccinium myrtilloides*, and (eastward) *Viburnum nudum var. cassinoides*. The herbaceous layer is often moderately sparse, with species such as *Anemone quinquefolia, Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Clintonia borealis, Coptis trifolia, Cornus canadensis, Dryopteris carthusiana, Maianthemum canadense, Mitella nuda* and *Trientalis borealis*. Mosses include *Dicranum polysetum, Pleurozium schreberi, Ptilium crista-castrensis*, and *Rhytidiadelphus triquetrus* (Sims et al. 1989, Chambers et al. 1997).

This community is found primarily on dry-mesic to mesic sites with well-drained, deep (>60 cm) loam, sand, or silt soils (Sims et al. 1989, Zoladeski et al. 1995). Less commonly, it may be found on wetter sites, that may approach seasonally saturated conditions (Maycock 1961). The soils have little organic content and the topography is flat to gently sloping.

COMMENTS: *1, MCS*. This type occurs in a variety of sites, including sites that are fairly wet, and occurs both after disturbances and as a late-successional type. It is difficult to separate from the mixed spruce-fir-hardwood types, *Picea glauca - Abies balsamea - Populus tremuloides* / Mixed Herbs Forest (CEGL002475), from which it may only differ in the degree of conifer dominance. Treefalls in this type can create a very open canopy. Inclusions of Spruce-Fir/Feathermoss, *Picea glauca - Abies balsamea / Pleurozium schreberi* Forest (CEGL002509), may occur in this type in the Great Lake states. Conversely, CEGL002509 appears to be the common type in Manitoba, and this type is not expected (J. Greenall pers. comm. 1999). In northern Wisconsin this type has been documented only in ravines or on stable clay bluffs and is not known from the extensive Lake Superior clayplains [see *Picea glauca - Abies balsamea - Populus tremuloides* / Mixed Herbs Forest (CEGL002475)].

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This white spruce - fir conifer forest type is found in the southern boreal region of the Great Lakes of the United States and elsewhere in central Canada.

USFS ECOREGIONS: 212Ha:CCP, 212Hb:CCP, 212He:CCP, 212Hh:CCP, 212Hi:CCP, 212Hj:CCC, 212Hk:CCP, 212Hl:CCP, 212Hm:CCP, 212Hn:CCP, 212Hr:CCP, 212Hs:CC?, 212Hv:CC?, 212Hw:CCP, 212Ib:CCC, 212Ja:CCC, 212Jb:CCP, 212Jc:CCC, 212Jk:CCP, 212Jl:CCP, 212Jn:CCP, 212Jo:CCP, 212Jr:CCP, 212Kb:CCC, 212La:CCC, 212Lb:CCC, 212Lc:CCP, 212Ld:CCP, 212Ma:CCC, 212Mb:CCP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 212Oa:CCC

CONSERVATION REGIONS: 47:C, 48:C

STATES: MI MN WI **PROVINCES:** MB? ON

MIDWEST HERITAGE SYNONYMY:

MI	boreal forest +
MN	spruce - fir forest white spruce - balsam fir subtype =
WI	boreal forest (spruce-fir subtype) =

OTHER SYNONYMY: Dry-mesic Stands (Maycock and Curtis 1960) =. uncertain if equivalent, Delaware Stand (Maycock 1961) =, Aetna Creek Stand (Maycock 1961) =, *Abies-Populus/Rosa/Mertensia, Corylus/Diervilla/Aster-Anemone* Group (La Roi 1967) =, White Spruce - Balsam Fir / Shrub Rich Forest (Sims et al. 1989) =, White Spruce - Balsam Fir / Shrub Forest (Zoladeski et al. 1995) =

USNVC HIERARCHY: PICEA GLAUCA - ABIES BALSAMEA FOREST ALLIANCE (I.A.8.N.c)

Betula papyrifera / Acer saccharum - Mixed Hardwoods Forest

Paper Birch / Sugar Maple - Mixed Hardwoods Forest

Paper Birch / Sugar Maple - Mixed Hardwoods Forest CEGL002464

DESCRIPTION: This type has a moderately open to closed canopy dominated strongly (>90%) by *Betula papyrifera*. *Populus tremuloides* may be present in small amounts. Tree reproduction layers are dominated by later successional deciduous trees. *Acer saccharum* is often the dominant species in these layers. *Acer rubrum, Betula alleghaniensis*, and *Quercus rubra* are common components. The shrub layer is dominated by *Acer spicatum* and *Corylus cornuta*. The understory contains species such as *Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Clintonia borealis, Cornus canadensis, Maianthemum canadense*, and *Trientalis borealis*. Diagnostic features include strong dominance by *Betula papyrifera*, and the presence of a variety of hardwood species in the understory, including *Acer saccharum, Acer rubrum, Betula alleghaniensis*, and *Quercus rubra* (Sims et al. 1989, MNNHP 1993).

Stands are often small, and found on shaded north-facing slopes or in recently burned areas (MNNHP 1993).

Type appears to regenerate on burned areas, perhaps where soils are thin.

COMMENTS: *2, MCS*. This type is currently only described from northeastern Minnesota and northwestern Ontario. Information is needed from other parts of the range. It may not be distinctive floristically to warrant separation from either the *Betula papyrifera / Diervilla lonicera - (Abies balsamea)* Forest (CEGL002463), which contains a boreal conifer understory, or the mixed *Populus tremuloides - Betula papyrifera / Acer saccharum* - Mixed Hardwoods Forest (CEGL002468). *Clintonia borealis, Lycopodium annotinum*, and mosses may be more common in this community, whereas *Eurybia macrophylla (= Aster macrophyllus)* may be more common in CEGL002468, or other early successional community types dominated by both *Populus tremuloides* and *Betula papyrifera* (MNNHP 1993), but these suggested patterns need further study.

CONSERVATION RANK: *G4?.*

DISTRIBUTION: This paper birch boreal forest type is found in the boreal regions of the Great Lakes of the United States and Canada and elsewhere in central Canada and the northeastern United States.

USFS ECOREGIONS: 212Lb:C??, 212Mb:C??, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 251Aa:CCC
CONSERVATION REGIONS: 35:C, 47:P, 48:C, 61:C, 63:C
STATES: ME MN NH NY VT **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MN paper birch forest northern hardwoods subtype =

OTHER SYNONYMY: White Birch Hardwood and Mixedwood (V4) (Sims et al. 1989) B, Successional hardwoods (NAP)

USNVC HIERARCHY: BETULA PAPYRIFERA FOREST ALLIANCE (I.B.2.N.b)

Betula papyrifera / Diervilla lonicera - (Abies balsamea) Forest

Paper Birch / Bush-honeysuckle - (Balsam Fir) Forest

Paper Birch / Fir Forest CEGL002463

DESCRIPTION: The canopy of this forested community is closed to moderately open. *Betula papyrifera* is the dominant canopy tree and can form nearly pure stands. *Populus tremuloides, Abies balsamea, Picea glauca*, and, especially in Canada, *Pinus banksiana* can be found in minor amounts, as well. Tree density can be high, but the growth form and size of the canopy dominants allows significant light to pass through. *Abies balsamea* is common to dense in the understory (Hansen et al. 1971) along with shrubs such as *Corylus cornuta, Diervilla lonicera, Rosa acicularis*, and *Taxus canadensis*. The herbaceous layer is similar to other dry-mesic to mesic northern communities. Species found in this layer include *Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Clintonia borealis, Cornus canadensis, Maianthemum canadense*, and *Trientalis borealis*.

This community is found on fresh to moist soils (Hansen et al. 1973, Sims et al. 1989). In Ontario, it occurs on coarse-textured, non-calcareous mineral soils. The soil texture is typically coarse loam (Sims et al. 1989).

COMMENTS: *2, MCS*. *Clintonia borealis, Lycopodium annotinum*, and mosses may be more common in this community while *Eurybia macrophylla (= Aster macrophyllus)* may be more common in other early successional community types dominated by *Populus tremuloides* (MNNHP 1993). Stands should usually have >90% of their deciduous canopy composed of *Betula papyrifera* to be included in this community. Manitoba is not sure this type forms significant stands in that province (J. Greenall pers. comm. 1999). Some authors treat this type as synonymous with the aspen-paper birch type *Populus tremuloides - Betula papyrifera / (Abies balsamea, Picea glauca)* Forest (CEGL002466) (K. Rusterholz pers. comm. 2000).

CONSERVATION RANK: *G4?.*

DISTRIBUTION: This paper birch forest type is found in the northern Great Lakes region of the United States and perhaps more widely in Canada, ranging from Minnesota and Manitoba east to Ontario and possibly Quebec.

USFS ECOREGIONS: 212Ib:CCC, 212La:CPP, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP
CONSERVATION REGIONS: 47:P, 48:C
STATES: MI MN **PROVINCES:** MB? ON

MIDWEST HERITAGE SYNONYMY: MI boreal forest +
MN paper birch forest spruce - fir subtype =

OTHER SYNONYMY: Paper Birch - Aspen - White Spruce (1936) (Hansen et al. 1973) =, White Birch Hardwood and Mixedwood (V4) (Sims et al. 1989) =

USNVC HIERARCHY: BETULA PAPYRIFERA FOREST ALLIANCE (I.B.2.N.b)

Populus tremuloides - Betula papyrifera - (Acer rubrum, Populus grandidentata) Forest

Quaking Aspen - Paper Birch - (Red Maple, Bigtooth Aspen) Forest

Aspen - Birch - Red Maple Forest CEGL002467

DESCRIPTION: This deciduous forest community has a moderately closed canopy usually dominated by *Populus tremuloides* and *Betula papyrifera*. *Acer rubrum* and *Populus grandidentata* may be absent to dominant. Other minor components of the overstory may include *Abies balsamea, Pinus resinosa, Pinus strobus, Picea glauca*, and *Quercus rubra*. The shrub layer is approximately 2 m tall and often well-developed (MNNHP 1993). The most abundant species are *Acer spicatum, Amelanchier* spp., *Corylus cornuta, Diervilla lonicera*, and *Rosa acicularis*. Other shrubs present include *Lonicera canadensis, Rubus pubescens, Vaccinium angustifolium*, and *Vaccinium myrtilloides*. The herbaceous layer tends to contain many species. Common species include *Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Clintonia borealis, Maianthemum canadense, Trientalis borealis*, and *Viola* spp.

This community is mostly found on level to rolling topography. It can occur on upper slopes or plateaus or in valley bottoms (Ohmann and Ream 1971). The soil is typically deep, sandy loam or loamy sand (Alban et al. 1991). The sites are on glacial outwash, lacustrine deposits, or moraines (Ohmann and Ream 1971, Sims et al. 1989). Most are well-drained, however, this community can be found on somewhat poorly drained sites.

COMMENTS: *2, MCS*. In Michigan, *Quercus rubra* may be present. This type can result from removal of conifers by logging; e.g., Wisconsin doesn't track this type for conservation purposes because it most commonly establishes after logging of spruce-fir stands. Stands with understories of pines or mixed aspen-birch-pines best fit under the mixed evergreen-deciduous types (e.g., white pine-aspen-birch forest, *Pinus strobus - Populus tremuloides / Corylus cornuta* Forest (CEGL002479)).

CONSERVATION RANK: *G5.*

DISTRIBUTION: This aspen - birch - maple forest community is found in the upper midwestern United States and southern and central Canada, ranging from Minnesota and Manitoba east to Michigan, Ontario and possibly Quebec.

USFS ECOREGIONS: 212Ha:CCP, 212Hb:CCP, 212He:CCP, 212Hh:CCP, 212Hi:CCP, 212Hj:CCP, 212Hk:CCP, 212Hl:CCC, 212Hn:CCP, 212Ho:CCP, 212Hp:CC?, 212Ib:C??, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Je:CPP, 212Jf:CPP, 212Jj:CPP, 212Jk:CPP, 212Jl:CPP, 212Jm:CPP, 212Jn:CPP, 212Jo:CPP, 212Jr:CPP, 212Ka:CCP, 212Kb:CCC, 212La:CCC, 212Mb:CCC, 212Na:CCP, 212Nb:CCP, 212Nc:CCC, 222Ma:CCC, 222Md:CCC

CONSERVATION REGIONS: 46:C, 47:C, 48:C

STATES: MI MN WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:
MI dry-mesic northern forest - aspen-birch =
MN aspen - birch forest =
WI northern mesic forest (aspen-birch-red maple subtype) =

OTHER SYNONYMY: Maple - Aspen - Birch (Ohmann and Ream 1971) =, Aspen Hardwood (V5) (Sims et al. 1989) =, Cloquet Site (Alban et al. 1991) =, Maple (Yellow Birch) Hardwood and Mixedwood (V3.1) (Sims et al. 1997) =

USNVC HIERARCHY: POPULUS TREMULOIDES - BETULA PAPYRIFERA FOREST ALLIANCE (I.B.2.N.b)

Populus tremuloides - Betula papyrifera / (Abies balsamea, Picea glauca) Forest

Quaking Aspen - Paper Birch / (Balsam Fir, White Spruce) Forest

Aspen - Birch / Boreal Conifer Forest CEGL002466

DESCRIPTION: This community is dominated by deciduous trees, with a moderate amount of conifers (<25%). The dominant tree species do not have dense leaf layers and allow a significant amount of light to pass through. This promotes the establishment of prominent sapling and shrub layers and a moderately dense herbaceous stratum. The canopy is dominated by *Betula papyrifera* and *Populus tremuloides*, and occasionally *Populus grandidentata*. Conifer associates include *Abies balsamea* and *Picea glauca*, either in the canopy or, more characteristically, in the subcanopy. *Abies balsamea* and *Picea glauca* are abundant in the sapling layer. Common shrubs include *Acer spicatum, Corylus cornuta, Diervilla lonicera, Linnaea borealis, Lonicera canadensis, Rosa acicularis, Rubus pubescens, Sorbus decora*, and *Vaccinium myrtilloides*. The herbaceous stratum is sometimes dominated by *Eurybia macrophylla (= Aster macrophyllus)*, but can include a diversity of forbs, such as *Anemone quinquefolia, Aralia nudicaulis, Clintonia borealis, Cornus canadensis, Galium triflorum, Maianthemum canadense, Mitella nuda, Pteridium aquilinum, Streptopus lanceolatus (= Streptopus roseus), Trientalis borealis*, and *Viola renifolia*. Mosses include *Plagiomnium cuspidatum, Pleurozium schreberi, Ptilium crista-castrensis*, and *Rhytidiadelphus triquetrus* (Sims et al. 1989, Chambers et al. 1997).

This community is found on a variety of topographic positions. Omann and Ream (1971) found it on ridgetops, upper, mid, and lower slopes. These slopes are gentle to moderate. The soils are deep, well-drained to rapidly drained mineral soils (Sims et al. 1989). The soils are usually loam but can be clay (including lacustrine clays or clayer tills), silt, or sand.

COMMENTS: *1, MCS*. Further north in Ontario, a *Populus tremuloides - Betula papyrifera* type, *Populus tremuloides - (Betula papyrifera) - Picea mariana / Alnus viridis* Forest (CEGL002514), occurs that contains greater proportions of *Picea mariana* and *Pinus banksiana*. *Acer spicatum* drops out of this type in the more western part of the type's range in Ontario and Minnesota. This type is often an early successional type following fire or logging, and occupies a wide variety of site types.

CONSERVATION RANK: *G5.*

DISTRIBUTION: This aspen - birch boreal hardwoods forest type is found in the boreal regions of the midwestern United States and in central Canada, ranging from Minnesota and Manitoba east to Michigan, Ontario and possibly Quebec.

USFS ECOREGIONS: 212Ha:CPP, 212Hb:CPP, 212He:CPP, 212Hh:CPP, 212Hi:CPP, 212Hj:CPP, 212Hk:CPP, 212Ib:CCC, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jk:CPP, 212Jl:CPP, 212Jm:CP?, 212Jn:CPP, 212Jo:CPP, 212Jr:CPP, 212La:CPP, 212Lb:CP?, 212Lc:CCC, 212Ld:CCC, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP
CONSERVATION REGIONS: 47:P, 48:C
STATES: MI MN WI **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY:

MI	boreal forest +
MN	aspen - birch forest spruce - fir subtype =
WI	boreal forest (aspen-birch-spruce-fir subtype) =

OTHER SYNONYMY: Aspen - Birch (Ohmann and Ream 1971) =, Paper Birch - Aspen - Balsam Fir - White Spruce (Hansen et al. 1973) =, Trembling Aspen (White Birch) - Balsam Fir / Mountain Maple (V6) (Sims et al. 1989) F, Trembling Aspen - Balsam Fir / Balsam Fir Shrub (V7) (Sims et al. 1989) F, Trembling Aspen-White Birch-White Spruce-Dwarf Raspberry (V22) (Chambers et al. 1997) =

USNVC HIERARCHY: POPULUS TREMULOIDES - BETULA PAPYRIFERA FOREST ALLIANCE (I.B.2.N.b)

Populus tremuloides - Betula papyrifera / Acer saccharum - Mixed Hardwoods Forest

Quaking Aspen - Paper Birch / Sugar Maple - Mixed Hardwoods Forest

Aspen - Birch / Sugar Maple - Mixed Hardwoods Forest CEGL002468

DESCRIPTION: Deciduous trees dominate the canopy and tree reproduction layers of this community. Conifers, when present, are widely scattered. Tree density is moderate to high, but substantial light penetrates the canopy due to the growth form of the dominant species, *Betula papyrifera* and *Populus tremuloides*. Other northern hardwoods may be found in the canopy but are more common in the sapling layer. These include *Acer rubrum, Acer saccharum, Betula alleghaniensis, Fraxinus pennsylvanica, Ostrya virginiana, Tilia americana*, and *Ulmus americana* (in more mesic sites). *Fagus grandifolia* and *Tsuga canadensis* become more common in eastern examples of this type. The shrub stratum is usually not well-developed due to shading from the canopy and subcanopy trees. Scattered *Acer spicatum, Corylus cornuta, Diervilla lonicera*, and *Rubus pubescens* are typical shrubs. *Taxus canadensis* and *Acer pensylvanicum* are present on some sites. For example, Hansen et al. (1973) found *Taxus canadensis* to be one of the more abundant shrubs on Isle Royale in Lake Superior. They also found this type to have the most diverse herbaceous layer of their sites. The herbaceous layer contains species such as *Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Clintonia borealis, Maianthemum canadense, Oryzopsis asperifolia*, and *Streptopus lanceolatus (= Streptopus roseus)*. Mosses include *Dicranum flagellare, Dicranum montanum*, and others (Chambers et al. 1997).

This community is found on a variety of rich mesic sites over clay or silt loam soils. Alban et al. (1991) identified two examples of this community in Minnesota and upper Michigan. Both sites had 6 cm of organic material over the mineral soil. One site was on clay soil and the other on silt loam.

This community is not stable. It succeeds to stands dominated by northern hardwoods.

COMMENTS: *2, MCS*. This type includes stands dominated by a mixture of *Populus tremuloides* and *Betula papyrifera*, with as little as 10% *Populus tremuloides*. Pure stands of *Betula papyrifera* (>90%) are classified as a pure *Betula* type, *Betula papyrifera / Acer saccharum* - Mixed Hardwoods Forest (CEGL002464).

CONSERVATION RANK: *G5.* This type is probably more extensive today than it was prior to European settlement. For example, in Wisconsin, over half of the northern mesic forests - the hemlock hardwood and sugar maple types - have been converted to this type since about 1850.

DISTRIBUTION: This boreal aspen - birch forest type is found in the north-central United States and southern Canada on a variety of mesic upland locations, ranging from Minnesota and Ontario east to Michigan.

USFS ECOREGIONS: 212Ha:CPP, 212Hb:CPP, 212He:CPP, 212Hh:CPP, 212Hi:CPP, 212Hj:CPP, 212Hk:CPP, 212Hm:CPP, 212Hn:CPP, 212Ho:CPP, 212Hq:CPP, 212Hr:CPP, 212Hs:CPP, 212Ht:CPP, 212Hv:CPP, 212Ib:CPP, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Je:CPP, 212Jf:CPP, 212Jj:CPP, 212Jk:CPP, 212Jl:CPP, 212Jm:CPP, 212Jn:CPP, 212Jo:CPP, 212Jr:CPP, 212Ka:CPP, 212Lb:C??, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP
CONSERVATION REGIONS: 47:P, 48:C
STATES: MI MN WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:
MI mesic northern forest - hemlock-sugar maple +
MN aspen - birch forest northern hardwoods subtype =
WI northern mesic forest (aspen-birch / hardwoods subtype) =

OTHER SYNONYMY: Paper Birch - Sugar Maple - Yellow Birch (Hansen et al. 1973) =, Baltimore Flats (Alban et al. 1991) F, Pike Bay (Alban et al. 1991) F, Sugar Maple-White Birch-Trembling Aspen-Red Maple-Balsam Fir Shrub (V12) (Chambers et al. 1997), Sugar Maple-White Birch-Red Maple-Fly Honeysuckle-Beaked Hazel (V13) (Chambers et al. 1997)

USNVC HIERARCHY: POPULUS TREMULOIDES - BETULA PAPYRIFERA FOREST ALLIANCE (I.B.2.N.b)

Populus tremuloides / Corylus americana Forest

Quaking Aspen / American Hazelnut Forest

Aspen / American Hazel Forest CEGL002063

DESCRIPTION: The mature trees in this community form an open to closed canopy. The canopies of individual trees usually touch, but because of the growth form of the dominant species, *Populus tremuloides*, significant light penetrates the canopy. *Betula papyrifera, Fraxinus pennsylvanica, Quercus macrocarpa, Quercus ellipsoidalis*, and *Tilia americana* are minor constituents of the canopy in this community. The understory is dominated by shrubs, especially *Corylus americana, Viburnum rafinesquianum*, and *Amelanchier* spp. Other species that make up the shrub layer vary with site factors such as soil moisture. The herbaceous layer is composed of species that can survive in the shade cast by the taller strata. Among these are *Aralia nudicaulis, Carex pensylvanica, Maianthemum canadense, Oryzopsis asperifolia*, and *Schizachne purpurascens*.

Grimm (1984) reported that aspen forest occurs on gently rolling, poorly drained topography in Minnesota's prairie-forest border region. The water table is usually high but not high enough to affect the composition of the ground layer or to allow peat formation (MNNHP 1993).

This community is an early successional stage. In the absence of disturbance, most sites of this community will evolve into forest types dominated by what are currently minor components of the canopy (MNNHP 1993).

COMMENTS: *2, MCS*. In Wisconsin stands of this description usually are a result of type conversion, especially of *Pinus banksiana, Quercus velutina*, or *Quercus ellipsoidalis* forest stands and are not usually tracked for conservation purposes, but natural stands may occur around the margins of glacial Lake Wisconsin in the central sand plains region (E. Epstein pers. comm. 1999). This type is restricted to the prairie-forest border transition and does not occur in the northern hardwood-conifer region where *Betula papyrifera* is more typically an associate. This type may be the type expected in eastern North Dakota at Pembina Gorge and in the Sheyenne Delta. See also *Populus tremuloides - Quercus macrocarpa / Aralia nudicaulis* Forest (CEGL002065).

CONSERVATION RANK: *G5.*

DISTRIBUTION: This aspen / hazelnut forest type is found along the tallgrass prairie-forest border in the United States and Canada, extending from northern Iowa and Wisconsin to Manitoba.

USFS ECOREGIONS: 212Hb:CPP, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Je:CPP, 212Jf:CPP, 212Jj:CPP, 212Jk:CPP, 212Jl:CPP, 212Jm:CPP, 212Ka:CPP, 212Mb:CCC, 212Nc:CCC, 222Md:CCC, 222Na:CCC, 251Aa:CCC
CONSERVATION REGIONS: 35:C, 46:C, 47:C
STATES: IA MN ND WI **PROVINCES:** MB

MIDWEST HERITAGE SYNONYMY: MN aspen forest +
WI northern dry-mesic forest (aspen subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: POPULUS TREMULOIDES FOREST ALLIANCE (I.B.2.N.b)

Pinus strobus - Tsuga canadensis Great Lakes Forest

Eastern White Pine - Eastern Hemlock Great Lakes Forest

Great Lakes White Pine - Hemlock Forest CEGL002590

DESCRIPTION: Generally, *Tsuga canadensis* and *Pinus strobus* are codominant, but other common associates include *Fagus grandifolia, Acer rubrum, Betula lenta, Betula alleghaniensis*, and *Quercus rubra*. *Quercus rubra* becomes more prevalent in the south. Typical shrubs include *Acer spicatum, Hamamelis virginiana*, and *Acer pensylvanicum*. The herbaceous layer may be sparse and generally depauperate, including *Trientalis borealis, Cypripedium acaule, Maianthemum canadense, Gaultheria procumbens, Clintonia borealis*, and *Lycopodium* spp. (Eyre 1980).

This community is found on acidic, nutrient-poor, usually moderately well-drained soils such as sandy loams. In the north, it may occur on ridges with a fragipan, and to the south the more prevalent habitat is higher elevations and north-facing slopes (Eyre 1980). In northern Michigan and northeastern Wisconsin, this community is commonly found on beach ridges and dunes within glacial lakebeds on poorly drained lakeplains.

This type can establish itself following a disturbance, such as drought, fire, or windthrow. Although both species are long-lived, *Pinus strobus* will eventually drop out and a hemlock or hemlock-hardwoods association will tend to replace it.

COMMENTS: *2, MCS*. This description is based on the Great Lakes portion of the SAF cover type 22 (Eyre 1980). The type is currently not recognized in recent Ontario publications of forest types (Chambers et al. 1997, Bakowsky and Lee 1996, Lee et al. 1998), which seems surprising. In Wisconsin and Michigan, white pine is often a supercanopy relict only and has been logged out of most stands (E. Epstein, D. Albert pers. comm. 1996). Presence of *Picea rubens* may be a good indicator of the separate type, *Pinus strobus - Tsuga canadensis - Picea rubens* Forest (CEGL006324), in northern New England (and Quebec).

CONSERVATION RANK: *G3?.*

DISTRIBUTION: This white pine - hemlock forest type is found in the Great Lakes region of the United States and Canada, ranging from northern Wisconsin and Michigan to central Ontario.

USFS ECOREGIONS: 212Ha:CC?, 212Hb:CC?, 212He:CCP, 212Hh:CCP, 212Hi:CCP, 212Hj:CCC, 212Hk:CC?, 212Hl:CCC, 212Hm:CCP, 212Hn:CCP, 212Ho:CCC, 212Hp:CCP, 212Hq:CCP, 212Hr:CCP, 212Hu:CC?, 212Hv:CCP, 212Hw:CCP, 212Hx:CCP, 212Hy:CCC, 212Ja:CCC, 212Jb:CCP, 212Jc:CCC, 212Jj:CCC, 212Jl:CCC, 212Jm:CCC, 212Jn:CCP, 212Jo:CCP, 212Js:CCC, 222Ja:???
CONSERVATION REGIONS: 47:C, 48:C
STATES: MI WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI mesic northern forest - hemlock-white pine =
WI northern mesic forest (white pine-hemlock subtype) =

OTHER SYNONYMY: White Pine - Hemlock: 22 (Eyre 1980) B

USNVC HIERARCHY: PINUS STROBUS - TSUGA CANADENSIS FOREST ALLIANCE (I.A.8.N.b)

Thuja occidentalis - (Betula alleghaniensis, Tsuga canadensis) Forest

Northern White-cedar - (Yellow Birch, Eastern Hemlock) Forest

White-cedar - (Hemlock) Mesic Forest CEGL002595

DESCRIPTION: This white-cedar - hemlock evergreen forest type is found in the Upper Great Lakes region of the United States and Canada. Stands occur in Michigan and Wisconsin on the Menominee Drumlins, and in Ontario on moist to fresh sites. The tree canopy contains at least 25% cover of *Thuja occidentalis*, with *Tsuga canadensis* the next leading dominant. Other associates include *Acer saccharum, Betula alleghaniensis, Fraxinus americana*, and *Pinus strobus*. The herbaceous layer may contain *Epipactis helleborine* (an exotic), *Maianthemum canadense*, and others. This type has not been well characterized and further survey work is needed. As an upland *Thuja occidentalis* type, this type has less of a boreal composition to it.

Stands occur in Michigan and Wisconsin on the Menominee Drumlins, and in Ontario on moist to fresh sites.

COMMENTS: *3, MCS*. This type has been proposed by the Michigan NFI (in 1996) and is listed by Lee et al. (1998). Bakowsky and Lee (1996) provide some dominance lists for the type, but it is otherwise in need of further characterization.

CONSERVATION RANK: *G3?.*

DISTRIBUTION: This cedar-hemlock evergreen forest type is found in the Upper Great Lakes region of the United States and Canada.

USFS ECOREGIONS: 212Hb:CPP, 212He:CPP, 212Ia:CCC, 212Ja:CCC, 212Jb:CCP, 212Jc:CCC, 212Jl:CCP, 212Jm:CCP, 212Jn:CCP, 212Jo:CCP
CONSERVATION REGIONS: 47:C, 48:C
STATES: MI? WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI? boreal forest
WI northern mesic forest (cedar-hemlock subtype?) =

OTHER SYNONYMY:

USNVC HIERARCHY: THUJA OCCIDENTALIS FOREST ALLIANCE (I.A.8.N.c)

Thuja occidentalis - Betula alleghaniensis Forest

Northern White-cedar - Yellow Birch Forest

Northern White-cedar - Yellow Birch Forest CEGL002450

DESCRIPTION: The canopy of this community is dominated by *Thuja occidentalis* and a variety of hardwoods, most typically *Betula alleghaniensis, Betula papyrifera*, and *Populus tremuloides*, but occasionally *Acer rubrum, Acer saccharum* and *Fraxinus nigra*. Associated conifers include *Abies balsamea, Picea glauca*, and rarely *Tsuga canadensis*. The understory usually contains a well-developed shrub/sapling layer, including *Abies balsamea, Acer spicatum, Corylus cornuta, Diervilla lonicera, Linnaea borealis, Ribes triste, Rubus pubescens*, and *Taxus canadensis*. Herbaceous species include *Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Clintonia borealis, Coptis trifolia, Cornus canadensis, Dryopteris carthusiana, Galium triflorum, Gymnocarpium dryopteris, Lycopodium* spp., *Maianthemum canadense, Mitella nuda, Onoclea sensibilis*, and *Trientalis borealis*. Moss species include *Pleurozium schreberi, Rhytidiadelphus triquetrus*, and others (MNNHP 1993, Chambers et al. 1997). Diagnostic features include the mixed dominance of *Thuja occidentalis* and hardwoods, particularly *Betula alleghaniensis*, in an essentially upland site type.

This community is found on poorly drained lowland soils, occasionally bordering on wet, organic soils (Beals and Cottam 1960, Chambers et al. 1997). The soil is typically moderately acidic sandy clay with a thin litter layer.

COMMENTS: *2, MCS*. This type is poorly differentiated from the pure evergreen *Thuja occidentalis* type, *Thuja occidentalis / Abies balsamea - Acer spicatum* Forest (CEGL002449), and not all studies have separated it from that type. In Minnesota, dominance by *Betula papyrifera* and *Populus tremuloides* may reflect logging disturbance. This type may also range from mesic to very wet-mesic. The hydrology of this type may be close to saturated.

CONSERVATION RANK: *G2Q*. There are probably fewer than 100 occurrences of this community rangewide. It is reported from Minnesota (where it is ranked S2), Wisconsin (S1), Michigan (S?), and Ontario (S?). Currently there is only one occurrence documented from Minnesota. Minimal data on current acreage are available; the one occurrence documented from Minnesota has 14 acres. It is likely that many stands have been degraded by logging. This community is reported from two ecoregion subsections in the western Lake Superior basin. Several old growth stands have been documented on the Apostle Islands, with the 120 ha stands on Raspberry Island the best developed (E. Epstein pers. comm. 1999).

DISTRIBUTION: This upland white-cedar - hardwood forest type is found in the northern Great Lakes region of the United States and Canada, and portions of central Canada, ranging from northeastern Minnesota to Wisconsin, Michigan, and Ontario.

USFS ECOREGIONS: 212Ib:CPP, 212Ja:CCP, 212Jb:CCC, 212Jr:CCC, 212Lb:CCC, 212Lc:CCP, 212Mb:CPP, 212Na:CP?, 212Nb:CPP, 212Nc:CPP, 212Pa:CCC
CONSERVATION REGIONS: 47:P, 48:C
STATES: MI? MN WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI? boreal forest
MN northern hardwood - conifer forest (northern section) yellow birch - white cedar subtype =
WI northern mesic forest (cedar-yellow birch subtype) =

OTHER SYNONYMY: White Cedar-Hardwoods-Dwarf Raspberry-Mountain Maple-Herb Rich (Chambers et al. 1997) =

USNVC HIERARCHY: THUJA OCCIDENTALIS - BETULA ALLEGHANIENSIS FOREST ALLIANCE (I.C.3.N.a)

Thuja occidentalis / Abies balsamea - Acer spicatum Forest

Northern White-cedar / Balsam Fir - Mountain Maple Forest

White-cedar - Boreal Conifer Mesic Forest CEGL002449

DESCRIPTION: The overstory is dominated by coniferous trees, with or without a substantial deciduous component. *Thuja occidentalis* is the most abundant tree and may occur in pure stands. Usually there are other canopy species, especially *Abies balsamea, Betula papyrifera, Picea glauca, Picea mariana, Populus tremuloides*, and *Pinus strobus*. There is usually an abundant shrub/sapling layer with saplings of *Thuja occidentalis* and *Abies balsamea* along with the shrubs *Acer spicatum, Corylus cornuta, Linnaea borealis, Lonicera canadensis, Rubus pubescens*, and *Sorbus decora*. The ground layer is typically diverse on mesic to wet-mesic stands and less so on steep drier stands. Wet-mesic stands can contain a hummock-and-hollow topography, with a seasonally saturated hydrology. Typical species include *Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Clintonia borealis, Coptis trifolia, Cornus canadensis, Dryopteris carthusiana, Galium triflorum, Maianthemum canadense, Mitella nuda*, and *Trientalis borealis*. Mosses include *Sanionia uncinata (= Drepanocladus uncinatus), Hylocomium splendens, Plagiomnium cuspidatum, Pleurozium schreberi, Ptilium crista-castrensis*, and *Rhytidiadelphus triquetrus* and, in wetter phases of the type, *Sphagnum* spp. (Ohmann and Ream 1971, Sims et al. 1989, MNNHP 1993, Chambers et al. 1997).

This community is found on gentle wet-mesic slopes to very steep well-drained slopes (MNNHP 1993). The predominant aspect is north to northeast. Soils are moderately deep to deep (50-100 cm), calcareous, coarse- to fine-textured, and often contain boulders at the surface (Ohmann and Ream 1971, Sims et al. 1989).

Browsing by deer can be a serious hindrance to *Thuja occidentalis* reproduction (MNNHP 1993).

COMMENTS: *1, MCS*. This type has a wet-mesic phase that can be difficult to distinguish from cedar swamps, such as *Thuja occidentalis - (Picea mariana, Abies balsamea) / Alnus incana* Forest (CEGL002456). (See also Harris et al. 1996 who consider W32, a white-cedar swamp, to be equivalent to V21, a white-cedar upland type, of Sims et al. 1989.) Type is equivalent in concept to V21 of Sims et al. 1989 and V21 Chambers et al. 1997). In Wisconsin, stands of this type are best developed near the Great Lakes shore, but the type concept is still not clear. Those stands may still best go with either *Thuja occidentalis - Betula alleghaniensis* Forest (CEGL002450) or *Thuja occidentalis - (Betula alleghaniensis, Tsuga canadensis)* Forest (CEGL002595).

CONSERVATION RANK: *G4.*

DISTRIBUTION: This sub-boreal upland white-cedar forest type occurs in the northern Great Lakes region of the United States and Canada.

USFS ECOREGIONS: 212He:CCC, 212Hj:CCP, 212Hl:CCC, 212Ho:CCC, 212Hr:CCP, 212Hw:CCC, 212Ia:CCC, 212Ib:CCC, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jl:CPP, 212Jn:CPP, 212Jo:CPP, 212La:CCC, 212Lb:CCC, 212Lc:CCC, 212Ld:CC?, 212Mb:CCC, 212Na:CCC, 212Nb:CCP, 212Nc:CC?, 212Oa:CCC, 212Ob:CCC, 212Pa:CCC, 222Na:CCC
CONSERVATION REGIONS: 35:C, 47:C, 48:C, 61:C, 63:C
STATES: MI MN NY VT WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:
MI boreal forest +
MN upland white cedar forest (northern section) mesic subtype; upland white cedar forest (lake superior section) wet-mesic subtype; upland white cedar forest (northern section) wet-mesic subtype; upland white cedar forest (lake superior section) mesic subtype -
WI mesic cedar forest (cedar-spruce-fir subtype) =

OTHER SYNONYMY: White Cedar Type (Grigal and Ohmann 1975) =, Cedar (inc. Mixedwood) / Mountain Maple Forest (V21) (Sims et al. 1989) =, White Cedar-Trembling Aspen-White Spruce-Twinflower (V21) (Chambers et al. 1997) =, Lowland lakeshore Northern white cedar forest (NAP)

USNVC HIERARCHY: THUJA OCCIDENTALIS FOREST ALLIANCE (I.A.8.N.c)

Tsuga canadensis - (Betula alleghaniensis) Forest

Eastern Hemlock - (Yellow Birch) Forest

Hemlock Mesic Forest CEGL002598

DESCRIPTION: The overstory of this community is strongly dominated by *Tsuga canadensis*, typically around 25 m tall (Martin 1951). *Betula alleghaniensis* is often present in the canopy and subcanopy, but at less than 25% cover. Other species that are a minor component of the canopy include *Abies balsamea, Acer rubrum, Acer saccharum, Pinus strobus, Tilia americana*, and *Thuja occidentalis*. The sapling layer may also contain *Abies balsamea* and *Thuja occidentalis*, especially in canopy gaps (Martin 1951). Shrubs are rare and herbaceous species only moderately abundant under the dense evergreen canopy; however, where gaps occur, *Acer pensylvanicum, Acer spicatum, Amelanchier* spp., *Gaultheria procumbens, Lonicera canadensis*, and *Rubus idaeus* may be moderately abundant. The herbaceous layer is poor under drier, more evergreen stands, and richer under more moist and somewhat deciduous stands. Herbaceous species found in this community include *Aralia nudicaulis, Clintonia borealis, Coptis trifolia, Cornus canadensis, Dryopteris carthusiana, Huperzia lucidula (= Lycopodium lucidulum), Maianthemum canadense, Oxalis montana (= Oxalis acetosella), Pteridium aquilinum, Streptopus lanceolatus (= Streptopus roseus)*, and *Trientalis borealis*. A sparse to dense moss layer includes *Brachythecium reflexum, Callicladium haldanianum, Dicranum flagellare, Dicranum montanum, Mnium marginatum, Plagiothecium laetum, Polytrichum commune, Ptilidium pulcherrimum*, and *Tetraphis pellucida*. Liverworts may include *Bazzania trilobata* and *Jamesoniella autumnalis* (Chambers et al. 1997).

This community is found on acidic soils that may be poorly drained. Coffman and Willis (1977) found this community on sandy loam and loams that averaged 115 cm deep and had a fragipan at 45-70 cm. This community may be found on shallow soils in the Huron Mountains of upper Michigan (P. Comer pers. com. 1996).

Frelich and Lorimer (1991a) studied forests dominated by *Tsuga canadensis* and *Acer saccharum* in Upper Michigan. They found that the predominant disturbances were light windthrow events and surface fires. Serious windthrows occurred during tornadoes and thunderstorm downbursts. Old-growth characteristics are summarized by Tyrrell and Crow (1994). Deer browse leads to generally poor reproduction.

COMMENTS: *1, MCS*. This type varies from almost pure *Tsuga canadensis* to more of a mix with *Betula alleghaniensis*, but the deciduous component is generally less than 25% cover (see e.g., Chambers et al. 1997, Ecosite 30.1 and 30.2). If hardwoods exceed 25%, the type is placed in *Tsuga canadensis - Acer saccharum - Betula alleghaniensis* Forest (CEGL005044), but logged stands, or remnants that occur in a matrix of secondary growth hardwoods, can be difficult to assign. Chambers et al. (1997) recognize a moist and a dry type in central Ontario. Those are treated as variants of the one type here. In Michigan this type is on the clay lakeplain in the western Upper Peninsula and in the Saginaw Bay Lakeplain. The data by Rogers (1980), who examined pure hemlock stands (many of them less than 2 ha in size) from Wisconsin to Nova Scotia, make clear that there are few species strictly associated with a pure hemlock versus a mixed hemlock-hardwood type, and also indicate that some distinction between a Great Lakes versus northeastern United States/eastern Canada has some merit, as done for the mixed hemlock-hardwood type (CEGL005044 versus *Tsuga canadensis - Betula alleghaniensis - Picea rubens / Cornus canadensis* Forest (CEGL006129)). No pure evergreen hemlock type is currently recognized in the northeast because of its small patch size.

CONSERVATION RANK: *G3G4.*

DISTRIBUTION: This mesic hemlock evergreen forest is found in the in the Great Lakes region of the United States and Canada, ranging from Wisconsin and Michigan to Ontario.

USFS ECOREGIONS: 212Hb:CC?, 212Hh:CCP, 212Hl:CCC, 212Ia:CCC, 212Ja:CCC, 212Jb:CCC, 212Jc:CCC, 212Je:CCC, 212Jf:CCC, 212Jj:CCC, 212Jl:CCC, 212Jm:CCC, 212Jn:CCP, 212Jo:CCP, 212Js:CCC, 222Ja:CCC, 222Je:CCC, 222Ld:CCC
CONSERVATION REGIONS: 46:C, 47:C, 48:C
STATES: MI WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI mesic northern forest - hemlock-yellow birch =
WI northern mesic forest (hemlock subtype) =

OTHER SYNONYMY: *Tsuga* Forest, Stands He1 and He2 (Martin 1959) =, *Tsuga-Coptis* Association (Coffman and Willis 1977) =, Hemlock-Yellow Birch-Goldthread-Wood Sorrel (V18) (Chambers et al. 1997) F, Hemlock-Spinulose Wood Fern-Herb Poor (V19) (Chambers et al. 1997) F, Hemlock - Yellow Birch: 24 (Eyre 1980), Eastern Hemlock: 23 (Eyre 1980)

USNVC HIERARCHY: TSUGA CANADENSIS FOREST ALLIANCE (I.A.8.N.c)

Tsuga canadensis - Acer saccharum - Betula alleghaniensis Forest

Eastern Hemlock - Sugar Maple - Yellow Birch Forest

North Central Hemlock - Hardwood Forest CEGL005044

DESCRIPTION: The tree canopy is dominated by a mix of evergreen and deciduous species. *Acer saccharum, Betula alleghaniensis*, and *Tsuga canadensis* dominate the canopy. Canopy associates include *Acer rubrum*. Shrub cover is moderate to sparse, including species such as *Acer pensylvanicum* (eastward), *Acer spicatum, Corylus cornuta, Sambucus racemosa var. racemosa (= Sambucus pubens)*, and *Viburnum lantanoides (= Viburnum alnifolium)* (eastward). Typical herbs include *Actaea pachypoda (= Actaea alba), Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Carex arctata, Clintonia borealis, Dryopteris carthusiana, Galium triflorum, Lycopodium dendroideum, Maianthemum canadense, Medeola virginiana, Mitella nuda, Osmorhiza claytonii, Polygonatum pubescens, Streptopus lanceolatus (= Streptopus roseus), Trientalis borealis, Trillium erectum*, and *Trillium grandiflorum*. Mosses include *Brachythecium reflexum, Callicladium haldanianum, Dicranum montanum*, and *Plagiothecium laetum* (Curtis 1959, Chapman et al. 1989, Chambers et al. 1997).

Sites are found on dry-mesic sites, typically on coarse- to medium-textured ground and end moraines, but also on silty/clayey lakeplains, thin glacial till over bedrock, and sand dunes. Soils are loamy sand to sandy loam, with moderately acid soils.

Natural blowdowns by windstorms drive the landscape dynamics of this type. Fires are very uncommon (Frelich and Lorimer 1991a, b; Frelich et al. 1993). The relatively small patch size of blow-downs leads to an old growth dominated landscape. Old growth characteristics are summarized by Tyrrell and Crow (1994).

COMMENTS: *2, MCS*. This type is either west of the range of *Fagus grandifolia*, or within the range of *Fagus* may occupy drier, and perhaps somewhat less acidic, sites (Chambers et al. 1997). In Michigan this type is found mostly on till/bedrock in western Upper Peninsula. Going eastward in the United States and Canada, the presence of *Picea rubens* may be a good indicator as to when *Tsuga canadensis - Betula alleghaniensis - Picea rubens / Cornus canadensis* Forest (CEGL006129) occurs. Other more eastern species include *Acer pensylvanicum, Viburnum lantanoides*, and *Trillium undulatum* (Rogers 1980). The data by Rogers (1980), who examined pure hemlock stands (many of them less than 2 ha in size) from Wisconsin to Nova Scotia, make clear that there are few species strictly associated with a pure hemlock versus a mixed hemlock-hardwood type, and also indicate that some distinction between a Great Lakes versus northeastern United States/eastern Canada has some merit.

CONSERVATION RANK: *G4?.*

DISTRIBUTION: This hemlock-hardwoods community type is found in the northern Great Lakes region of the United States and Canada, ranging from Michigan and Wisconsin to Ontario.

USFS ECOREGIONS: 212Ha:CCC, 212Hb:CCC, 212He:CC?, 212Hm:CCP, 212Hp:CCP, 212Hq:CCP, 212Hs:CCP, 212Ht:CCP, 212Hw:CCP, 212Ia:C??, 212Ja:CCP, 212Jb:CCC, 212Jc:CCC, 212Je:CC?, 212Jf:CCP, 212Jj:CCP, 212Jl:CCC, 212Jm:CCC, 212Jn:CCC, 212Jo:CCP, 212Jr:CCC, 212Js:CCC, 212Oa:CCC, 222Ja:CCC, 222Je:CCC, 222Jj:CCC, 222Ka:CCC
CONSERVATION REGIONS: 46:C, 47:C, 48:C
STATES: MI WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI mesic northern forest - hemlock-beech =
WI northern mesic forest (hemlock-maple subtype) =

OTHER SYNONYMY: Sugar Maple-Hemlock-Yellow Birch-Striped Maple (V16) (Chambers et al. 1997) =, Acer-Tsuga/Maianthemum (Kotar et al. 1988) F, Acer-Tsuga/Dryopteris (Kotar et al. 1988) F

USNVC HIERARCHY: TSUGA CANADENSIS - BETULA ALLEGHANIENSIS FOREST ALLIANCE (I.C.3.N.a)

Tsuga canadensis - Acer saccharum / (Hepatica nobilis var. acuta) Driftless Forest

Eastern Hemlock - Sugar Maple / Sharp-lobe Liverleaf Driftless Forest

Hemlock - Sugar Maple Relict Forest CEGL002597

DESCRIPTION: The tree canopy is tall and dominated by *Acer saccharum* and *Tsuga canadensis*, with *Betula alleghaniensis* always present. Other associates may include *Carya cordiformis, Fraxinus americana, Pinus strobus, Quercus rubra*, and *Tilia americana*. The shrub/sapling layer is not well-developed and contains *Acer spicatum, Hamamelis virginiana, Ostrya virginiana, Sambucus racemosa var. racemosa (= Sambucus pubens)*, and occasional *Acer rubrum*. The herbaceous layer contains a mix of southern and northern species; southern species include *Circaea lutetiana ssp. canadensis (= Circaea quadrisulcata), Hepatica nobilis var. acuta (= Hepatica acutiloba), Hydrophyllum virginianum, Osmorhiza claytonii*, and *Podophyllum peltatum*; the characteristic northern species include *Eurybia macrophylla (= Aster macrophyllus), Clintonia borealis, Huperzia lucidula (= Lycopodium lucidulum), Maianthemum canadense, Mitchella repens, Streptopus lanceolatus (= Streptopus roseus)*, and *Trientalis borealis*. Other common herbs include *Arisaema triphyllum (= Arisaema atrorubens), Athyrium filix-femina*, and *Polygonatum pubescens* (Kotar and Burger 1996, E. Epstein pers. comm. 1999).

Stands occur on steep north- or east-facing, thin soil slopes and in cool protected ravines that are associated with cliffs in the unglaciated part of Wisconsin (Curtis 1959, Kotar and Burger 1996).

According to Kotar and Burger (1996), it is uncertain what kind of disturbance favors regeneration of *Tsuga canadensis* in this type. It is not reproducing well in these stands, whereas *Acer saccharum* and *Betula alleghaniensis* are. They suggest that tip-up mounds created by infrequent severe windstorms or periodic fire are needed. High white-tail deer populations have also been suggested as a possible cause for lack of hemlock regeneration. In some stands regeneration is excellent, such as in gaps or edges of stands.

COMMENTS: *2, MCS*. This type may be similar to *Pinus strobus - Abies balsamea - Betula alleghaniensis* Driftless Forest (CEGL002111), which occurs in the Minnesota portion of the Driftless area, except that Wisconsin has virtually no *Abies balsamea* in the Driftless Area, and Minnesota has no *Tsuga canadensis*. See also *Pinus strobus - (Pinus resinosa)* Driftless Bluff Forest (CEGL002378), a dry *Pinus strobus* type in the Driftless region. It is unclear how distinctive these stands are from northern hemlock-hardwood stands, *Tsuga canadensis - Acer saccharum - Betula alleghaniensis* Forest (CEGL005044).

CONSERVATION RANK: *G2.* There may be fewer than 20 occurrences of this community rangewide. It is only known from Wisconsin (where it is ranked S2). There are currently 12 occurrences documented from the Driftless Area of southwestern Wisconsin. There are probably fewer than 1000 acres of this community rangewide. Currently 290 acres are documented from 10 sites in Wisconsin. This community is restricted to steep, north-facing slopes of gorges cut through Cambrian sandstone. The steep slopes make for difficult access for logging, so many occurrences are in very good condition. This community has probably always been rare.

DISTRIBUTION: This hemlock forest type occurs in the "Driftless region" of southern Wisconsin, the United States.

USFS ECOREGIONS: 222Ka:CCC, 222Lb:CCC, 222Lc:CCC, 222Ld:CCC
CONSERVATION REGIONS: 46:C
STATES: WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: WI northern mesic forest (hemlock driftless subtype) =

OTHER SYNONYMY: *Acer saccharum -Tsuga / Trientalis* habitat type (Kotar and Burger 1996) =

USNVC HIERARCHY: TSUGA CANADENSIS - BETULA ALLEGHANIENSIS FOREST ALLIANCE (I.C.3.N.a)

Tsuga canadensis - Fagus grandifolia - (Acer saccharum) Great Lakes Forest

Eastern Hemlock - American Beech - (Sugar Maple) Great Lakes Forest

Great Lakes Hemlock - Beech - Hardwood Forest CEGL005042

DESCRIPTION: The overstory is typically a closed canopy dominated by *Tsuga canadensis* and either *Acer saccharum* or *Fagus grandifolia*. *Betula alleghaniensis, Fraxinus americana*, and *Ulmus americana* are common associates, and occasionally *Acer rubrum, Pinus strobus*, and *Quercus rubra* can be found in the canopy. Along with smaller individuals of the canopy species, *Abies balsamea, Ostrya virginiana*, and *Picea glauca* can often be found in the undergrowth in Upper Michigan (Braun 1950). The shrub layer is usually not well-developed. *Corylus cornuta, Diervilla lonicera, Hamamelis virginiana*, and *Lonicera canadensis* can be found scattered in this community. The herbaceous layer may contain few to many species. In some stands, the shade from the overstory and a carpet of *Acer saccharum* seedlings do not allow other species to flourish (Braun 1950). In other places, herbaceous species such as *Anemone quinquefolia, Cornus canadensis, Dryopteris carthusiana (= Dryopteris spinulosa), Maianthemum canadense, Medeola virginiana, Maianthemum racemosum (= Smilacina racemosa), Trientalis borealis, Trillium grandiflorum*, and *Viola* spp. can be moderately abundant.

This community is found primarily on dry-mesic to mesic loams and sands and sometimes on loamy silts (Kotar et al. 1988). Stands may be found on flat to moderately steep slopes of any aspect.

COMMENTS: *2, MCS*. The type may be limited eastward by the main range of *Picea rubens*, whose presence may indicate a transition to *Tsuga canadensis - Betula alleghaniensis - Picea rubens / Cornus canadensis* Forest (CEGL006129) in the region of the Ontario/Quebec border. Other more eastern species include *Acer pensylvanicum, Viburnum lantanoides*, and *Trillium undulatum* (Rogers 1980). The data by Rogers (1980), who examined pure hemlock stands (many of them less than 2 ha in size) from Wisconsin to Nova Scotia, make clear that there are few species strictly associated with a pure hemlock versus a mixed hemlock-hardwood type, and also indicate that some distinction between a Great Lakes versus northeastern United States/eastern Canada has some merit. Southward this type probably does not extend below Lake Erie or Lake Ontario, though stands in western New York need to be reviewed. Presence of some boreal species, such as *Clintonia borealis, Coptis trifolia*, and *Cornus canadensis* separate this type from *Tsuga canadensis - Fagus grandifolia - Acer saccharum / (Hamamelis virginiana, Kalmia latifolia)* Forest (CEGL005043) (Black and Mack 1976), but this needs further study. In Michigan this type is mostly on the lakeplain/outwash throughout the Michigan range of beech. Compare with *Tsuga canadensis - Acer saccharum - Betula alleghaniensis* Forest (CEGL005044).

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This hemlock - beech hardwoods forest type is found in the central Great Lakes region of the United States and Canada, ranging from northeastern Wisconsin east to Michigan and southern Ontario.

USFS ECOREGIONS: 212Hb:CCC, 212Hd:CCC, 212He:CCC, 212Hi:CCP, 212Hj:CCC, 212Hl:CCC, 212Hm:CCP, 212Ho:CCC, 212Hp:CCP, 212Hq:CCP, 212Hs:CCC, 212Ht:CCP, 212Hv:CCC, 212Hw:CCC, 212Hx:CCC, 212Ia:CCC, 212Jj:CCC, 212Jk:CC?, 212Jl:CCC, 212Oc:CCC, 212Pa:CCC, 221Ea:CCC, 221Fa:CCC, 221Fb:CCC, 222Hb:CCC, 222Ia:CCC, 222Ja:CCC, 222Jj:CCC
CONSERVATION REGIONS: 45:C, 47:C, 48:C, 49:C
STATES: MI WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI mesic northern forest - hemlock-sugar maple +
WI northern mesic forest (hemlock-beech subtype) =

OTHER SYNONYMY: Hardwood and Hemlock-Hardwood Forests (Braun 1950) B, *Acer - Fagus / Dryopteris* (Kotar et al. 1988) F, *Acer - Tsuga / Dryopteris spinulosa* (Kotar et al. 1988) I

USNVC HIERARCHY: TSUGA CANADENSIS - BETULA ALLEGHANIENSIS FOREST ALLIANCE (I.C.3.N.a)

Acer saccharum - Betula alleghaniensis - (Tilia americana) Forest

Sugar Maple - Yellow Birch - (American Basswood) Forest

Maple - Yellow Birch Northern Hardwoods Forest CEGL002457

DESCRIPTION: This forest community is dominated by deciduous trees with scattered conifers in some stands. *Acer saccharum* is a dominant throughout the range of this community. It may form nearly pure stands (Flaccus and Ohmann 1964, Hansen et al. 1973). Other common canopy trees include *Acer rubrum, Betula alleghaniensis, Fraxinus americana*, and *Tilia americana*. Conifers, such as *Abies balsamea, Picea glauca, Pinus strobus, Thuja occidentalis*, and *Tsuga canadensis*, can be found in some stands. The shrub layer is sparse; however, it can be moderately developed where the tree canopy is not fully closed. Typical shrubs include *Acer spicatum, Corylus cornuta, Lonicera canadensis*, and *Taxus canadensis*. The herbaceous stratum includes *Clintonia borealis, Lycopodium* spp., *Maianthemum canadense, Osmorhiza claytonii, Streptopus lanceolatus (= Streptopus roseus)*, and *Viola* spp. (Chambers et al. 1997).

This community is found on moderate to deep (60->150 cm) sandy loam, clay loam, or loamy sand soils (Coffman and Willis 1977, Pregitzer and Barnes 1984). The soils are typically slightly acidic to circumneutral, mesic to wet-mesic and nutrient rich (Kotar and Burger 1989). Most stands develop on flat to moderate slopes over glacial till.

COMMENTS: *2, MCS*. This community has a sub-boreal herbaceous layer. This may be a useful feature to differentiate this community from the similar *Acer saccharum - Fraxinus spp. - Tilia americana / Osmorhiza claytonii - Caulophyllum thalictroides* Forest (CEGL005008). Some stands can have a scattered supercanopy of *Pinus strobus* (less than 25% cover), and although floristically such stands are very similar to this type, there may be some value in recognizing a separate type, *Acer saccharum - Pinus strobus / Acer pensylvanicum* Forest (CEGL005005). Further review of this issue is needed.

CONSERVATION RANK: *G3G4.* There are probably over 100 occurrences rangewide. Ninety have been documented: 77 in Minnesota (where the community is ranked S2), 10 in Wisconsin (S4), and 3 in Michigan (S4). Although no other occurrences have been documented, the community is also reported from Ontario (S?). The 90 occurrences total 13,401 acres.

DISTRIBUTION: This northern hardwoods community type occurs in the western and central Great Lakes area of the United States and Canada, ranging from Minnesota and Ontario east to Michigan.

USFS ECOREGIONS: 212Hb:CC?, 212Hi:CCP, 212Hj:CCP, 212Hs:CCC, 212Hv:CCP, 212Ib:CCC, 212Ja:CCC, 212Jb:CCC, 212Jc:CCC, 212Je:CCC, 212Jf:CCP, 212Jj:CCC, 212Jl:CCC, 212Jm:CCC, 212Jn:CCP, 212Jo:CCP, 212Jr:CCC, 212Js:CCC, 212Kb:CCC, 212La:CC?, 212Lb:CCC, 212Mb:C??, 212Na:CCC, 212Nb:CCC, 212Nc:CCC, 212Nd:CCC
CONSERVATION REGIONS: 47:C, 48:C
STATES: MI MN WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:
MI mesic northern forest - sugar maple-yellow birch-(balsam fir) =
MN northern hardwood forest (northern section) =
WI northern mesic forest (sugar maple-yellow birch subtype) =

OTHER SYNONYMY: Yellow Birch - Sugar Maple (Hansen et al. 1973) =, *Acer saccharum - Viola pennsylvanica - Ozmorhiza claytoni* Association (Coffman and Willis 1977) =, Site Unit 2 (Pregitzer and Barnes 1984) F, Site Unit 4 (Pregitzer and Barnes 1984) F, Site Unit 5 (Pregitzer and Barnes 1984) F, Site Unit 11 (Pregitzer and Barnes 1984) F, *Acer / Hydrophyllum* Habitat Type (Kotar and Burger 1989) =, Sugar Maple-Yellow Birch-Spinulose Wood Fern (V10) (Chambers et al. 1997) =

USNVC HIERARCHY: ACER SACCHARUM - BETULA ALLEGHANIENSIS - (FAGUS GRANDIFOLIA) FOREST ALLIANCE (I.B.2.N.a)

Acer saccharum - Fagus grandifolia - Betula spp. / Maianthemum canadense Forest

Sugar Maple - American Beech - Birch Species / Wild Lily-of-the-valley Forest

Beech - Maple - Northern Hardwoods Forest CEGL005004

DESCRIPTION: The tree canopy is dense, and after the trees leaf out, the forest floor is under dense shade. This community is dominated by two hardwood species, *Acer saccharum* and *Fagus grandifolia*. *Acer rubrum, Betula alleghaniensis, Fraxinus americana, Quercus rubra*, and *Tilia americana* are common associates. Shrubs are widely scattered and include *Lonicera canadensis, Ribes* spp., *Sambucus racemosa var. racemosa (= Sambucus pubens)*, and *Viburnum acerifolium*. Many of the herbaceous species are spring ephemerals which bloom before the tree leaves are fully formed (Thompson 1984). Among the common herbaceous species are *Adiantum pedatum, Arisaema triphyllum, Botrychium virginianum, Lycopodium* spp., *Maianthemum canadense, Maianthemum stellatum, Polygonatum pubescens, Trillium grandiflorum*, and *Viola* spp.

Stands occur on flat to moderately sloping terrain on glacial features such as till or moraines. Soil textures range from sandy loams to loams in Wisconsin (Kotar and Burger 1989) to sandy soils in northern Lower Michigan (Cleland et al. 1994). The soils are usually mesic, nutrient-rich, and deep. A relatively thick layer of fallen leaves covers the forest floor (Kotar and Burger 1989, Host and Pregitzer 1991).

Acer saccharum and *Fagus grandifolia* are the most abundant species in the sapling and seedling layers. Other tree species cannot persist under the dense shade cast by the fully developed canopy characteristic of most stands and can only invade when the canopy is broken by the death of overstory trees.

COMMENTS: *1, MCS*. *Fraxinus americana* can occur in this type. Burning can deflect this type to *Quercus rubra - Acer saccharum* Forest (CEGL002461) (D. Albert pers. comm. 1996, Michigan site at Colonial Point). Host and Pregitzer (1991) distinguish this community from *Acer saccharum - Betula alleghaniensis - (Tilia americana)* Forest (CEGL002457) based the abundance of *Lycopodium* spp., *Maianthemum canadense*, and *Polygonatum pubescens* in this type. Some stands can have a scattered supercanopy of *Pinus strobus* (less than 25% cover), and although floristically such stands are very similar to this type, there may be some value in recognizing a separate type, *Acer saccharum - Pinus strobus / Acer pensylvanicum* Forest (CEGL005005). Further review of this issue is needed.

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This northern hardwoods forest community type is found in the central Great Lakes area of the United States and Canada, ranging from Wisconsin and Michigan east to Ontario.

USFS ECOREGIONS: 212Ha:CCC, 212Hb:CCC, 212Hd:CCC, 212He:CCC, 212Hj:CCC, 212Hk:CCP, 212Hl:CCC, 212Hm:CCC, 212Hn:CCP, 212Ho:CCP, 212Hp:CCC, 212Hq:CCP, 212Hr:CCP, 212Hs:CCP, 212Ht:CCC, 212Hu:CCP, 212Hv:CCC, 212Hw:CCC, 212Hx:CCC, 212Hy:CCC, 212Jc:CC?, 212Jj:CCC, 212Jl:CCC, 212Oa:CCC, 222Ja:CCC, 222Kc:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC

CONSERVATION REGIONS: 46:C, 47:C, 48:C

STATES: MI WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI mesic northern forest - beech-sugar maple-yellow birch +
WI southern mesic forest (beech-maple subtype) =

OTHER SYNONYMY: Beech - Maple Hardwood Forest (Thompson 1984) =, *Maianthemum* Group (Host and Pregitzer 1991) =, *Acer - Fagus / Adiantum* Habitat Type (Kotar and Burger 1989) F, *Acer - Fagus / Viburnum* Habitat Type (Kotar and Burger 1989) F, ELTP 40 - Sugar maple-beech-*Maianthemum* plant association (Cleland et al. 1994) F, ELTP 42 - Sugar maple-*Maianthemum* plant association (Cleland et al. 1994) F, ELTP 43 - Sugar maple-red oak-*Maianthemum* plant association (Cleland et al. 1994) F

USNVC HIERARCHY: ACER SACCHARUM - BETULA ALLEGHANIENSIS - (FAGUS GRANDIFOLIA) FOREST ALLIANCE (I.B.2.N.a)

Acer saccharum - Fraxinus spp. - Tilia americana / Osmorhiza claytonii - Caulophyllum thalictroides Forest

Sugar Maple - Ash Species - American Basswood / Blank Sweet-cicely - Blue Cohosh Forest

Sugar Maple - Ash - Basswood Rich Mesic Forest CEGL005008

DESCRIPTION: This forest community has a well-developed tree canopy composed of deciduous species. Shrubs are scattered, but the herbaceous stratum is well-represented. *Acer saccharum, Fraxinus americana*, and *Tilia americana* are the dominant trees; *Ostrya virginiana* and *Quercus rubra* are very common. *Acer rubrum, Betula alleghaniensis, Fagus grandifolia*, and *Ulmus rubra* are typical associates. Shrubs that may be found in this community include *Cornus alternifolia, Hamamelis virginiana*, and *Lonicera canadensis*. The ground flora, much of which is spring ephemerals, is diverse and contains species such as *Allium tricoccum, Arisaema triphyllum, Botrychium virginianum, Caulophyllum thalictroides, Dicentra* spp., *Osmorhiza claytonii, Uvularia perfoliata*, and *Viola* spp. In the northern Appalachian region, ground layer species include *Adiantum pedatum, Cystopteris bulbifera, Deparia acrostichoides (= Athyrium thelypterioides), Dryopteris goldiana, Dryopteris filix-mas, Botrychium virginianum*, and *Phegopteris hexagonoptera (= Thelypteris hexagonoptera)*. Various sedges are present (particularly the Laxiflora group) such as *Carex laxiflora, Carex platyphylla, Carex plantaginea, Carex leptonervia, Carex hitchcockiana, Carex aestivalis, Carex davisii*, and others. Characteristic flowering herbs include *Dicentra cucullaria, Dicentra canadensis, Hepatica* spp., *Asarum canadense, Caulophyllum thalictroides, Viola canadensis, Viola rotundifolia, Actaea pachypoda, Osmorhiza claytonii, Panax quinquefolius, Sanguinaria canadensis*, and many others.

Stands occur on nutrient-rich, mesic or, sometimes, wet-mesic situations on flat to rolling terrain. The surface soils are deep sand, loamy sand, or loam and underlain by sandy clay loam to clay loam. The sites are somewhat poorly drained to well-drained and can have a water table 0.4-2 m below the surface. In the northern Appalachian region, sites occur in enriched cove and convex slopes within northern hardwood forests. The elevation of known examples ranges from 115 to 830 m (380 to 2700 feet). Ground cover is deciduous litter, predominantly of nitrogen-rich sugar maple leaves.

COMMENTS: *2, ECS*.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This rich forest association is found from the northeastern United States and Canada to the central Great Lakes area, ranging from Maine south to New Jersey and east to Michigan and Ontario.

USFS ECOREGIONS: 212B:CC, 212D:CC, 212E:C?, 212Fb:CPP, 212Hl:CPP, 212Hn:CPP, 212Ho:CPP, 212Hx:CPP, 212Hy:CPP, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jl:CPP, 212Jn:CPP, 212Jo:CPP, 221A:CC, 221B:CC, 222Id:CCP, M212Ad:CCC, M212Ae:CCC, M212Af:CCC, M212Ba:CCC, M212Ca:CCC, M212Cd:CCC, M212Da:CCC, M212Db:CCP, M212Dc:CCC, M212Dd:CCP, M212De:CCC, M212Df:CCC, M212E:CC, M212Fa:CPP, M212Fb:CPP, M221:C
CONSERVATION REGIONS: 47:P, 48:C, 61:C, 62:C, 63:C
STATES: CT MA ME MI NH NJ NY RI VT **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI mesic northern forest - sugar maple-basswood =

OTHER SYNONYMY: Rich northern hardwood forest (NAP), Sugar maple-white ash-basswood-bluebead cove forest (CAP)

USNVC HIERARCHY: ACER SACCHARUM - FRAXINUS AMERICANA - TILIA AMERICANA FOREST ALLIANCE (I.B.2.N.a)

Acer saccharum - Pinus strobus / Acer pensylvanicum Forest

Sugar Maple - Eastern White Pine / Striped Maple Forest

Sugar Maple - White Pine Forest CEGL005005

DESCRIPTION: Stands are dominated primarily by *Acer saccharum* with a *Pinus strobus* supercanopy (pine is usually less than 25%). There may be some *Tsuga canadensis*. Other northern hardwood tree species may also be present. The understory may contain *Oryzopsis asperifolia* and *Pteridium aquilinum* in addition to standard northern hardwood understory.

In the northern Appalachian region, stands occur on sandy-gravelly soils, eskers in Adirondacks, and also in a narrow band along lakeshores (Northern Appalachian Ecoregional Planning Team pers. comm. 1998).

COMMENTS: *2, ECS*. This type is difficult to sort out, and stands with only a scattered supercanopy of *Pinus strobus* (less than 25% cover) are floristically very similar to northern hardwoods types [see *Acer saccharum - Betula alleghaniensis - (Tilia americana*) Forest (CEGL002457), *Acer saccharum - Fagus grandifolia - Betula spp. / Maianthemum canadense* Forest (CEGL005004), and *Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides* Forest (CEGL006252)]. Further review of this issue is needed. Note that the Ontario type to which this type is crosswalked is a mixed evergreen-deciduous type, with white pine between 25% and 50% canopy cover. The importance of white pine in this association is considered to indicate relatively dry, nutrient-poor site conditions and includes mature stands in natural condition.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This type is found widely throughout the upper midwestern and northeastern United States and eastern Canada, ranging from Michigan and Ontario east to Pennsylvania and north to Maine.

USFS ECOREGIONS: 212Aa:CCC, 212Ab:CCC, 212Ba:CCC, 212Bb:CCC, 212Ca:CCC, 212Cb:CCC, 212Da:CCC, 212Dc:CCC, 212Hj:CPP, 212Hk:CPP, 212Hq:CPP, 212Jb:CCP, 212Jc:CCP, 212Jr:CCC, 212Oa:CCC, 221:P, 222:P, M212Aa:CCC, M212Ab:CCC, M212Ac:CCC, M212Ad:CCC, M212Ae:CCC, M212Af:CCC, M212Ag:CCC, M212Ba:CCC, M212Ca:CPP, M212Cd:CPP

CONSERVATION REGIONS: 47:P, 48:C, 61:P, 63:C

STATES: MA ME MI NH PA VT **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI mesic northern forest - beech-sugar maple-yellow birch +

OTHER SYNONYMY: White pine-Northern hardwood forest (NAP)

USNVC HIERARCHY: PINUS STROBUS - ACER SACCHARUM FOREST ALLIANCE (I.C.3.N.a)

Acer saccharum - Tilia americana / Ostrya virginiana / Lonicera canadensis Forest

Sugar Maple - American Basswood / Eastern Hop-hornbeam / Fly Honeysuckle Forest

Northern Maple - Basswood Forest CEGL002458

DESCRIPTION: The canopy contains a closed, deciduous tree layer that casts dense shade in summer and limits the growth of understory species. This results in a sparse shrub layer 1-2 m tall and the presence of many spring ephemerals in the herbaceous layer. *Acer saccharum* and *Tilia americana* are the most abundant trees and together make up virtually the entire canopy in many stands. Other trees that may be found include *Fraxinus pennsylvanica, Ostrya virginiana, Quercus rubra, Ulmus americana*, and, in more eastern stands, *Fagus grandifolia*. Typical shrubs are *Acer spicatum, Corylus americana, Dirca palustris, Hamamelis virginiana, Lonicera canadensis*, and *Viburnum acerifolium*. The herbaceous stratum contains species such as *Adiantum pedatum, Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Carex pensylvanica, Desmodium cuspidatum var. cuspidatum (= Desmodium grandiflorum), Epipactis helleborine, Galium triflorum, Hepatica nobilis var. acuta (= Hepatica triloba), Laportea canadensis, Maianthemum canadense, Oryzopsis asperifolia, Trillium grandiflorum*, and *Uvularia grandiflora* (Buell and Bormann 1955, Curtis 1959, MNNHP 1993, Chambers et al. 1997).

This community is usually found on gentle to moderate slopes but can sometimes be found on steep slopes. Stands occur on deep, well-drained soils formed from glacial deposits, usually till. Soils are nutrient-rich loam, silt loam, or sandy loam. The water table is rarely within the tree-rooting zone (MNNHP 1993).

Catastrophic disturbances, such as large fires, are rare in this community. This is a late successional community that can maintain itself through gap phase replacement (MNNHP 1993).

COMMENTS: *2, MCS*. Curtis' (1959) most northern maple-basswood stands belong here. This community is similar to *Acer saccharum - Tilia americana / Ostrya virginiana - Carpinus caroliniana* Forest (CEGL002062), but the canopy of this community is typically less diverse, with much less presence of some of the southern tree species found in the latter, such as *Juglans nigra, Carya* spp., and many *Quercus* spp. (Janssen 1967). This community also lacks appreciable amounts of *Betula alleghaniensis* and *Tsuga canadensis* which are found to the east and north in similar forests, such as *Acer saccharum - Betula alleghaniensis - (Tilia americana)* Forest (CEGL002457) and *Tsuga canadensis - Acer saccharum - Betula alleghaniensis* Forest (CEGL005044). In Minnesota, all stands of *Acer saccharum* - northern hardwoods in the Lake Superior Highlands region are placed in CEGL002457, but it may be that the more southern stands should be placed within this type. In Ontario this type occurs in Site Region 5, but may extend into Site Region 6.

CONSERVATION RANK: *G3?.* The total number of occurrences is unknown. Five have been documented in Wisconsin, where the community is ranked S3, and 22 in Minnesota (S3). It is found in 7 ecoregional subsections.

DISTRIBUTION: This maple - basswood forest community type is found in northern Great Lakes region of the United States and Canada, ranging from Minnesota and Wisconsin into Ontario.

USFS ECOREGIONS: 212Ja:CCC, 212Jc:CCC, 212Jg:CCC, 212Mb:CPP, 212Na:CCC, 212Nb:CCP, 212Nc:CCC
CONSERVATION REGIONS: 47:C, 48:C
STATES: MN WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MN maple-basswood forest (northern section) =
WI southern mesic forest (maple-basswood northern subtype) =

OTHER SYNONYMY: Sugar Maple - Basswood Stand (Buell and Bormann 1955) =, East Woods (Eggler 1938) F, Hunt Hill (Eggler 1938) F, Long Lake (Eggler 1938) F, *Tilio-Acerion sacchari* Alliance (Janssen 1967) =, Sugar Maple-Red Oak-Basswood-Ironwood-Leatherwood (V5) (Chambers et al. 1997) =

USNVC HIERARCHY: ACER SACCHARUM - TILIA AMERICANA - (QUERCUS RUBRA) FOREST ALLIANCE (I.B.2.N.a)

Quercus rubra - Acer saccharum Forest

Northern Red Oak - Sugar Maple Forest

Northern Red Oak - Sugar Maple Forest CEGL002461

DESCRIPTION: The canopy is dominated by deciduous trees. Dominant species in the canopy include *Quercus rubra, Acer saccharum*, and *Acer rubrum*. Associates include *Betula papyrifera, Pinus strobus, Tilia americana*, and in the eastern part of its range, *Fagus grandifolia, Fraxinus americana*, and *Ostrya virginiana*. Subcanopy species typically include the maples. Shrubs include *Amelanchier laevis, Acer pensylvanicum, Corylus cornuta, Hamamelis virginiana*, and *Lonicera canadensis*. Herbs include *Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Dryopteris carthusiana, Maianthemum canadense, Mitchella repens* (creeping semi-shrub), *Polygonatum pubescens*, and *Pteridium aquilinum*. Diagnostic species include *Quercus rubra* with ground layer species typical of the mixed hardwood/conifer region (Chambers et al. 1997).

Stands are found on glacial till (end and ground moraines), mesic portions of glacial outwash and glacial lakebeds, and, farther north, on dry to dry-mesic ridgetops and upper to midslopes, occasionally with bedrock outcrops. Soils are moderately shallow (30-60 cm) to deep, varying from fine sands to loams and clay loams (Nowacki et al. 1990, Chambers et al. 1997). Site characteristics are well-described in central Ontario by Chambers et al. (1997, ecosites 23.1 and 23.2).

The type is thought to have originated, at least in part, through a combination of logging and burning of pine or pine oak stands, and the natural patterns of disturbance are not clear (Nowacki et al. 1990, MNNHP 1993). Nowacki et al. (1990) report that the historical data indicate that these stands were typically pine or pine-oak stands prior to European settlement. Logging and subsequent fires in the mid- to late-1800s created conditions favorable to red oak regeneration. Major recruitment occurred for about 25-30 years after these disturbances. Subsequent low light levels and increased competition from other trees, such as sugar and red maple, has prevented further establishment.

COMMENTS: *2, MCS*. See also *Quercus rubra - Acer saccharum - Fagus grandifolia / Viburnum acerifolium* Forest (CEGL006173) in the East. Compare with *Quercus rubra - Quercus alba - (Quercus velutina, Acer rubrum) / Viburnum acerifolium* Forest (CEGL002462), which is more dry. Because the type is thought to have originated through logging and burning of pine stands (at least in Minnesota), its composition is fairly generic. Range distribution needs further review, and should perhaps be restricted, more-or-less, to Province 212. In the Manistee National Forest ecological land type classification, see ELTP 40, 42, 43 (Cleland et al. 1994).

CONSERVATION RANK: *G4G5.* Type often arises after logging or logging and fire, and may be as common, or more so, than it was prior to European settlement.

DISTRIBUTION: This red oak-hardwood community type is found in the sub-boreal/mixed hardwood-conifer region of the Great Lakes, in both the United States and Canada, ranging from northeastern Minnesota east to Wisconsin, Michigan, and Ontario.

USFS ECOREGIONS: 212Hc:CCC, 212Ia:CCC, 212Jd:CCC, 212Jj:CCC, 212Jl:CC?, 212Lb:CCC, 212Na:C??, 212Nb:C??, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Lb:CCC, 222Lc:CCC, 222Le:CCC
CONSERVATION REGIONS: 46:C, 47:C, 48:C
STATES: MI? MN WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:
MI? mesic northern forest - beech-sugar maple-yellow birch
MN oak forest (northeast section) =
WI northern dry-mesic forest (red oak-sugar maple subtype) =

OTHER SYNONYMY: Red Oak-Sugar Maple-Ironwood-Fly Honeysuckle (V6) (Chambers et al. 1997) =

USNVC HIERARCHY: QUERCUS RUBRA - (ACER SACCHARUM) FOREST ALLIANCE (I.B.2.N.a)

Populus tremuloides - Quercus macrocarpa / Aralia nudicaulis Forest

Quaking Aspen / Bur Oak / Wild Sarsaparilla Forest

Aspen - Bur Oak Forest CEGL002065

DESCRIPTION: This deciduous forest community has a somewhat open to closed canopy. Significant light typically reaches the forest floor. The overstory is dominated by *Populus tremuloides* with *Quercus macrocarpa, Betula papyrifera*, and *Ulmus americana* of secondary importance. *Quercus macrocarpa* often has the largest individuals. Potter and Moir (1961) found bur oaks up to 65 cm dbh. The larger of these were probably well over 200 years old since one 38-cm tree that was dated using tree ring counts was 193 years old. There is a vigorous shrub layer between 1 and 2 m tall. It is dominated by *Corylus cornuta*. Other species that are found in this stratum are *Prunus virginiana, Amelanchier alnifolia, Symphoricarpos occidentalis*, and *Viburnum opulus var. americanum (= Viburnum trilobum)*. The herbaceous layer is also well represented. The most abundant species is *Aralia nudicaulis*. *Carex pensylvanica, Thalictrum dioicum, Sanicula marilandica*, and *Maianthemum canadense* can also be found in this community. Potter and Moir (1961) found that the shrub layer had 45% cover and the herbaceous layer had 60% cover.

This community has been found on rolling topography with a variety of slopes and aspects (Potter and Moir 1961). The soils are loamy and often deep, well developed, and slightly acidic.

COMMENTS: *3, MCS*. This type is conceptually defined as the tallgrass prairie region aspen-oak type distinct from the prairie parkland type, *Quercus macrocarpa - Populus tremuloides / Corylus* spp. Woodland (CEGL002139). A similar forest type is *Populus tremuloides / Corylus americana* Forest (CEGL002063), found more eastward in the prairie-forest border region. This description is based on one stand (Scully's Woods - Unburned) sampled by Potter and Moir (1961) in North Dakota.

CONSERVATION RANK: *G?Q*.

DISTRIBUTION: This aspen - oak forest type is found primarily in the northern tallgrass region of the United States and Canada.

USFS ECOREGIONS: 251Aa:CCC
CONSERVATION REGIONS: 34:C
STATES: MN ND SD **PROVINCES:** MB SK

MIDWEST HERITAGE SYNONYMY: MN aspen forest +

OTHER SYNONYMY: Scully's Woods (Potter and Moir 1961) =

USNVC HIERARCHY: POPULUS TREMULOIDES FOREST ALLIANCE (I.B.2.N.b)

Quercus alba - (Quercus velutina) - Carya ovata / Ostrya virginiana Forest

White Oak - (Black Oak) - Shagbark Hickory / Eastern Hop-hornbeam Forest

White Oak - Hickory Forest CEGL002011

DESCRIPTION: This community has a tall tree canopy with little or no subcanopy. The shrub and herbaceous strata are well-developed. The most abundant tree species are *Quercus alba, Quercus rubra, Quercus velutina, Carya ovata, Carya cordiformis*, and *Tilia americana*. The shrubs in this community rarely exceed 2 m. They include *Symphoricarpos orbiculatus, Amelanchier alnifolia, Cercis canadensis, Cornus drummondii*, and *Ribes* spp. Where stands occur near the tops of bluffs, the tree layer of this community is more open and the shrubs are often dense. Species typical of the herbaceous layer include *Aquilegia canadensis, Dicentra cucullaria, Laportea canadensis*, and *Verbena urticifolia*. Among the herbaceous species present in Nebraska stands are *Aquilegia canadensis, Dicentra cucullaria, Erythronium albidum, Hydrophyllum virginianum, Laportea canadensis, Smilax tamnoides*, and *Verbena urticifolia*. In Nebraska, this type is dominated by *Quercus velutina, Quercus rubra, Quercus macrocarpa*, and *Carya cordiformis*, and *Quercus alba* is rare here at its western range limit. In Iowa, the absence of *Carpinus caroliniana* could be used to separate this type from *Quercus alba*-dominated stands in Ledges State Park (Johnson-Groh 1985).

This community occurs on gentle to moderately steep slopes on uplands and on steep valley sides. In Iowa, this type is typically found on flat uplands. This community does not flood or have saturated soils. Soils are silt, clay, or loam, moderately deep to deep, and somewhat poorly drained to well-drained. The parent material is loess, glacial till, limestone, shale, or sandstone (Nelson 1985, Lauver et al. 1999).

COMMENTS: *2, MCS*. This type is at the western limits of oak - hickory types and, because of the relatively simple tree layer composition, is treated as a separate type. Further comparisons may suggest that it be lumped with *Quercus velutina - Quercus alba - Carya (glabra, ovata)* Forest (CEGL002076) (as also recommended by M. Leahy (pers. comm. 1999) for Missouri). When managed with fire it may develop into a *Quercus alba - (Carya ovata) / Carex pensylvanica* Glaciated Woodland (CEGL002134). Two types from Weaver (1965) are included here; the *Quercus velutina - Carya ovata* community and the *Quercus rubra - Tilia americana* community. The latter type should also be compared with *Acer saccharum - Acer nigrum - Tilia americana - Quercus rubra / Ostrya virginiana* Forest (CEGL002061).

CONSERVATION RANK: *G3.* There may be fewer than 100 occurrences of this community rangewide. It is reported from western Iowa (where it is ranked S1?), southeastern Nebraska (S2), eastern Kansas (S2?), and northern Missouri (S4S5); it may also occur in Oklahoma. Currently 28 occurrences have been documented. Many sites have been cleared or degraded by grazing.

DISTRIBUTION: This oak - hickory forest community is found in the western tallgrass prairie region of the central midwestern United States, ranging from western Iowa and southeastern Nebraska, to Missouri and eastern Oklahoma.

USFS ECOREGIONS: 222Ak:CCC, 251Be:CCC, 251Ca:CC?, 251Cb:CC?, 251Cc:CCC, 251Cg:CCC, 251Ch:CCC, 251Cn:CC?, 251Co:CC?, 251Cp:CCC, 251Cq:CCC, 251Ea:CCC
CONSERVATION REGIONS: 32:P, 35:C, 36:C, 37:C
STATES: IA KS MO NE OK **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO dry-mesic forest +
NE southeastern upland forest =

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS ALBA - (QUERCUS RUBRA, CARYA SPP.) FOREST ALLIANCE (I.B.2.N.a)

Quercus alba - Quercus rubra - Carya ovata Glaciated Forest

White Oak - Northern Red Oak - Shagbark Hickory Glaciated Forest

Midwestern White Oak - Red Oak Forest CEGL002068

DESCRIPTION: The canopy is variable but typically closed (>80%). *Quercus alba* and *Quercus rubra* are the leading dominants, but *Quercus ellipsoidalis, Quercus macrocarpa, Quercus velutina*, and *Carya ovata* can also be codominant. Typical associates include *Juglans nigra*, and more south or east, *Carya alba* and *Carya glabra*. The subcanopy contains *Ostrya virginiana, Prunus serotina, Sassafras albidum*, and, increasingly, *Acer rubrum* or *Acer saccharum*. The shrub layer is quite variable but can include *Cornus alternifolia, Cornus florida* (southward), *Cornus foemina, Corylus americana* (northward), *Parthenocissus quinquefolia, Ribes cynosbati*, and *Zanthoxylum americanum*. The herbaceous layer includes *Amphicarpaea bracteata, Anemone virginiana, Symphyotrichum cordifolium (= Aster sagittifolius), Botrychium virginianum, Brachyelytrum erectum, Circaea lutetiana ssp. canadensis (= Circaea quadrisulcata), Desmodium glutinosum, Galium concinnum, Geranium maculatum, Osmorhiza claytonii, Sanicula odorata (= Sanicula gregaria)*, and *Maianthemum racemosum (= Smilacina racemosa)* (Anderson 1996, Curtis 1959, MNNHP 1993, Nelson 1985).

This community is found primarily on glaciated, rolling topography on a wide variety of soils that have a dry-mesic moisture condition. It is also found in the unglaciated Driftless Area of the upper Midwest.

See Abrams (1992) for a review of fire dynamics in oak forests.

COMMENTS: *1, MCS*. This type rarely has any other oak species in it beyond *Quercus alba, Quercus rubra, Quercus velutina*, and occasional *Quercus macrocarpa* or *Quercus ellipsoidalis*, unlike stands farther south with southern oak species. This type is primarily found on glaciated terrain, including Wisconsinan through Kansan, but its distribution may extend beyond that. Where stands have either *Acer rubrum* or *Acer saccharum* at >20% canopy coverage or basal area, they should be placed in *Quercus rubra - (Acer saccharum, Quercus alba)* Forest (CEGL005017), an oak-maple type. Also compare to *Quercus alba - (Quercus rubra) - Tilia americana var. heterophylla / Aesculus flava* Forest (CEGL007233) of the southeastern states.

CONSERVATION RANK: *G4?.* Many sites have been cleared, logged, and grazed. It is not clear how many high quality, large tracts exist.

DISTRIBUTION: This oak forest community is widespread in the north-central United States, ranging from Ohio west to Minnesota, south to Iowa, and east to Indiana.

USFS ECOREGIONS: 212Fb:PPP, 212Jj:P??, 212Ka:P??, 221Ea:CCC, 222Aa:CCC, 222Ak:CCC, 222Ao:CCC, 222Aq:CCC, 222Fe:CCC, 222Ga:CCC, 222Gb:CCC, 222Gc:CCC, 222Ha:CCC, 222Hb:CCC, 222Hf:CCC, 222Id:CCP, 222If:CCC, 222Ja:CCC, 222Jb:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Kj:CCC, 222Lb:CCC, 222Lc:CCC, 222Qb:CCC, 251Be:CCC, 251Cb:CCC, 251Cc:CCC, 251Cd:CCC, 251Ce:CCC, 251Cf:CCC, 251Cg:CCC, 251Cj:CCC, 251Ck:CCC, 251Dc:CCC, 251Dd:CCC, 251De:CCC, 251Df:CCC, 251Dh:CCP
CONSERVATION REGIONS: 35:C, 36:C, 37:C, 38:C, 44:C, 45:C, 46:C, 47:?, 48:C, 49:C
STATES: IA IL IN MI MN MO OH WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:
IL dry-mesic upland forest (S); dry-mesic upland forest (N) I
IN dry-mesic upland forest +
MI dry-mesic southern forest - white oak (red oak)-hickory +
MN oak forest (big woods section) mesic subtype; oak forest (southeast section) mesic subtype; oak forest (central section) mesic subtype -
MO dry-mesic forest +
OH oak-hickory forest +
WI southern dry-mesic forest (white oak-red oak subtype) =

OTHER SYNONYMY: oak-hickory forests (Anderson 1996) =. uncertain if equivalent; may include both the black oak-white oak-hickory type (CEGL002076) and this type, Southern Dry-Mesic Forest (Curtis 1959) =

USNVC HIERARCHY: QUERCUS ALBA - (QUERCUS RUBRA, CARYA SPP.) FOREST ALLIANCE (I.B.2.N.a)

Quercus ellipsoidalis - (Quercus macrocarpa) Forest

Northern Pin Oak - (Bur Oak) Forest

Northern Pin Oak - (Bur Oak) Forest CEGL002077

DESCRIPTION: The tree canopy is moderately closed, with typically 70-80% cover (MNNHP 1993). The more open stands tend to have well-developed shrub layers while closed-canopy stands have fewer shrubs. Some stands, especially those in which fire has been excluded for long periods, can have tree densities up to several hundred trees per hectare (Curtis 1959). *Quercus ellipsoidalis* is the dominant tree species and comprises the great majority of the canopy in most stands. Other common tree species include *Pinus banksiana* (especially in Wisconsin), *Populus tremuloides*, and sometimes *Acer rubrum, Quercus rubra, Quercus macrocarpa, Quercus velutina*, and *Prunus serotina*. Shrubs such as *Cornus racemosa, Corylus cornuta, Juniperus communis*, and *Vaccinium* spp. are typical. The ground layer contains species such as *Amphicarpaea bracteata, Aster* spp., *Carex pensylvanica, Geranium maculatum, Maianthemum racemosum*, and *Pteridium aquilinum*.

Stands are found on sandy, well-drained to excessively well-drained soils. These develop from glacial outwash, glaciofluvial deposits, or alluvial sediments. The soils are relatively infertile and acidic (Eyre 1980). Stands can be found on flat to moderately sloping sites.

This forest type often occurs on sites that could support barrens or savanna communities. The forests develop where natural fire breaks have limited burning frequency or where fire suppression has been instituted (White and Madany 1978, E. Epstein pers. comm. 1999).

COMMENTS: *2, MCS*. Stands of this community typically contain at least 50% cover or basal area of *Quercus ellipsoidalis*. Stands in this association may be similar to stands in the *Quercus velutina - Quercus alba - (Quercus coccinea)* Forest Alliance (A.1911). The type concept in Minnesota was developed by H. Dunevitz (pers. comm. 2000), who considers this type to be absent in subsections 222Lc and 222Lf, where soils are finer, loess-derived and more likely to retain moisture. Stands on drier slopes in these subsections are more likely to resemble dry-mesic stands that are classified as white oak - red oak forests, *Quercus alba - Quercus rubra - Carya ovata* Glaciated Forest (CEGL002068).

CONSERVATION RANK: *G4?.*

DISTRIBUTION: This community, found in the upper midwestern United States, ranging from the northern parts of Indiana, Illinois, and Iowa, north to Minnesota, Wisconsin, and possibly Michigan.

USFS ECOREGIONS: 212Hb:CPP, 212Ja:CPP, 212Jj:CPP, 212Jm:CPP, 212Ka:CCP, 212Kb:CCC, 212Na:CCP, 212Nb:CC?, 212Nc:CCC, 222Lc:C??, 222Lf:C??, 222Ma:CCC, 222Mc:CCC, 222Md:CCC, 251Ba:CCC
CONSERVATION REGIONS: 35:C, 46:C, 47:C, 48:C
STATES: IA IN? MN WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IN?	dry upland forest ?
MN	oak forest (central section) dry subtype +
WI	northern dry forest (northern pin oak subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS ELLIPSOIDALIS FOREST ALLIANCE (I.B.2.N.a)

Quercus velutina - Quercus alba - Carya (glabra, ovata) Forest

Black Oak - White Oak - (Pignut Hickory, Shagbark Hickory) Forest

Black Oak - White Oak - Hickory Forest CEGL002076

DESCRIPTION: Trees in this community often have moderate to short trunks and spreading crowns, and canopy can vary from open to closed (50-100%). *Quercus velutina, Quercus alba, Carya glabra*, and *Carya ovata* are typical tree dominants. Associated oaks can include *Quercus ellipsoidalis* (northward), *Quercus muehlenbergii*, and southward, *Quercus coccinea, Quercus prinus* and *Quercus stellata*. Typical shrubs and small trees include *Cornus florida* (southward), *Cornus foemina, Corylus americana* (northward), *Ostrya virginiana*, and *Sassafras albidum*. Vines include *Toxicodendron radicans, Parthenocissus quinquefolia*, and *Vitis* spp. The herbaceous layer can include *Agrimonia gryposepala, Agrimonia rostellata, Amphicarpaea bracteata, Botrychium virginianum, Carex blanda, Carex pensylvanica, Desmodium glutinosum, Desmodium nudiflorum, Dioscorea quaternata, Galium circaezans, Geranium maculatum, Polystichum acrostichoides, Maianthemum racemosum (= Smilacina racemosa*), and *Maianthemum stellatum (= Smilacina stellata*), among others (Curtis 1959, White and Madany 1978, Nelson 1985, TNC 1995a).

This community is often found on ridge crests or upper slopes that are well-drained to excessively drained. Soils are often sandy loam, thin and rocky, with outcroppings of exposed bedrock. Bedrock is sandstone, siltstone, chert, or shale, or northward covered by thin loess or glacial till (Curtis 1959, White and Madany 1978, Nelson 1985).

Occasional drought stress, wind, and lightning damage are evident. Historically, fire may have periodically affected this community, increasing its range into more moist sites (Fralish et al. 1991, Robertson and Heikens 1994). Fires in the Shawnee and Ozark Hills, just north of the range of this type, were more frequent (almost annual) from the early 1900s to 1930, but there is little information on presettlement (prior to 1800) fire frequency (Robertson and Heikens 1994). Erosion also converts mesic forest soils to dry-mesic, thereby creating conditions which favor the occurrence of this community. McCune and Cottam (1985) present a detailed 30-year successional analysis of a stand in southern Wisconsin.

COMMENTS: *2, MCS*. It is possible that unglaciated stands may differ sufficiently from glaciated stands to warrant separating into two types, but this depends on resolving the types distribution southward. Is there a thin acid soil, non-glaciated type (i.e., *Quercus alba - Carya alba - (Quercus velutina) / Polystichum acrostichoides - (Carex picta)* Forest (CEGL007795)) versus deeper, glacial soil type? This type appears to go as far north as northern Illinois, Indiana, and southern Michigan, and probably into southern Wisconsin in section 222K, but not 222L (H. Dunevitz pers. comm. 2000, Eric Epstein pers. comm. 1999). The type concept in Wisconsin remains to be resolved. Indiana suggested that the unglaciated stands have more *Quercus coccinea*. In Michigan this could fit the interlobate region. Types on sand and typically more dominated by *Quercus velutina* are placed in either *Quercus velutina - Quercus alba / Vaccinium (angustifolium, pallidum) / Carex pensylvanica* Forest (CEGL005030) or *Quercus velutina / Carex pensylvanica* Forest (CEGL002078). This type has been described in southern Illinois by Robertson et al. (1984), Fralish (1988), and Fralish et al. (1991). Braun (1950, p. 145-146) also noted the prominence of black and white oaks in the Ozark Hills and Illinois, the Mammoth Cave area of Kentucky, and throughout the oak - hickory forest region, especially the Mississippi Valley and Prairie Peninsula regions. In Minnesota, the Bigwoods Southeast section may not contain consistent enough black oak to fit this type, but northern pin oak may be common. In the Ozarks this type may exist, but, based on the recommendations from D. Ladd, T. Nigh, D. Zollner, and B. Heumann, stands are placed either in *Quercus alba - Quercus stellata - Quercus velutina / Schizachyrium scoparium* Woodland (CEGL002150) or in *Quercus velutina - Quercus coccinea - Carya texana* Ozark Forest (CEGL002399). *Quercus alba - (Quercus velutina) - Carya ovata / Ostrya virginiana* Forest (CEGL002011) may be equivalent to this type, at least in northern Missouri (M. Leahy pers. comm. 1999)

CONSERVATION RANK: *G4?.*

DISTRIBUTION: This oak forest community is found throughout the northern and central midwestern United States and adjacent Canada, ranging from Ohio and Ontario, west to possibly southern Wisconsin, south to northern Missouri, and east to Indiana and possibly Kentucky.

USFS ECOREGIONS: 221:P, 222Ca:CCC, 222De:CCC, 222Df:CCC, 222Dh:CCP, 222Di:CCP, 222Ek:CCC, 222Em:CCC, 222Fe:CCC, 222Ga:CCC, 222Gb:CCC, 222Gd:CCC, 222Ha:CCC, 222Hb:CCP, 222Hf:CCP, 222Jb:CCP, 222Jg:CCC, 222Jh:CCC, 222Ji:CCP, 222Jj:CCC, 222Kf:CCC, 222Kj:CCC, 231:C, 251Cf:CCC, 251Ci:CCC, 251Cj:CCC, 251Ck:CCC, 251Dc:CCC, 251Dd:CCC, 251Df:CCC, 251Dh:CCP

CONSERVATION REGIONS: 36:C, 44:P, 46:C, 48:C

STATES: AR? IA? IL IN KY? MI MO OH? **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	dry-mesic upland forest (S); dry upland forest (N) I
IN	dry upland forest +
MI	dry southern forest - black oak-white oak +
MO	dry forest; dry acid bedrock forest (dry chert forest, dry sandstone forest, dry igneous forest) I
OH?	oak-hickory forest ?

OTHER SYNONYMY: Dry-mesic Upland Forest B. (IL) The Illinois Natural Areas Inventory names communities according to broad environmental conditions, *Quercus velutina - Q. alba* upper slope community type (Robertson et al. 1984) =. Good fit, White Oak-Black Oak-Hickory Association (Gordon 1969) =. Uncertain if equivalent. In Ohio, Gordon (1969, p. 40) notes that "Over the glacial till plains of Ohio, in the vicinity of prairie grasslands, forests were mainly of the white oak-black oak-shagbark hickory type at the time of settlement.", Oak-hickory forests (Anderson 1996) B. Anderson notes that white oak-red oak dominance may occur, and that his Oak-Hickory Forests type includes Gordon's white oak-black oak-shagbark hickory type., Southern Dry Forest (Curtis 1959) =, TlB4aIl4c. *Quercus alba - Quercus velutina - Quercus falcata* (Foti et al. 1994), Dry Forest, Dry Acid (Chert, Igneous, Sandstone) Forest (Nelson 1987)

USNVC HIERARCHY: QUERCUS VELUTINA - QUERCUS ALBA - (QUERCUS COCCINEA) FOREST ALLIANCE (I.B.2.N.a)

Quercus velutina - Quercus alba / Vaccinium (angustifolium, pallidum) / Carex pensylvanica Forest

Black Oak - White Oak / (Northern Lowbush Blueberry, Hillside Blueberry) / Pennsylvania Sedge Forest

Black Oak - White Oak / Blueberry Forest CEGL005030

DESCRIPTION: The tree canopy is typically closed, with greater than 80% cover. *Quercus velutina* and *Quercus alba* are the dominant species. The shrub layer contains *Vaccinium angustifolium* and *Vaccinium pallidum*, at least in Ohio. The herbaceous layer can be strongly dominated by *Carex pensylvanica* (Anderson 1996, White and Madany 1978).

Soils are well-drained (water moves through readily, but not rapidly), sandy and free of mottling. Horizons may be brownish, yellowish, grayish, or reddish. The soils may be mottled deep in the C horizon or below depths of 0.6 m. Stands are limited to areas of sand deposits.

Sand forests occupy portions of sand deposits where natural firebreaks have greatly reduced burning frequency. Post-settlement fire exclusion has probably increased the acreage of sand forest at the expense of sand savannas (such as *Quercus velutina - (Quercus alba) - Quercus ellipsoidalis / Schizachyrium scoparium - Lupinus perennis* Wooded Herbaceous Vegetation CEGL002492).

COMMENTS: *2, MCS*. This type is found on sands, but tends to be dry-mesic, thereby increasing the relative contribution of *Quercus alba* in the type. The concept is initially derived from Illinois' "dry-mesic sand forest" (White and Madany 1978), where it can be found in Mason County, and may occur in close proximity to pure *Quercus velutina* stands, *Quercus velutina / Carex pensylvanica* Forest (CEGL002078), which may be on dry sand ridges. Type may be in northern Indiana on sand. This type may historically have had a more woodland structure. In Michigan, type may be equivalent to Manistee National Forest ecological land types ELTP 10, 11, 12, if not too far north (Cleland et al. 1994). In Ohio this type represents acid Oak Openings region forest.

CONSERVATION RANK: *G4?.*

DISTRIBUTION: This oak-dominated forest community is found in the southern Great Lakes region of the United States and Canada, ranging from the northern parts of Illinois and Indiana to Michigan, Ohio and Ontario.

USFS ECOREGIONS: 212Ht:PPP, 212Hu:PPP, 212Hw:PP?, 212Hx:PPP, 222Ig:CCC, 222Ja:CC?, 222Ji:CCC, 222Jj:CCC, 222Kj:CCC, 251Cf:CCC
CONSERVATION REGIONS: 36:C, 45:C, 48:C
STATES: IL IN MI OH **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	dry-mesic sand forest =
IN	dry upland forest +
MI	dry southern forest - black oak-white oak +
OH	oak-hickory forest +

OTHER SYNONYMY: oak barrens (Anderson 1996) B. Anderson suggests that all physiognomic categories of forest, woodland, scrub and herbaceous could be applied to his concept of oak barrens. The more closed condition would fall under this type, and rarely under his oak-hickory forest type. In his chapter on Oak Forests, Anderson states, "Another oak forest type excluded from the general oak category is the black oak-white oak stands on beach ridges in northern Ohio, especially in and near the Oak Openings region west of Toledo. All of these, mostly closed canopied stands are closely related to the partly wooded oak barrens there, and most were probably somewhat open oak barrens themselves in the early 19th century. They may be legitimately considered as a newly formed, closed canopied oak type, but because of their close relationship with oak barrens and their limited areal extent, they are not separated here as a discrete, major forest type. They are included as part of the oak barren complex."

USNVC HIERARCHY: QUERCUS VELUTINA - QUERCUS ALBA - (QUERCUS COCCINEA) FOREST ALLIANCE (I.B.2.N.a)

Quercus velutina / Carex pensylvanica Forest

Black Oak / Pennsylvania Sedge Forest

Black Oak Forest CEGL002078

DESCRIPTION: The tree canopy is moderately closed, with typically 70-80% cover (MNNHP 1993, White and Madany 1978). The more open stands tend to have well-developed shrub layers while closed-canopy stands have fewer shrubs. Some stands, especially those in which fire has been excluded for long periods, can have tree densities up to several hundred trees per hectare (Curtis 1959). *Quercus velutina* is the dominant tree species and comprises the great majority of the canopy in most stands. Other common tree species include *Acer rubrum* and *Prunus serotina*. Typical shrubs include *Cornus racemosa, Corylus cornuta, Vaccinium angustifolium*, and *Vaccinium myrtilloides*. The ground layer contains species such as *Amphicarpaea bracteata, Aster* spp., *Carex pensylvanica, Geranium maculatum, Maianthemum racemosum*, and *Pteridium aquilinum*. Where *Carex pensylvanica* forms dense sods it may exclude shrub or sapling cover (E. Epstein pers. comm. 1999).

Stands are found on sandy, well-drained to excessively well-drained soils. These develop from glacial outwash, glaciofluvial deposits, alluvial sediments, and dunes. The soils are relatively infertile and acidic, and free of mottling (Eyre 1980). Stands can be found on flat to moderately sloping sites.

This forest alliance often occurs on sites that could support woodland or savanna communities. The forests develop where natural fire breaks have limited burning frequency (White and Madany 1978).

COMMENTS: *2, MCS*. Stands of this community contain at least 70% cover or basal area of *Quercus velutina* and are found on well-drained, sandy soils.

CONSERVATION RANK: *G4?.*

DISTRIBUTION: This community is found in the upper midwestern United States, ranging from northern Indiana to possibly southeastern Minnesota.

USFS ECOREGIONS: 222Kg:CPP, 222Lc:CCC, 222Lf:CCC, 222Md:CCC, 222Me:CCC, 251Cf:CCC, 251Df:CCC, 251Dg:CCC
CONSERVATION REGIONS: 36:C, 46:C, 48:C
STATES: IA IL IN? MN WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	dry sand forest +
IN?	dry upland forest ?
MN	oak forest (southeast section) dry subtype =
WI	southern dry forest (black oak sand subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS VELUTINA - QUERCUS ALBA - (QUERCUS COCCINEA) FOREST ALLIANCE (I.B.2.N.a)

Acer saccharum - Quercus muehlenbergii Forest

Sugar Maple - Chinquapin Oak Forest

Sugar Maple - Chinquapin Oak Forest CEGL005010

DESCRIPTION: The tree canopy is dominated by *Quercus muehlenbergii*, the diagnostic dominant, and *Acer saccharum*. Oaks in general comprise at least 50% of the stand and maple at least 20%. In Ohio, other oak associates include *Quercus alba, Quercus rubra*, and, locally, *Quercus shumardii*. Other hardwoods include *Carya ovata, Celtis occidentalis, Fraxinus americana, Fraxinus quadrangulata*, and *Tilia americana*. In the northeastern states, *Carya ovata* and *Quercus rubra* are the associated species. Shrub and small tree species include *Amelanchier sanguinea, Carpinus caroliniana, Cercis canadensis, Cornus racemosa, Diervilla lonicera, Lindera benzoin* and *Staphylea trifolia*. Herbaceous species include *Carex eburnea, Carex platyphylla*, and *Sanicula marilandica*, among many others.

Stands occur on upper slopes or summits of limestone or marble ridges with dry soils. Limestone outcrops or boulders are often present.

COMMENTS: *3, ECS*. Anderson (1996) provides further references for Ohio. He notes that it occurs mainly in northern Ohio, where it is primarily a calcareous substrate type but can also represent a transition from oak stands around prairies to beech - maple forests. In Illinois, this type may have occurred as a mesic sand forest subtype, e.g., around Peoria, where both sugar maple and chinquapin oak are noted in the General Land Office (presettlement) Survey notes. Stands on thin soil over dolomite may overlap with limestone woodlands (e.g., in New York *Quercus alba - Quercus macrocarpa / Andropogon gerardii* Wooded Herbaceous Vegetation (CEGL005121)). *Acer saccharum - Quercus muehlenbergii / Cercis canadensis* Forest (CEGL006017) is a related unglaciated type found to the south of this type.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This dry-mesic forest community is found from the eastern seaboard to the central United States on calcareous substrates.

USFS ECOREGIONS: 212B:CC, 212E:CC, 221A:CC, 221B:CC, 221D:CC, 222Ha:CCC, 222Hb:CCC, 222Hc:CCC, 222I:CC, 231:C, M212B:CC, M212C:CC, M221:C
CONSERVATION REGIONS: 45:C, 48:C, 61:C
STATES: CT IL? MA? MI? NJ NY OH **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:
IL? mesic upland forest (N) ?
MI? no state equivalent
OH oak-maple forest +

OTHER SYNONYMY: Yellow oak-sugar maple calcareous forest (CAP)

USNVC HIERARCHY: QUERCUS MUEHLENBERGII - (ACER SACCHARUM) FOREST ALLIANCE (I.B.2.N.a)

Quercus rubra - (Acer saccharum, Quercus alba) Forest

Northern Red Oak - (Sugar Maple, White Oak) Forest

Red Oak - Sugar Maple - Elm Forest CEGL005017

DESCRIPTION: The vegetation is comprised of a closed-canopy tree layer. The major tree dominant is *Quercus rubra*. Other associates may include *Acer saccharum, Quercus alba*, and *Ulmus americana*. The subcanopy and sapling layers often contain *Prunus virginiana* or *Prunus serotina*. Further characterization of this type is needed.

The oak stands generally are found on either mesic sites protected from fire or on drier slopes, where, historically, fires could sweep through, but where fire protection is creating more mesic conditions.

This type may occur where, historically, fires were more prevalent; current stands may represent both mesic stands protected from fire, and somewhat more dry-mesic stands protected from fire that are shifting from oak dominance to maple, basswood and elm dominance.

COMMENTS: *3, MCS*. This type is poorly understood; current stands may represent both mesic stands protected from fire, and somewhat more dry-mesic stands represent a successional type shifting from oak dominance to maple, basswood and elm dominance. The type concept should probably be restricted to be south of Province 212 (Bailey et al. 1994), and north of the limits of glaciation. Stands in Ohio may differ from those further west. See also Kline and Cottam (1979) where a white oak - maple forest type is described in the prairie - forest border. Stands in southern Indiana need to be compared with other red oak-maple types in the alliance as well as *Acer saccharum - Carya cordiformis* Temporarily Flooded Forest Alliance (A.302).

CONSERVATION RANK: *G?Q.*

DISTRIBUTION: This community is found in the northern prairie-forest border and central midwestern region of the United States, ranging from western Ohio, west to southern Minnesota, south to Iowa, and east to Indiana.

USFS ECOREGIONS: 221Eg:CCC, 221Fa:CCC, 222Aq:CCC, 222Fd:CCC, 222Ga:CCC, 222Ha:CCC, 222Hb:CCC, 222Hc:CCC, 222Jb:CCC, 222Jc:CCC, 222Jg:CCC, 222Kg:CCC, 222L:CP, 222M:CP, 251Cf:CCC, 251Ci:CCC, 251Cj:CCC, 251Dc:CCC, 251De:CCC, 251Dg:CCC

CONSERVATION REGIONS: 36:C, 44:C, 45:C, 48:C, 49:C

STATES: IA IL IN OH? WI **PROVINCES:** ON?

MIDWEST HERITAGE SYNONYMY:

IL	mesic upland forest (S); mesic upland forest (N) I
IN	dry-mesic upland forest +
OH?	oak-maple forest ?
WI	southern dry-mesic forest (mesic red oak subtype?) =

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS RUBRA - (ACER SACCHARUM) FOREST ALLIANCE (I.B.2.N.a)

Quercus rubra - Quercus alba - (Quercus velutina, Acer rubrum) / Viburnum acerifolium Forest

Northern Red Oak - White Oak - (Black Oak, Red Maple) / Mapleleaf Viburnum Forest

Northern Red Oak - White Oak - (Maple) Forest CEGL002462

DESCRIPTION: The overstory contains *Quercus rubra, Quercus alba, Acer rubrum*, and, less frequently, *Pinus strobus, Populus grandidentata*, and *Quercus velutina*. The sapling layer contains *Prunus serotina* and *Ostrya virginiana*, with *Acer rubrum* or *Acer saccharum*. Shrubs include *Amelanchier* spp. and *Viburnum acerifolium*. The herbaceous layer contains *Aralia nudicaulis, Eurybia macrophylla (= Aster macrophyllus), Desmodium glutinosum, Desmodium nudiflorum, Maianthemum canadense*, and *Trientalis borealis* (Nowacki et al. 1990, Cleland et al. 1994). Further work is needed to characterize this type rangewide.

Stands occur on well-drained sandy and sandy loam, coarse-textured, moraines, ice-contact topography, and fine-textured glacial lakebeds. Occasionally stands may occur on poorly drained sandy soils (Nowacki et al. 1990, Cleland et al. 1994).

Natural disturbances necessary for the persistence of this type are not clear. Nowacki et al. (1990) report that the historical data indicate that these stands were typically pine or pine-oak stands prior to European settlement. Logging and subsequent fires in the mid to late 1800s created conditions favorable to red oak regeneration. Major recruitment occurred for about 25-30 years after these disturbances. Subsequent low light levels and increased competition from other trees, such as sugar and red maple, have prevented further establishment.

COMMENTS: *2, MCS*. This type represents a drier type than *Quercus rubra - Acer saccharum* Forest (CEGL002461). Moisture in the Minnesota type should be checked. This type may be a result of logging of white pine or white pine-oak stands (Nowacki et al. 1990) [see also *Pinus strobus - (Pinus resinosa) - Quercus rubra* Forest (CEGL002480) or *Pinus strobus - Quercus alba / (Corylus americana, Gaylussacia baccata)* Forest (CEGL002481)]. On the Manistee National Forest in Michigan, this type may occur on ELTP 32, 34, 35, 37, and perhaps some parts of 62 and 63 (Cleland et al. 1994). Drier forested stands on sand in the Manistee may be placed in *Quercus velutina - Quercus alba / Vaccinium (angustifolium, pallidum) / Carex pensylvanica* Forest (CEGL005030) or at the most extreme dry end, into black oak - white oak woodland, *Quercus velutina - (Quercus ellipsoidalis) - Quercus alba / Deschampsia flexuosa* Woodland (CEGL005029). In Michigan the southern limits of this type compared to the northern limits of *Quercus alba - Quercus rubra - Carya ovata* Glaciated Forest (CEGL002068) and *Quercus velutina - Quercus alba - Carya (glabra, ovata)* Forest (CEGL002076) need to be resolved.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This dry to dry-mesic oak forest community is found in the central regions of the Great Lakes in the United States and Canada, ranging from parts of Minnesota east to Michigan and Ontario.

USFS ECOREGIONS: 212Hl:CPP, 212Hm:CPP, 212Hn:CPP, 212Ho:CPP, 212Hp:CPP, 212Hq:CPP, 212Hs:CPP, 212Ht:CPP, 212Hu:CPP, 212Hv:CPP, 212Hw:CPP, 212Hx:CPP, 212Hy:CPP, 212Ja:CCP, 212Jb:CCP, 212Jc:CCP, 212Jf:CC?, 212Jl:CCC, 212Jn:CCP, 212Jo:CCP, 212L:C?, 212Nb:C??, 222Dc:C??, 222Em:CPP, 222Fe:C??, 222Ja:CPP, 222Ke:CCC, 222Kf:CCC, 222Lc:CCC, 222Ld:CCC

CONSERVATION REGIONS: 46:?, 47:C, 48:C

STATES: MI MN WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

	MI	dry-mesic southern forest - white oak (red oak)-hickory +
	MN	oak forest (northeast section) red maple subtype =
	WI	northern dry-mesic forest (red oak-red maple subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS RUBRA - (ACER SACCHARUM) FOREST ALLIANCE (I.B.2.N.a)

Acer saccharum - Acer nigrum - Tilia americana - Quercus rubra / Ostrya virginiana Forest

Sugar Maple - Black Maple - American Basswood - Northern Red Oak / Eastern Hop-hornbeam Forest

Central Maple - Basswood Forest CEGL002061

DESCRIPTION: The most abundant tree species in this forest community are *Tilia americana, Quercus rubra*, and *Ostrya virginiana*. *Acer nigrum, Acer saccharum*, and *Carpinus caroliniana* are more common farther east. Other canopy associates include *Carya cordiformis, Celtis occidentalis, Fraxinus pennsylvanica*, and *Juglans nigra*. *Ostrya virginiana* can also be a prominent subcanopy and sapling species. The shrub layer is variable and includes *Prunus virginiana, Sambucus canadensis, Viburnum prunifolium*, and, in Missouri, *Asimina triloba*. Ground layer species include a rich mixture of herbaceous species, including *Adiantum pedatum, Arisaema triphyllum, Erythronium albidum, Geum canadense, Impatiens pallida, Polygonatum biflorum, Sanicula* spp., *Staphylea trifolia, Thalictrum dioicum*, and others (Nelson 1985, Lauver et al. 1999, Steinauer and Rolfsmeier 2000).

This community is found on valley slopes and bottoms, often with northern or eastern aspects (Johnson-Groh 1985). Soils are moderately well-drained and moderate to deep silty and clay loams formed in loess, glacial till, or sandstone and limestone parent material (Nelson 1985, Lauver et al. 1999).

COMMENTS: *2, MCS*. *Acer nigrum* is scarce in Kansas, but the mesic understory and dominance by *Tilia americana* and *Quercus rubra* make this comparable to variation in the type found in central Iowa (see Johnson-Groh 1985). The name could perhaps be changed to put the maples in parentheses after the *Tilia* and *Quercus*. In Nebraska, Weaver reports a *Quercus rubra – Tilia americana* type, but that type is currently crosswalked to *Quercus alba - (Quercus velutina) - Carya ovata / Ostrya virginiana* Forest (CEGL002011) based on discussions with Gerry Steinauer (pers. comm. 1999). Eastward the type drops out around the Mississippi River region.

CONSERVATION RANK: *G3G4.* There are probably over 100 occurrences rangewide. Twenty-four have been documented: 3 in Iowa (where the community is ranked S4?), 1 in Kansas (S?), and 20 in Missouri (S3,S3). The community occurs in nine ecoregional subsections. There are probably over 1000 acres rangewide. The community has moderately restrictive environmental requirements.

DISTRIBUTION: This deciduous forest community is found in the central midwestern United States on valley slopes and bottoms, often with northern or eastern aspects, ranging from Iowa to Missouri and Kansas.

USFS ECOREGIONS: 222Aa:CCC, 222Ae:CCC, 222Af:CCC, 222Ag:CCC, 222Aj:CCC, 222Ak:CCC, 251Be:CCC, 251Cb:CC?, 251Cc:CCC, 251Cd:CC?, 251Ce:CCC, 251Cg:CCC, 251Ch:CC?, 251Cp:CCC, 251Cq:CCP
CONSERVATION REGIONS: 35:C, 36:C, 38:C
STATES: IA KS MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO mesic forest; mesic limestone/dolomite forest I

OTHER SYNONYMY: *Quercus rubra - Tilia americana* Vegetation Type (Johnson-Groh 1985) F, *Tilia americana* Vegetation Type (Johnson-Groh 1985) F

USNVC HIERARCHY: ACER SACCHARUM - TILIA AMERICANA - (QUERCUS RUBRA) FOREST ALLIANCE (I.B.2.N.a)

Acer saccharum - Tilia americana / Ostrya virginiana - Carpinus caroliniana Forest

Sugar Maple - American Basswood / Eastern Hop-hornbeam - Ironwood Forest

North-central Maple - Basswood Forest CEGL002062

DESCRIPTION: The tree canopy of this community is moderately dense to dense and greatly affects the composition of the understory. Only shade-tolerant species are able to persist (Curtis 1959). *Acer saccharum* and *Tilia americana* are the most prevalent tree species. Other common tree species include *Carpinus caroliniana, Carya cordiformis, Carya ovata, Fraxinus pennsylvanica, Juglans nigra, Ostrya virginiana, Quercus alba, Quercus rubra*, and *Ulmus* spp. The scattered shrub layer contains species such as *Cornus alternifolia, Ribes* spp., *Sambucus* spp., and *Zanthoxylum americanum*. Spring ephemerals are a distinctive part of the herbaceous layer. Common herbaceous species include *Anemone quinquefolia, Claytonia* spp., *Dicentra cucullaria, Erythronium* spp., *Polygonatum pubescens, Sanicula odorata (= Sanicula gregaria), Trillium grandiflorum*, and *Uvularia grandiflora* (Curtis 1959, MNNHP 1993).

This community is found on flat to steep slopes on loamy soils derived from glacial till or, less commonly, loess (Curtis 1959). The soils are well-drained, fertile, and deep (MNNHP 1993).

COMMENTS: *1, MCS*. This type may be in Indiana (see Lindsey et al. 1969, p. 532-533 at Ecology Cove Dune State Park). Pure basswood stands in the western part of range are placed in *Tilia americana - (Quercus macrocarpa) / Ostrya virginiana* Forest (CEGL002012). Stands in northwestern Wisconsin probably should go with *Acer saccharum - Tilia americana / Ostrya virginiana / Lonicera canadensis* Forest (CEGL002458). Compare with *Acer saccharum - Acer nigrum - Tilia americana - Quercus rubra / Ostrya virginiana* Forest (CEGL002061) in the central Midwest.

CONSERVATION RANK: *G3G4.* These rich mesic hardwood forests are poorly protected throughout their range. They were once the matrix forests over large parts of the upper Midwest, and now occur primarily in small (<1000 ac) fragments, many of which have been logged or grazed.

DISTRIBUTION: This maple - basswood forest community type is found in the north-central United States, ranging from northern Illinois west to South Dakota.

USFS ECOREGIONS: 212Hd:CCC, 212JI:CCC, 212Kb:CCC, 212Nc:CCC, 222Ga:CCC, 222Hf:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Kj:CCC, 222Lc:CCC, 222Ld:CCC, 222Le:CCC, 222Lf:CCC, 222Ma:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 251Aa:CCC, 251Ba:CCC, 251Bb:CCC, 251Be:CCC, 251Cf:CCC, 251De:CCC, 251Df:CCC

CONSERVATION REGIONS: 35:C, 36:C, 44:C, 45:C, 46:C, 47:C, 48:C

STATES: IA IL MN SD WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL mesic floodplain forest (N); mesic upland forest (N); mesic upland forest (S); wet-mesic upland forest (N) I
MN maple-basswood forest (southeast section); maple-basswood forest (big woods section); maple-basswood forest (east central section); maple-basswood forest (west central section) -
WI southern mesic forest (maple-basswood southern subtype) =

OTHER SYNONYMY: *Acer* Forest (Cahayla-Wynne and Glenn-Lewis 1978) F, *Tilia* Forest (Cahayla-Wynne and Glenn-Lewis 1978) F, Southern Mesic Forest (Curtis 1959) B

USNVC HIERARCHY: ACER SACCHARUM - TILIA AMERICANA - (QUERCUS RUBRA) FOREST ALLIANCE (I.B.2.N.a)

Fagus grandifolia - Acer saccharum Glaciated Midwest Forest

American Beech - Sugar Maple Glaciated Midwest Forest

Beech - Maple Glaciated Forest CEGL005013

DESCRIPTION: This community is characterized by a dense to moderately dense canopy of deciduous trees, an absent to sparse shrub layer, and a moderately to well-developed herbaceous layer. The canopy formed by the overstory trees and smaller saplings greatly reduces the amount of light that reaches lower vegetation strata. This canopy is composed primarily of *Acer saccharum* and *Fagus grandifolia*. *Liriodendron tulipifera* is sometimes codominant and *Carpinus caroliniana, Fraxinus americana, Ostrya virginiana, Quercus rubra, Tilia americana*, and *Ulmus americana* are often present in the canopy or subcanopy. *Diervilla lonicera, Euonymus obovata, Lonicera canadensis, Sambucus racemosa var. racemosa (= Sambucus pubens)*, and *Viburnum* spp. are typical shrubs. The herbaceous layer is often diverse, typically including spring ephemerals. Common species include *Arisaema triphyllum (= Arisaema atrorubens), Dryopteris intermedia, Galium aparine, Maianthemum canadense* (in northern stands), *Maianthemum racemosum, Osmorhiza claytonii, Podophyllum peltatum, Polygonatum biflorum, Trillium grandiflorum*, and *Viola* spp.

This community is found on flat to rolling topography (Braun 1950, Pell and Mack 1977). In the southern parts of its range, it is more likely to be found on steeper slopes than in the northern portion (Braun 1950). The soils are predominantly silt loam, loam, or sandy loam and develop over glacial till of Wisconsin age (Braun 1950, Dodge and Harman 1985). This community was found to develop on sites with till 0.4-4.0 m thick in southern Michigan (Dodge and Harman 1985).

COMMENTS: *1, MCS*. Wisconsin glaciation history is used to define the southern limits of this type, and further work is needed to determine how floristically distinct these glaciated stands are from southern unglaciated stands, which are placed in the *Fagus grandifolia - Acer saccharum - Liriodendron tulipifera* Unglaciated Forest (CEGL002411). *Liriodendron tulipifera* and other southern hardwoods, such as *Liquidambar styraciflua*, are much less constant in this type compared to the unglaciated stands, as is, perhaps, *Asimina triloba*. Northward, *Betula alleghaniensis* and *Betula papyrifera* are very infrequent compared to *Acer saccharum - Fagus grandifolia - Betula spp. / Maianthemum canadense* Forest (CEGL005004). In New York and Pennsylvania this type may cover both the glaciated lake till plain and perhaps some parts of the glaciated Allegheny Plateau, consistent with its distribution in Ohio. Arguing for this is the low dominance or absence of *Liriodendron tulipifera*, low dominance of *Betula* spp., and the high dominance of *Tilia americana*. On the other hand, the presence of *Betula lenta*, and perhaps that of *Tsuga canadensis*, in that region are somewhat unusual for this type, indicating the more Allegheny influence. And the inclusion of both glaciated till plain and plateau habitats in the type would broaden the environmental parameters. This type may be in east-central Illinois (Vermillion County, near Danville), but is largely extirpated (B. McClain pers. comm. 1999). Stands still occur across the stateline in Indiana.

CONSERVATION RANK: *G3G4.* One hundred and fifty-five occurrences have been documented: 3 in Illinois (where the community is ranked S4), 86 in Indiana (S3), 36 in Michigan (S3), and 30 in Ohio (S3). Although no other occurrences have been documented, the community is also reported in Ontario (S?), and it may occur in New York (SP). Sizes of 129 occurrences total 8895 acres. This type was once a widespread matrix forest that now occupies small remnants, often less than 500 acres in size.

DISTRIBUTION: This upland forest community is found in the southern Great Lakes area of the United States and Canada, ranging from Illinois, Indiana, and Michigan, east to Ontario and western New York.

USFS ECOREGIONS: 212Fa:PP?, 212Fb:PPP, 221Fa:CCC, 221Fb:CC?, 221Fc:CCC, 222De:CCC, 222Ga:CCC, 222Gc:CCC, 222Gd:CCC, 222Ha:CCC, 222Hb:CCC, 222Hc:CCC, 222Hd:CCC, 222Hf:CCC, 222Ia:CC?, 222Ib:CC?, 222Ic:CC?, 222Id:CCP, 222If:CCC, 222Ja:CCC, 222Jb:CCC, 222Jc:CCC, 222Jd:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kj:CCC, 251De:CCC

CONSERVATION REGIONS: 36:C, 44:C, 45:C, 48:C, 49:C

STATES: IL IN MI NY OH **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	mesic upland forest (S) +
IN	mesic upland forest +
MI	mesic southern forest - beech-sugar maple-basswood =
OH	beech-sugar maple forest +

OTHER SYNONYMY: Beech - Maple Forest Region (Braun 1950) I, Warren's Woods (Cain 1935) =, *Fagus grandifolia - Acer saccharum - Podophyllum peltatum* association (Pell and Mack 1977) =

USNVC HIERARCHY: FAGUS GRANDIFOLIA - ACER SACCHARUM - (LIRIODENDRON TULIPIFERA) FOREST ALLIANCE (I.B.2.N.a)

Quercus alba - (Carya ovata) / Carex pensylvanica Glaciated Woodland

White Oak - (Shagbark Hickory) / Pennsylvania Sedge Glaciated Woodland

Central Midwest White Oak - Mixed Oak Woodland CEGL002134

DESCRIPTION: The tree canopy is moderately tall (20-25 m), somewhat open-grown with low tree densities and somewhat spreading canopies. Canopy cover is 30-80%, but varies with fire regime. The woody sapling layer is variable, typically absent or scattered, but increasing in the absence of fire. Dominant trees include *Quercus alba, Carya ovata, Carya ovalis, Carya alba (= Carya tomentosa), Quercus rubra*, and *Quercus velutina*. Shrubs and saplings may include *Cornus foemina, Corylus americana, Crataegus* spp., *Malus ioensis*, and *Rhus aromatica*, and, in the absence of fire, *Amelanchier arborea, Cornus florida, Ostrya virginiana, Viburnum prunifolium, Viburnum rufidulum*, and *Viburnum rafinesquianum*. The ground layer is a mix of graminoids and forbs. Typical graminoid dominants may include *Andropogon gerardii* and *Carex pensylvanica* in more open areas, and *Bromus kalmii (= Bromus purgans), Elymus virginicus, Festuca subverticillata (= Festuca obtusa), Elymus hystrix (= Hystrix patula), Dichanthelium oligosanthes (= Panicum oligosanthes), Dichanthelium boscii (= Panicum boscii)*, and *Chasmanthium latifolium (= Uniola latifolia)* in woodland areas. Common herbs include *Amphicarpaea bracteata, Asclepias purpurascens, Symphyotrichum drummondii (= Aster drummondii), Echinacea purpurea, Helianthus hirsutus, Helianthus strumosus, Lespedeza violacea, Penstemon digitalis, Sanicula canadensis, Sanicula odorata (= Sanicula gregaria), Solidago ulmifolia, Veronicastrum virginicum*, and others (Nelson 1985, M. Leahy pers. comm. 1999).

Stands occur on gentle upper and midslopes of hills, ridges and plains, on a variety of aspects, or on flatland. Soils are well-drained, moderately deep to deep (>100 cm). The parent material is primarily loess, glacial till, gravel, or deeply weathered bedrock (Nelson 1985, M. Leahy pers. comm. 1999).

Fires were an important influence on this community, maintaining its open character and preventing shrubby and mesophytic trees from invading. Other disturbances include windstorms, icestorms, and grazing (historically by bison and elk) (Nelson 1985, M. Leahy pers. comm. 1999). Stands in Illinois, described as "streamside groves" typically had a combination of thin-barked and thick-barked tree species, suggesting that fires were infrequent.

COMMENTS: *2, MCS*. In the absence of burning this type may succeed to *Quercus alba - (Quercus velutina) - Carya ovata / Ostrya virginiana* Forest (CEGL002011). This forested stage has been described by Paul Nelson (M. Leahy pers. comm. 1999). Type is more closed canopy than the central oak openings, *Quercus macrocarpa - (Quercus alba, Quercus velutina) / Andropogon gerardii* Wooded Herbaceous Vegetation (CEGL002020), but its rangewide limits are not well understood. Its range should not overlap with that of *Quercus alba - Quercus macrocarpa - Quercus rubra / Corylus americana* Woodland (CEGL002142) to the north. Kuchler's prairie-forest mosaic in southern Iowa, central Illinois and northern and western Missouri may have contained more such woodland communities and fewer oak openings and barrens compared to areas further north in Minnesota and Wisconsin. The "streamside groves" described by McClain et al. (1998), described as being associated with mesic valleys and terraces of streams and rivers, also fit the woodland type described here.

CONSERVATION RANK: *G1Q*. There are probably fewer than 20 high quality occurrences for a type that has a relatively restricted range. Only one occurrence, a 10 acre tract of fair quality, is currently documented from Missouri; this community also occurs in Iowa and probably in central Illinois. In northern Missouri and southern Iowa alone, there are 100s, if not 1000s of low quality examples. Historical trends are unknown. Condition of the known occurrence is fair.

DISTRIBUTION: This oak woodland type is found in the central tallgrass region of the United States, particularly in northern Missouri, southern Iowa, and perhaps central Illinois.

USFS ECOREGIONS: 251Cc:CCC, 251Cd:CC?, 251Cj:CCC
CONSERVATION REGIONS: 36:C
STATES: IA? IL MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL dry-mesic barren (N) +
MO dry-mesic forest +

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS ALBA - (QUERCUS VELUTINA) WOODLAND ALLIANCE (II.B.2.N.a)

Quercus alba - Quercus macrocarpa - Quercus rubra / Corylus americana Woodland

White Oak - Bur Oak - Northern Red Oak / American Hazelnut Woodland

North-central Dry-mesic Oak Woodland CEGL002142

DESCRIPTION: There are three main structural layers - tree canopy, tall-shrub and herbaceous. Tree densities for stems greater than 10 cm dbh may historically have been between 50-200 stems per hectare (Bowles et al. 1994). The tree layer is composed predominantly of *Quercus alba* and *Quercus macrocarpa*, with *Quercus ellipsoidalis* or *Quercus velutina* more common on dry sites, and occasional codominance by *Quercus rubra, Carya* spp., and *Populus* spp. (MNNHP 1993). *Sassafras albidum* can become an important tree layer component in the eastern end of the oak woodland range.

This community may include portions of stands also described as brushland (Grimm 1984, MNNHP 1993) or barrens (Bowles and McBride 1994, White 1994). Shrub cover is usually high (30-50%) with some stands forming impenetrable thickets. Typical shrubs include *Corylus americana* and *Cornus foemina*. Throughout the range of the type, dominant herbs include *Andropogon gerardii, Carex pensylvanica, Desmodium glutinosum, Geranium maculatum*, and many others. These brushlands are dominated by woody species capable of reaching overstory size, but nearly all woody individuals are found in a shrubby state because intense fires are frequent enough to preclude them from reaching overstory size. Other barrens have been described to have scattered woody individuals of canopy size (White 1994).

This community may also include stands described as 'closed savanna' or 'closed woodland' (Swink and Wilhelm 1994, Packard 1988). These stands experience low-intensity but moderately frequent fires that preclude the establishment of fire-sensitive tree saplings of species such as *Acer saccharum, Tilia americana* and *Fagus grandifolia*, but allow the establishment and growth to canopy size of moderately fire-tolerant tree saplings such as *Quercus rubra* and even *Acer nigrum*. Shrub cover is quite low in this subtype due to the high frequency of low-intensity fire. Fuel loads for fires in this community are provided by several cool-season sedges and grasses such as *Carex rosea, Carex pensylvanica, Elymus villosus*, and *Elymus hystrix* (Wilhelm 1991).

Stands occur on level to rolling topography on well-drained outwash plains and coarse-textured end moraines, as well as on moderately fire-protected slopes in the Driftless Area. The pH varies from 6.1-7.3. Soils are excessively to moderately well-drained (dry to dry-mesic). Texture ranges range from loams to sandy loams, and include silt loams (loess-derived) close to bedrock in the Driftless Area. This community may develop on a slope of any aspect so long as the topography encourages infrequent but occasional fire. On shallow-to-bedrock slopes, a lower fire frequency is required to maintain Oak Woodland on south-facing slopes. This is because the combination of shallow soils and high evapotranspiration slows the rate of canopy closure by slowing the rate at which trees grow to canopy size.

Occasional, but often intense fire, is the important natural disturbance which encourages woodland formation. Fires must be infrequent enough to allow tree species to occasionally reach tree size yet frequent enough to kill fire-tolerant tree saplings as well as prevent canopy closure.

Because fires are rather infrequent, a large buildup of woody fuels occurs between fires. Woodland understories, shaded by heavier tree and shrub canopies, do not dry out during spring and fall as quickly as prairie and savanna (Stearns 1974) and so are not always dry enough to burn during these seasons. Additionally these site are often topographically protected from fire by streams or lakes (Bowles et al. 1994). Yet when they do burn, woodlands often burn so intensely that many of the adult trees die, and woodland overstory canopy is temporarily reduced to that of a brushland or brushy oak savanna. With vigorous resprouting of oak grubs and an extended period before another catastrophic fire, these temporal brushlands can recover to a woodland overstory.

Fires were intentionally set by Native Americans in the pre-European settlement era. This may have led to larger expanses of oak woodland than would have occurred without human presence, particularly in the eastern end of the oak woodland range where fire prevented the development of closed forests composed of shade-tolerant tree species (Grimm 1984).

COMMENTS: *2, MCS*. This type typically covers dry to dry-mesic stands, but some mesic stands could also be placed here. Traditionally, partially canopied communities with a canopy cover of 10-50% have been classified as savanna, while communities with greater than 50% canopy cover have been classified as forest (Curtis 1959). Recent studies (Pruka 1994, Faber-Langendoen et al. unpubl.) suggest that there is enough turnover in understory composition along this broad canopy continuum to merit the subdivision of partially canopied communities into two communities: savanna (10-30% canopy) and woodland (30-80% canopy) (Anderson 1991, MNNHP 1993, Packard 1993, Pruka 1994). Forest communities in this region generally have >80% canopy cover. This distinction, however, is not clean. For example, in the Driftless area, drier oak forests on loess are typically treated as part of the dry-mesic white oak -

red oak forest, *Quercus alba - Quercus rubra - Carya ovata* Glaciated Forest (CEGL002068) because of the finer soils that, despite slope and aspect, are more nutrient rich and moist. The driest stands would have been maintained by fire and best fit into this woodland type (H. Dunevitz pers. comm. 2000). This type may occur in Missouri and southern Iowa. Stands in southern Iowa and northern Missouri are currently placed in *Quercus alba - (Carya ovata) / Carex pensylvanica* Glaciated Woodland (CEGL002134).

CONSERVATION RANK: *G3G4.* Most former examples of this community have been eliminated by cultivation, grazing, or conversion to forest due to fire suppression (Curtis 1959, Grimm 1984). Most of the remaining examples are relatively small. Minnesota appears to have the most acreage left.

DISTRIBUTION: This white oak - bur oak woodland is found in the northern prairie-forest border of the midwestern United States, ranging from central Minnesota and Wisconsin south to northeastern Iowa and northern Illinois, and possibly further east in the prairie peninsula.

USFS ECOREGIONS: 212Je:P??, 212Jf:P??, 222Kf:CCC, 222Kg:CCC, 222Lc:CCC, 222Lf:CCC, 222Mb:CCC, 222Md:CCC, 222Me:CCC, 251Aa:C??, 251Ci:CCC
CONSERVATION REGIONS: 35:C, 36:?, 46:C, 47:?, 48:C
STATES: IA? IL MN WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:
IL dry-mesic barren (N) +
MN oak woodland-brushland (southeast section); oak woodland-brushland (big woods section) -
WI southern mesic woodland (white oak-bur oak subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS MACROCARPA - QUERCUS (ALBA, ELLIPSOIDALIS, VELUTINA) WOODLAND ALLIANCE (II.B.2.N.a)

Quercus muehlenbergii - Quercus (alba, velutina) Bluff Woodland

Chinquapin Oak - (White Oak, Black Oak) Bluff Woodland

Chinquapin Oak Bluff Woodland CEGL002144

DESCRIPTION: Stands contain an open tree layer, with *Quercus muehlenbergii* as the characteristic dominant, and *Quercus alba, Quercus velutina, Quercus macrocarpa*, and *Juniperus virginiana* as common associates. *Cornus foemina* may be common in the shrub layer. The ground layer may contain a dry to dry-mesic prairie flora, but little is known about this type, and few stands are available for characterization.

Stands occur in scattered areas along steep, southwest-facing bluffs or slopes, particularly on the Mississippi River. Presumably the underlying soils and bedrock have a calcareous influence.

COMMENTS: *3, MCS*. This association is similar in some respects to limestone glades farther south, such as *Quercus muehlenbergii - Juniperus virginiana / Schizachyrium scoparium - Manfreda virginica* Wooded Herbaceous Vegetation (CEGL005131), and may represent the more northern equivalent of this type. This type is poorly defined and may currently only consist of small inclusions on steep slopes, especially on Mississippi River bluffs. In Wisconsin, this type is almost of historic note only, occurring now in a few locations where cedar glades or bedrock bluff prairies also occur. A single occurrence of good quality in Grant County along the Mississippi River is now being managed to maintain its woodland character (Eric Epstein, WINHP, pers. comm. 1999). Type may have varied from more open savanna or glade-like conditions to more closed-canopy conditions.

CONSERVATION RANK: *G2G3.* This type has a relatively restricted range, occurring in small patches on large bluffs along big rivers. Further evidence from Iowa concerning its status there is needed to more firmly establish the rank of this type.

DISTRIBUTION: This chinquapin oak woodland type occurs primarily on bluffs of large rivers in the midwestern United States, ranging from Iowa and Illinois to Michigan and Wisconsin.

USFS ECOREGIONS: 222Lc:CCC, 251:P
CONSERVATION REGIONS: 46:C, 48:C
STATES: IA IL? MI WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL?	dry-mesic savanna (N) ?
MI	inland oak opening +
WI	cedar glade =

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS MUEHLENBERGII WOODLAND ALLIANCE (II.B.2.N.a)

Quercus muehlenbergii - Quercus macrocarpa / Andropogon gerardii Ravine Woodland

Chinquapin Oak - Bur Oak / Big Bluestem Ravine Woodland

Chinquapin Oak - Bur Oak Ravine Woodland CEGL002145

DESCRIPTION: This community is dominated by broad-leaved deciduous trees. *Quercus muehlenbergii* dominates the overstory of the driest stands with *Quercus macrocarpa* as a subdominant. *Quercus macrocarpa* becomes more important in sites where conditions are more mesic until, eventually, the community grades into a forest with relatively little *Quercus muehlenbergii*. *Ulmus* spp. and *Cercis canadensis* can be abundant, especially as smaller individuals, and *Juniperus virginiana* is uncommon. The potential of *Ulmus* spp. to remain as an important part of this community is in doubt because of Dutch elm disease. The two most common shrubs are *Cornus drummondii* and *Symphoricarpos orbiculatus*. *Celtis occidentalis* and *Ulmus* spp. are often in the shrub layer, especially on sites that have not been burned recently. Herbaceous dominants include *Schizachyrium scoparium* and *Panicum virgatum*.

Tree canopy cover is not completely closed in this community; it may be between 25-80%. The height of dominant trees is limited on drier sites. Shrub cover varies inversely with tree canopy cover, achieving 50-60% in some of the drier stands surveyed by Abrams (1986, 1988). The high values for shrub canopy cover may be a result of the increase in fire intervals since the 1850s. Shrub canopy fell from 59.7% to 9.5% when a woodland of this type was burned in two consecutive springs (Abrams 1988).

This community occurs on moderate to steep south-facing and west-facing slopes of ravines and river valleys. The surface is not saturated or flooded by groundwater at any time during the year. Drought is relatively common, occurring in 38% of the months from 1931-1968 (Abrams and Knapp 1986). Soils of this community are deep, moderately well-drained to well-drained silts and loams. The parent material is primarily loess or glacial till. Cherty shales or limestones are the parent material in some areas of Kansas (Lauver et al. 1999).

The average temperature of northeastern Kansas ranged from -2.7 to 26.6 C with an average of 12.8 C for the period 1951-1980. Average rainfall was 835 mm. Most of the precipitation falls as rain in May and June. December through February are the driest months (Abrams and Knapp 1986).

Drought and fire were common natural disturbances in this community type. Fire was very important in determining which species were able to survive and reproduce successfully. Fire killed or stunted the woody growth enough to maintain the relatively open canopy necessary for the dominant plants to reproduce successfully. The mean fire intervals for the period 1862-1983 in three stands studied by Abrams (1985) were 11.2, 12.6, and 19.7 years based on fire scars in the cross section of trees. This may be longer than the actual fire intervals because not all fires in a stand result in identifiable scars. Fire intervals prior to settlement in the Flint Hills of Konza were thought to be 2-3 years (Abrams 1985).

COMMENTS: *2, MCS*. Discuss with Missouri and Kansas whether or not this type should be combined with *Quercus macrocarpa / Andropogon gerardii - Hesperostipa spartea* Woodland (CEGL002053).

CONSERVATION RANK: *G2.* This woodland type has a relatively restricted distribution in a predominantly prairie landscape. Remaining occurrences have been logged, grazed, impacted by herbicides, or have begun to succeed to other community types.

DISTRIBUTION: This chinquapin oak - bur oak woodland community is found in the central tallgrass prairie region of the United States, particularly in northeastern Kansas and possibly adjacent states.

USFS ECOREGIONS: 222De:PPP, 251Cq:CCC, 251Ea:CCC
CONSERVATION REGIONS: 36:C, 37:C
STATES: KS **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Celtis occidentalis - Quercus macrocarpa* Type (Abrams 1986). Abrams' analysis of a gallery forest at Konza Prairie in northeastern Kansas found this closely related mesic forest . This allied forest community has a similar suite of species but differs in structure, species dominance patterns, and environmental parameters. The forest was dominated by *Quercus macrocarpa* and *Celtis occidentalis*, had a greater basal area/ha of trees, and less shrub cover. It is also generally on lower, gentler slopes, and has more silt content to its soils.

USNVC HIERARCHY: QUERCUS MUEHLENBERGII WOODLAND ALLIANCE (II.B.2.N.a)

Quercus stellata - Quercus velutina / Schizachyrium scoparium Woodland

Post Oak - Black Oak / Little Bluestem Woodland

Central Tallgrass Post Oak Woodland CEGL005281

DESCRIPTION: The open tree canopy is dominated by *Quercus stellata* and *Quercus velutina*, with minor associates of *Carya alba (= Carya tomentosa)* and *Carya ovata*. Saplings of *Sassafras albidum* and *Prunus serotina* may be present. The herbaceous layer probably contained a fairly diverse mix of prairie and forest flora, with prairie grasses such as *Schizachyrium scoparium* abundant (T. Nigh pers. comm. 1999, McClain et al. 1998).

Stands occur on dry narrow ridges and steep slopes of glaciated ridges, or on rolling topography that was prone to fires (T. Nigh pers. comm. 1999, McClain et al. 1998).

Historically stands were maintained by frequent fires. McClain et al. (1998) report a total of 36 fires over a 75-year period from 1776 to 1850 in one stand in Hamilton County, Illinois. Increased scarring was noted during drought years.

COMMENTS: *3, MCS*. As described in Missouri, this type may remain in woodland condition due to more xeric slope conditions, whereas in Illinois, stands, which occur on more rolling topography, may have remained open due to frequent fires, and the woodland/forest conditions are more prevalent under reduced fires. McClain et al. (1998) note that this type occurs in the post flatwoods region of Illinois, but stands of this type lack the micro-depressions typical of post oak flatwoods, *Quercus stellata / Cinna arundinacea* Flatwoods Forest (CEGL002405), nor do they contain the typical indicators of the xero-hydric conditions of flatwoods, such as *Cinna arundinacea*.

CONSERVATION RANK: *G1G3.* Few stands of this type remain.

DISTRIBUTION: This post oak - black oak woodland type occurs in the glaciated central tallgrass region of the United States, particularly in northern Missouri and south-central Illinois.

USFS ECOREGIONS: 222Gb:CCC, 251Cc:CCP, 251Cd:CCP, 251Ci:CCC
CONSERVATION REGIONS: 36:C
STATES: IA? IL MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL dry barren (S) +
MO dry savanna +

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS STELLATA - QUERCUS MARILANDICA WOODLAND ALLIANCE (II.B.2.N.a)

Quercus velutina - (Quercus ellipsoidalis) - Quercus alba / Deschampsia flexuosa Woodland

Black Oak - (Northern Pin Oak) - White Oak / Wavy Hairgrass Woodland

Black Oak - Northern Pin Oak / Common Hairgrass Woodland CEGL005029

DESCRIPTION: The canopy is open. Dominant species include *Quercus alba, Quercus ellipsoidalis*, and *Quercus velutina*. *Pinus banksiana* and *Pinus strobus* are common associates. The ground layer consists of a near continuous mat of *Carex pensylvanica* and *Deschampsia flexuosa*. Other species present include *Arctostaphylos uva-ursi, Comptonia peregrina, Chimaphila umbellata*, and *Pteridium aquilinum*. *Andropogon gerardii* and *Schizachyrium scoparium* may occasionally occur in this type. (Cleland et al. 1994)

Stands occur on excessively well-drained sands of outwash plains. Soil development is minimal, with a thin A horizon (5-10 cm) (Cleland et al. 1994).

This is a very dry oak woodland type, and historically may have experienced fires. Many of these stands may have been oak or pine-oak barrens prior to European settlement (Cleland et al. 1994)

COMMENTS: *3, MCS*. In southern Michigan this is on the fringe of oak barrens, *Quercus velutina - (Quercus alba) - Quercus ellipsoidalis / Schizachyrium scoparium - Lupinus perennis* Wooded Herbaceous Vegetation (CEGL002492), and further north, of oak-pine barrens, *Pinus banksiana - (Quercus ellipsoidalis) / Schizachyrium scoparium* - Prairie Forbs Wooded Herbaceous Vegetation (CEGL002490) and *Pinus strobus - Quercus alba - (Quercus velutina) / Andropogon gerardii* Wooded Herbaceous Vegetation (CEGL005127). In Ontario, this type is found at Turkey Point. There, as well, a variant described as "Bur Oak - White Oak - Shagbark Hickory Woodland" is placed with this type (Bakowsky pers. comm. 1998).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This oak woodland type is found in the upper midwestern United States and Canada, particularly in central Michigan and Ontario.

USFS ECOREGIONS: 212Hp:CPP, 212Hq:CPP, 212Hr:CPP, 212Ht:CPP, 212Hu:CPP, 212Hv:CPP, 212Hw:CPP, 212Hx:CPP
CONSERVATION REGIONS: 48:C
STATES: MI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI oak barren +

OTHER SYNONYMY: ELTP 1 - Northern pin oak - white oak- *Deschampsia* plant association (Cleland et al. 1994) =

USNVC HIERARCHY: QUERCUS ALBA - (QUERCUS VELUTINA) WOODLAND ALLIANCE (II.B.2.N.a)

Quercus alba - Quercus velutina - Quercus palustris / Carex pensylvanica Woodland

White Oak - Black Oak - Pin Oak / Pennsylvania Sedge Woodland

Lakeplain Mesic Oak Woodland CEGL005054

DESCRIPTION: Oaks (*Quercus alba, Quercus macrocarpa, Quercus palustris*, and *Quercus velutina*) dominate the canopy, while the ground layer is dominated by *Amphicarpaea bracteata, Andropogon gerardii, Apios americana, Calamagrostis canadensis, Carex pensylvanica, Galium boreale*, and *Pteridium aquilinum*. Tree densities for stems greater than 7.0 cm dbh average 98 stems/ha, with an average canopy cover of 48% (Bakowsky 1988).

This community occurs on undisturbed sand ridges and raised areas in poorly drained glacial lakeplains. The soils are very loamy sands, or sometimes sand. The pH is typically 5.0-7.2.

COMMENTS: *2, MCS*. It is possible that this type is in Ohio, but questionable. There is not much prairie flora because of the shady conditions.

CONSERVATION RANK: *G2.* This type may have a restricted distribution within the lakeplain of the Great Lakes. Many sites have been converted for agricultural development or have succeeded to forest due to fire suppression.

DISTRIBUTION: This community is found in the southern Great Lakes lakeplain of the United States and Canada, ranging from southeastern Michigan to southwestern Ontario.

USFS ECOREGIONS: 222Ib:CCC, 222Ic:CCC, 222Ie:CCC
CONSERVATION REGIONS: 48:C
STATES: MI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI lakeplain oak opening +

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS ALBA - (QUERCUS VELUTINA) WOODLAND ALLIANCE (II.B.2.N.a)

Quercus bicolor - (Quercus macrocarpa, Quercus stellata) Woodland

Swamp White Oak - (Bur Oak, Post Oak) Woodland

Swamp White Oak Woodland CEGL005181

DESCRIPTION: This community has an open tree canopy dominated by *Quercus bicolor* with *Quercus macrocarpa* sparse to codominant. *Quercus stellata, Quercus rubra* and *Quercus alba* may also be found, especially on the drier portions of this mesic to wet-mesic community.

This community is found on silt loam soils formed over glacial till or loess (Bowles and McBride 1996).

Fires were part of the historic natural disturbance regime that kept these stands open (B. McClain pers. comm. 1997).

COMMENTS: *3, MCS*. Bowles and McBride (1996) describe this type as both mesic and wet-mesic. Historically, stands were more open than they are today.

CONSERVATION RANK: *G1.*

DISTRIBUTION: This swamp white oak woodland community type is found in central Illinois and possibly Iowa.

USFS ECOREGIONS: 251Cf:CCC, 251Cj:CCC
CONSERVATION REGIONS: 36:C, 48:C
STATES: IA? IL **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL mesic savanna (N) I

OTHER SYNONYMY: Wet-mesic Woodland (Bowles and McBride 1996) =

USNVC HIERARCHY: QUERCUS MACROCARPA - QUERCUS (ALBA, ELLIPSOIDALIS, VELUTINA) WOODLAND ALLIANCE (II.B.2.N.a)

Quercus macrocarpa - Quercus bicolor - (Celtis occidentalis) Woodland

Bur Oak - Swamp White Oak - (Northern Hackberry) Woodland

Bur Oak Bottomland Woodland CEGL002140

DESCRIPTION: This community contains large-diameter stems of *Quercus macrocarpa* (>90 cm dbh) with scattered *Quercus bicolor*. *Celtis occidentalis* is much more common in the smaller size classes. Lower terraces of this community can contain subdominants such as *Gleditsia triacanthos, Platanus occidentalis*, and *Ulmus americana*, while higher terraces can contain subdominants such as *Juglans nigra, Ulmus americana*, and *Ulmus rubra*. *Euonymus atropurpurea* is a common understory shrub. The ground layer is dominated by *Elymus virginicus* and *Laportea canadensis* (McClain et al. 1993).

This community occurs on river floodplain terraces. Soils associated with this type are silt loam, with neutral pH. The soil profile has a black A horizon to 95 cm deep, is high in organic matter, has moderate permeability, and is very high in available water capacity (McClain et al. 1993).

Information is needed on the frequency of flooding in this type.

COMMENTS: *2, MCS*. In Wisconsin several examples have recently been found, but grazing has influenced their current composition and structure. Missouri recommends that the name be changed to *Quercus macrocarpa - Quercus bicolor - Quercus palustris / Carex* spp. Woodland. Compare with *Quercus bicolor - (Quercus macrocarpa, Quercus stellata)* Woodland (CEGL005181) and *Quercus palustris - Quercus bicolor - (Liquidambar styraciflua)* Mixed Hardwood Forest (CEGL002432). In Missouri, their wet-mesic bottomland savanna may be treated as a phase of their wet-mesic bottomland forest (M. Leahy pers. comm. 1999).

CONSERVATION RANK: *G1*. No sizeable examples of an intact rich soil savanna or woodland are known to exist in Illinois or Wisconsin. Most have been destroyed or converted to closed-canopy forests. Grazing has influenced composition and structure in all known Wisconsin stands. Small remnants of this type do occur in Missouri.

DISTRIBUTION: This bur oak - swamp white oak woodland community is found in the midwestern United States.

USFS ECOREGIONS: 212Jm:???, 222Kh:CCC, 251:C
CONSERVATION REGIONS: 36:, 46:C
STATES: IL MO WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	mesic savanna (N) I
MO	wet-mesic savanna +
WI	southern mesic woodland (bur oak-swamp white oak subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS MACROCARPA - QUERCUS (ALBA, ELLIPSOIDALIS, VELUTINA) WOODLAND ALLIANCE (II.B.2.N.a)

Quercus macrocarpa / Andropogon gerardii - Hesperostipa spartea Woodland

Bur Oak / Big Bluestem - Porcupine Grass Woodland

Western Tallgrass Bur Oak Woodland CEGL002053

DESCRIPTION: The overstory of this community is open and dominated by *Quercus macrocarpa*. *Quercus muehlenbergii* can be a common associate. Shrubs are absent to common and include *Cornus drummondii, Ceanothus herbaceus (= Ceanothus ovatus), Corylus americana, Prunus americana, Rhus glabra, Ribes missouriense, Symphoricarpos occidentalis*, and *Zanthoxylum americanum*. The herbaceous stratum can be similar to dry prairie. It includes the grasses *Andropogon gerardii, Schizachyrium scoparium, Sorghastrum nutans, Sporobolus heterolepis*, and *Hesperostipa spartea (= Stipa spartea)*, as well as *Maianthemum stellatum, Monarda fistulosa*, and *Solidago canadensis*. In the past, periodic fires kept the canopy from closing. Where fire regimes have been disrupted, this community often begins to succeed to other, more closed oak types (Nelson 1985, Lauver et al. 1999, Steinauer and Rolfsmeier 2000).

This community occurs near floodplains and on gently sloping to steep upland mesic sites especially within 30 km of the Missouri River but possibly along other rivers. In Nebraska it may have been most abundant in the southeast because conditions are most suitable for tree growth there. The soils on which this community occurs are silt or loam, shallow to deep, with a pH range from 5.6-7.3. The soils of this community are moderately well-drained to well-drained. The parent material is loess or glacial till (Nelson 1985, Lauver et al. 1999, Steinauer and Rolfsmeier 2000).

This community depends on fire to maintain a prairie understory and open canopy structure (Nelson 1985).

COMMENTS: *2, MCS*. In Missouri it's possible that *Quercus alba, Quercus rubra*, and *Quercus velutina* were also present in the loess hills region. The type may have once occurred widely across glaciated northern Missouri (T. Nigh pers. comm. 2000). In Nebraska this type is fairly heterogeneous and needs further review. Currently Nebraska combines oak savanna and oak woodland in this type (Steinauer and Rolfsmeier 2000). This community may overlap with *Quercus macrocarpa / (Amelanchier alnifolia, Cornus drummondii) / Aralia nudicaulis* Forest (CEGL002072) in a more closed condition, and can overlap with *Quercus macrocarpa / Andropogon gerardii - Panicum virgatum* Woodland (CEGL002052) in stream bottoms. Type should be in southeastern South Dakota on loess soils.

CONSERVATION RANK: *G2G3*. This community has been highly degraded in the mesic sites where it occurred historically. Bur oak woodlands and forests have recently spread upslope into drier areas in the absence of fires. Sites do occur in Missouri in association with loess hill prairies, but are not tracked for conservation purposes because of low quality (M. Leahy pers. comm. 1999).

DISTRIBUTION: This community is associated with the floodplains of rivers and streams in the central-western tallgrass region of the midwestern United States, ranging from Nebraska and northeastern Kansas to northwestern Missouri and western Iowa.

USFS ECOREGIONS: 251Ca:CCP, 251Cb:CCP, 251Cd:CC?, 251Cp:CCC, 251Cq:CCP, 332E:PP
CONSERVATION REGIONS: 36:C
STATES: IA KS MO NE SD? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO dry savanna +
NE oak woodland =

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS MACROCARPA WOODLAND ALLIANCE (II.B.2.N.a)

Quercus macrocarpa / Andropogon gerardii - Panicum virgatum Woodland

Bur Oak / Big Bluestem - Switchgrass Woodland

Western Tallgrass Bur Oak Mesic Woodland CEGL002052

DESCRIPTION: The overstory of this community is dominated by short to moderately tall fire-resistant, deciduous trees. In Nebraska, the typical overstory was historically dominated by *Quercus macrocarpa*. Currently, in the absence of fire, typical associates include *Carya illinoinensis, Celtis occidentalis, Fraxinus pennsylvanica, Juglans nigra, Juniperus virginiana, Quercus macrocarpa*, and *Ulmus* spp. There is often a short-shrub layer, but it is rarely extensive. *Symphoricarpos orbiculatus* and small trees make up this layer. The understory is composed of a mixture of woodland and grassland species, including *Andropogon gerardii, Panicum virgatum*, and *Spartina pectinata* (Lauver et al. 1999, Steinauer and Rolfsmeier 2000).

This community occurs in river valleys, on nearly level to gently sloping soils. Soils are deep, fertile and relatively mesic. They usually have a significant silt component. Drought is common in this community but the sheltered position in the valleys and the presence of a watercourse somewhat ameliorate the effects (Lauver et al. 1999, Steinauer and Rolfsmeier 2000).

This community was historically dominated by tall, fire-resistant *Quercus macrocarpa* (Abrams 1986). In the absence of fire there has been a marked shift to co-dominance by more fire-tolerant hardwoods (Abrams 1986).

COMMENTS: *2, MCS*. This type may have a temporarily flooded hydrology.

CONSERVATION RANK: *G1G2.* There are probably fewer than 20 occurrences of this community rangewide. This type has a somewhat restricted distribution in a predominantly prairie landscape; it occurs in river valleys on deep, fertile, and fairly mesic soils. It is reported from eastern Kansas (where it is ranked SU) and eastern Nebraska (SU), and it may also occur in Oklahoma. No occurrences are currently documented. Probably many occurrences have been destroyed by conversion to agriculture, or degraded by overgrazing and fire suppression.

DISTRIBUTION: This bur oak woodland occurs in the central-western tallgrass prairie region of the United States, ranging from eastern Nebraska to possibly Oklahoma.

USFS ECOREGIONS: 251:C
CONSERVATION REGIONS: 37:C
STATES: KS NE OK? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE mesic bur oak forest =

OTHER SYNONYMY: *Quercus macrocarpa - Quercus muehlenbergii* Type (Abrams 1986) I. Abrams (1986) *Quercus macrocarpa - Q. muehlenbergii* type may be too dry to fit this type but no understory or soils data are given for his types., *Celtis occidentalis - Quercus macrocarpa* Type (Abrams 1986) I

USNVC HIERARCHY: QUERCUS MACROCARPA WOODLAND ALLIANCE (II.B.2.N.a)

Quercus stellata / (Danthonia spicata, Croton willdenowii) Woodland

Post Oak / (Poverty Oatgrass, Broadleaf Rushfoil) Woodland

Post Oak Clay Barrens CEGL005057

DESCRIPTION: The best examples of this type occur in flats, where *Quercus stellata* is the dominant tree, and the barrens area range in size from 0.25-2 ha. Although the barrens occupy the highest elevational point in the stand, the trapped water forms pools that may contain *Eleocharis tenuis var. verrucosa (= Eleocharis verrucosa), Carex annectens, Eleocharis wolfii, Ranunculus pusillus*, and *Isoetes melanopoda*. In July, when the site is dry and the above species have faded away, *Danthonia spicata* and *Schizachyrium scoparium* dominate the ground layer. Small annuals, such as *Diodia teres, Hypericum drummondii, Hypericum gentianoides*, and *Croton willdenowii*, are abundant. *Aristida ramosissima* and *Trichostema setaceum* may also be abundant. Other species present in the barrens include *Boltonia asteroides, Carex bushii, Coreopsis tripteris, Helianthus divaricatus, Helianthus mollis, Hypericum denticulatum, Hieracium gronovii, Krigia biflora, Lechea tenuifolia, Liatris spicata, Dichanthelium depauperatum (= Panicum depauperatum), Parthenium integrifolium, Poa wolfii, Polygala sanguinea, Orbexilum pedunculatum var. psoralioides (= Psoralea psoralioides), Solidago nemoralis, Oligoneuron rigidum (= Solidago rigida)*, and *Trifolium reflexum* (Aldrich and Homoya 1986, Homoya 1994).

Stands occur in areas with a dense, relatively impervious, argillic layer of soil at or just below the surface. This clay layer apparently impedes water percolation and subsoil recharge, resulting in droughty conditions. Plant roots may also have a difficult time penetrating the layer. It also causes temporary ponding (vernal pools) that persist long enough to influence the species composition (Aldrich and Homoya 1986, Homoya 1994).

Fire appears to play a role in this type. Early land survey records and scientific visits to these barrens make reference to burnt-over flats and barrens. Only a few trees contained fire scars in more recent visits. The suppression of fire may account for the decline of *Trifolium reflexum* at the site (Aldrich and Homoya 1986).

COMMENTS: *3, MCS*. Concept of this type is taken from Indiana state type - clay barrens (Homoya et al. 1985). But this type is very limited, perhaps only one stand, which occurs as a mosaic with *Quercus stellata / Cinna arundinacea* Flatwoods Forest (CEGL002405). Therefore, it is possible that this type should be treated as part of *Quercus stellata / Cinna arundinacea* Flatwoods Forest (CEGL002405).

CONSERVATION RANK: *G1*. There are probably fewer than 6 occurrences of this community rangewide. It is only reported from Indiana where it is ranked SU? No occurrences are currently documented. Historic acreage and trends are unknown. This community is restricted to dry clay soils in southwestern Indiana.

DISTRIBUTION: This community is reported only from Indiana, from one ecoregion province.

USFS ECOREGIONS: 222Db:CC?, 222Dc:CCC
CONSERVATION REGIONS: 44:C
STATES: IN KY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IN clay barrens =

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS STELLATA - QUERCUS MARILANDICA WOODLAND ALLIANCE (II.B.2.N.a)

Quercus stellata / Cinna arundinacea Flatwoods Forest

Post Oak / Stout Woodreed Flatwoods Forest

Post Oak Flatwoods CEGL002405

DESCRIPTION: The vegetation contains a dominant tree layer with an average canopy cover of 80% or more. Trees may be stunted due to the unfavorable soil conditions. The canopy is typically strongly dominated by *Quercus stellata*, but may include *Quercus alba, Quercus bicolor, Quercus falcata, Quercus marilandica* and, more rarely *Quercus palustris*. In Illinois, the shrub and woody vine strata may contain *Parthenocissus quinquefolia, Rosa carolina, Rubus allegheniensis, Rubus flagellaris*, and *Toxicodendron radicans* (Taft et al. 1995). The shrub strata may not be distinct. In Indiana, shrubs include *Rhus copallinum* and *Hypericum prolificum*. The herbaceous layer can be fairly disparate from one stand to the next. Some stands can be dominated by *Cinna arundinacea, Chasmanthium latifolium* and *Eleocharis tenuis var. verrucosa (= Eleocharis verrucosa)*. Plants more typical of dry and dry-mesic soil grow on slight rises, including *Carex festucacea, Carex pensylvanica, Danthonia spicata, Helianthus divaricatus*, and others (Aldrich and Homoya 1986, Taft et al. 1995). In addition to the nominal species, the canopy in Kentucky may have *Quercus alba* and *Carya texana*. Herbaceous cover is sparse to moderate; leaf litter is the dominant ground cover. A fragipan layer leads to 'xerohydric' conditions. Local dominance in depressions is of wetland species (*Juncus*, etc.). Dry areas in Kentucky will have *Manfreda virginica, Croton willdenowii, Danthonia spicata, Porteranthus stipulatus, Pycnanthemum tenuifolium*, and *Prenanthes aspera* (characteristic of open areas). These areas grade downslope into bottomland hardwood forest and cypress swamp and upslope into mesic upland or dry oak-hickory forest.

This community occurs on level or nearly level sites. Soils have a well-developed hardpan that causes a shallowly perched water table (White and Madany 1978). The soil moisture fluctuates widely throughout the growing season. Depressions often contain seasonal or ephemeral (vernal) ponds. This community usually is found over glacial till of Illinoisan age, but its distribution south of glacial deposits in Kentucky is uncertain. In Missouri, these flatwoods once occupied broad, flat ridges of the Salem Plateau in the Ozarks, where thin loess soils occur over Ordovician residuum of cherty clay loam (M. Leahy pers. comm. 1999). In Kentucky, this community occurs on relatively high flat areas that are no longer flooded, such as ancient Quaternary or Tertiary post-glacial meltwater lakebeds and high terraces of the Upper Gulf Coastal Plain and Shawnee Hills.

COMMENTS: *2, MCS*. Rangewide review may find that, apart from the post oak dominance and flatwoods environment, understory composition may vary widely (see Taft et al. 1995). In Kentucky, this type is thought to be fire-suppressed; structure varies from forest to woodland (M. Evans pers. comm. 1999). The former is thought to represent the fire-suppressed condition, the latter the more natural state, remnants of which still exist in the Jackson Purchase area. Many noteworthy herbaceous species are characteristic of prairie barrens. Compare also with other Kentucky "Flatwoods" types. In Missouri stands also may contain a large prairie flora (see Ladd and Heumann 1994). See Taft et al. (1995) for an excellent review of this type in Illinois. Clay barrens in Indiana, *Quercus stellata / (Danthonia spicata, Croton willdenowii)* Woodland (CEGL005057), may be a variant of this type.

CONSERVATION RANK: *G2G3.* There are probably fewer than 50 occurrences of this community rangewide. Currently 23 occurrences have been documented in Illinois, Indiana, and Missouri. The community is ranked S2 in Illinois, Indiana, and Missouri, and S? in Kentucky; it may also occur in Arkansas. There are probably fewer than 10,000 acres rangewide; currently over 3150 acres have been documented. Some occurrences have been destroyed or degraded by clearing and selective logging, and some have been degraded by grazing. In Missouri most examples have been converted to fescue pastures. This community occurs in a fairly broad range, but it has somewhat restricted environmental requirements.

DISTRIBUTION: This dry post oak flatwoods type is found in the central midwestern United States in both glaciated and unglaciated areas, with the majority of the range over glacial till of Illinoisan age, to the north of the Ohio River. States include Illinois, Indiana, Kentucky, Missouri, and possibly in the Mississippi Delta of Arkansas.

USFS ECOREGIONS: 222Ab:CCC, 222Ae:CC?, 222Af:CCP, 222Db:CCC, 222Dc:CCC, 222Ga:CCC, 222Gb:CCC, 222Gc:CCC, 222Ge:CCC, 231Ga:???, 231Gc:???, 234Ac:CCC, 234Ae:CC?, 251D:PP
CONSERVATION REGIONS: 32:?, 38:C, 39:?, 42:C, 43:P, 44:C
STATES: AR IL IN KY MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

	IL	southern flatwoods +
	IN	dry flatwoods =
	MO	flatwoods +

OTHER SYNONYMY: *Quercus stellata - Cinna arundinacea* (Fralish 1987) =

USNVC HIERARCHY: QUERCUS STELLATA FLATWOODS FOREST ALLIANCE (I.B.2.N.a)

Pinus virginiana - Pinus (rigida, echinata) - (Quercus prinus) / Vaccinium pallidum Forest

Virginia Pine - (Pitch Pine, Shortleaf Pine) - (Rock Chestnut Oak) / Hillside Blueberry Forest

Appalachian Low Elevation Mixed Pine Forest CEGL007119

DESCRIPTION: This community is a needle-leaved evergreen forest with a somewhat open to closed canopy. A deciduous subcanopy may be present, especially in areas where fire has been excluded. The shrub layers can be sparse to very dense and are composed of tall and short shrubs, predominantly ericaceous species. Herb cover is sparse, and leaf litter often dominates the ground layer. *Pinus virginiana* is the canopy dominant throughout the range of the type. In the southern Appalachians and southern Ridge and Valley it may occur with mixes of *Pinus rigida, Pinus echinata*, or *Pinus strobus*. Within its range, *Pinus pungens* may be present as a very minor component. Small stems of *Quercus prinus, Quercus coccinea, Acer rubrum, Nyssa sylvatica*, and *Oxydendrum arboreum* are common in the subcanopy and sapling strata, particularly in areas where fire has been excluded. In the southern Blue Ridge/Piedmont and southern Blue Ridge/Ridge and Valley transition regions, *Quercus marilandica, Quercus falcata*, and *Quercus stellata* can be deciduous components. Common shrub dominants include *Vaccinium pallidum, Vaccinium stamineum*, and *Kalmia latifolia*. Other typical shrubs can include *Gaylussacia ursina, Gaylussacia baccata, Sassafras albidum*, and *Vaccinium hirsutum* (southwestern North Carolina and southeastern Tennessee only). *Smilax glauca* and *Smilax rotundifolia* can be common vines. Characteristic herbaceous species from the southern Blue Ridge and southern Ridge and Valley include *Baptisia tinctoria, Chimaphila maculata, Dichanthelium commutatum, Epigaea repens, Euphorbia corollata, Galax urceolata, Hypoxis hirsuta, Iris verna, Pityopsis graminifolia var. latifolia, Pteridium aquilinum var. latiusculum*, and *Schizachyrium scoparium*. Typical herbs from examples in the western portion of the range (Interior Low Plateau) include *Antennaria plantaginifolia, Antennaria solitaria, Carex albicans var. albicans (= Carex artitecta), Danthonia spicata, Dichanthelium dichotomum, Lespedeza violacea (= Lespedeza intermedia), Hieracium gronovii, Hieracium venosum, Krigia biflora, Solidago erecta*, and *Tephrosia virginiana* (M. Homoya pers. comm. 1999). In some of these examples *Opuntia humifusa, Calamagrostis porteri ssp. insperata*, and *Solidago squarrosa* may occur locally.

Stands of this forest occur on narrow ridges and knobs, steep, upper slopes, bluff and cliff tops, and other exposed sites throughout the range of the type. They are found primarily on south-, southeast- or southwest-facing aspects on excessively drained, shallow soils. In the Blue Ridge Escarpment region, the western margin of the Blue Ridge, and west into the Ridge and Valley and Cumberland Mountains, this xeric forest occurs on convex slopes and ridges below 610 meters (2000 feet) elevation, over soils classed as Inceptisols, typically Lithic Dystrochrepts originating from sandstone, shale and other noncalcareous parent material. Its environmental situation in the western Alleghenies is not known. In the Interior Low Plateau of Kentucky, Tennessee, and Indiana, this association occurs in edaphically extreme situations, including bluff tops and narrow ridges in thin soils weathered from relatively acidic caprocks with southern and western aspects, as well as other similar slopes, over cherty limestone, siltstones, sandstones, and shales. In particular, in the Knobstone Escarpment Subsection (a few Indiana counties just north of Louisville, Kentucky) it occurs in glade-like situations on steep slopes with thin soils.

Southern pine beetle (*Dendroctonus frontalis*) can cause significant damage to canopy trees in this community. This forest is also susceptible to damage by fire and has been found to be particularly sensitive to ozone, which causes foliar damage of *Pinus virginiana* (Burns and Honkala 1990a).

COMMENTS: *1, SCS*. Some vegetation formerly placed (at least conceptually) in the *Pinus virginiana - Quercus (coccinea, prinus)* Forest Alliance (A.408) and its provisional association *Pinus virginiana - Quercus (coccinea, prinus)* Forest (CEGL005040), has been transferred here, with this association (CEGL007119) becoming more geographically inclusive. In Indiana examples, the substrate is primarily a matrix of acidic siltstone, shale, and sandstone. Rarely are cliffs formed; instead the setting is mostly very steep slopes with high hills and deep ravines.

Early successional vegetation associated with old fields, old pastures, clearcuts, and burned or eroded areas and dominated by *Pinus virginiana* is classified as *Pinus virginiana* Successional Forest (CEGL002591). Appalachian xeric oak forests with similar floristics, but with a mainly deciduous canopy are classed in *(Quercus prinus, Quercus coccinea) / Kalmia latifolia / Galax urceolata* Forest (CEGL006271). Appalachian shale forests and woodlands with *Pinus virginiana* occur on steep, shaley slopes and have a stunted canopies and sparse herb and shrub strata, characterized by species adapted to shaley substrates. These shale communities are classed in *Pinus virginiana - Quercus (coccinea, prinus)* Forest Alliance (A.408) and *Pinus (rigida, pungens, virginiana) - Quercus prinus* Woodland Alliance (A.677).

CONSERVATION RANK: *G4?.* This xeric evergreen forest community will be maintained on sites where local soil conditions, topographic extremes, or occasional fire function to retard hardwood invasion. Infestations of southern pine beetle (*Dendroctonus frontalis*) can cause mortality of canopy trees. Examples affected by southern pine beetle in the Great Smoky Mountains can have up to 80-90% standing dead pine.

DISTRIBUTION: This community occurs primarily in the Appalachian region of the United States, ranging from central Pennsylvania, south and west through the Ridge and Valley, Blue Ridge, and Cumberland Plateau to northern Georgia and Alabama, extending westward to scattered areas in the Interior Low Plateau and eastward into the upper Piedmont. It is reported from the states of Georgia, North Carolina, South Carolina, Tennessee, Kentucky, Pennsylvania, Indiana, Ohio, and is probably in Maryland, Virginia, and West Virginia.

USFS ECOREGIONS: 221Ec:CCP, 221Ed:CCP, 221Ef:CCP, 221Eg:CCC, 221Ha:CCC, 221Hb:CCC, 221Hc:CCP, 221He:CCC, 221Ja:CCC, 221Jb:CCC, 222Da:CCC, 222Dc:CCC, 222Dg:CCC, 222Dj:CCC, 222Eg:CCC, 222Ej:CCC, 222El:CCC, 222En:CCC, 222Eo:CCC, 222Fd:CCC, 222Ff:CCC, 231Aa:CCC, 231Ae:CCC, 231Cd:CCC, 231Da:CCC, 231Dc:CCC, M221Aa:CCP, M221Ab:CCC, M221Ac:CCC, M221Bd:CCP, M221Be:CCP, M221Cd:CCC, M221Dc:CCC, M221Dd:CCC

CONSERVATION REGIONS: 44:C, 49:C, 50:C, 51:C, 52:C, 59:C, 61:C

STATES: AL GA IN KY MD? NC OH? PA SC TN VA? WV? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IN	dry upland forest +
OH?	appalachian oak forest ?

OTHER SYNONYMY: IA7c. Xeric Virginia Pine Ridge Forest (Allard 1990), Virginia Pine: 79 (Eyre 1980), Virginia Pine - Oak: 78 (Eyre 1980), Virginia pine forest (CAP)

USNVC HIERARCHY: PINUS VIRGINIANA FOREST ALLIANCE (I.A.8.N.b)

Quercus alba - Quercus rubra - Quercus prinus - Acer saccharum / Lindera benzoin Forest

White Oak - Northern Red Oak - Rock Chestnut Oak - Sugar Maple / Northern Spicebush Forest

White Oak - Chestnut Oak - Maple Acid Forest CEGL002059

DESCRIPTION: Stands are dominated by *Quercus alba, Quercus rubra*, and *Acer saccharum*. *Quercus prinus* is often present and occasionally codominant. Other minor associates include *Acer rubrum, Carya ovata, Fagus grandifolia, Liriodendron tulipifera, Nyssa sylvatica*, and *Quercus velutina*. The shrub and small-tree layer includes *Amelanchier arborea, Carpinus caroliniana, Cercis canadensis, Corylus americana, Cornus florida*, and *Ostrya virginiana*. Ericaceous shrubs may be uncommon. The herbaceous layer includes *Aralia nudicaulis, Carex pensylvanica, Carex communis, Hieracium venosum, Lysimachia quadrifolia*, and *Maianthemum stellatum (= Smilacina stellata)* (Anderson 1996, Fike 1999).

This forest community type is found primarily in the unglaciated plateau region in southeastern Ohio and Pennsylvania, where it occurs on non-calcareous substrates, but it may also occur on glaciated regions of the Allegheny Plateau (Anderson 1996).

COMMENTS: *2, MCS*. The concept of the type is that of oak-maple-dominated stands on neutral to acidic substrates. Pennsylvania considered the shrub layer most diagnostic. Sugar maple should be at least 20-25% of stand dominance (cover or basal area), and oaks at least 60%. If beech or tuliptree contain 20-25% dominance, the type should be placed elsewhere; if beech dominates, then white oak-beech forest, *Quercus alba - Fagus grandifolia* Western Allegheny Plateau Forest (CEGL006144) [but see discussion with beech-maple unglaciated forest, *Fagus grandifolia - Acer saccharum - Liriodendron tulipifera* Unglaciated Forest (CEGL002411)]; if tuliptree then red oak-maple-tuliptree, *Quercus rubra - Acer saccharum - Liriodendron tulipifera* Forest (CEGL006125). The type is perhaps transitional between Appalachian oak forests, *Quercus prinus - Quercus (alba, coccinea, velutina) / Viburnum acerifolium - (Kalmia latifolia)* Forest (CEGL005023), and mixed mesophytic forests or beech-maple unglaciated forests (CEGL002411). Type may be in Indiana, but there see *Quercus prinus / Smilax* spp. Forest (CEGL005022).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This mixed oak acid forest community type is found primarily from the Allegheny Plateau region of southeastern Ohio and Pennsylvania.

USFS ECOREGIONS: 221Ea:CCC, 221Ec:CCC, 221Ed:CCC, 221Ee:CCP, 221Ef:CCC, 221Eg:CCC, 221F:CP, 222Ha:CCC, 222Hb:CCC, 222Hc:CCC
CONSERVATION REGIONS: 45:C, 48:C, 49:C
STATES: OH PA WV? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: OH oak-maple forest +

OTHER SYNONYMY: oak-maple forests (Anderson 1996) B. Anderson generally restricts the oak-maple type to calcareous substrates in glaciated, western Ohio. However, there may still be a need for an oak-maple type in southeast Ohio. In his chapter on oak-maple forests he states, "there are frequent stands in the plateaus dominated by oaks and sugar maple. These, however, are mostly over non-calcareous substrates, they often possess species characteristic of acidic substrates....most of these are more naturally considered as usually drier segments of mixed mesophytic communities....[S]tands dominated by oak and sugar maple in the unglaciated plateau are often transitions between mixed mesophytic and upland oak."

USNVC HIERARCHY: QUERCUS RUBRA - (ACER SACCHARUM) FOREST ALLIANCE (I.B.2.N.a)

Quercus prinus - Quercus (alba, coccinea, velutina) / Viburnum acerifolium - (Kalmia latifolia) Forest

Rock Chestnut Oak - (White Oak, Scarlet Oak, Black Oak) / Mapleleaf Viburnum - (Mountain Laurel) Forest

Appalachian / Interior Low Plateau Oak - (Chestnut) Forest CEGL005023

DESCRIPTION: Tree species commonly include *Quercus prinus* and *Quercus coccinea*, along with *Quercus alba, Quercus rubra* and *Quercus velutina*. *Castanea dentata* was a major component in the past. Other associates can include *Acer rubrum, Carya alba, Nyssa sylvatica, Oxydendrum arboreum*, and occasional *Pinus* spp. (*Pinus echinata, Pinus rigida, Pinus virginiana*). Tall shrubs and small trees can include *Cornus florida, Fagus grandifolia, Sassafras albidum, Aralia spinosa*, and *Viburnum acerifolium*. Characteristic dwarf-shrubs and vines include *Gaylussacia baccata, Gaultheria procumbens, Hypericum frondosum, Smilax glauca, Smilax rotundifolia, Vaccinium pallidum, Vaccinium stamineum*, and, more locally, *Kalmia latifolia*. The herbaceous layer includes *Antennaria plantaginifolia, Symphyotrichum cordifolium (= Aster cordifolius), Carex pensylvanica, Cypripedium acaule, Dichanthelium dichotomum var. dichotomum, Danthonia spicata, Epigaea repens, Helianthus divaricatus, Helianthus hirsutus, Polystichum acrostichoides, Tipularia discolor*, and others. Lichens (*Cladina* spp. and *Cladonia* spp.) and mosses can form a prominent layer (Anderson 1996, Fike 1999).

Stands occur on dry/xeric upper slopes and narrow ridgetops. Soils are typically shallow and occur over non-calcareous bedrock of sandstone, conglomerate, or shale, or, to the south, over thin loess and siliceous limestones and cherts. In the glaciated region of the Allegheny Plateau, stands are more isolated, but have been reported over dry glacial features, such as kames or gravel knobs (Anderson 1996).

COMMENTS: *2, MCS*. This is the historic chestnut oak forest after loss of chestnut. *Quercus alba* may often be a codominant. *Quercus velutina* and *Quercus rubra* may be as common as *Quercus coccinea* in Ohio stands. In Ohio the type apparently occurs on both the glaciated and unglaciated portions of the Allegheny Plateau. Distinguishing this type from *Quercus alba - Quercus rubra - Carya ovata* Glaciated Forest (CEGL002068) may require some minimum cutoff values for the dominance of *Quercus prinus* and *Quercus coccinea* (perhaps at least 20% cover or basal area of either), or ground layer species, such as *Vaccinium* or the lichens and mosses. Dominance by *Acer saccharum* (perhaps at least 25%) would place a stand in *Quercus alba - Quercus rubra - Quercus prinus - Acer saccharum / Lindera benzoin* Forest (CEGL002059), the Appalachian oak - maple type. Compare this type with *Quercus prinus - Quercus (rubra, velutina) / Gaylussacia baccata* Forest (CEGL006282) and *Quercus prinus / Smilax* spp. Forest (CEGL005022). Some Tennessee stands (e.g., in 222Eg, the Western Highland Rim) are outside of the range of *Viburnum acerifolium*. It appears to be replaced by *Styrax grandifolius* in some of these situations.

CONSERVATION RANK: *G4?*. This is a widespread type; *Quercus prinus* replaces itself after canopy removal, seeds germinate in the shade of parent trees, and stands can also replace themselves from stump sprouts.

DISTRIBUTION: This chestnut oak - mixed oak forest community ranges in the United States from the Allegheny Plateau region of Ohio, Pennsylvania and West Virginia to the Interior Low Plateau of Kentucky, Tennessee, and Alabama (and possibly into Mississippi).

USFS ECOREGIONS: 221Ea:CCC, 221Ec:CCC, 221Ed:CCP, 221Ee:CCP, 221Ef:CCC, 221Eg:CCC, 221F:CC, 221Hc:C??, 222Cf:CPP, 222Cg:CPP, 222Eb:CCC, 222Eg:CCC, 222Eo:CCC, 222Fd:CCC, 222Hb:CCC, 231Be:PPP
CONSERVATION REGIONS: 43:P, 44:C, 45:C, 48:C, 49:C, 50:C
STATES: AL? KY MS? OH PA TN WV **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: OH appalachian oak forest =

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS PRINUS - (QUERCUS COCCINEA, QUERCUS VELUTINA) FOREST ALLIANCE (I.B.2.N.a)

Quercus rubra - Acer saccharum - Liriodendron tulipifera Forest

Northern Red Oak - Sugar Maple - Tuliptree Forest

High Allegheny Rich Red Oak - Sugar Maple Forest CEGL006125

DESCRIPTION: Stands of this red oak - sugar maple forest contain a closed-canopy tree layer. *Acer saccharum, Liriodendron tulipifera, Quercus alba*, and *Quercus rubra* are the leading dominants. *Acer rubrum, Carya ovata, Carya alba (= Carya tomentosa), Nyssa sylvatica, Quercus coccinea, Quercus prinus*, and *Quercus velutina* are possible associates. *Liriodendron* dominance may indicate a past disturbance history, and *Carya* spp. may share dominance in some stands. There is evidence (Fleming 1999) that *Castanea dentata* may have been important in these stands prior to its demise. A wide variety of more mesic associates, such as *Betula alleghaniensis, Betula lenta, Fagus grandifolia*, and *Fraxinus americana*, could occur but are negligible in dominance. In addition to *Acer saccharum* reproduction, some understory species may include *Carpinus caroliniana, Cercis canadensis*, and *Ostrya virginiana*. Shrub and vine species include *Amelanchier laevis, Amelanchier arborea, Cornus* spp., *Hamamelis virginiana, Lindera benzoin, Viburnum acerifolium, Viburnum recognitum*, and *Vitis riparia*. Ericaceous shrubs, such as *Kalmia latifolia, Vaccinium angustifolium* and *Vaccinium pallidum*, may also be present. The ground layer species are highly variable but include *Caulophyllum thalictroides, Dennstaedtia punctilobula, Podophyllum peltatum, Maianthemum racemosum (= Smilacina racemosa), Medeola virginiana, Thelypteris noveboracensis*, and *Uvularia sessilifolia*. Some additional herbs which are constant or abundant in Virginia stands include *Ageratina altissima, Bromus pubescens, Actaea racemosa (= Cimicifuga racemosa), Galium circaezans, Galium triflorum*, and *Polystichum acrostichoides*. (Anderson 1982, Reschke 1990, Fike 1999, Fleming 1999).

Stands are typically found in coves, on moist north- and east-facing slopes, and on well-drained flats. Soils are slightly acid and of intermediate fertility (Anderson 1982, Reschke 1990, Fike 1999).

COMMENTS: *2, ECS*. Possible differential species include *Liriodendron tulipifera* and *Magnolia tripetala*, though the latter species would restrict the type's concept. Fleming (1999) notes that (in Virginia examples) *Liriodendron* is "inconstant in mature stands, absent above 975 meters (3200 feet), and dominant only in heavily disturbed, successional stands. According to Anderson (1982) in Ohio, where this community is found in the southeastern unglaciated plateau region, it is differentiated from the oak-maple type, *Quercus alba - Quercus rubra - Quercus prinus - Acer saccharum / Lindera benzoin* Forest (CEGL002059), and the Appalachian oak forest type, *Quercus prinus - Quercus (alba, coccinea, velutina) / Viburnum acerifolium - (Kalmia latifolia)* Forest (CEGL005023), by the substantial presence (over 20% canopy or basal area) of *Liriodendron tulipifera* and insignificant amounts of *Fagus grandifolia* or other mesic tree species. This type concept may overlap considerably with that of the oak-maple type, *Quercus alba - Quercus rubra - Quercus prinus - Acer saccharum / Lindera benzoin* Forest (CEGL002059). Braun (1950, e.g., p. 140) reports stands similar to this type in the Shawnee Hills and Mammoth Cave area of Kentucky, as well as other Interior Low Plateau sites. In New York, this type is reported primarily from the southeastern part of the State (Reschke 1990).

CONSERVATION RANK: *G?.* Fleming (1999) cites G4G5 for an equivalent type in Virginia, with a Srank of S4.

DISTRIBUTION: This red oak - sugar maple community is found primarily in the Allegheny Plateau and Appalachian Mountain regions of the United States, with possible extensions east and west of those areas, ranging from southeastern New York and New Jersey, south to Virginia and west to Pennsylvania, West Virginia, and southeast Ohio.

USFS ECOREGIONS: 212F:CC, 212G:CC, 221D:CC, 221Ea:CCC, 221Ec:CCC, 221Ed:CCC, 221Ee:CCP, 221Ef:CCC, 221F:CC, 221He:CCC, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCC, M221Ba:CCC, M221Bb:CCC, M221Bc:CCC, M221Bd:CC?, M221Be:CC?, M221Bf:CCC, M221C:C?, M221Da:CCP
CONSERVATION REGIONS: 48:C, 49:C, 50:C, 59:C, 61:C
STATES: NJ NY OH PA VA WV? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: OH oak-maple forest +

OTHER SYNONYMY: *Acer saccharum var. saccharum - Quercus rubra - Carya (glabra, ovata) / Ageratina altissima* Forest (3.3) (Fleming 1999), Dry-mesic Calcareous Forest (Fleming 1999), Oak-maple-beech-tuliptree mesic forests (matrix) (CAP)

USNVC HIERARCHY: QUERCUS RUBRA - (ACER SACCHARUM) FOREST ALLIANCE (I.B.2.N.a)

Liriodendron tulipifera - Tilia americana var. heterophylla - Aesculus flava - Acer saccharum / Magnolia tripetala Forest

Tuliptree - Appalachian Basswood - Yellow Buckeye - Sugar Maple / Umbrella Magnolia Forest

Northern Mixed Mesophytic Forest CEGL005222

DESCRIPTION: The tree canopy is often tall, closed and contains a variety of tree species, including *Acer saccharum, Acer rubrum, Fagus grandifolia, Fraxinus americana, Liriodendron tulipifera, Prunus serotina, Quercus alba*, and *Quercus rubra*. Trees indicative of the type include *Aesculus flava* and *Tilia americana var. heterophylla*. *Magnolia acuminata* occurs locally. Frequent vines and shrubs include *Asimina triloba, Carpinus caroliniana, Hamamelis virginiana, Lindera benzoin, Staphylea trifolia*, and, more locally, *Magnolia tripetala* and *Rhododendron maximum*. The herbaceous layer is extremely rich, including *Caulophyllum thalictroides, Actaea racemosa (= Cimicifuga racemosa), Claytonia virginica, Dicentra canadensis, Erythronium americanum, Sanguinaria canadensis, Tiarella cordifolia, Trillium erectum, Trillium grandiflorum*, and many others (Anderson 1982, Fike 1999).

Stands occur on mesic slopes and steep ravines or bottoms.

COMMENTS: *3, MCS*. Trees indicative of the type include *Aesculus flava* and *Tilia americana var. heterophylla*. In Ohio, however, these are restricted to the more southern parts of Ohio, which, depending on the definition of the type, may restrict its concept. Stands strongly dominated by beech and maple go with the Beech - Maple Unglaciated Forest, *Fagus grandifolia - Acer saccharum - Liriodendron tulipifera* Unglaciated Forest (CEGL002411); by beech and white oak with the White Oak - Beech Western Allegheny Forest, *Quercus alba - Fagus grandifolia* Western Allegheny Plateau Forest (CEGL006144); and by at least 25% hemlock with the East-Central Hemlock Hardwood Forest, *Tsuga canadensis - Fagus grandifolia - Acer saccharum / (Hamamelis virginiana, Kalmia latifolia)* Forest (CEGL005043). In Indiana this type occurs in the southeastern part of the Bluegrass Region, where it is found on calcareous substrates. Mike Homoya of the Indiana Heritage Program has species list. More information is needed to distinguish these more northern (Central Appalachian) mixed mesophytic forests from similar forests in the southern Appalachians. Further divisions may be warranted.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This type is found primarily in the Central Appalachian, Western Allegheny Plateau, and Cumberland Plateau regions of the United States, ranging from southern Pennsylvania and eastern Ohio south to West Virginia and Tennessee, with outliers in Indiana.

USFS ECOREGIONS: 221E:CC, 221Ha:CPP, 221Hb:CPP, 221Hc:CPP, 221He:CPP, 222E:CC, 222F:CC, M221Bb:CCC, M221Bd:CCC, M221Be:CCC, M221Cd:CCC
CONSERVATION REGIONS: 44:C, 49:P, 50:C, 59:C
STATES: IN KY OH PA TN WV **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IN mesic upland forest +
OH mixed mesophytic forest =

OTHER SYNONYMY: Typic Mesophytic Forest (Allard 1990)

USNVC HIERARCHY: LIRIODENDRON TULIPIFERA - TILIA AMERICANA VAR. HETEROPHYLLA - AESCULUS FLAVA - ACER SACCHARUM FOREST ALLIANCE (I.B.2.N.a)

Tsuga canadensis - Fagus grandifolia - Acer saccharum / (Hamamelis virginiana, Kalmia latifolia) Forest

Eastern Hemlock - American Beech - Sugar Maple / (Witch-hazel, Mountain Laurel) Forest

East-central Hemlock Hardwood Forest CEGL005043

DESCRIPTION: The overstory is dominated by *Tsuga canadensis, Acer saccharum, Acer rubrum*, and *Fagus grandifolia*. Rarely does any one of these comprise more than 50% of the mature trees in a stand. Other trees are common in the canopy, among them *Betula alleghaniensis, Betula lenta, Carya* spp., *Liriodendron tulipifera, Nyssa sylvatica, Pinus strobus, Prunus serotina, Quercus alba, Quercus rubra*, and *Tilia americana*. The shrub layer, occasionally sparse, contains *Hamamelis virginiana, Lindera benzoin*, and *Viburnum acerifolium*, as well as ericaceous shrubs, including *Kalmia latifolia* and *Rhododendron maximum*. The ground layer contains the ferns *Botrychium virginianum, Dryopteris intermedia, Dryopteris marginalis, Polystichum acrostichoides*, and the herbs *Arisaema triphyllum, Maianthemum canadense, Mitchella repens, Podophyllum peltatum, Viola blanda*, and *Viola rotundifolia*, among others. Three subtypes are possible: (1) steep-walled sandstone gorges and talus, where *Hydrangea arborescens, Kalmia latifolia*, and *Dryopteris marginalis* may be indicative; (2) more gently sloped valleys, with shrubs such as *Hamamelis virginiana, Viburnum acerifolium*; and (3) rolling lakeplain ridges (Black and Mack 1976, Anderson 1982). In Virginia, this type would be expected north of the range of *Rhododendron maximum* (G. Fleming pers. comm. 2000). The Kentucky examples, which are mesic rather than dry-mesic, may lack *Acer saccharum, Maianthemum canadense*, and several other species, and may contain *Magnolia* spp., (e.g., *Magnolia tripetala, Magnolia acuminata*, and *Magnolia macrophylla*) (J. Campbell pers. comm. 2000). In addition, *Betula lenta* (widespread on Appalachian Plateaus) is replaced by *Betula alleghaniensis (var. macrolepis?)* in western Kentucky and southern Indiana.

Stands occur on dry-mesic to mesic slopes, sometimes in steep-sloped valleys, but also in more gently sloped valleys and rolling lakeplain ridges. Soils are typically acid, silty to sandy loams, with a sandstone or shale parent material (Anderson 1982). Some Indiana stands occur on limestone (M. Homoya pers. comm. 1999).

COMMENTS: *2, ECS*. This type appears to vary from pure evergreen to mixed evergreen-deciduous. Black and Mack (1976) suggest that this type contains more temperate species, such as several *Dryopteris* spp. (*Dryopteris intermedia, Dryopteris marginalis*) and *Viburnum acerifolium* when compared to more northern/boreal types, such as *Tsuga canadensis - Fagus grandifolia - (Acer saccharum)* Great Lakes Forest (CEGL005042), which contains *Clintonia borealis, Coptis trifolia*, and *Cornus canadensis*. One of their subtypes, the steep-walled sandstone gorges and talus, where *Hydrangea arborescens, Kalmia latifolia*, and *Dryopteris marginalis* may be indicative has some conceptual and environmental overlap with *Tsuga canadensis - (Fagus grandifolia, Tilia americana var. heterophylla) / Magnolia tripetala* Forest (CEGL008407) of the southern Cumberland Plateau and Central Appalachians.

CONSERVATION RANK: *G3?*. Occurrences are threatened by the Hemlock Woolly Adelgid (*Adelges tsugae*), an exotic insect pest.

DISTRIBUTION: This community is found in parts of the Interior Low Plateau and the Western Allegheny Plateau of the northeastern and east-central United States, ranging from Pennsylvania and Ohio, south to Maryland and West Virginia, and westward to a few stands in Indiana, and possibly Kentucky. Stands in Indiana are not part of the continuous range of *Tsuga canadensis*.

USFS ECOREGIONS: 212:C, 221Ea:CCC, 221Ec:CCC, 221Ed:CCC, 221Ef:CCC, 221Eg:CCC, 221Fa:CCC, 221Fb:CCC, 222De:C??, 222Ek:CCC, 222Em:CCC, 222Hb:CCC, 222Hf:CCC
CONSERVATION REGIONS: 44:C, 45:C, 48:C, 49:C, 50:?, 59:?, 61:C
STATES: IN KY MD OH PA VA? WV **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IN mesic upland forest +
OH hemlock-white pine-hardwood forest =

OTHER SYNONYMY:

USNVC HIERARCHY: TSUGA CANADENSIS - LIRIODENDRON TULIPIFERA FOREST ALLIANCE (I.C.3.N.a)

Pinus echinata - Quercus (alba, rubra) / Vaccinium (arboreum, pallidum) / Schizachyrium scoparium - Chasmanthium sessiliflorum - Solidago ulmifolia Forest

Shortleaf Pine - (White Oak, Northern Red Oak) / (Farkleberry, Hillside Blueberry) / Little Bluestem - Longleaf Spikegrass - Elmleaf Goldenrod Forest

Interior Highlands Shortleaf Pine - Oak Dry-mesic Forest CEGL007489

DESCRIPTION: The canopy is dominated by *Pinus echinata* codominating with *Quercus alba, Quercus rubra*, or *Quercus velutina*, either singly or in combination. Shortleaf pine often forms an emergent canopy over the oaks. *Carya texana* or *Cornus florida* are typical subcanopy components. Other trees in the canopy and subcanopy can include *Acer rubrum, Amelanchier arborea, Carya alba, Nyssa sylvatica, Ostrya virginiana, Quercus falcata*, and *Quercus stellata*. There is little understory, and the shrub layer is typically open with *Vaccinium pallidum* common as a low shrub and *Vaccinium arboreum* as a locally abundant tall shrub. Other species in the shrub stratum vary among occurrences but can include *Callicarpa americana, Lyonia ligustrina, Morus rubra, Sassafras albidum, Styrax americanus*, and *Ulmus alata*, and the vines *Smilax glauca, Smilax bona-nox, Smilax rotundifolia, Toxicodendron radicans*, and *Vitis rotundifolia*. The density of the herbaceous stratum varies with age of the stand and disturbance history but increases with fire. Composition of the herbaceous stratum in these forests can be quite diverse but tends to vary among occurrences. Most examples of this association exist with sparse shrub and herb strata and ground cover dominated by leaf litter. Typical herbaceous species include *Antennaria parlinii, Antennaria plantaginifolia, Symphyotrichum anomalum (= Aster anomalus), Symphyotrichum patens (= Aster patens), Brachyelytrum erectum, Chasmanthium latifolium, Chasmanthium sessiliflorum, Danthonia spicata, Desmodium glabellum, Desmodium laevigatum, Desmodium nudiflorum, Desmodium rotundifolium, Dichanthelium linearifolium, Dichanthelium boscii, Dichanthelium commutatum, Helianthus divaricatus, Helianthus hirsutus, Helianthus X laetiflorus, Hieracium gronovii, Hypericum hypericoides ssp. hypericoides, Piptochaetium avenaceum, Schizachyrium scoparium, Solidago hispida, Solidago odora, Solidago ulmifolia*, and *Viola pedata*. Fire increases coverage by grasses (*Schizachyrium scoparium* and *Andropogon gyrans (= Andropogon elliottii)*) and legumes (Zollner pers. comm. 1994, Nelson 1985).

Stands occur on upper to middle, south-facing slopes, saddles, and flatter ridgelines. Soils are shallow to deep (25-100 cm). Parent material is a variety of sandstone and mixed sandstone-shale-derived substrates, or, in parts of the Missouri Ozarks, chert substrates (Zollner pers. comm. 1994, Nelson 1985).

COMMENTS: *3, SCS*. The harvesting and management of this forest community, combined with long-term fire suppression, has blurred what, under historical ecosystem processes, would likely be several association-level communities. It may be better ranked as GM (Zollner 1998). Examples of this community are known from throughout the Ouachita National Forest, including Beech Creek Special Interest Area (LeFlore County, Oklahoma), Roaring Branch RNA (Polk County, Arkansas), Lake Winona RNA (Saline County, Arkansas), Dismal Hollow RNA (Newton County, Arkansas), McCurtain County Wilderness Area (McCurtain County, Oklahoma) and others. See related pure evergreen woodland associations, *Pinus echinata / Schizachyrium scoparium - Solidago ulmifolia - Monarda russeliana - Echinacea pallida* Woodland (CEGL007815) and the mixed pine - oak associations *Pinus echinata - Quercus alba / Schizachyrium scoparium* Woodland (CEGL002394) and *Pinus echinata - Quercus alba - Quercus falcata* Woodland (CEGL004444). This forest type has been suggested to be a fire-suppressed version of these mixed pine - oak woodlands (M. Leahy pers. comm. 1999).

CONSERVATION RANK: *G3G4*. The harvesting and management of this forest community, combined with long-term fire suppression, have blurred what, under historical ecosystem processes, would likely be several association-level communities. Although this is one of the most widespread forest types in the region, high-quality mature examples are uncommon. In mature, fire-suppressed examples, the component of *Pinus echinata* and other fire-tolerant species declines, being replaced by greater canopy closure, higher stem density, and greater coverage of fire-intolerant species. Mature fire-maintained examples are extremely rare. Much of this forest community is managed to maintain specific tree densities and overstory composition.

DISTRIBUTION: This upland, subxeric to submesic forest community is the matrix forest community of the Ouachita Mountains and surrounding areas, ranging into areas adjacent to the Ouachitas and into the Ozarks of northern Arkansas, Oklahoma, and Missouri.

USFS ECOREGIONS: 222Aa:CCC, 222Ad:CCC, 222Af:CCC, 222Ag:CCC, 222Aj:CCC, 222Al:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ac:CCC, M231Ad:CCC
CONSERVATION REGIONS: 38:C, 39:C
STATES: AR MO OK **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO dry-mesic acid bedrock forest (dry-mesic chert forest, dry-mesic sandstone forest, dry-mesic igneous forest) I

OTHER SYNONYMY: IA6a. Dry Shortleaf Pine - Oak - Hickory Forest, in part (Allard 1990), T1B3aII3b. *Quercus alba - Pinus echinata - Quercus (velutina, falcata)* (Foti et al. 1994), Shortleaf Pine - Oak: 76, in part (Eyre 1980)

USNVC HIERARCHY: PINUS ECHINATA - QUERCUS (ALBA, FALCATA, STELLATA, VELUTINA) FOREST ALLIANCE (I.C.3.N.a)

Pinus echinata - Quercus alba / Schizachyrium scoparium Woodland

Shortleaf Pine - White Oak / Little Bluestem Woodland

Shortleaf Pine - Oak Dry-mesic Woodland CEGL002394

DESCRIPTION: The vegetation contains an open canopy. The canopy is dominated by *Pinus echinata* codominating with *Quercus alba, Quercus rubra*, or *Quercus velutina*, either singly or in combination. *Pinus echinata* often forms an emergent canopy over the oaks. Other woody species may be present in the shrub and sapling strata. Species from examples in the central Ouachita Mountains include *Acer rubrum, Amelanchier arborea, Carya alba, Castanea pumila var. ozarkensis (= Castanea ozarkensis), Cornus florida, Hamamelis virginiana, Nyssa sylvatica, Ostrya virginiana, Prunus serotina, Sassafras albidum, Toxicodendron radicans, Vaccinium arboreum, Vaccinium stamineum*, and *Vitis rotundifolia*. The ground layer is dominated by grasses, including *Schizachyrium scoparium*, but a diversity of herbaceous species is present. Other herbaceous species can include *Antennaria plantaginifolia, Symphyotrichum anomalum (= Aster anomalus), Baptisia bracteata var. leucophaea, Carex* sp., *Clitoria mariana, Cunila origanoides, Danthonia spicata, Desmodium marilandicum, Desmodium glutinosum, Lespedeza capitata, Lespedeza virginica, Dichanthelium latifolium, Dichanthelium sphaerocarpon var. isophyllum, Solidago caesia, Solidago petiolaris*, and *Solidago ulmifolia*.

Stands occur on upper to middle, south-facing slopes, saddles, and flatter ridgelines. Soils are shallow to deep (25-100 cm) and well-drained. Parent material is a variety of sandstone and mixed sandstone/shale-derived substrates or, in parts of the Missouri Ozarks and Central Ouachitas, chert substrates (Nelson 1985, D. Zollner pers. comm.).

Fires played a key role in maintaining the open character of the overstory and the grassland character of the ground layer (Nelson 1985, M. Leahy pers. comm. 1999).

COMMENTS: *2, MCS*. Compare with *Pinus echinata / Schizachyrium scoparium - Solidago ulmifolia - Monarda russeliana - Echinacea pallida* Woodland (CEGL007815), which may be synonymous with this type apart from not having a high percentage of oaks in the canopy, and whose ground layer description may apply equally well to stands of this type. See also *Pinus echinata - Quercus alba - Quercus falcata* Woodland (CEGL004444) of the Southern Ouachita and Upper West Gulf Coastal Plain. See also *Pinus echinata - Quercus (alba, rubra) / Vaccinium (arboreum, pallidum) / Schizachyrium scoparium - Chasmanthium sessiliflorum - Solidago ulmifolia* Forest (CEGL007489), which may represent the fire-suppressed version of this type (M. Leahy pers. comm. 1999). Sites occur at Big Spring Pines Natural Area, Hawn State Park, and a few sites on the Mark Twain National Forest (M. Leahy pers. comm. 1999). In Arkansas, this community is found in the Ouachita National Forest, with examples known from Polk, Montgomery, Garland, and Hot Spring counties.

CONSERVATION RANK: *G3G4.* There are probably fewer than 20 occurrences of this community rangewide; it is reported from Missouri (where it is ranked S2) and Arkansas (S?). No occurrences are currently documented from any state.

DISTRIBUTION: This shortleaf pine - oak woodland community is reported from Missouri and Arkansas, where it is known from the Ozark and Ouachita Mountains. It may range into Oklahoma. It is reported from two provinces, but subsection distribution is not fully known.

USFS ECOREGIONS: 222Am:CC?, M231Ab:CCC, M231Ac:CCC
CONSERVATION REGIONS: 38:C, 39:C
STATES: AR MO OK **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO acid bedrock savanna (chert savanna, sandstone savanna, igneous savanna) I

OTHER SYNONYMY: *Quercus alba - Quercus rubra - (Pinus echinata) / Cornus florida / Vaccinium arboreum - Vaccinium stamineum / Schizachyrium scoparium - Panicum linearifolium - Antennaria plantaginifolia* Dry-mesic Slope Woodland (Smith et al. 2000)

USNVC HIERARCHY: PINUS ECHINATA - QUERCUS (ALBA, FALCATA, STELLATA, VELUTINA) WOODLAND ALLIANCE (II.C.3.N.a)

Pinus echinata - Quercus stellata - Quercus marilandica / Schizachyrium scoparium Woodland

Shortleaf Pine - Post Oak - Blackjack Oak / Little Bluestem Woodland

Shortleaf Pine - Oak Dry Woodland CEGL002393

DESCRIPTION: The vegetation contains an open canopy dominated by *Pinus echinata* codominating with *Quercus stellata* and *Quercus marilandica*, either singly or in combination. *Pinus echinata* may form an emergent canopy over the oaks. Common woody associates include *Carya texana, Quercus velutina*, and *Diospyros virginiana*. Grassy openings are dominated by *Schizachyrium scoparium*. Other abundant herbs include *Baptisia bracteata, Helianthus hirsutus, Liatris aspera, Solidago nemoralis, Solidago petiolaris*, and *Tephrosia virginiana*.

Stands occur along ridges and on upper south- to southwest-facing slopes. This type represents the driest shortleaf pine - oak communities in the Ozarks.

Stands depend on fires to maintain their open character and grass-dominated ground layer.

COMMENTS: *1, SCS*. See related oak-dominated vegetation in II.B.2.N.a *Quercus stellata - Quercus marilandica* Woodland Alliance (A.625), and see *Pinus echinata - Quercus velutina - Quercus stellata / Vaccinium* spp. Forest (CEGL002401), a similar dry forest type. The equivalent dry-mesic pine - oak type is *Pinus echinata - Quercus alba / Schizachyrium scoparium* Woodland (CEGL002394).

CONSERVATION RANK: *G2G3*. High-quality examples of this community are rare throughout its range, most sites having been chronically fire-suppressed, resulting in a loss of the characteristic open canopy cover and the grassy understory. This community is also threatened by forest type conversion, and residential, agricultural, and commercial development.

DISTRIBUTION: This shortleaf pine - oak woodland is found in the Ozark-Ouachita region of the United States, ranging from southern Missouri to Arkansas and eastern Oklahoma.

USFS ECOREGIONS: 222Am:CP?, 231G:CC, M222A:CC, M231A:CC
CONSERVATION REGIONS: 38:C, 39:C
STATES: AR MO OK **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO acid bedrock savanna (chert savanna, sandstone savanna, igneous savanna) I

OTHER SYNONYMY:

USNVC HIERARCHY: PINUS ECHINATA - QUERCUS STELLATA - QUERCUS MARILANDICA WOODLAND ALLIANCE (II.C.3.N.a)

Pinus echinata - Quercus velutina - Quercus stellata / Vaccinium spp. Forest

Shortleaf Pine - Black Oak - Post Oak / Blueberry Species Forest

Shortleaf Pine - Black Oak Forest CEGL002401

DESCRIPTION: The tree canopy is short, spreading, open, and limby. It is dominated by *Pinus echinata*, which often forms an emergent canopy over a shorter canopy of oaks comprised of various combinations of *Quercus stellata, Quercus velutina, Quercus marilandica*, and *Quercus alba*. *Carya texana* is a common subcanopy component. *Vaccinium arboreum* and *Sassafras albidum* are common tall shrubs, while *Vaccinium pallidum* often dominates the short-shrub stratum. Other characteristic shrubs can include *Castanea pumila var. ozarkensis (= Castanea ozarkensis)* and *Hypericum hypericoides*. Woody vines include *Smilax glauca* and *Vitis rotundifolia*. The ground cover is sparse and can be dominated by leaf litter with only scattered herbaceous species such as *Antennaria plantaginifolia, Baptisia alba var. macrophylla, Baptisia bracteata var. leucophaea, Clitoria mariana, Cunila origanoides, Danthonia spicata, Desmodium nudiflorum, Dichanthelium commutatum, Dichanthelium linearifolium, Elymus hystrix, Helianthus divaricatus, Helianthus hirsutus, Liatris aspera, Pityopsis graminifolia, Schizachyrium scoparium, Solidago odora, Solidago ulmifolia*, and *Tephrosia virginiana*. Numerous lichens and mosses can be found on rocks and stumps (Nelson 1985, TNC 1995a).

Stands occur on gentle to moderately steep, mid and upper slopes of hills and plains, especially on southern and western aspects of steep-walled valleys and canyons. Soils are thin, somewhat rapidly to rapidly drained, and dry, rocky, and sandy. Bedrock is primarily sandstone and chert, although this forest can also occur on igneous rock, their commonality being acidic pH. Bedrock and rock fragments are often exposed near the surface (Nelson 1985, TNC 1995a). In the central Ouachita Mountains of eastern Oklahoma and western Arkansas, this community usually occurs on bands of friable shale embedded within the novaculite uplift formation.

Natural disturbance includes drought stress, wind and lightning damage, and periodic low intensity fires.

COMMENTS: *2, MCS*. The relation of this type to other dry shortleaf pine - oak forests in the Southeast needs further clarification, e.g., compare with *Pinus echinata - Quercus (alba, rubra) / Vaccinium (arboreum, pallidum) / Schizachyrium scoparium - Chasmanthium sessiliflorum - Solidago ulmifolia* Forest (CEGL007489). More open fire-maintained stands may be classified as *Pinus echinata - Quercus stellata - Quercus marilandica / Schizachyrium scoparium* Woodland (CEGL002393). Logging of shortleaf pine may cause some classification difficulties when all or most of the mature specimens of this species have been removed. Compare to associations in II.C.3.N.a *Pinus echinata - Quercus stellata - Quercus marilandica* Woodland Alliance (A.680) and I.C.3.N.a *Pinus echinata - Quercus stellata - Quercus marilandica* Forest Alliance (A.396).

CONSERVATION RANK: *G3.* There are probably over 100 occurrences of this community rangewide. It is reported from Missouri (where it is ranked from S3 to S4S5), Illinois (S4), and the central Ouachita Mountains of Arkansas and Oklahoma. Currently there are 10 occurrences documented in Missouri. In Arkansas and Oklahoma high-quality examples are uncommon, but it is more common in the Ouachita Mountains than in the Ozarks. Throughout its range, this community is under severe pressure from fire suppression and silvicultural activities. There are probably over 3000 acres rangewide, and there may be more than 10,000 acres, but there has been an overall reduction in its aerial extant in the past 50 years. Currently over 260 acres are documented in Missouri, and all occurrences are less than 60 acres. This community was more widespread prior to heavy harvesting of shortleaf pine and the practice of fire suppression.

DISTRIBUTION: This shortleaf pine - oak forest is found primarily in the Interior Highlands of the United States, ranging from eastern Oklahoma to the southwestern corner of Illinois. This community reaches its westernmost extension in the central Ouachitas of Oklahoma, but may have been widespread prior to excessive harvest of shortleaf pine. This community is still known from Missouri, southern Illinois, Arkansas, and Oklahoma.

USFS ECOREGIONS: 222Aa:CCC, 222Af:CCC, 222Ag:CC?, 222Aj:CCC, 222Ak:CCC, 222Aq:CCC, 222D:CP, 231G:PP, M221:?, M222A:CC, M231Ab:CCC, M231Ac:CCC
CONSERVATION REGIONS: 38:C, 39:C
STATES: AR IL MO OK **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL dry upland forest (S) +
MO dry acid bedrock forest (dry chert forest, dry sandstone forest, dry igneous forest) I

OTHER SYNONYMY: IA6a. Dry Shortleaf Pine - Oak - Hickory Forest, in part (Allard 1990), *Pinus echinata - Quercus velutina / Vaccinium arboreum / Danthonia spicata - Baptisia alba var. microphylla - Solidago odora* Dry South-slope Woodland (Smith et al. 2000)

USNVC HIERARCHY: PINUS ECHINATA - QUERCUS (ALBA, FALCATA, STELLATA, VELUTINA) FOREST ALLIANCE (I.C.3.N.a)

Pinus echinata / Rock Outcrop Interior Highland Woodland

Shortleaf Pine / Rock Outcrop Interior Highland Woodland

Shortleaf Pine / Little Bluestem Woodland CEGL002402

DESCRIPTION: Characteristic tree species include *Pinus echinata, Juniperus virginiana var. virginiana, Quercus marilandica* and *Quercus stellata*. Shrubs and vines include *Toxicodendron radicans* and *Vaccinium pallidum*. Herbaceous species include *Antennaria parlinii* and *Danthonia spicata*.

Stands occur on shallow rocky soils, especially on south-facing slopes and cliffs.

COMMENTS: *2, MCS*. This community is uncommon in Arkansas and is restricted in Oklahoma to McCurtain County. Fire and extreme habitat are thought to inhibit invasion by deciduous species. Type should be compared against another pure evergreen type, *Pinus echinata / Vaccinium (arboreum, pallidum, stamineum)* Forest (CEGL002400). Type occurs at Big Springs Natural Area, Stegall Mountain Natural Area, and Hawn State Park, Missouri, and at Hot Spring National Park, Arkansas.

CONSERVATION RANK: *G2G3*. There may be fewer than 100 occurrences of this community rangewide; it is reported from Missouri (where it is ranked S3 to S4S5), Arkansas (S?), and Oklahoma (S?). Currently no occurrences have been documented; current acreage, condition, and trends are unknown.

DISTRIBUTION: This shortleaf pine rock outcrop woodland type is found in the Interior Highlands region of the United States.

USFS ECOREGIONS: 222A:CC, 231Gb:CCC, M222A:CC
CONSERVATION REGIONS: 38:C, 39:C
STATES: AR MO OK **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MOI dry acid bedrock forest (dry chert forest, dry sandstone forest, dry igneous forest)

OTHER SYNONYMY:

USNVC HIERARCHY: PINUS ECHINATA WOODLAND ALLIANCE (II.A.4.N.a)

Pinus echinata / Schizachyrium scoparium - Solidago ulmifolia - Monarda russeliana - Echinacea pallida Woodland

Shortleaf Pine / Little Bluestem - Elmleaf Goldenrod - Red-purple Beebalm - Pale Purple Coneflower Woodland

Ouachita Shortleaf Pine Savannah CEGL007815

DESCRIPTION: This woodland community has an open canopy dominated by *Pinus echinata* and a dense, diverse herbaceous layer. Scattered oaks (*Quercus alba, Quercus stellata, Quercus velutina, Quercus marilandica*) may appear in the canopy or subcanopy. These are expansive open woodlands on gentle slopes, saddles and flatter ridgelines in eastern Oklahoma, western Arkansas, and southern Missouri. The dense herbaceous stratum is dominated by both graminoid and forb species. Dominant graminoids include *Schizachyrium scoparium, Danthonia spicata, Chasmanthium sessiliflorum, Scleria triglomerata*, and *Dichanthelium* spp. Other graminoid species include *Andropogon gyrans, Andropogon gerardii, Andropogon virginicus, Chasmanthium latifolium, Gymnopogon ambiguus, Muhlenbergia schreberi, Panicum virgatum, Paspalum* sp., *Sorghastrum nutans, Sporobolus compositus (= Sporobolus asper)*, and *Tridens flavus*. Dominant forb species include *Solidago ulmifolia, Clitoria mariana, Lespedeza repens, Antennaria plantaginifolia, Symphyotrichum anomalum (= Aster anomalus), Symphyotrichum patens (= Aster patens), Erechtites hieraciifolia, Helianthus hirsutus*, and *Monarda russeliana*. Many other forb species are known from these woodlands. Some of the more typical ones include *Acalypha virginica, Amphicarpaea bracteata, Baptisia nuttalliana, Chamaecrista fasciculata (= Cassia fasciculata), Coreopsis tinctoria, Conyza canadensis, Cunila origanoides, Dalea candida, Desmodium ciliare, Echinacea pallida, Echinacea purpurea, Euphorbia corollata, Pseudognaphalium obtusifolium (= Gnaphalium obtusifolium), Hieracium gronovii, Lespedeza* spp., *Liatris squarrosa, Phlox* spp., *Polygala alba, Pycnanthemum tenuifolium, Rudbeckia hirta, Solidago hispida, Solidago odora, Solidago radula, Stylosanthes biflora*, and *Tephrosia virginiana*. Shrubs are sparse, especially in more frequently burned locations. Shrub density is related to fire frequency, and many shrubs are coppices, sprouting from stumps. Some common shrubs and vines include *Baptisia bracteata var. leucophaea, Carya alba, Carya texana, Ceanothus* spp., *Crataegus crus-galli, Mimosa microphylla, Prunus serotina, Quercus stellata, Rhus copallinum, Rhus glabra, Rubus* spp., *Toxicodendron radicans, Ulmus alata, Vaccinium arboreum, Vaccinium pallidum, Viburnum rufidulum*, and *Vitis rotundifolia*, but many others can occur (D. Zollner pers. comm. 1998).

This community occurs on a variety of sandstone and mixed sandstone/shale-derived substrates in the northern and western Ouachita Mountains and on chert/novaculite-derived substrates in the central Ouachitas. On the sharper ridges of the central Ouachitas (novaculite uplift), these woodlands are reduced in extent and bounded by submesic pine - oak forest on lower slopes and xeric oak woodlands on the ridgelines (D. Zollner pers. comm. 1998).

This is a fire-maintained community where woody succession and canopy closure can be rapid with fire suppression (Sparks et al. 1998).

COMMENTS: *2, SCS*. These open *Pinus echinata* woodlands were more common historically. Currently few mature, high-quality examples of this community exist, and they are dependent on management with prescribed fire. This community has been restored around areas of remnant woodlands that provide habitat for colonies of Red-cockaded Woodpecker (Masters and Wilson 1994). Examples are known from Buffalo Creek (Scott County, Arkansas), Camp Robinson (Pulaski County, Arkansas), McCurtain County Wilderness (McCurtain County, Oklahoma), and Pushmataha Wildlife Management Area (Pushmataha County, Oklahoma). See also Sparks et al. (1998). See related forest association *Pinus echinata - Quercus (alba, rubra) / Vaccinium (arboreum, pallidum) / Schizachyrium scoparium - Chasmanthium sessiliflorum - Solidago ulmifolia* Forest (CEGL007489). Some extremely fire-suppressed examples of this community may be better classified as CEGL007489. The relationship of this type to *Pinus echinata - Quercus alba / Schizachyrium scoparium* Woodland (CEGL002394) needs to be explored and documented. *Pinus echinata - Quercus alba - Quercus falcata* Woodland (CEGL004444) is a southern Ouachita and Coastal Plain type.

CONSERVATION RANK: *G1G2.* These open *Pinus echinata* woodlands were more common historically. Currently few mature, high-quality examples of this community exist, and they are dependent on management with prescribed fire. Restoration efforts are underway on public lands in Arkansas and Missouri.

DISTRIBUTION: This upland subxeric woodland community was a matrix forest type in the Ouachita Mountains and, historically, north into parts of the Ozarks.

USFS ECOREGIONS: 222:?, 231:?, M222:?, M231:C
CONSERVATION REGIONS: 38:C, 39:C
STATES: AR MO OK **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO dry acid bedrock forest (dry chert forest, dry sandstone forest, dry igneous forest) I

OTHER SYNONYMY:

USNVC HIERARCHY: PINUS ECHINATA WOODLAND ALLIANCE (II.A.4.N.a)

Pinus echinata / Vaccinium (arboreum, pallidum, stamineum) Forest

Shortleaf Pine / (Farkleberry, Hillside Blueberry, Deerberry) Forest

Shortleaf Pine / Blueberry Forest CEGL002400

DESCRIPTION: This is a mid-successional to mature forest with the canopy dominated by *Pinus echinata*. A subcanopy of oaks, such as *Quercus alba, Quercus stellata*, and *Quercus falcata*, may be present and may succeed into the canopy in the prolonged absence of fire. *Cornus florida* is also typically present. Shrub and herbaceous strata may be sparse to dense, with any of *Vaccinium arboreum, Vaccinium pallidum, Vaccinium stamineum*, or *Aesculus glabra* present. Dry forest herbs are typical.

Stands occur on dry, thin-soil slopes. Soils may be somewhat acidic, often overlaying a variety of acidic bedrock substrates, including chert, igneous or sandstone material. In northern Arkansas (Springfield Plateau), these forests occur naturally on steep slopes, over cherty residuum of the Boone Formation. They also occur on sandstone shelf bluffs in the Ozarks.

COMMENTS: *2, MCS*. This association is intended to describe evergreen pine forests west of the Mississippi River in the Ouachita Mountains and Ozarks. The mixed pine-oak forest are partially described as *Pinus echinata - Quercus (alba, rubra) / Vaccinium (arboreum, pallidum) / Schizachyrium scoparium - Chasmanthium sessiliflorum - Solidago ulmifolia* Forest. This association should be compared with various drier woodlands, including II.A.4.N.a *Pinus echinata* / Rock Outcrop Interior Highland Woodland (CEGL002402), *Pinus echinata - Quercus stellata - Quercus marilandica / Schizachyrium scoparium* Woodland (CEGL002393), and, in the Ouachitas and Boston Mountains, *Pinus echinata / Schizachyrium scoparium - Solidago ulmifolia - Monarda russeliana - Echinacea pallida* Woodland (CEGL007815), which typically has a more open canopy, more herbaceous cover and diversity, and more frequent fire.

CONSERVATION RANK: *G3G4.*

DISTRIBUTION: This shortleaf pine / blueberry forest type is found in the Interior Highlands region of the United States, including the Ouachita Mountains and Ozarks of Arkansas, Oklahoma, and Missouri.

USFS ECOREGIONS: 221:C, 222A:CC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, M222A:CC, M231A:CC
CONSERVATION REGIONS: 38:C, 39:C
STATES: AR MO OK **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MOI dry acid bedrock forest (dry chert forest, dry sandstone forest, dry igneous forest)

OTHER SYNONYMY:

USNVC HIERARCHY: PINUS ECHINATA FOREST ALLIANCE (I.A.8.N.b)

Quercus marilandica / Vaccinium arboreum / Danthonia spicata Scrub Woodland

Blackjack Oak / Farkleberry / Poverty Oatgrass Scrub Woodland

Blackjack Oak Xeric Scrub CEGL002425

DESCRIPTION: The canopy is stunted (3-8 m) and forms a scrub woodland dominated by *Quercus marilandica*. Some *Quercus stellata* is present. The shrub layer is typically sparse (<50% cover) and contains *Vaccinium arboreum*, or occasional *Vaccinium pallidum*. The herb layer is sparse (<50% cover). Typical species include *Danthonia spicata*, along with *Allium canadense var. mobilense (= Allium mutabile), Cunila origanoides, Dichanthelium acuminatum, Diodia teres*. Mosses and lichens are often prevalent, including the mosses *Polytrichum* spp. and the lichens *Cladina subtenuis, Pseudoparmelia baltimorensis*, and *Parmelina obsessa* (Nelson 1985).

Stands occur on xeric bedrock outcrops on moderately steep to steep south- or southwest-facing slopes and ridgetops of hills and mountains. Soils are rapidly drained and very shallow (0-40 cm). Parent material may be igneous or sandstone. The bedrock is often exposed with fragments of rocks and boulders strewn over the surface (Nelson 1985).

Drought stress may act to open up the canopy (Nelson 1985).

COMMENTS: *2, MCS*. The concept of the type is mainly taken from the Missouri state classification - xeric acid (igneous, sandstone) forest (Nelson 1985). Chert substrates are unlikely to contain this type. This scrub woodland type may also be treated as a phase of either sandstone or igneous glades. *Quercus stellata* can be present. Compare with *Quercus stellata - Quercus marilandica var. ashei* Interior Highlands Scrub Woodland (CEGL003884). Pure *Quercus marilandica* vegetation is uncommon in the Arkansas Ozarks (D. Zollner pers. comm. 2000).

CONSERVATION RANK: *G3G4.*

DISTRIBUTION: This xeric blackjack oak type is found in the Interior Highlands region of the central United States.

USFS ECOREGIONS: 222Aa:CCC, 222Ac:CCC, 222Ae:CCC, 222Af:CCC, 222Aj:CCC, 222Ak:CCC, 222Am:CCC, 222Aq:CCP, 222Ca:CPP, 222Dh:CCC, 222Di:CCP, 231Gb:CCC, 231Gc:CCC, M231Aa:CCC
CONSERVATION REGIONS: 32:C, 38:C, 39:C, 43:P, 44:C
STATES: AR IL MO OK? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL xeric upland forest =
MO igneous glade; xeric acid bedrock forest (xeric chert forest, xeric sandstone forest, xeric igneous forest) I

OTHER SYNONYMY: Xeric Chert Forest, Xeric Igneous Forest, Xeric Sandstone Forest (Nelson 1987)

USNVC HIERARCHY: QUERCUS STELLATA - QUERCUS MARILANDICA WOODLAND ALLIANCE (II.B.2.N.a)

Quercus stellata - Quercus alba - (Quercus falcata) / Schizachyrium scoparium Woodland

Post Oak - White Oak - (Southern Red Oak) / Little Bluestem Woodland

Post Oak - White Oak Dry-mesic Barrens CEGL004217

DESCRIPTION: This community is dominated by graminoids, with a scattering of trees. The partial tree canopy cover is probably between 10% and 60%, thus varying from savanna to woodland. The open canopy is dominated by *Quercus stellata*, along with *Quercus alba, Quercus falcata, Quercus coccinea, Carya glabra*, and an occasional *Quercus imbricaria* and *Quercus marilandica*. Mature trees exhibit short trunks and wide-spreading, open crowns. The subcanopy consists of scattered, small oaks (*Quercus stellata, Quercus velutina, Quercus alba*) and *Carya glabra*. The shrub layer is dominated by *Cornus florida*, but *Aralia spinosa, Sassafras albidum*, and *Rhus copallinum* are also common. The herbaceous layer is quite dense, and dominated by *Schizachyrium scoparium* with a diverse assemblage of grasses and forbs represented. Characteristic grasses and herbs include *Dichanthelium* spp., *Coreopsis tripteris, Elephantopus carolinianus, Agrimonia pubescens*, and *Symphyotrichum shortii (= Aster shortii)*. Although *Toxicodendron radicans* and *Parthenocissus quinquefolia* occur in abundance here, *Smilax glauca* is characteristic of this dry environment (TNC 1995a).

This type is restricted to mid and lower slope hillsides and terraces where soils are predominantly thin, well-drained, and gravelly, particularly as observed in the Cretaceous Hills of Illinois (Schwegman 1973). The Cretaceous Hills Section is composed of unconsolidated sediments of Cretaceous and Tertiary sands, gravels, and clays. Soils of this community are silt loam to silty clay loam, composed primarily of Peoria loess and Roxana silt. Aspect is generally south to west and plays a major role in moisture availability, vegetative composition, and soil formation.

There is evidence that prior to their disappearance, bison and elk grazing helped maintain this natural community (Hall 1970). Fire also periodically swept through these barrens, killing woody vegetation and encouraging herbaceous growth (Robertson and Heikens 1994). Drought stress is prevalent, and openings are occasionally enlarged when trees are removed by wind or lightning.

COMMENTS: *2, MCS*. Concept of this type is taken from the Illinois state classification - dry-mesic barrens and mesic barrens (White and Madany 1978, Hutchison 1994). Few stands of this type remain, making characterization difficult, and one of the dry-mesic stands has a very open canopy due to management, whereas the mesic barrens variant has a dense canopy. Currently this type spans both the open savanna condition (10-25% cover, or even less) and more woodland-like conditions (25-60%), though this woodland phase could be equal to *Quercus alba - Quercus stellata - Quercus velutina / Schizachyrium scoparium* Woodland (CEGL002150), found in the Ozarks. This type needs to be reviewed in Kentucky. This dry-mesic barrens is closely related to the dry barrens, *Quercus stellata - Quercus marilandica - Quercus velutina - Carya texana / Schizachyrium scoparium* Woodland (CEGL002149). This community has both medium and tall grasses and forbs species.

CONSERVATION RANK: *G1*. This is an unusual community. Few examples remain because the soils usually support forests and succession has extirpated many examples of this type. Agricultural clearing and development may also have either eliminated most occurrences of the type or removed the open woody layer.

DISTRIBUTION: This dry-mesic and mesic barrens community is found in the Interior Low Plateau of the United States on dry-mesic terraces and midslopes, particularly in the Cretaceous Hills of Illinois (Pope and Massac counties), and perhaps elsewhere.

USFS ECOREGIONS: 222Ca:CCC, 222Di:CPP
CONSERVATION REGIONS: 43:C, 44:C
STATES: IL KY? MO? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL dry-mesic barren (S); mesic barren (S) -
MO? acid bedrock savanna (chert savanna, sandstone savanna, igneous savanna) ?

OTHER SYNONYMY: Barrens B

USNVC HIERARCHY: QUERCUS STELLATA - QUERCUS MARILANDICA WOODLAND ALLIANCE (II.B.2.N.a)

Quercus stellata - Quercus marilandica - Carya (glabra, texana) / Vaccinium arboreum Forest

Post Oak - Blackjack Oak - (Pignut Hickory, Black Hickory) / Farkleberry Forest

Midwest Post Oak - Blackjack Oak Forest CEGL002075

DESCRIPTION: This community is a broad-leaved deciduous forest type. Canopy closure is often incomplete but may be more than 60%. Typical tree species dominants include *Quercus stellata*, mixed with a variety of other oaks, including *Quercus marilandica, Quercus alba, Quercus falcata*, and *Quercus velutina*. The tree canopy is short (8-20 m), slow-growing, and open. The understory is poorly developed and consists of widely scattered shrubs. Typical species include *Amelanchier arborea, Ostrya virginiana*, and *Vaccinium arboreum*. Dwarf-shrubs include *Hypericum punctatum, Hypericum hypericoides ssp. multicaule (= Hypericum stragulum), Rosa carolina*, and *Toxicodendron radicans*. Herbaceous cover is sparse. Species include *Antennaria plantaginifolia, Symphyotrichum patens (= Aster patens), Danthonia spicata, Dichanthelium commutatum, Dichanthelium laxiflorum, Helianthus divaricatus, Hieracium gronovii, Lespedeza hirta*, and *Schizachyrium scoparium*. Mosses and lichens are abundant (Nelson 1985, TNC 1995a).

This community is found on dry, upper slopes and ridgetops. Bedrock is most often igneous materials or chert which suggests neutral to slightly acid pH. Soils are typically shallow, droughty, and infertile. Bedrock pavement, boulders, cobble, gravel, and sand are strewn over the surface, contributing significantly to soil droughtiness and increased soil temperatures (Nelson 1985, TNC 1995a).

Natural disturbances includes drought stress and occasionally low intensity fire. The structure and form of tree canopies are infrequently damaged by wind, ice, and lightning (Nelson 1985, TNC 1995a).

COMMENTS: *2, MCS*. In Kentucky this is a common forest on sandstone ridges in the Shawnee Hills (222Da, 222De, 222Dg, 222Dj). Kentucky occurrences are often old-growth, gnarly woodlands. Concept and distribution of this association in the Southeast needs assessment. Distinguishing this community from *Quercus stellata - Quercus marilandica - Quercus velutina - Carya texana / Schizachyrium scoparium* Woodland (CEGL002149) can be difficult when canopy cover is at or near 60%. Black hickory is diagnostic for this community, which is most common west of the Mississippi Alluvial Basin. Where *Quercus alba* is codominant with either post oak or blackjack oak, suggesting types are less xeric, stands belong in the *Quercus alba - (Quercus rubra, Carya spp.)* Forest Alliance (A.239) or the *Quercus velutina - Quercus alba - (Quercus coccinea)* Forest Alliance (A.1911). Braun (1950) summarizes information on this type in the Ozarks of Missouri and Arkansas. Anderson (1996) notes that this type may be found in southwestern Ohio, but further review is needed.

CONSERVATION RANK: *G4.*

DISTRIBUTION: This community is found in Arkansas, Illinois, Indiana, Kentucky, Missouri, and Oklahoma. Reports from southwest Ohio need verification.

USFS ECOREGIONS: 222Aa:CCC, 222Ab:CCC, 222Ac:CCC, 222Ad:CCC, 222Af:CCC, 222Ag:CCC, 222Ak:CCC, 222Aq:CCC, 222Dc:CCC, 222De:CCC, 222Df:CCP, 222Dh:CCC, 222Di:CCC, 222El:CCC, 222Ga:CCC, 255A:PP, 255C:PP, M222A:PP, M231A:PP

CONSERVATION REGIONS: 38:C, 44:C

STATES: AR IL IN KY MO OK **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	dry upland forest (S) +
IN	dry upland forest +
MO	dry acid bedrock forest (dry chert forest, dry sandstone forest, dry igneous forest)
I	

OTHER SYNONYMY: *Quercus stellata - Quercus marilandica / Danthonia* community (Voigt and Mohlenbrock 1964) B

USNVC HIERARCHY: QUERCUS STELLATA - QUERCUS MARILANDICA FOREST ALLIANCE (I.B.2.N.a)

Quercus stellata - Quercus marilandica - Quercus falcata / Schizachyrium scoparium Sand Woodland

Post Oak - Blackjack Oak - Southern Red Oak / Little Bluestem Sand Woodland

Post Oak - Blackjack Oak / Bluestem Sand Woodland CEGL002417

DESCRIPTION: The vegetation is an oak or mixed hardwood woodland complex with variable tree cover ranging from 10-60%. It is open-grown and often limby with natural pruning by fire. The tree canopy is short to medium in height (7-20 m) and dominated by *Quercus stellata, Quercus marilandica*, and *Quercus falcata*. A woody understory is generally absent; when present it is sometimes variable, consisting of shrubs and small trees. The herbaceous layer is dominated by grasses (*Schizachyrium scoparium, Sorghastrum nutans*) with forbs common. *Lithospermum caroliniense* is characteristic of this type in Missouri. *Callirhoe triangulata* is found in both Missouri and Indiana. *Gymnopogon ambiguus, Anemone caroliniana, Penstemon tubiflorus, Heterotheca villosa var. villosa, Commelina erecta var. angustifolia, Carya texana, Carya pallida, Androsace occidentalis, Sabatia campanulata*, and *Conyza canadensis var. pusilla* are described as characteristic species in Indiana. Mosses are often present (Nelson 1985)

Stands on Crowley's Ridge occur on dry rolling hills and plains, and on knolls and ridges on terraces. It is associated with well-drained to rapidly drained soils derived from alluvial or eolian deposits. The soils of this type are well-drained to rapidly drained and shallow to deep (40-100 cm). The pH ranges from 4.6-6.4. The parent material is sand from alluvial or eolian deposits (Nelson 1985).

This woodland is part of a forest - woodland - grassland mosaic in which fire and wind may play an important role. Periodic fires (perhaps every 5 to 10 years) prevent woody vegetation from excluding the grasses and associated shade-intolerant plants, while winds deposit and move the sandy substrate (Nelson 1985).

COMMENTS: *2, MCS*. Concept of this type is taken in part from the Missouri state type - dry sand forest (Nelson 1985). It is possible that *Quercus stellata - Quercus velutina - Quercus alba - (Quercus falcata) / Croton michauxii* Sand Woodland (CEGL002396) could be combined with this type. In Missouri this community type is associated with sand prairie on Sikeston Ridge. This type is not known from the Arkansas portion of Crowley's Ridge (D. Zollner pers. comm.). Crowley's Ridge is wind-deposited loess, and substrates are not typically sandy. There are, however, sand dunes found on the Mississippi River Alluvial Plain in northeastern Arkansas and southeastern Missouri, west of Crowley's Ridge (D. Zollner pers. comm. 1999), so there may be an Arkansas sand woodland barren (T. Foti pers. comm. 1999). Louisiana has a similar community -- judging only from the name.

CONSERVATION RANK: *G2.* There are probably fewer than 50 occurrences of this community rangewide. Currently only one occurrence is documented from Missouri. It is reported from southeastern Missouri (where it is ranked S2) and Indiana (S2?); it may also occur in Arkansas, Illinois, Kentucky, and Louisiana. There are probably fewer than 1000 acres rangewide; currently 10 acres are documented from one occurrence in Missouri.

DISTRIBUTION: This post oak - blackjack oak woodland community is found in the alluvial sand terraces of the Upper Mississippi River Delta and lower Wabash River regions of the United States, ranging from Indiana and possibly Illinois to Missouri (Crowley's Ridge) and possibly Kentucky, Arkansas and Louisiana.

USFS ECOREGIONS: 222:P, 234Ab:CCC, 234Ac:CC?
CONSERVATION REGIONS: 38:P, 42:C, 44:C
STATES: AR? IL? IN? KY? LA? MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

	IL?	dry barren (S) ?
	IN?	sand barrens ?
	MO	dry sand forest; sand savanna -

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS STELLATA - QUERCUS MARILANDICA WOODLAND ALLIANCE (II.B.2.N.a)

Quercus stellata - Quercus marilandica - Quercus velutina - Carya texana / Schizachyrium scoparium Woodland

Post Oak - Blackjack Oak - Black Oak - Black Hickory / Little Bluestem Woodland

Post Oak - Blackjack Oak / Little Bluestem Woodland CEGL002149

DESCRIPTION: The tree canopy is short to medium (7-20 m), spreading, open, and limby. Dominant species include *Quercus stellata* and/or *Quercus marilandica*. Other species may form a minor canopy component, scattered in the canopy, and include *Quercus velutina, Quercus rubra, Quercus alba*, and *Carya alba*. The understory is very poorly developed, consisting of a few widely scattered shrubs and small trees, including, in addition to the dominant trees, *Ulmus alata* and *Vaccinium* spp. (*Vaccinium arboreum, Vaccinium stamineum*, or *Vaccinium pallidum*). Coverage of the herbaceous stratum can vary from quite sparse to moderately dense, consisting of mixed grasses and forbs. Typical species include *Helianthus divaricatus, Porteranthus stipulatus, Danthonia spicata, Schizachyrium scoparium, Cunila origanoides, Andropogon gerardii*, and *Liatris aspera*, but others may occur. Lichens and mosses can be abundant (Nelson 1985, TNC 1995a).

Stands occur on gentle to steep hills and plains, bluff escarpments, and broad ridges and flats with any aspect, but primarily south- and west-facing slopes. Soils are rapidly to very rapidly drained, shallow, and strewn with boulders, cobbles, gravel, and sand. Soil pH is neutral to slightly acid. Bedrock can be sandstone, chert, or igneous rock and is often exposed (Nelson 1985, TNC 1995a).

Natural disturbance includes drought stress and occasional to frequent fire (frequency 4-10 years) (Nelson 1985, Robertson and Heikens 1994). Wind and storm damage are also often evident (Nelson 1985).

COMMENTS: *2, MCS*. The concept of this type is somewhat related to the Missouri state type - acid (chert, igneous, sandstone) savanna (Nelson 1985), and also includes woodland phases of Illinois' dry barrens, including those in the Cretaceous Hills (White and Madany 1978). Illinois prefers *Danthonia spicata* as an herb layer nominal species (they have no *Schizachyrium scoparium* in this community). This type has been managed with fire in the Shawnee National Forest, forming a "woodland barrens" type [see *Quercus stellata - Quercus marilandica / Schizachyrium scoparium* Wooded Herbaceous Vegetation (CEGL002391) for the " open barrens" type]. This association should be compared with and distinguished from *Quercus stellata - Quercus marilandica - Carya (glabra, texana) / Vaccinium arboreum* Forest (CEGL002075). *Quercus alba - Quercus stellata - Quercus velutina / Schizachyrium scoparium* Woodland (CEGL002150) is a similar, moister type. Something similar to this may be in Caddo Parish, Louisiana, at least historically (L. Smith pers. comm. 1999). A West Gulf Coastal Plain type may need to be split out.

CONSERVATION RANK: *G2G3*. There are probably fewer than 100 occurrences rangewide. Currently 29 occurrences have been documented in Missouri where it is ranked S2; the community is also reported from Arkansas, Oklahoma, and Indiana where it is ranked S?, S?, and S1, respectively. This community may also occur in Illinois, Louisiana, and Texas. There are probably less than 15,000 acres rangewide. Currently there are about 4700 acres documented from Missouri, and most occurrences are less than 1500 acres. This community was once widespread throughout its range. It has been significantly impacted and continues to be threatened by grazing, overseeding with non-native grasses, and conversion to forest due to fire suppression. Some expansion of individual occurrences may have occurred due to extensive logging of pines. About half the currently documented occurrences are ranked A or B, with sizes ranging from 30 to 1200 acres.

DISTRIBUTION: This post oak - blackjack oak woodland type occurs in the central United States, particularly in the Interior Low Plateau and Interior Highlands region, ranging from southern parts of both Indiana and Illinois south and west to Missouri, Arkansas, Oklahoma, and possibly Louisiana and Texas.

USFS ECOREGIONS: 222Ab:CCC, 222Ac:CCC, 222Ag:CCC, 222Ak:CCC, 222Am:CCC, 222An:CCC, 222Aq:CCP, 222Ca:CPP, 222Ch:CPP, 222De:CCC, 222Dh:CCP, 222Di:CCP, 222E:CP, 222Gc:CPP, 222Gd:CPP, 231E:CP, 231G:CC, M222A:CC, M231A:CC

CONSERVATION REGIONS: 38:C, 39:C, 43:P, 44:P

STATES: AR IL IN LA? MO OK TX? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	dry barren (S) +
IN	chert barrens +
MO	acid bedrock savanna (chert savanna, sandstone savanna, igneous savanna) I

OTHER SYNONYMY: Xeric oak ridgetop woodlands (R. Turner pers. comm.), Oak Savanna B, Glade B, Oak Woodland B

USNVC HIERARCHY: QUERCUS STELLATA - QUERCUS MARILANDICA WOODLAND ALLIANCE (II.B.2.N.a)

Quercus stellata - Quercus velutina - Quercus alba - (Quercus falcata) / Croton michauxii Sand Woodland

Post Oak - Black Oak - White Oak - (Southern Red Oak) / Narrowleaf Rushfoil Sand Woodland

Post Oak - Mixed Oak Sand Woodland CEGL002396

DESCRIPTION: This woodland community has a tree canopy 7-30 m tall with 25-60% cover. The physiognomy of this community is largely shaped by the degree of moisture available. The more mesic stands have taller, more closed canopies. The understory of the drier stands is shorter, more sparse, and the plants have an open-grown morphology. The dominant tree species include *Quercus alba, Quercus falcata, Quercus stellata*, and *Quercus velutina*. The understory is 2-8 m tall with less than 75% cover. Shrubs and small trees are both present in the understory. The low-shrub *Vaccinium pallidum* is present in Missouri. communities. The ground cover consists of mixed herbaceous species with a cover of 10-60%. Herbaceous species include *Saccharum alopecuroidum, Polygonella americana, Helianthus microcephalus, Solidago odora, Asclepias variegata, Desmodium viridiflorum, Croton michauxii (= Crotonopsis linearis), Cyperus grayoides*, and *Sida elliottii*.

In Missouri, this community occurs on sandy alluvial terraces coming off the west side of Crowley's Ridge and on sand dunes of the Sikeston Ridge. Stands may also be found on loamy sand ridges of Crowley's Ridge (loess deposits on ancient sand/gravel deposits) (M. Leahy pers. comm. 1999). The drier stands of this community are best developed on southern and western aspects, and have excessively drained soils, 40-100 cm deep. The dry-mesic stands are typically on eastern and northern aspects, except on terraces where the aspect is neutral. These stands have well-drained soils, 100 cm or more deep. The parent material of dry and dry-mesic stands is aeolian or alluvial sand and loess (Nelson 1985).

Occasional droughts, wind storms, and lightning damage may occur (Nelson 1985).

COMMENTS: *3, MCS*. Concept of this type is taken in part from the Missouri state type - dry-mesic sand forest (Nelson 1985). It is similar to the dry sand forest type, *Quercus stellata - Quercus marilandica - Quercus falcata / Schizachyrium scoparium* Sand Woodland (CEGL002417). This community is poorly understood and further studies are needed. Most remaining examples of this community have been severely altered and at present their classification is unresolved. This community may be similar to submesic oak - hickory forests in the Arkansas portion of Crowley's Ridge, although *Croton michauxii (= Crotonopsis linearis)* is not known from Arkansas. Crowley's Ridge is wind-deposited loess and substrates are not typically sand. There are, however, sand dunes found on the Mississippi Alluvial Plain in northeastern Arkansas and southeastern Missouri, west of Crowley's ridge (D. Zollner pers. comm. 1999).

CONSERVATION RANK: *G2.* Most of the examples of this community have been degraded or destroyed by logging.

DISTRIBUTION: This post oak - mixed oak woodland community is found in the upper reaches of the Mississippi River Alluvial Plain of the southeastern United States, particularly in southeastern Missouri and, at least historically, in adjacent states.

USFS ECOREGIONS: 222:C, 234Ab:CCC, 234Ac:CCC
CONSERVATION REGIONS: 42:C
STATES: AR KY? MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO dry-mesic sand forest =

OTHER SYNONYMY: Post Oak-Mixed Oak Sand Forest (MRO-LAPS)

USNVC HIERARCHY: QUERCUS ALBA - QUERCUS STELLATA - QUERCUS VELUTINA - (QUERCUS FALCATA) WOODLAND ALLIANCE (II.B.2.N.a)

Quercus alba - Carya alba - (Quercus velutina) / Desmodium nudiflorum - (Carex picta) Forest

White Oak - Mockernut Hickory - (Black Oak) / Naked-stem Tick-trefoil - (Painted Sedge) Forest

Interior Dry-mesic White Oak - Hickory Forest CEGL007795

DESCRIPTION: The canopy is typically dominated by *Quercus alba* and *Carya alba*, with *Carya glabra* and *Quercus velutina*. *Quercus rubra* may be found in the subcanopy of some examples, particularly on north- and east-facing slopes. The subcanopy may also contain *Acer rubrum, Acer saccharum, Amelanchier arborea, Carpinus caroliniana, Nyssa sylvatica*, and *Oxydendrum arboreum*. *Vaccinium pallidum* may be a prominent low shrub in some examples, along with *Vaccinium stamineum* and *Viburnum acerifolium*. The herb dominance may be quite variable depending on aspect. Within its range, extensive carpets of *Carex picta* present a dramatic winter aspect dominance in south- or west-facing examples. In contrast, *Polystichum acrostichoides* may be equally dominant on north- or east-facing slopes. Some other herbs which may be found include *Cardamine angustata, Cynoglossum virginianum var. virginianum, Sanicula smallii*, and the fern *Asplenium platyneuron*. More information is needed on the detailed floristics of this association, as this description is primarily based on spring floristics.

Stands occur in dissected landscapes at low to moderate elevations (200-350 meters; 600-1200 feet), on mid to lower slopes of various aspects, as well as toeslopes of gently convex form. It varies somewhat in its expression on different aspects.

COMMENTS: *2, SCS.* This type was originally described from the Western Highland Rim of Tennessee, and is reported from Kentucky. This type could also be expected in adjacent Alabama, and possibly also from the adjacent Upper East Gulf Coastal Plain. It is also possible in Illinois and Indiana; however, in those two states the type may overlap in concept with *Quercus alba / Cornus florida* Unglaciated Forest (CEGL002066), and it may be that those stands should be removed from CEGL002066 and placed with this type. Alternatively if this type can be white oak and black oak-dominated, there may be some overlap with unglaciated stands placed in *Quercus velutina - Quercus alba - Carya (glabra, ovata)* Forest (CEGL002076). A similar association defined from the southern Cumberland Plateau, *Quercus alba - (Quercus prinus) / Hydrangea quercifolia - Viburnum acerifolium / Carex picta - Piptochaetium avenaceum* Forest (CEGL008430), is dominated by *Quercus alba* and *Quercus prinus*, with character species such as *Magnolia macrophylla* and *Hydrangea quercifolia*.

CONSERVATION RANK: *G4.* This is not an inherently rare forest type, and many examples are still extant. The lack of element occurrences of this type does not reflect its relative abundance. It is an extensive and widespread forest type within its range. This type is described from the Interior Low Plateau. Some stands have been impacted by removal of more valuable timber species (e.g., *Quercus alba*). There may be some loss of herbaceous species diversity from the disturbance effects of logging.

DISTRIBUTION: This association is found from Kentucky and Tennessee north to Indiana and Illinois, possibly south to northern Alabama and northeastern Mississippi.

USFS ECOREGIONS: 221Ha:CCC, 221Hb:CCC, 221Hc:CCC, 221He:CCC, 222Cg:CPP, 222Ee:CCP, 222Ef:CCP, 222Eg:CCC, 222Eh:CCP, 222En:CCC, 222Eo:CCC, 231Be:???, M221Cd:CCC
CONSERVATION REGIONS: 43:?, 44:C, 50:C
STATES: AL? IL? IN? KY MS? TN **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL? dry-mesic upland forest (S) ?
IN? dry-mesic upland forest ?

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS ALBA - (QUERCUS RUBRA, CARYA SPP.) FOREST ALLIANCE (I.B.2.N.a)

Quercus alba - Quercus rubra - Carya (alba, ovata) / Cornus florida Acid Forest

White Oak - Northern Red Oak - (Mockernut Hickory, Shagbark Hickory) / Flowering Dogwood Acid Forest

White Oak - Red Oak Dry-mesic Acid Forest CEGL002067

DESCRIPTION: Stands are dominated by a closed-canopy deciduous tree layer. The dominants are *Quercus alba* and *Quercus rubra*. Typical associates including *Carya ovata, Carya ovalis, Nyssa sylvatica, Quercus falcata*, and *Pinus echinata* in parts of the range. The shrub and small-tree layer contains *Cornus florida*. *Parthenocissus quinquefolia* is a typical vine. The herbaceous layer contains *Actaea racemosa (= Cimicifuga racemosa), Desmodium glutinosum, Desmodium nudiflorum, Galium arkansanum, Galium pilosum*, and *Polystichum acrostichoides*, among others (Nelson 1985).

Soils are well-drained, shallow to deep (40 to over 100 cm), often over sandstone, cherts, or cherty limestone (Nelson 1985).

COMMENTS: *2, MCS*. This type may be difficult to distinguish from *Quercus alba - Quercus rubra - Quercus muehlenbergii / Cercis canadensis* Forest (CEGL002070), the alkaline equivalent, but more acidic species such as *Cornus florida, Nyssa sylvatica* and *Pinus echinata* may be present. Further characterization is needed.

CONSERVATION RANK: *G3.*

DISTRIBUTION: This community is found in the Interior Highlands of the south-central United States, ranging from Arkansas and Missouri eastward to Tennessee, Kentucky, and southern Ohio.

USFS ECOREGIONS: 221Ea:CCC, 221Ec:CCC, 221Ed:CCP, 221Ef:CCP, 221Eg:CCC, 222Aa:CCC, 222Ab:CCC, 222Ac:CCC, 222Ad:CCC, 222Ae:CCC, 222Af:CCC, 222Ag:CCC, 222Ah:CCC, 222Aj:CCC, 222Ak:CCC, 222Am:CCC, 222Ao:CCC, 222Ap:CCC, 222Aq:CCP, 222Db:CCC, 222Dc:CCC, 222De:CCC, 222Df:CCC, 222Eg:CCP, 222Ei:CCC, 222Ek:CCC, 222Em:CCC, 222Fd:CCC, 222Fe:CCC, 222Ff:CCC, 231:C, 251Ce:CCC, M231A:CC
CONSERVATION REGIONS: 36:C, 38:C, 39:C, 43:P, 44:C, 48:C, 49:C
STATES: AR IL? IN KY MO OH? TN **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:
IL? dry-mesic upland forest (S) ?
IN dry-mesic upland forest +
MO dry-mesic acid bedrock forest (dry-mesic chert forest, dry-mesic sandstone forest, dry-mesic igneous forest) I
OH? oak-hickory forest ?

OTHER SYNONYMY: TIB4aIII. *Quercus rubra - Quercus* spp. (Foti et al. 1994), Dry-Mesic Acid (Chert, Igneous, Sandstone) forest (Nelson 1987)

USNVC HIERARCHY: QUERCUS ALBA - (QUERCUS RUBRA, CARYA SPP.) FOREST ALLIANCE (I.B.2.N.a)

Quercus alba - Quercus rubra - Quercus muehlenbergii / Cercis canadensis Forest

White Oak - Northern Red Oak - Chinquapin Oak / Redbud Forest

White Oak - Mixed Oak Dry-mesic Alkaline Forest CEGL002070

DESCRIPTION: The canopy is dense, yet enough scattered light penetrates to encourage a rich and diverse herbaceous layer. Typical tree dominants include *Quercus alba, Quercus rubra, Quercus velutina*, and *Quercus muehlenbergii*. Typical associates include *Carya ovata* and *Carya alba*. Other shade-tolerant tree associates that may dominate the subcanopy include *Acer saccharum* (and/or *Acer barbatum* or *Acer leucoderme* to the south), *Ulmus rubra, Juglans nigra, Fraxinus americana, Ostrya virginiana, Carpinus caroliniana*, and *Amelanchier arborea*. *Quercus muehlenbergii* is a key, but perhaps uncommon, indicator of the more neutral to alkaline soil characteristics of this type. Typical shrubs include *Aesculus glabra, Asimina triloba, Cercis canadensis, Cornus florida, Euonymus americana, Frangula caroliniana*, and *Viburnum rufidulum*. Woody vines include *Parthenocissus quinquefolia* and *Toxicodendron radicans*. Herbaceous species include *Anemone virginiana, Arisaema triphyllum, Botrychium virginianum, Carex jamesii, Actaea racemosa (= Cimicifuga racemosa), Desmodium glutinosum, Desmodium rotundifolium, Dioscorea quaternata, Goodyera pubescens, Hybanthus concolor, Iris cristata, Maianthemum racemosum, Passiflora lutea*, and *Sanicula canadensis*. These forests occur in habitats transitional between mesic to wet riparian and floodplain communities and the drier ridgetop ecosystems (Nelson 1985, TNC 1995a).

Stands occur on gentle to steep slopes with moderately to well-drained moist loamy/sandy, relatively neutral to basic soils, which are underlain by bedrock of limestone and less commonly sandstone, siltstone, or shale. Soils may be shallow to somewhat deep (20-100 cm), with rock fragments present. In Illinois, this community occurs on thin, sandy/loamy soils underlain by sedimentary rock (mostly Pennsylvanian age sandstone). Limestone and shale are commonly found where erosion has removed resistant sandstone layers near the surface (TNC 1995a). In Missouri, non-cherty limestones and dolomites prevail (Nelson 1985). In Alabama, this type occurs on mixed limestone and sandstone substrate, providing a subcalcareous substrate.

Fire, drought, wind, and weathering of bedrock are primary biophysical parameters that affect species composition within this community element, promoting a more graminoid understory (e.g., *Bromus pubescens (= Bromus purgans), Chasmanthium latifolium, Carex* spp.). Insects, fungus, and blight can also severely impact dominance within and among occurrences of this forest. Moderate to severe disturbances, such as cutting, catastrophic wind, and/or fire in mesic stands dominated by beech and maple, may allow white and red oak stands to form (Fralish 1988, Fralish et al. 1991). These stands may succeed back to beech - maple stands over time. Fires were more frequent (almost annual) from the early 1900s to 1930, but there is little information on presettlement (prior to 1800) fire frequency (Robertson and Heikens 1994).

COMMENTS: *2, MCS*. Concept of this type relies, in part, on Missouri's "dry-mesic limestone/dolomite forest" (Nelson 1985). Stands in Illinois and Indiana may not have strongly contrasting alkaline and acidic rocks compared to those in the Ozarks. This type may also occur in the south-central glaciated portion of Illinois. Examples from Arkansas may lack *Quercus rubra*. Neither *Quercus muehlenbergii* nor *Cercis canadensis* may be very common in this type. Extensive selective logging of *Quercus alba* and *Quercus rubra* for sawtimber has severely impacted this community. Stands placed in this type in northern Alabama (Bankhead National Forest) and the Nashville Basin of Tennessee are not a perfect match, but seem similar enough to classify here.

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This white oak - red oak, dry-mesic alkaline forest community is found in calcareous regions of Interior Highlands of the east-central United States, ranging from Missouri and Arkansas east to Indiana, south to Kentucky, Tennessee and northern Alabama, and possibly in Oklahoma.

USFS ECOREGIONS: 221Hb:CCC, 221Hc:CCC, 222Aa:CCC, 222Ab:CCC, 222Ac:CCC, 222Ae:CCP, 222Af:CC?, 222Ag:CCC, 222Ak:CCC, 222Am:CCC, 222An:CCC, 222Ao:CCC, 222Aq:CCC, 222Ch:CCC, 222De:CC?, 222Df:CCC, 222Dh:CCC, 222Di:CCC, 222Ec:CCC, 222Ed:CCC, 222Ej:CCP, 222Ek:CCC, 222Em:CCP, 222Eo:CCC, 222Fa:CCP, 222Fb:CCC, 222Fe:CCC, 231Cd:CCC, 231Gb:CCC, 251Cd:CCC, 251Ce:CCC, 251Ea:CCC

CONSERVATION REGIONS: 36:C, 37:C, 38:C, 39:C, 43:P, 44:C, 48:C, 50:C

STATES: AL AR IL IN KY MO OK? TN **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	dry-mesic upland forest (S) +
IN	dry-mesic upland forest +
MO	dry-mesic limestone/dolomite forest +

OTHER SYNONYMY: Dry-mesic Upland Forest (S) B. (IL) Illinois Natural Areas Inventory (INAI) nomenclature relies on hydrologic variability and topographic position to determine vegetative community composition (White and Madany 1978)., *Quercus rubra - Quercus alba* mesic lower slope community type (Robertson et al. 1984) =, Calcareous mesophytic forest, in part? (Evans 1991), Dry-Mesic Limestone/Dolomite Forest, in part (Nelson 1987)

USNVC HIERARCHY: QUERCUS ALBA - (QUERCUS RUBRA, CARYA SPP.) FOREST ALLIANCE (I.B.2.N.a)

Quercus alba - Quercus stellata - Quercus velutina / Schizachyrium scoparium Woodland

White Oak - Post Oak - Black Oak / Little Bluestem Woodland

White Oak - Post Oak / Bluestem Woodland CEGL002150

DESCRIPTION: This woodland community has 20-60% tree canopy cover, 7-20 m tall, and dominated by tree species such as *Crataegus* spp., *Pinus echinata, Quercus alba, Quercus marilandica, Quercus stellata*, and *Quercus velutina*. The trees are often limby or shrubby in areas of sparse cover where bedrock is exposed. When an understory is present it is variable, consisting of a mosaic of scattered shrubs or groups of small trees. Shrubs include *Rhus aromatica, Vaccinium arboreum*, and *Vaccinium pallidum*. The ground cover is dominated by grasses such as *Andropogon gerardii, Schizachyrium scoparium* and *Sorghastrum nutans*, with sparse to mixed forbs. Mosses and lichens are often present.

This community occurs on gentle to steep hills, plains, ridges, and flats of all aspects. The soils are well- to very rapidly drained, and very shallow to deep (0-100 cm). The parent material is chert, sandstone, or, rarely, igneous with areas of bedrock or rock residuum present at the surface.

This community is subject to periodic fires, wind damage, and grazing by large herbivores. These disturbances keep woody vegetation from forming a closed canopy.

COMMENTS: *2, MCS*. Only a few occurrences of this community are known. Most of the original sites have been destroyed by logging, grazing, conversion to forest because of fire suppression, or invasion by exotic species. This community is associated with glades, cliffs, and dry forests in southeastern Missouri. *Quercus stellata - Quercus marilandica - Quercus velutina - Carya texana / Schizachyrium scoparium* Woodland (CEGL002149) is similar to this type but drier; however, in Missouri they may be similar enough to combine (M. Leahy pers. comm. 1999). This type could also be in Illinois as the woodland form of the dry-mesic barren type *Quercus stellata - Quercus alba - (Quercus falcata) / Schizachyrium scoparium* Woodland (CEGL004217).

CONSERVATION RANK: *G2G3.* Only a few occurrences of this community are known. Most of the original sites have been destroyed by logging, grazing, conversion to forest because of fire suppression, or invasion by exotic species.

DISTRIBUTION: This white oak - post oak woodland community is found in the Ozark region of the United States, particularly in Missouri and Arkansas.

USFS ECOREGIONS: 222Ab:CC?, 222Aj:CCP, 222Am:CC?, 222Ao:CCP, 222Aq:CC?, 222De:CPP, 222Di:CPP, 222Gb:CCC, 231Gb:CCC, 251:?, M222A:CC
CONSERVATION REGIONS: 37:C, 38:C, 39:C, 44:C
STATES: AR MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO dry-mesic savanna I

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS ALBA - QUERCUS STELLATA - QUERCUS VELUTINA - (QUERCUS FALCATA) WOODLAND ALLIANCE (II.B.2.N.a)

Quercus alba / Cornus florida Unglaciated Forest

White Oak / Flowering Dogwood Unglaciated Forest

White Oak / Dogwood Dry-mesic Forest CEGL002066

DESCRIPTION: The vegetation is dominated by closed-canopy trees. Historically stands may have had a woodland structure. The vegetation is strongly dominated by *Quercus alba*. Stands in Illinois and Indiana contain 80-90% *Quercus alba*, and *Quercus prinus* and *Pinus virginiana* are minor components. In Kansas, associated tree species include *Carya cordiformis, Carya ovata, Ostrya virginiana*, and *Sassafras albidum*. Shrubs include *Staphylea trifolia* and *Vaccinium arboreum*, and *Cornus florida* is not very constant (Lauver et al. 1999).

Stands may occur on fairly rich sites with a strong clay component in the soil, or on steep slopes, where soils are silty, well-drained soils formed from cherty limestone (Lauver et al. 1999).

COMMENTS: *3, MCS*. In Indiana, stands may occur in the Knobstone Escarpment region on lower foothills east of escarpments on deeper soils. In Illinois, stands occur at Rock Cave, Effingham County. (222Ga). However, it may be that this type is just a variant of *Quercus alba - Quercus rubra - Carya (alba, ovata) / Cornus florida* Acid Forest (CEGL002067), as suggested for Missouri (M. Leahy pers. comm. 1999). In Illinois and Indiana, stands may better fit with *Quercus alba - Carya alba - (Quercus velutina) / Polystichum acrostichoides - (Carex picta)* Forest (CEGL007795).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This white oak type is found sporadically across the central midwestern United States, extending from Kansas and possibly Arkansas to Indiana, and possibly Ohio.

USFS ECOREGIONS: 222Ad:CC?, 222Ae:CC?, 222Af:CC?, 222Ag:CC?, 222Al:CC?, 222Am:CCC, 222Aq:CCP, 222Di:CPP, 251Ce:CCC
CONSERVATION REGIONS: 36:C, 38:C, 44:C
STATES: AR IL? IN KS MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:
IL? dry-mesic upland forest (S) +
IN dry-mesic upland forest +
MO dry-mesic acid bedrock forest (dry-mesic chert forest, dry-mesic sandstone forest, dry-mesic igneous forest) I

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS ALBA - (QUERCUS RUBRA, CARYA SPP.) FOREST ALLIANCE (I.B.2.N.a)

Quercus falcata - Quercus alba - Quercus stellata - Quercus velutina Forest

Southern Red Oak - White Oak - Post Oak - Black Oak Forest

Southern Red Oak - Mixed Oak Forest CEGL005018

DESCRIPTION: The vegetation is dominated by a closed-tree canopy. *Quercus alba, Quercus coccinea, Quercus falcata, Quercus stellata*, and *Quercus velutina* are among the oaks which dominate this dry-mesic forest. *Quercus falcata* reaches the northern extent of its range within this community. Other tree species include *Carya ovata, Carya glabra*, and *Carya alba*. The density and diversity of subcanopy, shrub, and herbaceous species are substantially less than are found in mesic forests due to limited moisture availability during most of the growing season. Typical shrubs and small trees include *Cornus florida* and *Sassafras albidum*. Common herbaceous species include *Sanicula canadensis, Desmodium nudiflorum, Desmodium nuttallii, Symphyotrichum urophyllum (= Aster sagittifolius), Symphyotrichum patens (= Aster patens), Solidago ulmifolia*, and *Podophyllum peltatum*.

Stands occur on the upper slopes and ridgetops of moderately to maturely dissected hills, where they occupy narrow bands of dry-mesic habitat transitional between lower and midslope mesic communities and xeric ridgetops. Soils are most often a well-drained sandy loam, although clay loams are not uncommon. Bedrock is predominantly Paleozoic sandstone of Pennsylvanian age and is often exposed; the association may also occur on siltstone, shale, or coal, or over Mississippian limestones, especially in the southern part of its range (Kentucky). Karst topography can be found in areas where this community occurs.

Historically, fire may have periodically affected this community, increasing its range into more moist sites (Fralish et al. 1991, Robertson and Heikens 1994). Fires in the Shawnee and Ozark Hills just north of the range of this type were more frequent (almost annual) from the early 1900s to 1930, but there is little information on presettlement (prior to 1800) fire frequency (Robertson and Heikens 1994). Erosion also converts mesic forest soils to dry-mesic, creating conditions which may favor the occurrence of this community.

COMMENTS: *2, MCS*. More information is needed to distinguish this association from those recognized in the Southeast, such as *Quercus falcata - Quercus alba - Carya alba / Oxydendrum arboreum / Vaccinium stamineum* Forest (CEGL007244) and *Quercus falcata - Quercus (coccinea, stellata) / Vaccinium (pallidum, stamineum)* Forest (CEGL007247). The type does not appear to occur in the Ozark region, and in Arkansas, *Quercus falcata* is more common in the coastal plain. Selective removal of oaks for sawtimber can cause shifts in tree species dominance, thereby creating classification difficulties. *Quercus falcata* is a key dominant distinguishing this oak type from others. Braun (1950, p. 154-158) noted the prominence of *Quercus falcata* and *Quercus alba* on the low hills of the Mississippi Embayment Section of her Western Mesophytic Forest Region as well as in the Mississippian Plateau (TNC 1995a).

CONSERVATION RANK: *G3G5.*

DISTRIBUTION: This dry-mesic southern red oak - mixed oak forest type is found in the central United States in the Interior Low Plateau region of Illinois, Indiana, and Kentucky.

USFS ECOREGIONS: 222Ca:CP?, 222Ch:CP?, 222De:CCC, 222Di:CCP, 222E:CP
CONSERVATION REGIONS: 44:C
STATES: IL IN? KY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL dry-mesic upland forest (S) +
IN? dry upland forest +

OTHER SYNONYMY: Dry-mesic Upland Forest, in part (White and Madany 1978) B. Dry-mesic Upland Forest is a community name based on moisture availability and topographic position. A broad range of species occur in this community, Western Mesophytic Forest (Braun 1950) B. Western Mesophytic Forest relies on moisture availability and geographic region to define a community. A broad range of species occur in this community

USNVC HIERARCHY: QUERCUS ALBA - QUERCUS (FALCATA, STELLATA) FOREST ALLIANCE (I.B.2.N.a)

Quercus prinus / Smilax spp. Forest

Rock Chestnut Oak / Greenbrier Species Forest

Chestnut Oak Forest CEGL005022

DESCRIPTION: Trees in this forest make their best growth on steep lower slopes of small spur ridges. Individual trees are medium in size (8-20 m), with open, spreading, and often irregularly shaped crowns. Canopy closure is around 80-90%. Dominant tree species include *Quercus prinus*, with some *Quercus alba, Quercus velutina*, and *Quercus coccinea*. The understory is poorly developed (less than 50% cover), consisting of scattered, open-grown trees and shrubs, including *Vaccinium arboreum*. Ground cover consists of mixed herbaceous species and is generally sparse (less than 20%), with an abundance of lichens and mosses occurring on exposed rock and dead wood. Typical herbaceous species include *Antennaria plantaginifolia* and *Danthonia spicata* (TNC 1995a).

Stands occur on dry sandy, rocky, and gravelly, non-calcareous, thin to deep upland soils of steep mid and upper slopes of hills, bluffs and ridges. Aspect is generally southern and western. Bedrock is predominantly sandstone (sometimes chert), with boulders and rock fragments at or near the surface (TNC 1995a).

Occasional fire, wind, and lightning damage occurs. Seasonal drought can be severe.

COMMENTS: *2, MCS*. In Illinois, *Smilax* spp. are not as common as in Indiana. Some stands may have more of a mixed oak component. Type is also found in the Shawnee Hill region of Kentucky. Distribution of this type in the Southeast needs to be assessed. This community is conceptually related to *Quercus prinus - Quercus (alba, coccinea, velutina) / Viburnum acerifolium - (Kalmia latifolia)* Forest (CEGL005023), which is a more dry-mesic and diverse forest.

CONSERVATION RANK: *G3G5.*

DISTRIBUTION: This chestnut oak / greenbrier forest type is found in the Interior Low Plateau region of the United States, ranging from southern Illinois east to southern Ohio and south to Kentucky and possibly Tennessee.

USFS ECOREGIONS: 221D:PP, 221Ec:PPP, 221Ed:PPP, 221Ef:PPP, 221H:PP, 221I:PP, 222Aq:CCC, 222Da:CCP, 222Db:CCC, 222Dc:CCP, 222De:CCC, 222Dg:CCP, 222Dh:CCP, 222Dj:CCP, 222Ei:CCC, 222Ek:CCP, 222El:CCC, 222Em:CCC, 231A:PP, 231C:PP, 231D:PP, M221A:PP, M221C:P?
CONSERVATION REGIONS: 38:C, 44:C, 50:?
STATES: IL IN KY OH? TN? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	dry upland forest (S) +
IN	dry upland forest +
OH?	appalachian oak forest ?

OTHER SYNONYMY: Dry Upland Forest B. Other names listed rely upon moisture availability, topographic position, and bedrock to establish community boundaries., Dry Sandstone Forest B. Other names listed rely upon moisture availability, topographic position, and bedrock to establish community boundaries.

USNVC HIERARCHY: QUERCUS PRINUS - (QUERCUS COCCINEA, QUERCUS VELUTINA) FOREST ALLIANCE (I.B.2.N.a)

Quercus velutina - Quercus coccinea - Carya texana Ozark Forest

Black Oak - Scarlet Oak - Black Hickory Ozark Forest

Ozark Black Oak - Scarlet Oak Forest CEGL002399

DESCRIPTION: The canopy is dominated by *Quercus velutina, Quercus coccinea*, and *Carya texana*. Other associates and understory characteristics have yet to be described, but *Quercus alba* may also be present, along with minor amounts of *Pinus echinata* and shrubs such as *Vaccinium arboreum* (Nelson 1985).

Stands occur on dry slopes, with thin soils (15-40 cm deep), with primarily a cherty bedrock near the surface (Nelson 1985).

According to M. Leahy (pers. comm. 1999), this type primarily occurs on former *Pinus echinata* woodland sites that were completely logged, then grazed and burned, then abandoned, leading to a degraded oak forest. There are no known examples of a natural disturbance pattern that would have produced a similar community to this type.

COMMENTS: *3, MCS*. Little is known about this type and further work is needed to characterize its composition. The type is narrowly circumscribed by the western limits of *Quercus coccinea* and the eastern limits of *Carya texana*. It is possible that this type, along with the unglaciated portions of *Quercus velutina - Quercus alba - Carya (glabra, ovata)* Forest (CEGL002076), could be combined into one type. *Quercus coccinea* could have served as a differential in this regard, but it is taxonomically problematic, and its distribution, once restricted more-or-less south of glaciation, has recently been broadened northward by the Flora of North American treatment. *Vaccinium arboreum* is another potential differential species for the possible unglaciated type, but its presence in black oak - white oak stands in Illinois and Indiana needs to be checked. This type may historically have been a *Pinus echinata - Quercus alba / Schizachyrium scoparium* Woodland (CEGL002394) prior to human impacts.

CONSERVATION RANK: *G?.* Pending further historical review, this type may need to be treated as a semi-natural type, as it may only have originated following heavy logging of shortleaf pine-oak forest sites followed by grazing and burning, before abandonment.

DISTRIBUTION: This oak - hickory forest community is found in the Ozarks of southeastern Missouri and northeastern Arkansas.

USFS ECOREGIONS: 222Aa:CCC, 222Ab:CCP, 222Ad:CCP, 222Ae:CCP, 222Af:CCP, 222Ag:CCP, 222Aj:CCP, 222Am:CCP
CONSERVATION REGIONS: 38:C
STATES: AR? MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO I dry acid bedrock forest (dry chert forest, dry sandstone forest, dry igneous forest)

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS VELUTINA - QUERCUS ALBA - (QUERCUS COCCINEA) FOREST ALLIANCE (I.B.2.N.a)

Quercus muehlenbergii - Fraxinus (quadrangulata, americana) / Schizachyrium scoparium Woodland

Chinquapin Oak - (Blue Ash, White Ash) / Little Bluestem Woodland

Chinquapin Oak - Ash / Little Bluestem Woodland CEGL002143

DESCRIPTION: The tree canopy is open, sometimes somewhat stunted or limby, and occasionally complex in pattern due to the bedrock influence. Typical dominants include *Quercus muehlenbergii, Fraxinus americana*, and *Fraxinus quadrangulata*, along with *Juniperus virginiana*. Shrubs may include *Rhus aromatica, Frangula caroliniana (= Rhamnus caroliniana), Crataegus* spp., or more rarely, *Cotinus obovatus*. Dominant ground layer species include *Schizachyrium scoparium, Sorghastrum nutans*, and *Bouteloua curtipendula*. Other characteristic species include *Astragalus crassicarpus var. berlandieri (= Astragalus mexicanus), Galium arkansanum, Ophioglossum engelmannii, Polygala senega, Smilax bona-nox*, and, in more western stands of the Springfield Plateau, *Astragalus distortus, Berlandiera betonicifolia (= Berlandiera texana)*, and *Erysimum capitatum* (Nelson 1985). Arkansas occurrences are often moderately steep, with associated species including *Cotinus obovatus* and *Sideroxylon lanuginosum*.

Stands occur on moderately steep to steep upper slopes of hills, ridges, and plains, and on steep slopes and bluffs along streams and rivers. Aspect can be in any direction. Soils are rapidly drained to well-drained, and very shallow to shallow (0-100 cm). The parent material is limestone, cherty limestone, or dolomite with bedrock at or near the surface (Nelson 1985).

The key disturbances include a combination of drought and occasional fire, sometimes patchy because of the exposed bedrock (Nelson 1985).

COMMENTS: *2, MCS*. The concept of this type is taken in part from the Missouri state type - limestone/dolomite savanna (Nelson 1985). *Juniperus virginiana* increases without fire, and its relative dominance in this type can be variable. Closed forest chinquapin oak - red-cedar stands are tracked as *Quercus muehlenbergii - Juniperus virginiana - Acer saccharum / Frangula caroliniana* Forest (CEGL002108). Pure red-cedar woodlands along bluffs of cliffs are treated as a distinct type, the *Juniperus virginiana* Alkaline Bluff Woodland (CEGL002426). More open limestone-dolostone savannas are placed in the *Quercus muehlenbergii / Schizachyrium scoparium - Bouteloua curtipendula* Wooded Herbaceous Vegetation (CEGL005284).

CONSERVATION RANK: *G3G4.* Numerous small fire-suppressed sites exist, but there are few high-quality sites currently known or reported in the Missouri state databases.

DISTRIBUTION: This chinquapin oak - ash woodland community is found in the Ozark region of the United States, particularly Missouri and Arkansas.

USFS ECOREGIONS: 222Ab:CCC, 222Ac:CCC, 222Af:CCP, 222Ag:CCC, 222Ak:CC?, 222Am:CC?, 222An:CCC, 222Ao:CCC, 231G:PP, M222Aa:CCC
CONSERVATION REGIONS: 38:C
STATES: AR MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO limestone/dolomite savanna =

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS MUEHLENBERGII WOODLAND ALLIANCE (II.B.2.N.a)

Quercus muehlenbergii - Juniperus virginiana - Acer saccharum / Frangula caroliniana Forest

Chinquapin Oak - Eastern Red-cedar - Sugar Maple / Carolina Buckthorn Forest

Chinquapin Oak - Red Cedar Dry Alkaline Forest CEGL002108

DESCRIPTION: Tree canopies are short and slow-growing with slow replacement. The understory may be poorly developed, with shrubs sometimes dominant. Mosses may dominate the ground layer. The canopy contains *Quercus muehlenbergii, Quercus alba*, and *Acer saccharum*. The subcanopy contains *Acer saccharum, Juniperus virginiana, Cornus florida*, and *Celtis laevigata var. texana*. Other tall shrubs include *Chionanthus virginicus, Cotinus obovatus, Frangula caroliniana, Ilex decidua, Sideroxylon lanuginosum*, and *Viburnum rufidulum*. Herbs include *Anemone virginiana, Arabis missouriensis, Astragalus distortus, Berlandiera betonicifolia (= Berlandiera texana), Erysimum capitatum, Galium arkansanum, Hexalectris spicata, Hybanthus concolor, Penstemon arkansanus, Polygala senega*, and *Tragia cordata*. This vegetation is associated with limestone or dolomite glades.

Stands are typically found on moderate to steep mid and upper slopes of hills and plains, crests of bluffs, and ridges, generally with a southern and western aspect. Soils are shallow and well-drained, and the parent material is limestone or dolomite bedrock with fragments or boulders at or near the surface (Nelson 1985).

Drought stress, wind and lightning damage may disturb these stands. Fires may spread into these stands and convert them to a more open woodland structure.

COMMENTS: *2, MCS*. The type concept is taken in part from the Missouri state classification - dry limestone/dolomite forest (Nelson 1985), which often occurs adjacent to glades. It may be entirely synonymous with *Quercus muehlenbergii - Fraxinus (quadrangulata, americana) / Schizachyrium scoparium* Woodland (CEGL002143), and Missouri recommends combining it with that type (M. Leahy pers. comm. 1999). Related vegetation of Tennessee's Nashville Basin has been interpreted as a *Quercus muehlenbergii - Quercus* spp. forest in which subcanopy dominance by *Juniperus virginiana* is regarded as a symptom of fire suppression. See *Quercus muehlenbergii - Quercus (falcata, shumardii, stellata) / Cercis canadensis / Viburnum rufidulum* Forest (CEGL007699) in the *Quercus muehlenbergii - (Acer saccharum)* Forest Alliance (A.1912).

CONSERVATION RANK: *G3G4.* Few high-quality occurrences of this type have been reported, but this is complicated by the fact that stands of this type are sometimes treated as fire-suppressed chinquapin oak woodlands.

DISTRIBUTION: This chinquapin oak - red-cedar forest is found in the Ozark region of the United States, ranging from southern Missouri to Arkansas and possibly Oklahoma.

USFS ECOREGIONS: 222Ac:CCC, 222Af:CCC, 222Ag:CCP, 222Am:CC?, 251Ce:CCC
CONSERVATION REGIONS: 36:C, 38:C
STATES: AR? MO OK? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO dry limestone/dolomite forest =

OTHER SYNONYMY:

USNVC HIERARCHY: JUNIPERUS VIRGINIANA - QUERCUS (MUEHLENBERGII, STELLATA) FOREST ALLIANCE (I.C.3.N.a)

Quercus muehlenbergii - Quercus (falcata, shumardii, stellata) / Cercis canadensis / Viburnum rufidulum Forest

Chinquapin Oak - (Southern Red Oak, Shumard Oak, Post Oak) / Redbud / Rusty Blackhaw Forest

Interior Low Plateau Chinquapin Oak - Mixed Oak Forest CEGL007699

DESCRIPTION: The vegetation is dominated by a mixture of *Quercus muehlenbergii, Quercus falcata, Quercus shumardii*, and *Quercus stellata*, with *Quercus velutina* in smaller amounts. *Carya carolinae-septentrionalis, Carya glabra*, and *Fraxinus americana* may also be present in the canopy, which is typically somewhat open. The relatively open subcanopy contains *Acer saccharum, Fraxinus americana, Fraxinus quadrangulata, Ulmus alata, Ulmus serotina*, and *Celtis laevigata*. *Juniperus virginiana var. virginiana, Viburnum rufidulum, Frangula caroliniana, Cercis canadensis, Ostrya virginiana, Sideroxylon lycioides, Prunus americana*, and *Prunus angustifolia* are present as tall shrubs or small trees. Coverage of *Juniperus* in the subcanopy may be dense in some examples, but this vegetation is treated here rather than as a mixed forest. Low shrubs include *Rhus aromatica, Forestiera ligustrina, Viburnum rufidulum, Hypericum frondosum, Ptelea trifoliata*, and *Symphoricarpos orbiculatus*. Herbs present include *Andropogon* spp., *Antennaria plantaginifolia, Symphyotrichum shortii (= Aster shortii), Cheilanthes lanosa, Cunila origanoides, Diarrhena americana, Dichanthelium boscii, Galium circaezans, Heuchera americana, Monarda fistulosa, Schizachyrium scoparium, Scutellaria ovata, Solidago missouriensis, Solidago sphacelata*, and *Verbesina virginica*. A prominent woody vine is *Bignonia capreolata*. This type also includes examples from slopes above limestone cliffs along the Ohio River in Harrison County (southern Indiana) and possibly adjacent Kentucky (the former CEGL005020), where *Quercus muehlenbergii* is found with *Fraxinus americana* and *Fraxinus quadrangulata*.

Stands includes dry to subxeric forests of flat to rolling topography. Some stands in the Shawnee Hills may have a southerly exposure with thin loess-derived soils (TNC 1995a). In Tennessee's Nashville Basin, this association is found over Ordovician limestones (Lebanon, Ridley) at about 200 meters elevation.

COMMENTS: *2, SCS*. See also the II.B.2.N.a *Quercus muehlenbergii* Woodland Alliance (A.621) and the II.B.2.N.a *Fraxinus quadrangulata - (Juniperus virginiana)* Woodland Alliance (A.1913). *Acer saccharum - Quercus muehlenbergii / Cercis canadensis* Forest (CEGL006017) is a more mesic type with a somewhat overlapping distribution, but is typically found more eastward toward and in the Appalachian region.

CONSERVATION RANK: *G3.* Examples of this association in Tennessee's Nashville Basin occur in areas of rapid human population growth, and remaining unprotected examples are threatened by timber removal and land conversion. Kentucky examples are more scattered in several regions of the state, but many are small examples on isolated ridges. Some are found within the proclamation boundaries of the Daniel Boone National Forest but may lack protection.

DISTRIBUTION: This chinquapin oak - mixed oak forest association is found in the inner Central Basin of central Tennessee and related areas of the Interior Low Plateau, such as the northern edge of the Pennyroyal Karst Plain of Kentucky, and Shawnee Hills in Indiana and Illinois, as well as limestone ridges in the Eastern Knobs region, the Palisades of the Inner Bluegrass, and the eastern edge of the Mississippian Plateaus region of Kentucky.

USFS ECOREGIONS: 222Df:CPP, 222Eb:CC?, 222Ec:CC?, 222Ed:CCC, 222Eh:CCC, 222Ej:CCC, 222En:CCC, 222Fa:CCP, 222Fb:CCC, 231Ce:???
CONSERVATION REGIONS: 44:C, 50:?
STATES: AL? IL? IN KY TN **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL? dry upland forest (S) ?
IN dry upland forest +

OTHER SYNONYMY: IA6j. Interior Calcareous Oak-Hickory Forest, in part? (Allard 1990), IA6l. Cedar - Oak - Hackberry Elm Forest, in part (Allard 1990)

USNVC HIERARCHY: QUERCUS MUEHLENBERGII - (ACER SACCHARUM) FOREST ALLIANCE (I.B.2.N.a)

Fagus grandifolia - Acer saccharum - Liriodendron tulipifera Unglaciated Forest

American Beech - Sugar Maple - Tuliptree Unglaciated Forest

Beech - Maple Unglaciated Forest CEGL002411

DESCRIPTION: The vegetation is dominated by a closed-canopy forest with a well-developed tall-shrub layer. The forest canopy is dominated by *Fagus grandifolia* and *Acer saccharum*. Other canopy species include *Liriodendron tulipifera, Liquidambar styraciflua, Fraxinus americana, Quercus rubra, Carya glabra*, and *Carya cordiformis*. Shrubs commonly found in this community are *Asimina triloba* and *Lindera benzoin*. Herbaceous species are diverse, forming a dense cover. They include *Adiantum pedatum, Arisaema triphyllum, Asarum canadense, Carex blanda, Dicentra canadensis, Dioscorea quaternata, Galium circaezans, Menispermum canadense, Phegopteris hexagonoptera, Polystichum acrostichoides*, and *Sanguinaria canadensis*. The large size of dominant canopy species (over 30 m tall), herbaceous diversity, and accumulated litter emphasize the high degree of mesophytism (TNC 1995a).

Stands occur on unglaciated terraces and mesic slopes of maturely dissected plateaus and submontane regions. The aspect is neutral on sandy alluvial terraces and is northern to eastern on slopes. Soils are moderately well-drained, moist, rich, and deep (100+ cm). In Crowley's Ridge, stands occur on moderate slopes of hills and valleys and on knolls or ridges of large alluvial terraces.

Canopy openings due to wind throws are the most common form of natural disturbance.

COMMENTS: *2, MCS*. Braun (1950, p. 141-150) describes these beech - maple forests in the Hill Section of her Western Mesophytic Forest Region. Dry-mesic forests, in which *Quercus alba, Quercus rubra*, and *Carya ovata* dominate, often have American beech and sugar maple regeneration due to an increased availability of moisture when mature oaks are removed. Where logging is heavy in these oak - hickory stands, second-growth regeneration is often dominated by sugar maple and, to a lesser extent, American beech. Classification under these circumstances can be difficult. Conversely, where sugar maple is selectively removed by logging, American beech can occur in pure stands. Forests from the southern part of Crowley's Ridge (Arkansas) are placed in *Fagus grandifolia - Quercus alba - Liriodendron tulipifera / Hydrangea arborescens / Schisandra glabra* Forest (CEGL004663), where *Acer saccharum* is not a big component and *Quercus alba* is more common. This type may apply to other parts of Crowley's Ridge, but more information is needed.

CONSERVATION RANK: *G4?*. Many community occurrences have been extensively logged, and the canopy openings favor regeneration of *Acer saccharum*. In Crowley's Ridge Section of Missouri, this community is rare and confined to protected valleys (Vancil Hollow Natural Area), but it has been so extensively eliminated that its classification is problematic. It is probably eliminated in the Lowlands Section of the state. Possible occurrences in Arkansas need to be examined further.

DISTRIBUTION: This beech - maple forest is found in unglaciated areas of the east-central United States, ranging from southern Pennsylvania and Maryland southwest to southeastern Missouri, Kentucky and Tennessee, and possibly Arkansas.

USFS ECOREGIONS: 221Ea:CCC, 221Ec:CCC, 221Ed:CCC, 221Ef:CCC, 221Eg:CCC, 221Ha:CCP, 221Hb:CCC, 221He:CCP, 221I:CP, 221J:CP, 222Ak:CP?, 222Ao:CPP, 222Aq:CPP, 222Ca:CPP, 222Ch:CPP, 222Db:CCC, 222Dc:CCC, 222De:CCC, 222Df:CCC, 222Dh:CCP, 222Di:CCC, 222Ei:CCC, 222Ek:CCC, 222El:CCC, 222Em:CCC, 222En:CCP, 222Eo:CCP, 222Fa:CCP, 222Fb:CCC, 222Fc:CCC, 222Fd:CCC, 222Fe:CCC, 222Ff:CCC, 222Gc:CCC, 222Gd:CCP, 222Hc:CCC, 234Ab:CCC, 234Ac:CCC, 234An:CCP, M221Ab:CCP, M221Ac:CCC, M221Ad:CCP, M221Ba:CCC, M221Bb:CCC, M221Da:CPP
CONSERVATION REGIONS: 38:C, 42:C, 43:C, 44:C, 45:C, 49:C, 50:P, 59:C
STATES: AR? IL IN KY MD? MO OH PA TN WV **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	mesic upland forest (S) +
IN	mesic upland forest +
MO	mesic forest; mesic sand forest I
OH	beech-sugar maple forest +

OTHER SYNONYMY: Western Mesophytic Forest (Braun 1950) I. The terms "western mesophytic" and "mesic upland" rely upon moisture and topographic position to establish community boundaries., Beech - Maple Forest (Braun 1950) I. The "Beech - Maple Forest" community also includes a significant forest community type of the glaciated mesic forests of the northeastern United States., *Fagus - Acer saccharum - Liriodendron / Rhus radicans* Community (Voigt and Mohlenbrock 1964) =, Coastal Plain mesophytic cane forest? (Evans 1991), Beech-maple-tuliptree forest (matrix, large patch) (CAP)

USNVC HIERARCHY: FAGUS GRANDIFOLIA - ACER SACCHARUM - (LIRIODENDRON TULIPIFERA) FOREST ALLIANCE (I.B.2.N.a)

Fagus grandifolia - Quercus alba / Cornus florida Forest

American Beech - White Oak / Flowering Dogwood Forest

Central Beech - White Oak Forest CEGL007881

DESCRIPTION: The vegetation is dominated by *Fagus grandifolia* with more or less *Quercus alba* depending on past logging history. Associated canopy and subcanopy species can include *Liriodendron tulipifera, Acer saccharum, Quercus muehlenbergii, Acer rubrum, Cornus florida, Ostrya virginiana*, and *Ilex opaca*. Shrubs which may be present include *Vaccinium stamineum, Viburnum acerifolium, Euonymus americana*, and, in some occurrences, *Kalmia latifolia*. The herb layer can be relatively lush with such species as *Polystichum acrostichoides, Galium circaezans, Desmodium nudiflorum, Erythronium americanum, Hepatica nobilis var. obtusa, Epifagus virginiana, Tiarella cordifolia var. collina, Heuchera americana, Stellaria pubera, Podophyllum peltatum, Botrychium virginianum*, and others.

Stands occur on mesic mid to lower slopes in moderately dissected terrain. Stand positions vary from north-facing slopes and low slopes to high terraces along streams.

COMMENTS: *2, SCS.* This association is similar to *Quercus alba - Fagus grandifolia / Hydrangea quercifolia - Viburnum acerifolium / Carex picta - Polystichum acrostichoides* Forest (CEGL007213), found in northern Alabama, but is more broadly defined and geographically distinct from CEGL007213. The associations have been kept separate until more detailed floristic and range information can be obtained for this type (CEGL007881). *Fagus grandifolia - Liriodendron tulipifera / Euonymus americana / Athyrium filix-femina ssp. asplenioides* Forest (CEGL007201) is somewhat similar, but lacks dominance by *Quercus* species.

CONSERVATION RANK: *G4.* This is not an inherently rare forest type, and many examples are still extant. The lack of element occurrences of this type does not reflect its relative abundance. Patch size may be small, but this is a somewhat widespread association (and may be merged with others as classification is resolved); many examples are still extant. Some stands have been impacted by removal of more valuable timber species (e.g., *Quercus alba*) and loss of herbaceous species diversity from the disturbance effects of logging. The Grank has been changed from G3G4 to G4 to reflect its true abundance.

DISTRIBUTION: This association was defined for the Interior Low Plateau of Tennessee. It ranges to the Cumberlands of Kentucky, and may range into other adjacent ecoregions, but more information is needed to determine its full range.

USFS ECOREGIONS: 221Ha:CCC, 221He:CCC, 222Eb:CCP, 222Eg:CCC, 222Eh:CCP, 222Ei:CCP, 222Ek:CCP, 222Em:CCP, 222En:CCP, 222Eo:CCP
CONSERVATION REGIONS: 43:P, 44:C, 50:C
STATES: AL? IN? KY TN **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IN? mesic upland forest ?

OTHER SYNONYMY:

USNVC HIERARCHY: FAGUS GRANDIFOLIA - QUERCUS RUBRA - QUERCUS ALBA FOREST ALLIANCE (I.B.2.N.a)

Quercus alba - Quercus rubra - Acer saccharum - Carya cordiformis / Lindera benzoin Forest

White Oak - Northern Red Oak - Sugar Maple - Bitternut Hickory / Northern Spicebush Forest

White Oak - Red Oak - Sugar Maple Mesic Forest CEGL002058

DESCRIPTION: The canopy is dominated by *Quercus rubra* with *Quercus alba, Acer saccharum, Fraxinus americana*, and *Tilia americana var. americana*, with lesser amounts of *Carya alba, Carya cordiformis, Fraxinus americana, Juglans nigra*, and *Ulmus rubra*. The understory closure varies with the moisture status of the site, being more closed under greater moisture conditions. Other characteristic woody species include *Aesculus glabra, Asimina triloba, Carya cordiformis, Carpinus caroliniana, Celtis laevigata, Cercis canadensis, Cornus florida, Euonymus atropurpurea, Ilex decidua, Juglans cinerea, Magnolia acuminata, Morus rubra, Ostrya virginiana, Prunus serotina, Quercus muehlenbergii*, and *Staphylea trifolia*. Shrubs and woody vines include *Euonymus americana, Castanea pumila var. ozarkensis, Frangula caroliniana, Hamamelis virginiana, Hydrangea arborescens, Parthenocissus quinquefolia, Toxicodendron radicans*, and *Viburnum rufidulum*. Characteristic herbs include *Amphicarpaea bracteata, Aplectrum hyemale, Aralia racemosa, Aristolochia serpentaria, Asarum canadense, Brachyelytrum erectum, Cardamine concatenata, Carex albursina, Chasmanthium latifolium, Actaea racemosa (= Cimicifuga racemosa), Circaea lutetiana ssp. canadensis, Collinsonia canadensis, Cynoglossum virginianum, Desmodium nudiflorum, Dicentra canadensis, Dicentra cucullaria, Dioscorea quaternata, Elymus virginicus, Erigenia bulbosa, Erythronium rostratum, Hepatica nobilis var. obtusa, Hybanthus concolor, Hydrastis canadensis, Hydrophyllum* spp., *Iris cristata, Panax quinquefolius, Phryma leptostachya, Podophyllum peltatum, Polygonum virginianum, Sanguinaria canadensis, Silene ovata, Solidago flexicaulis, Stylophorum diphyllum, Uvularia grandiflora*, and *Melanthium woodii (= Veratrum woodii)*. Numerous ferns may be found in examples of this association, including *Adiantum pedatum, Asplenium platyneuron, Cystopteris protrusa, Dennstaedtia punctilobula, Deparia acrostichoides (= Athyrium thelypterioides), Diplazium pycnocarpon (= Athyrium pycnocarpon), Phegopteris hexagonoptera*, and *Polystichum acrostichoides* (Nelson 1985, Campbell et al. 1996, Hoagland 1997).

Stands occur on gentle to moderately steep lower slopes in ravines, valleys, bases of bluffs, and sinkhole basins, generally with northern or eastern aspects. The soils are moderately well-drained and shallow to deep. The substrate is various types of bedrock (and colluvium derived from the bedrock), typically limestone or dolomite, but also sandstone or igneous material. The bedrock may be exposed directly or present as residual rock fragments or talus boulders (Nelson 1985, Campbell et al. 1996).

COMMENTS: *3, MCS*. This type fits in with a moist oak - maple group, and many sites may succeed to more sugar maple-dominated stands. In Arkansas, this vegetation is closely related to *Acer saccharum - Quercus rubra - Carya cordiformis / Asimina triloba* Forest (CEGL002060). Douglas Zollner (pers. comm. 1998) suggests that fire frequency may account for the differences, since *Acer saccharum* is more susceptible to fire. Mike Homoya (pers. comm. 1996) thought this type could be in Indiana as described. This type is described by Hoagland (1997) as occurring on mesic slopes and floodplains in the easternmost tier of Oklahoma counties (Adair, Cherokee, Delaware, LeFlore, Mayes, McCurtain, Muskogee, Ottawa, and Sequoyah). Missouri's Mesic Igneous Forest (Nelson 1985) is a poorly understood variant that needs further study.

CONSERVATION RANK: *G3?.*

DISTRIBUTION: This mesic white oak - red oak - maple forest type is known from the south-central United States, particularly the Ozark and Ouachita regions of Arkansas, Missouri, and eastern Oklahoma.

USFS ECOREGIONS: 222Ac:CCC, 222Ad:CC?, 222Ae:CC?, 222Aj:CCP, 222Ak:CCC, 222Am:CC?, 222Ao:CCC, 222Ap:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 231:C, 251Cb:CCC, 251Cc:CCC, 251Cd:CC?, 251Ce:CCC, 251Cg:CCC
CONSERVATION REGIONS: 36:C, 38:C, 39:C
STATES: AR MO OK **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO mesic forest; mesic limestone/dolomite forest; mesic acid bedrock forest (mesic sandstone forest, mesic igneous forest) I

OTHER SYNONYMY: T1B4aII3a. *Acer saccharum-Quercus spp. (alba, rubra)-Carya spp. (ovata, tomentosa, cordiformis)* (Foti et al. 1994), Mesic Forest, Mesic Limestone/Dolomite Forest, Mesic Igneous Forest, Mesic Sandstone Forest (Nelson 1987), Mesic oak - hickory community (Tucker 1989)

USNVC HIERARCHY: QUERCUS RUBRA - (ACER SACCHARUM) FOREST ALLIANCE (I.B.2.N.a)

Populus tremuloides - Populus balsamifera / Calamagrostis canadensis Forest

Quaking Aspen - Balsam Poplar / Bluejoint Forest

Aspen Prairie Lowland Forest CEGL002097

DESCRIPTION: The tree canopy is most often dominated by *Populus tremuloides*. *Populus balsamifera* is a component of most stands, and may be codominant on the wettest sites. Other less constant associates include *Fraxinus pennsylvanica, Quercus macrocarpa*, or *Tilia americana*. The shrub layer varies depending on moisture, but can be scrubby. Among the possible species, *Cornus sericea* and *Corylus americana* are almost always present, the latter preferring somewhat drier conditions. The herbaceous layer is dominated by species tolerant of the wet, shady conditions. Characteristic species include *Calamagrostis canadensis, Carex pellita (= Carex lanuginosa), Carex lacustris*, and *Carex duriuscula (= Carex stenophylla)*. Other characteristic forbs have yet to be described (MNNHP 1993).

Stands occur on wet, poorly drained soils with high water tables (MNNHP 1993).

The aspen forest is an early successional community. They may currently be more extensive than prior to European settlement in the aspen parkland region, where, due to frequent fires, they were reduced to scattered groves or open woodlands, or even wet brush prairie. In the absence of fire in oak-aspen woodlands (CEGL002139), that type may succeed to this type.

COMMENTS: *2, MCS*. This type is the aspen-parkland version of *Populus tremuloides - Populus balsamifera* - Mixed Hardwoods Lowland Forest (CEGL005036), found in the more boreal zones of the Midwest and Canada. Further work is needed to clarify the floristic differences between these two types.

CONSERVATION RANK: *G3G4*. The global rank is suggested based on information in Minnesota (R. Dana pers. comm. 1999)

DISTRIBUTION: This lowland aspen forest is found in the aspen parkland region of the United States (Minnesota and North Dakota) and the prairie provinces of Canada.

USFS ECOREGIONS: 212Mb:PPP, 212Na:PP?, 212Nb:PPP, 212Nc:PP?, 222Na:CCC, 251Aa:CCC
CONSERVATION REGIONS: 34:C, 35:C, 47:P
STATES: MN ND **PROVINCES:** MB SK

MIDWEST HERITAGE SYNONYMY: MN aspen forest +

OTHER SYNONYMY:

USNVC HIERARCHY: POPULUS TREMULOIDES TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Populus tremuloides / Corylus spp. / Andropogon gerardii Woodland

Quaking Aspen / Hazelnut Species / Big Bluestem Woodland

Aspen Parkland Tallgrass Woodland CEGL005205

DESCRIPTION: The canopy is open and may either be somewhat dense with even-aged immature trees, have an irregular canopy of young and old trees, or have tall, even canopies of mature trees. The dominant canopy species is *Populus tremuloides*. In places *Populus grandidentata* and *Populus balsamifera* may dominate. *Quercus macrocarpa*, if present, is less than 20% cover. *Ulmus americana* is often present as small individuals, and *Fraxinus pennsylvanica* is sometimes present as an invader (Robert Dana pers. comm. 1997). The shrub/sapling layer is usually well-developed. Species present on drier sites include *Amelanchier alnifolia, Corylus americana, Cornus foemina, Prunus virginiana, Rosa* spp., and *Rubus* spp. On wetter sites, species include *Betula pumila, Cornus sericea, Salix bebbiana*, and *Spiraea alba* (MNNHP 1993).

Stands occur on level to rolling terrain. Soils are typically wet-mesic, but may range to dry-mesic (MNNHP 1993).

This community is an early successional type intermediate between upland prairie or brush prairie and aspen or oak forests. Prior to European settlement, the distribution of this type was determined by prairie fires, with the type occurring in areas where fires were less frequent and intense than in open prairie areas. Currently aspen woodlands may be more common than prior to settlement because of fire suppression and draining of wet prairies. Aspen woodlands that originate after logging in other parts of Minnesota may resemble this type (MNNHP 1993). This type may also, in the absence of fire, invade stands of *Quercus macrocarpa - Populus tremuloides / Corylus spp.* Woodland (CEGL002139).

COMMENTS: *3, MCS*. This type has been suggested as occurring at Pembina Gorge and perhaps at Sheyenne Delta in North Dakota, but those stands may best be tracked either as *Populus tremuloides - Quercus macrocarpa / Aralia nudicaulis* Forest (CEGL002065) or as *Populus tremuloides / Corylus americana* Forest (CEGL002063), both of which are more typical of the tallgrass prairie region. The similar oak woodland type in this region is *Quercus macrocarpa - Populus tremuloides / Corylus spp*. Woodland (CEGL002139).

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This aspen woodland type is found in the aspen parkland region of the upper midwestern United States and adjacent Canada, from Minnesota to Manitoba.

USFS ECOREGIONS: 222Na:CCC, 251Aa:C??, 251Ab:C??, 251Ba:C??
CONSERVATION REGIONS: 35:C
STATES: MN ND **PROVINCES:** MB?

MIDWEST HERITAGE SYNONYMY: MN aspen opening; aspen opening sand - gravel subtype; aspen woodland I

OTHER SYNONYMY:

USNVC HIERARCHY: POPULUS TREMULOIDES WOODLAND ALLIANCE (II.B.2.N.a)

Quercus macrocarpa - Populus tremuloides / Corylus spp. Woodland

Bur Oak - Quaking Aspen / Hazelnut Species Woodland

Bur Oak - Aspen Woodland CEGL002139

DESCRIPTION: Structurally, these stands are intermediate between closed-canopy forests and a more open, widely scattered savanna structure. Dominants in the tree canopy include *Quercus macrocarpa* and *Populus tremuloides*, the latter increasing in the absence of fire. Occasional associates include *Fraxinus pennsylvanica, Betula papyrifera*, and *Ulmus americana*. The shrub layer can be quite dense (40-50% cover). Dominant species include *Amelanchier* spp. (especially *Amelanchier alnifolia), Cornus foemina, Corylus americana, Corylus cornuta, Rosa* spp., *Rubus* spp., *Symphoricarpos occidentalis*, and *Viburnum* spp. (including *Viburnum opulus var. americanum (= Viburnum trilobum)*). The herbaceous layer can contain prairie species, but these occur in small openings in the tree or shrub layer. More typically, the herb layer is composed of species able to tolerate the more dense shade cast by the woody layers, including *Aralia nudicaulis, Carex pensylvanica, Maianthemum canadense, Sanicula marilandica*, and *Thalictrum dioicum* (MNNHP 1993).

Stands occur on dry to mesic sites, particularly where there were firebreaks, such as glacial lake beach ridges or terraces along rivers (MNNHP 1993).

This is a fire-maintained community. It is most common on rich sites where trees and shrubs grow well, but recurrent fires prevent the formation of a forest. Early surveys describe this type as woodland, brushland or thicket. Brushy stands would be placed in *Populus tremuloides - Quercus macrocarpa - Salix spp. / Andropogon gerardii* Shrubland type (CEGL002182). Without fire, this type may remain dominated by the same tree species, but become more closed, or it may resemble the aspen forest (CEGL002097).

COMMENTS: *2, MCS*. Distribution in Minnesota in NW Section versus Central Section needs review. Currently, this type is conceptually restricted to the aspen parkland. In the aspen parkland this type grades imperceptibly into the aspen woodland *Populus tremuloides / Corylus spp. / Andropogon gerardii* Woodland (CEGL005205). Type is typically dry-mesic on coarser textured soils. Dominance by *Populus tremuloides* can be up to 70% of the relative canopy cover.

CONSERVATION RANK: *G4?.*

DISTRIBUTION: This bur oak - aspen woodland is found in the aspen parkland tallgrass region of the United States (Minnesota) and adjacent Canada (Manitoba).

USFS ECOREGIONS: 222Na:CCC, 332:?
CONSERVATION REGIONS: 34:C, 35:C
STATES: MN ND **PROVINCES:** MB

MIDWEST HERITAGE SYNONYMY: MN oak woodland-brushland (northwest section) =

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS MACROCARPA WOODLAND ALLIANCE (II.B.2.N.a)

Juniperus scopulorum / Piptatherum micranthum Woodland

Rocky Mountain Juniper / Little-seed Mountain Ricegrass Woodland

Rocky Mountain Juniper / Little-seed Ricegrass Woodland CEGL000747

DESCRIPTION: This woodland community is dominated by small *Juniperus scopulorum* trees through most of its range, and is replaced by *Juniperus virginiana* and introgressant hybrids in the eastern portion of its range in Nebraska and South Dakota (Kaul et al. 1983, Von Loh et al. 1999). *Acer negundo* and *Fraxinus pennsylvanica* saplings are sometimes found in depressions where soil and moisture accumulate. Most of the juniper trees are 10-20 cm dbh and 4-6 m tall, but some trees can be up to 30-40 cm dbh. The basal area has been reported at 22-29 m2/ha in North Dakota and up to 22-41 m2/ha in southeastern Montana and northwestern South Dakota (Nelson 1961, Hansen et al. 1984, Hansen and Hoffman 1988). Tree canopy is moderate to dense, e.g., in North Dakota, Girard et al. (1989) measured densities of 975 trees/ha. Where the canopy is dense the shrub and herbaceous strata are poorly developed. Where the canopy is less full, shrubs and herbaceous species are more abundant, e.g. on 7 stands in southwest North Dakota mosses and lichens covered 72% of the ground surface, shrubs covered 17.4%; graminoids 69.1%, and forbs 9.4% (Hansen et al. 1984). Among the shrubs that may be found in this community are *Juniperus communis, Juniperus horizontalis*, small *Juniperus scopulorum* or *Juniperus virginiana, Mahonia repens, Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda), Prunus virginiana, Rhus trilobata, Ribes aureum, Ribes cereum, Rosa woodsii, Symphoricarpos albus*, and *Symphoricarpos occidentalis*. Typical herbaceous species include *Pulsatilla patens ssp. multifida (= Anemone patens), Antennaria microphylla, Campanula rotundifolia, Carex inops ssp. heliophila, Chenopodium fremontii, Elymus lanceolatus, Elymus trachycaulus, Galium boreale, Geum triflorum, Koeleria macrantha, Piptatherum micranthum (= Oryzopsis micrantha)*, and *Maianthemum stellatum, Parietaria pensylvanica*, and *Taraxacum officinale* (Hansen et al. 1984, Hansen and Hoffman 1988).

This community typically occurs on moderate to steep (16-70%), north-facing slopes, but can occur on a variety of aspects (Johnston 1987, Von Loh et al. 1999). The soils are poorly developed, shallow, loamy sands, sandy loams, and clay loams, sometimes with high gravel content. These woodlands are frequently associated with outcrops of sandstone (DeVelice et al. 1995) or scoria and clay slopes (Girard et al. 1989).

COMMENTS: *1, MCS*. This description includes stands with both *Juniperus scopulorum* and *Juniperus virginiana* over a herbaceous layer with *Piptatherum micranthum (= Oryzopsis micrantha)*. *Pinus ponderosa*, if present, is less than 25% tree canopy cover.

CONSERVATION RANK: *G3G4.* A number of sites have been impacted by cutting for fenceposts or railroad ties. Fire suppression may increase the extent of the community within its range.

DISTRIBUTION: This rocky mountain juniper community type is found in the western Great Plains of the United States. It is found in the Black Hills and the Badlands of North and South Dakota and Montana, and from the High Plains of eastern Wyoming eastward to central Nebraska.

USFS ECOREGIONS: 331D:CC, 331E:C?, 331F:CC, 331G:CC, 332C:CC, M334A:CC
CONSERVATION REGIONS: 25:C, 26:C, 27:C
STATES: MT ND NE SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE juniper woodland =

OTHER SYNONYMY: *Juniperus scopulorum / Oryzopsis micrantha* plant association (DeVelice et al. 1995) =, *Juniperus scopulorum / Oryzopsis micrantha* Habitat Type (Girard et al. 1989) =, *Juniperus scopulorum / Oryzopsis micrantha* Habitat Type (Hansen et al. 1984) =, *Juniperus scopulorum / Oryzopsis micrantha* Plant Association (Johnston 1987) =, Closed canopy juniper groves (Kaul et al. 1983) =

USNVC HIERARCHY: JUNIPERUS SCOPULORUM WOODLAND ALLIANCE (II.A.4.N.a)

Pinus flexilis / Pseudoroegneria spicata Woodland

Limber Pine / Bluebunch Wheatgrass Woodland

Limber Pine / Bluebunch Wheatgrass Woodland CEGL000813

DESCRIPTION: The vegetation is dominated by evergreen trees. In The Little Missouri National Grasslands in western North Dakota the average stratal cover was trees 38%, shrubs 21%, graminoids 20%, and forbs 9% (USFS 1992). The overstory is dominated by *Pinus flexilis*, with lesser amounts of *Juniperus scopulorum*. Girard et al. (1989) reported that the canopy averaged 44% and 5 m tall on several stands in North Dakota, while the density was 463 trees/ha. Ninety percent of the canopy cover was from *Pinus flexilis*. Shrubs are present but not common. The taller shrubs include *Rhus trilobata var. trilobata* and small *Juniperus scopulorum*. The most frequent low shrubs are *Opuntia* spp. and *Yucca glauca*. The most common species of the herbaceous layer is *Pseudoroegneria spicata*. Other graminoids are *Bouteloua gracilis, Leucopoa kingii (= Festuca kingii), Koeleria macrantha*, and *Achnatherum hymenoides (= Oryzopsis hymenoides)*. Forb species typical of this community are *Draba* spp., *Liatris* spp., and *Phlox* spp.

This community occurs on shallow dry rocky soils on mid to upper slopes (Johnston 1987). The slopes in North Dakota averaged around 30% (Girard et al. 1989). The parent material is commonly limestone or sandstone.

COMMENTS: *1, WCS*.

CONSERVATION RANK: *G4?.* This type occupies approximately 495 ha in North Dakota (Girard et al. 1989). Its abundance in Montana is presumably much more extensive, given the state S4 rank.

DISTRIBUTION: This limber pine woodland is a dry evergreen woodland found in the northern Rocky Mountains and adjacent northwestern Great Plains of the United States.

USFS ECOREGIONS: 331F:CC, M331A:CC, M331B:C?, M332B:CC, M332C:CC, M332D:CC, M332E:CC
CONSERVATION REGIONS: 10:C, 26:C
STATES: MT ND WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Pinus flexilis / Agropyron spicatum* Habitat Type (Alexander 1985) F, *Pinus flexilis / Agropyron spicatum* Community Type (Girard et al. 1989) =, *Pinus flexilis / Roegneria spicata* Plant Association (Johnston 1987) =, *Pinus flexilis* Habitat Type (U.S. Forest Service (USFS) 1992) =

USNVC HIERARCHY: PINUS FLEXILIS WOODLAND ALLIANCE (II.A.4.N.a)

Quercus macrocarpa / (Amelanchier alnifolia, Cornus drummondii) / Aralia nudicaulis Forest

Bur Oak / (Saskatoon Serviceberry, Roughleaf Dogwood) / Wild Sarsaparilla Forest

Northern Bur Oak Mesic Forest CEGL002072

DESCRIPTION: The tree layer is a closed canopy dominated by *Quercus macrocarpa* with a mixture of shade-tolerant trees, such as *Celtis occidentalis, Fraxinus pennsylvanica, Ulmus americana*, and *Ulmus rubra*, and farther north *Populus tremuloides*. Occasionally *Ostrya virginiana, Tilia americana* or *Quercus rubra* are present. The shrub layer is often prominent, dominated by *Amelanchier alnifolia* in the north and *Cornus drummondii* in the south. Other species shared across the range include *Prunus virginiana, Ribes missouriense, Rubus occidentalis, Symphoricarpos occidentalis, Symphoricarpos orbiculatus*, and *Zanthoxylum americanum*. Vines include *Celastrus scandens, Parthenocissus quinquefolia*, and *Toxicodendron radicans*. The herbaceous layer can be quite sparse. Common species include *Aralia nudicaulis, Carex assiniboinensis, Carex blanda, Elymus villosus, Galium boreale, Geum canadense, Maianthemum stellatum, Osmorhiza longistylis, Poa pratensis, Polygonatum biflorum*, and *Viola sororia* (MNNHP 1993, Rosburg and Glenn-Lewin 1996, Steinauer and Rolfsmeier 2000).

This community is found in the central and northern tallgrass prairie region of the Midwest United States and adjacent Canada. It typically occurs on gentle to steep slopes of draws and bluffs, where, historically, fire breaks occurred. Soils in the northern part of the range include well-drained sandy loams to loams formed in glacial till, and in the southern part include silty to sand loams formed primarily in loess and glacial till (MNNHP 1993, Rosburg and Glenn-Lewin 1996, Steinauer and Rolfsmeier 2000).

COMMENTS: *3, MCS*. Stands in Iowa needs review, since this type may not be as dry as the stands (but see Rosburg and Glenn-Lewin 1996). A *Quercus macrocarpa / Ostrya virginiana* phase may better describe the Iowa stands. This type may represent advanced succession of many *Quercus macrocarpa* woodland stands that historically had a fire-disturbance history. As a result, many of the forest stands may be depauperate floristically. The name of this type reflects a more characteristic set of northern U.S. species (*Amelanchier alnifolia, Carex assiniboinensis, Aralia nudicaulis*), and less so of more central U.S. species, such as *Cornus drummondii*). The name may need to be modified to better reflect Nebraska and Iowa stands, or be split into two types. Stands at Voyageurs NP in northern Minnesota may also be a separate subtype. Further comparisons are needed with more mesic bur oak stands in northwestern Ontario and northwestern Minnesota.

CONSERVATION RANK: *G4.*

DISTRIBUTION: This community is found in the central and northern tallgrass prairie region of the midwestern United States and adjacent Canada, extending from western Iowa and eastern Nebraska northward to southern Manitoba and adjacent Ontario.

USFS ECOREGIONS: 222Mb:CPP, 222Na:CCC, 251Aa:CCC, 251Bb:CCC, 251Bd:CCC, 251Be:CCC, 251Ca:CCC, 251Cm:CCC, 251Cp:CCC

CONSERVATION REGIONS: 34:C, 35:C

STATES: IA MN ND NE SD? **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY: MN oak forest (northwest section) dry subtype; oak forest (big woods section) dry subtype; oak forest (central section) dry subtype; oak forest (northwest section) mesic subtype I
NE bur oak forest =

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS MACROCARPA FOREST ALLIANCE (I.B.2.N.a)

Quercus macrocarpa / Carex inops ssp. heliophila Woodland

Bur Oak / Sun Sedge Woodland

Bur Oak / Sedge Woodland CEGL000554

DESCRIPTION: Stands occur on the eastern and northern flanks of the northern Black Hills (in the vicinity of Colony, WY, and Alva, MT). Cover of *Quercus macrocarpa* is quite variable. On the eastern flank of the northern Black Hills in the vicinity of Colony, WY, rolling low hills are covered with oak savannas. On the northern flank, slopes are somewhat steeper, and denser stands of oaks are found. In these situations, oaks are sometimes small and shrub-like, forming thickets. In some stands seen during reconnaissance, *Carex inops ssp. heliophila* was the dominant understory graminoid. Stands where mixed-grass prairie species such as *Hesperostipa comata (= Stipa comata)* dominate the understory may fall outside the concept of this type (Marriott and Faber-Langendoen 2000).

This type is best developed in the northern and northeastern foothills in areas underlain by the Cretaceous Mowry Formation, which includes siliceous shales, clays and bentonite. On the eastern flank of the northern Black Hills in the vicinity of Colony, WY, these strata dip very gently, and form extensive rolling low hills covered with oak savannas. On the northern flank, dips are somewhat steeper, and denser stands of oaks are found. Elevations are in the range of 950 to 1150 m (3100 to 3700 feet) (Marriott and Faber-Langendoen 2000).

COMMENTS: *2, MCS*. This type has been provisionally applied to the extensive oak stands on the eastern and northern flanks of the northern Black Hills (in the vicinity of Colony, WY, and Alva, MT). However, there is at least one other association present, with mixed-grass prairie species, such as *Hesperostipa comata (= Stipa comata)*, dominating the understory. These stands may be examples of the Bur Oak / Mixedgrass Shale Wooded Herbaceous type, *Quercus macrocarpa* / Mixedgrass Shale Wooded Herbaceous Vegetation (CEGL002164). Neither type has been surveyed beyond limited reconnaissance (mostly from roadsides).

This type has been observed in areas of the Hogback around the Black Hills (H. Marriott pers. comm. 1999).

CONSERVATION RANK: *G1G2.*

DISTRIBUTION: This type occurs in the Great Plains and margins of the Black Hills in the Unites States, ranging from western South Dakota to northeastern Wyoming. Stands are most extensive on the eastern and northern flanks of the northern Black Hills (in the vicinity of Colony, WY, and Alva, MT).

USFS ECOREGIONS: 331F:CC, M334A:CC
CONSERVATION REGIONS: 25:C, 26:C
STATES: SD WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS MACROCARPA WOODLAND ALLIANCE (II.B.2.N.a)

Quercus macrocarpa / Corylus americana - Amelanchier alnifolia Woodland

Bur Oak / American Hazelnut - Saskatoon Serviceberry Woodland

Bur Oak / Hazelnut Woodland CEGL000556

DESCRIPTION: The tree canopy in this type is dominated by *Quercus macrocarpa*. Less commonly, *Fraxinus pennsylvanica* and *Populus tremuloides* are present in the canopy. A layer of short shrubs is present, with *Amelanchier alnifolia, Corylus* spp., and *Symphoricarpos occidentalis* prevalent.

This type occurs on widely scattered hills and in ravines, primarily in glaciated regions of the prairies and plains. In Minnesota, stands occur on dry to dry-mesic hilly moraines and glacial beach ridges (MNNHP 1993). In North Dakota it is considered the potential natural vegetation of the Turtle Mountains and the Devils Lake area and is the prevailing woodland type in the Pembina Hills, the largest continuous woodland area in North Dakota (D. Lenz pers. comm. 1997). In Ontario it is found near Thunder Bay on a gravel terrace at the Kaministiqua River, with a surrounding boreal landscape (W. Bakowsky pers. comm. 1998).

COMMENTS: *2, MCS*. In Manitoba *Amelanchier alnifolia* is not characteristic. This type has undergone gradual changes in concept and is still in need of serious rangewide classification review. Compare with *Quercus macrocarpa / Corylus cornuta* Woodland (CEGL002137), which is best described from the Killdeer Mountains in unglaciated regions of North Dakota, but which is listed as possible for Saskatchewan. Saskatchewan should perhaps be listed only for either CEGL002137 or CEGL000556. Compare also *Quercus macrocarpa / Prunus virginiana - Symphoricarpos occidentalis* Woodland (CEGL002138), found in moist bottomland sites in the Black Hills and adjacent plains, and *Quercus macrocarpa - Populus tremuloides / Corylus* spp. Woodland (CEGL002139), found in the aspen parkland regions, and finally, *Quercus macrocarpa* / Mixedgrass Loam Wooded Herbaceous Vegetation (CEGL002163), an open savanna type in the northern Great Plains.

CONSERVATION RANK: *G3.* This woodland type has a restricted distribution in a largely prairie landscape.

DISTRIBUTION: This bur oak community type is found on widely scattered hillsides and ravine slopes in the northeastern Great Plains and northern tallgrass prairie region of the United States and Canada, and scattered localities eastward. In North Dakota, it is considered the potential natural vegetation of the Turtle Mountains and the Devils Lake area and is the prevailing woodland type in the Pembina Hills, the largest continuous woodland area in North Dakota. It is also found in southern Manitoba and possibly Saskatchewan. In Minnesota it occurs in the northern tallgrass region (not aspen parkland) on dry to dry-mesic hilly moraines and glacial beach ridges. Scattered, somewhat disjunct stands occur in Ontario near Thunder Bay on a gravel terrace at the Kaministiqua River.

USFS ECOREGIONS: 251Aa:CCC, 331:C, 332A:CC
CONSERVATION REGIONS: 34:C, 35:C
STATES: MN ND **PROVINCES:** MB? ON? SK?

MIDWEST HERITAGE SYNONYMY: MN oak woodland-brushland (central section) =

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS MACROCARPA WOODLAND ALLIANCE (II.B.2.N.a)

Quercus macrocarpa / Corylus cornuta Woodland

Bur Oak / Beaked Hazelnut Woodland

Northwestern Great Plains Bur Oak Woodland CEGL002137

DESCRIPTION: The overstory of this community is dominated by deciduous tree species, especially *Quercus macrocarpa*, but including *Fraxinus americana, Populus tremuloides*, and *Ulmus americana*. Girard (1985) reported that *Quercus macrocarpa* contributed 10.2 m2 of a total basal area of 13.1 m2/ha, had a density of 517 trees/ha, and covered 100% of the canopy. *Prunus virginiana* may be present in the tree subcanopy, while the shrub layer may contain species such as *Amelanchier alnifolia, Corylus americana, Corylus cornuta*, and *Ribes missouriense*. Species such as *Apocynum androsaemifolium, Aralia nudicaulis, Galium boreale*, and *Viola canadensis* occur in the herbaceous layer. Wali et al. (1980) found that bur oak accounted for over 70% of the relative density and dominance. *Corylus cornuta, Corylus americana*, and *Amelanchier alnifolia* account for over 75% of all shrub stratum stems.

This type occurs on level to gentle lower slopes of isolated buttes. Slopes range from nearly level to 30%. The soils are sandy loams, with pH 7.0-7.5. These communities may be found on any aspect, although they are more likely on east-facing and southeast-facing slopes. The slope angle and aspect of the stands results in a relatively dry site (Girard 1985).

COMMENTS: *2, MCS*. This type concept emphasizes a northwestern, and perhaps unglaciated, Great Plains distribution. It is not found in the tallgrass prairie region, unlike *Quercus macrocarpa / Corylus americana - Amelanchier alnifolia* Woodland (CEGL000556), which is found in the northeastern Great Plains and northern tallgrass prairie ecoregion. In contrast, *Quercus macrocarpa / Prunus virginiana - Symphoricarpos occidentalis* Woodland (CEGL002138) is found in moist bottomland sites in the Black Hills and adjacent Great Plains and *Quercus macrocarpa - Populus tremuloides / Corylus* spp. Woodland (CEGL002139) is found in the aspen parkland region. Saskatchewan should perhaps be listed only for either this type (CEGL002137) or CEGL000556.

CONSERVATION RANK: *G2G3.* There are probably fewer than 50 occurrences of this community rangewide. It has a restricted distribution in a predominantly prairie landscape; it is found on level to gentle lower slopes of isolated buttes and hills. It is reported from the Killdeer Mountains of western North Dakota (where it is ranked S2) and from Saskatchewan (S?). Currently there are less than 12 occurrences documented from North Dakota.

DISTRIBUTION: This bur oak / beaked hazelnut is found in the north-central Great Plains, particularly North Dakota and possibly adjacent states and provinces in the United States and Canada. It is particularly reported in the Killdeer Mountains of western North Dakota, and possibly elsewhere in North Dakota and Saskatchewan.

USFS ECOREGIONS: 331E:C?, 331F:CC
CONSERVATION REGIONS: 26:C, 34:C
STATES: ND **PROVINCES:** SK

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Quercus macrocarpa / Corylus* spp. Plant Association (Johnston 1987) B, *Quercus macrocarpa / Corylus* spp. Habitat Type (Girard 1985) =, Bur oak community (Wali et al. 1980) =

USNVC HIERARCHY: QUERCUS MACROCARPA WOODLAND ALLIANCE (II.B.2.N.a)

Quercus macrocarpa / Ostrya virginiana Forest

Bur Oak / Eastern Hop-hornbeam Forest

Bur Oak / Ironwood Forest CEGL000555

DESCRIPTION: This community is dominated by closely spaced small trees of *Quercus macrocarpa*. In some areas across the range of this type *Fraxinus pennsylvanica* may be present. *Ostrya virginiana* is present in the tree subcanopy. The shrub layer may contain *Prunus virginiana var. virginiana, Ribes* spp., and *Symphoricarpos occidentalis*. The herbaceous layer is moderately diverse. Species include *Carex siccata (= Carex foenea), Carex saximontana, Carex sprengelii, Elymus virginicus, Mahonia repens, Maianthemum stellatum, Phlox gracilis ssp. gracilis, Thalictrum* spp., and *Woodsia* spp. In four stands sampled by Hoffman and Alexander (1987), the shrubs covered an average of 16%, graminoids 17%, and forbs 17%. The basal area in these stands was 26.6 m2/ ha.

This community has been reported on gentle to moderately steep (14-47%) northerly slopes (Hoffman and Alexander 1987, Johnston 1987). Most occurrences are on upland slopes, but some are along streams and gullies. The soils are sandy loams and loams with pH of 5.8-7.4 (Johnston 1987).

The riparian edges of some stands may experience periodic flooding. The upland portions of some stands may also be exposed to periodic fire (which may encourage oak regeneration).

COMMENTS: *2, MCS*. This community has been described only from the Black Hills, but has some affinities to Great Plains Bur Oak types, such as *Quercus macrocarpa / Prunus virginiana - Symphoricarpos occidentalis* Woodland (CEGL002138). *Quercus macrocarpa* has a physiognomic appearance similar to *Quercus gambelii*, e.g., the *Pinus ponderosa / Quercus gambelii* Woodland (CEGL000870).

CONSERVATION RANK: *G2G3*. Most *Quercus macrocarpa*-dominated stands in the Black Hills are heavily grazed (Hoffman and Alexander 1987).

DISTRIBUTION: This community type is found in the Black Hills of the western United States, particularly South Dakota and Wyoming.

USFS ECOREGIONS: M334A:CC
CONSERVATION REGIONS: 25:C
STATES: SD WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Quercus macrocarpa / Ostrya virginiana* Habitat Type (Hoffman and Alexander 1987) =, *Ostrya virginiana / Quercus macrocarpa* sparse understory Plant Association (Johnston 1987) =, *Quercus macrocarpa / Ostrya virginiana* community (Jones 1992) =

USNVC HIERARCHY: QUERCUS MACROCARPA FOREST ALLIANCE (I.B.2.N.a)

Quercus macrocarpa / Prunus virginiana - Symphoricarpos occidentalis Woodland

Bur Oak / Choke Cherry - Western Snowberry Woodland

Bur Oak / Chokecherry - Western Snowberry Woodland CEGL002138

DESCRIPTION: This community is a woodland or forest dominated by *Quercus macrocarpa* and *Fraxinus pennsylvanica*. *Populus tremuloides, Populus balsamifera*, and *Ulmus americana* may be present. In addition to *Prunus virginiana* and *Amelanchier alnifolia*, other shrub species may include *Prunus americana, Ribes americanum*, and *Rosa woodsii* (Lautenschlager 1964). Ten stands in western North Dakota were dominated by *Quercus macrocarpa* and *Fraxinus pennsylvanica* in the tree layer, *Amelanchier alnifolia* and *Prunus virginiana* in the shrub layer, and *Carex sprengelii, Poa pratensis*, and *Galium boreale* in the herbaceous layer (USFS 1992). Stands in the Black Hills often have *Symphoricarpos occidentalis* as a dominant shrub (Hoffman and Alexander 1987). Average cover by strata was trees 77%, shrubs 38%, and herbaceous 32%.

Along the Missouri River in North Dakota, these forests have rather closed canopies, resulting in a lack of a tall shrub and sapling layer. These forests reach a height of about 23 m at maturity (Keammerer et al. 1975).

This community is located in upland situations along intermittent streams (Girard et al. 1989). It may occur in river valleys on the sideslopes or rarely on the valley bottom. It is also located along ravines and hills of the Missouri Coteau and Escarpment (Barlow 1987, Dodds 1966). Soils are fertile and relatively mesic. The U.S. Forest Service (1992) sampled 10 stands of this community in western North Dakota. The average slope was north- to east-facing and 20%. In some North Dakota stands, soils are loamy with pH of 7.0 (Girard 1985). In the Black Hills, stands occupy low-lying mesic habitats (Hoffman and Alexander 1987).

COMMENTS: *3, MCS*. This type was first described from southwestern North Dakota as the *Quercus macrocarpa / Prunus virginiana* habitat type (Girard et al. 1989). The *Quercus macrocarpa / Symphoricarpos occidentalis* type described for the northern Black Hills (in an area between Sundance, Wyoming, and Whitewood, South Dakota) by Hoffman and Alexander (1987), was added to the concept in October 1999. It should be compared to *Quercus macrocarpa / Ostrya virginiana* Forest (CEGL000555). Further survey of oak types in the Black Hills would be useful; there may be other types that have not been described.

CONSERVATION RANK: *G3G4.* Areas where this type is found are widely threatened by multiple impacts, including clearing of land, suppression of fire, and concentrated grazing by livestock.

DISTRIBUTION: This oak woodland type is found in the northwestern Great Plains and Black Hills of the United States, ranging from North Dakota to South Dakota and Wyoming.

USFS ECOREGIONS: 331E:CC, 331F:CC, M334A:CC
CONSERVATION REGIONS: 25:C, 26:C, 34:C
STATES: ND SD WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS MACROCARPA WOODLAND ALLIANCE (II.B.2.N.a)

Tilia americana - (Quercus macrocarpa) / Ostrya virginiana Forest

American Basswood - (Bur Oak) / Eastern Hop-hornbeam Forest

Basswood - Bur Oak Forest CEGL002012

DESCRIPTION: This community has a tall, deciduous overstory typically made up of tree species such as *Tilia americana* and *Quercus macrocarpa*. Other tree species commonly found in this community across its range include *Celtis occidentalis, Fraxinus pennsylvanica, Juglans nigra, Ostrya virginiana*, and *Ulmus americana*. Although the subcanopy is poorly developed, the herbaceous and shrub layers are well developed. Shrub layer species may include *Juniperus virginiana, Symphoricarpos occidentalis*, and *Zanthoxylum americanum*. Species found within the herbaceous layer may include *Amelanchier alnifolia, Anemone* spp., *Aquilegia canadensis, Caulophyllum thalictroides, Dicentra cucullaria, Heracleum maximum, Laportea canadensis, Menispermum canadense, Phlox divaricata, Podophyllum peltatum, Polygonatum biflorum, Rudbeckia laciniata, Maianthemum stellatum, Smilax tamnoides, Urtica dioica*, and *Viola pubescens*. Near the tops of bluffs, the tree canopy is open and shrubs are abundant. The shrubs often form dense thickets that may extend well beyond the forest edge (MNNHP 1993, Steinauer and Rolfsmeier 2000).

This community occurs on the bluffs of streams and rivers and on the adjacent uplands. Soils are well-drained loams. They are moderately acidic and generally fertile because of the high nutrient content of *Tilia* leaves. The parent material is primarily loess. The soils are not flooded or saturated during the year (MNNHP 1993, Steinauer and Rolfsmeier 2000).

COMMENTS: *2, MCS*. This type may exist in western Minnesota, where it overlaps with the maple-basswood type *Acer saccharum - Tilia americana / Ostrya virginiana - Carpinus caroliniana* Forest (CEGL002062), and if so, maple may be more abundant than in the main part of this community's range. The maple-basswood stands in southeastern South Dakota may be part of this type or treated as an outlier of the maple-basswood type. In southeastern Nebraska, a *Quercus rubra - Tilia americana* type was described by Weaver (1965) and may be similar to this community, but it is currently treated as part of the *Quercus alba - (Quercus velutina) - Carya ovata / Ostrya virginiana* Forest (CEGL002011) as recommended by G. Steinauer (pers. comm. 1999).

CONSERVATION RANK: *G3.* There may be fewer than 100 occurrences of this community rangewide. It occurs in eastern Nebraska (where it is ranked S2S3), eastern South Dakota (S2), western Iowa (S4?), western Minnesota (S3), and extreme eastern North Dakota (S2S3?). Currently there are 12 occurrences documented from Minnesota, North Dakota, and Nebraska. This community may be degraded by grazing and selective logging throughout much of its range.

DISTRIBUTION: This basswood-bur oak forest type is found in the western tallgrass region of the midwestern United States, ranging from Iowa and Nebraska to western Minnesota and the Dakotas.

USFS ECOREGIONS: 251Aa:CCC, 251Ab:CCC, 251Ba:CCC, 251Bb:CCC, 251Bd:CC?, 251Bf:CC?, 251Ca:CCP, 251Cg:CCC, 251Cm:CCC, 251Cn:CCC, 332D:CP
CONSERVATION REGIONS: 34:C, 35:C, 36:C
STATES: IA MN ND NE SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MN maple-basswood forest (west central section) -
NE northeastern upland forest =

OTHER SYNONYMY:

USNVC HIERARCHY: ACER SACCHARUM - TILIA AMERICANA - (QUERCUS RUBRA) FOREST ALLIANCE (I.B.2.N.a)

Fraxinus pennsylvanica - Ulmus americana / Prunus virginiana Woodland

Green Ash - American Elm / Choke Cherry Woodland

Green Ash - Elm Woody Draw CEGL000643

DESCRIPTION: This community is an open- to closed-canopy woodland dominated by *Fraxinus pennsylvanica*. *Ulmus americana* or *Acer negundo* sometimes achieve codominance. The largest trees are 50-60 cm dbh, but most trees are 20-30 cm dbh. In sharply cut, V-shaped upland ravines, the largest trees are near the center or bottom of the ravine where there is greater soil moisture. The average tree age is 70 to 80 years. The tree subcanopy, when present, consists of the same species, with the infrequent addition of *Betula occidentalis, Crataegus succulenta, Ostrya virginiana*, and *Populus tremuloides* at some sites. In undisturbed stands, the understory is composed of two layers. The taller and more conspicuous layer is a shrub layer 2-3 m tall. This layer is dominated by *Prunus virginiana* with smaller amounts of *Symphoricarpos occidentalis*. In Nebraska, a variety of other shrubs occur. The most common are *Prunus americana, Prunus virginiana, Ribes aureum var. villosum, Rosa woodsii*, and *Symphoricarpos occidentalis*; less common shrubs include *Acer glabrum, Amorpha fruticosa, Cornus sericea, Crataegus succulenta, Rhus glabra, Ribes americanum, Ribes oxyacanthoides*, and *Rubus occidentalis*. *Toxicodendron rydbergii* frequently forms a short-shrub layer. *Vitis riparia* is the most common vine. Rangewide, the lower layer is dominated by grasses and sedges such as *Elymus virginicus* and *Carex sprengelii*. Common herbaceous species include *Aquilegia canadensis, Galium boreale, Galium aparine, Maianthemum stellatum*, and *Thalictrum dasycarpum*. In central South Dakota this community is a woodland with an open canopy of ash trees and an extremely dense shrubby understory. The average tree height is 6.7 m and the shrub understory is 1.6 m high. There are few herbaceous species. The continuation of the status of *Ulmus americana* as a prominent part of this community is uncertain due to the effects of Dutch Elm disease (Hansen et al. 1984, Hansen and Hoffman 1988, Girard et al. 1989, Hansen et al. 1990, U.S. Army Corp of Engineers 1979, Steinauer and Rolfsmeier 2000).

Stands occur in upland ravines and broad valleys or on moderately steep slopes. They also occur along small permanent or ephemeral streams. In central North Dakota, this community is also found along the north slopes of end moraines or kames and along lakeshores. On these sites, soil and topography permit greater than normal moisture conditions. In south-central South Dakota stands occur on steep, north-facing escarpments and around boulder outcrops. In northwestern Nebraska they occur in deep mesic ravines or canyons. Soils are clay loams, sandy clay loam, silty clay, and sandy loam. Soil pH ranges from 6.0 to 8.1. Slopes range from 0 to 40%. In south-central South Dakota soils are dry to moist, and moderately drained (Godfread 1976, William 1979, Hansen and Hoffman 1988, Girard et al. 1989, Steinauer and Rolfsmeier 2000).

In Theodore Roosevelt National Park, bison utilize this habitat for grazing, watering, and summertime shade (Hansen et al. 1984). Past heavy grazing by cattle is reflected in the dominance of some weedy species, such as *Melilotus officinalis (= Melilotus albus)* and *Poa pratensis* (Hansen et al. 1984).

COMMENTS: *2, MCS*. The community described by Girard et al. (1989) in southwestern North Dakota was very dense for a woodland (700 trees/ha); however, the basal area was fairly low (18 m2/ha) and the trees averaged 9 m tall. This appears to be a dense woodland and may overlap with *Fraxinus pennsylvanica / Prunus virginiana* Forest (CEGL000642) that occurs in Montana and Wyoming. For example, the *Fraxinus pennsylvanica - Prunus virginiana* habitat type in Theodore Roosevelt National Park, western North Dakota (Hansen et al. 1985) was expanded in Hansen et al. (1990) to include this community in eastern Montana. Wali et al. (1980) also described a green ash-American elm forest in western North Dakota. Montana lumps most stands with *Ulmus americana* into *Fraxinus pennsylvanica / Prunus virginiana* Forest (CEGL000642).

CONSERVATION RANK: *G2G3.* There are probably fewer than 100 occurrences of this community rangewide. It is reported from Montana (where it is ranked S1Q), North Dakota (SU), and South Dakota (SU). Currently 41 occurrences are documented from North Dakota. Historical acreage and trends are unknown.

DISTRIBUTION: This community type occurs in the northwestern Great Plains of the United States, from northern and western Nebraska to the Dakotas and Montana.

USFS ECOREGIONS: 331E:CC, 331F:CC, 332A:??, 332C:PP, 332D:??
CONSERVATION REGIONS: 26:C
STATES: MT ND NE SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE northwestern canyon bottom deciduous woodland =

OTHER SYNONYMY: *Fraxinus pennsylvanica - Zanthoxylum americanum* (U. S. Army Corps of Engineers 1979). Similar. In south-central South Dakota along the east bank of the Lake Francis Case Reservoir on the Missouri River. This type was trampled heavily as domestic animals and wildlife commonly use it for shade from the mid-day sun., Deciduous woods (Tolstead 1947) B

USNVC HIERARCHY: FRAXINUS PENNSYLVANICA - (ULMUS AMERICANA) WOODLAND ALLIANCE (II.B.2.N.a)

Fraxinus pennsylvanica - Ulmus americana / Symphoricarpos occidentalis Forest

Green Ash - American Elm / Western Snowberry Forest

Ash - Elm / Wolfberry Forest CEGL002082

DESCRIPTION: This community is a moderately to densely vegetated forest with an open to dense shrub understory. The average height of the tree layer was 5-7 m in south-central South Dakota (U.S. Army Corps of Engineers 1979) and 8 m in southwestern North Dakota (Girard et al. 1989). There is 25-30% bare soil, and litter is present as trace amounts of the previous year's vegetation. The tree layer is dominated by *Fraxinus pennsylvanica* and *Ulmus americana*. Widely scattered old *Populus deltoides* occur as remnants of a previous successional stage. The shrub layer is dominated by *Symphoricarpos occidentalis*. Other shrubs that can be found with it are *Rosa woodsii, Juniperus scopulorum* (which can also be in the canopy or subcanopy), and *Prunus virginiana*. *Symphoricarpos occidentalis* tends to increase under grazing pressure, and it may be almost the only shrub where grazing has been intense. Herbaceous species that may be found in this community are *Pascopyrum smithii, Andropogon gerardii, Poa* spp., *Carex* spp. (wide-leaved), *Rumex* spp., *Carex filifolia, Anemone cylindrica, Piptatherum micranthum (= Oryzopsis micrantha), Galium* spp., *Anemone canadensis, Taraxacum* spp., *Lappula* spp., *Conyza canadensis*, and *Cirsium* spp.

This community occurs on upland sites along steep north-facing slopes and, occasionally, along intermittent drainages or near the bases of north-facing slopes of upland sites. Soils are typically moist (occasionally dry) and poorly drained. Girard et al. (1989) found this community on silty clay and clay soils.

This community was trampled heavily as domestic animals and wildlife commonly use it for shade from the mid-day sun.

COMMENTS: *2, MCS*. The *Fraxinus pennsylvanica - Ulmus americana / Prunus virginiana Woodland (CEGL000643)* is less moist, and typically occurs in draws or ravines. The description for this type is taken, in part, from a study of upland plant communities along the east bank of the Lake Francis Case Reservoir on the Missouri River in south-central South Dakota (U.S. Army Corp of Engineers 1979). The study recognized four types that are treated together here: (1) *Juniperus virginiana - Fraxinus pennsylvanica - Ulmus americana*, (2) *Fraxinus pennsylvanica - Juniperus virginiana - Symphoricarpos occidentalis*, (3) *Juniperus virginiana - Fraxinus pennsylvanica - Prunus virginiana*, and (4) *Fraxinus pennsylvanica - Juniperus virginiana - Celtis occidentalis*. Species composition for this type may reflect a lower-quality condition caused by grazing.

CONSERVATION RANK: *G3G5.*

DISTRIBUTION: This ash - elm woody draw community type is found in the northern Great Plains of the United States and Canada, from the Dakotas to Manitoba.

USFS ECOREGIONS: 331:P, 332:P, M334A:CC
CONSERVATION REGIONS: 25:C, 26:C
STATES: ND SD **PROVINCES:** MB

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Fraxinus pennsylvanica/Juniperus virginiana - Symphoricarpos occidentalis* (Girard et al. 1989) =

USNVC HIERARCHY: FRAXINUS PENNSYLVANICA - (ULMUS AMERICANA) FOREST ALLIANCE (I.B.2.N.a)

Betula papyrifera - (Tilia americana, Quercus macrocarpa) Canyon Forest

Paper Birch - (American Basswood, Bur Oak) Canyon Forest

Paper Birch Canyon Forest CEGL002013

DESCRIPTION: In this community the overstory is dominated by deciduous trees, such as *Betula papyrifera, Fraxinus pennsylvanica, Quercus macrocarpa*, and *Tilia americana*. The trees are moderately tall with a dense canopy in the lower portions of springbranch canyons and river bluffs. *Betula papyrifera* is restricted to the lower slopes, where their roots are continuously in contact with the water table. On upper slopes, trees are shorter with a more open canopy and the physiognomy is more like a woodland. The shrub layer is relatively sparse except near the edges of stands and where the canopy is open. A short-shrub layer of *Toxicodendron rydbergii* is often abundant. The herbaceous layer is sparse to well-developed, and is usually dominated by graminoids, primarily *Carex eburnea, Carex sprengelii, Elymus villosus, Festuca subverticillata*, and *Piptatherum micranthum (= Oryzopsis micrantha)*. Along springs and seeps, a dense layer of moss and fungi is present. The species composition is a mixture of species from the western montane, eastern deciduous, and northern boreal forests (Steinauer and Rolfsmeier 2000).

This community occurs along steep springbranch canyons and adjacent river bluffs. Soils are deep, loamy, and poorly drained to well-drained. The parent material is aeolian sand, alluvium, or Rosebud siltstone. Soils that occur near seeps may be highly saturated and have a dense layer of humus and leaf mold. Other than near seeps, the soils of this community are not saturated or flooded during the year (Steinauer and Rolfsmeier 2000).

COMMENTS: *3, MCS*. Concept of this type is taken from the Nebraska state type - northern springbranch canyon forest (Steinauer and Rolfsmeier 2000). This community needs to be compared with *Betula papyrifera* communities in the Black Hills, particularly *Betula papyrifera / Corylus cornuta* Forest (CEGL002079).

CONSERVATION RANK: *G2?*. This community has a fairly restricted distribution and many occurrences have been cleared for pasture or overgrazed. *Betula papyrifera* does not appear to be successfully reproducing in this community.

DISTRIBUTION: This paper birch canyon forest is found in a restricted area along the Niobrara River in western Nebraska, United States. Stands occur along an approximately 50-km stretch of the Niobrara River in western Brown, western Keya Paha, and eastern Cherry counties of Nebraska.

USFS ECOREGIONS: 331F:??, 332C:CC
CONSERVATION REGIONS: 26:?
STATES: NE SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE northern springbranch canyon forest =

OTHER SYNONYMY: Northern Boreal Relicts (Churchill et al. 1988) =, Boreal Relict Community (Kantak 1995) =, Paper Birch Association (Pool 1914) =, Deciduous woodland (Tolstead 1942) B

USNVC HIERARCHY: BETULA PAPYRIFERA FOREST ALLIANCE (I.B.2.N.b)

Betula papyrifera / Corylus cornuta Forest

Paper Birch / Beaked Hazelnut Forest

Paper Birch / Hazel Forest CEGL002079

DESCRIPTION: This community has a predominantly closed canopy dominated by *Betula papyrifera*. Other trees that may contribute significantly to the canopy are *Quercus macrocarpa, Populus tremuloides*, and, in the Bear Lodge Mountains, *Pinus ponderosa*. *Fraxinus pennsylvanica* may be present, especially as small trees or saplings. There is a tall-shrub layer that usually reaches 2 m or more. The most abundant shrub is *Corylus cornuta*. Other species found in this layer are *Amelanchier alnifolia* and *Prunus virginiana*. Jones (1992) reported a low-shrub layer that consisted of *Symphoricarpos* spp., *Spiraea betulifolia, Shepherdia argentea*, and *Ribes* spp. Common herbaceous species include *Actaea rubra, Maianthemum canadense, Carex* spp., *Aralia nudicaulis, Apocynum androsaemifolium*, and *Schizachne purpurascens*.

This community has been sampled in the Killdeer Mountains of North Dakota and the Black Hills of western South Dakota and eastern Wyoming, where it is found on nearly level ground or lower slopes with silt loam soil in North Dakota and the Black Hills (Girard et al. 1989, McAdams et al. 1998) and, more rarely, on steep north-facing slopes in the Black Hills (Jones 1992).

This community type may occasionally be flooded during periods of unusually high rainfall.

COMMENTS: *2, MCS*. This type is predominately based on information from the Black Hills (McAdams et al. 1998). It is similar to *Betula papyrifera / Corylus cornuta* Woodland (CEGL002128). *Clematis occidentalis* may be a diagnostic species for the woodland type, and that type also occurs on the top of steep, north-facing slopes (Girard et al. 1989). This type may be more similar to the *Quercus macrocarpa / Corylus cornuta* Woodland (CEGL002137), to which it may be related successionally. See also *Betula papyrifera - (Tilia americana, Quercus macrocarpa)* Canyon Forest (CEGL002013) in Nebraska, which may be an outlier set of stands that fit with this type.

CONSERVATION RANK: *G2G3.* Currently there are seven occurrences documented from North Dakota; the community is also reported from Wyoming, and possibly South Dakota. The state rank in Wyoming is S1S2. Estimated total number of occurrences is fewer than 25. The total currently documented acreage is less than 300 acres. Most occurrences are smaller than 50 acres, so the total acreage is probably less than 1000 acres. The range may be fairly restricted. Most of the documented occurrences are from one gorge in one county in North Dakota. Most of the documented occurrences are also in good condition.

DISTRIBUTION: This paper birch / beaked hazelnut forest type is found in the northwestern Great Plains and Black Hills of the United States, particularly the western Dakotas and Wyoming.

USFS ECOREGIONS: 251Aa:CCC, 331:?, 332:?, M334A:CC
CONSERVATION REGIONS: 25:C, 26:C, 34:C, 35:C
STATES: ND SD WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Betlua papyrifera / Corylus cornuta* Community Type (Girard et al. 1989) =, *Betlua papyrifera / Corylus cornuta* Plant Association (Johnston 1987) =, *Betlua papyrifera* Series (Jones 1992) =

USNVC HIERARCHY: BETULA PAPYRIFERA FOREST ALLIANCE (I.B.2.N.b)

Betula papyrifera / Corylus cornuta Woodland

Paper Birch / Beaked Hazelnut Woodland

Paper Birch / Beaked Hazel Woodland CEGL002128

DESCRIPTION: The overstory of this woodland community is dominated by *Betula papyrifera*. Others include *Populus tremuloides, Quercus macrocarpa*, and, less frequently, *Fraxinus pennsylvanica*. There is a vigorous shrub layer that is typically 1-2 m tall. *Corylus cornuta* is the most abundant species in this stratum. Other typical species include *Symphoricarpos occidentalis, Prunus virginiana, Corylus americana, Amelanchier alnifolia*, and *Rosa woodsii*. The herbaceus layer may have several species with northern affinities, such as *Galium boreale, Aralia nudicaulis, Cornus canadensis, Clematis occidentalis, Maianthemum canadense, Pyrola elliptica*, and *Linnaea borealis*. Although graminoid species do not usually contribute substantially to the herbaceous layer, Girard (1985) found *Schizachne purpurascens* and *Carex* spp. to be important components in this type.

This community is found on slopes or rolling topography. Soils are silty or sandy loams in North Dakota stands. In the southwestern portion of its range, in the Killdeer Mountains of North Dakota, it is restricted to the top of steep (30%) north-facing slopes (Girard et al. 1989). Wali et al. (1980) found growth most favorable on north- and west-facing slopes and found that paper birch was dominant on steep slopes, whereas aspen was more frequently found on moderate slopes. In other parts of its range, it occurs on other aspects as well.

COMMENTS: *2, MCS*. This type is somewhat similar to *Betula papyrifera / Corylus cornuta* Forest (CEGL002079), though that type occurs on lower slopes or drainage ways, and is a more closed-canopy type. *Clematis occidentalis* may be an indicator for this type. It occurs as small, scattered stands.

CONSERVATION RANK: *G2G3.* Few occurrences have been documented. The range of this woodland community is restricted to slopes and rolling topography in the northern Great Plains. Occurrences may represent a slow succession following fire; if so, then fire suppression could eventually reduce the acreage.

DISTRIBUTION: This white birch / beaked hazelnut woodland is found in the northern Great Plains of the United States and Canada, ranging from western North Dakota to Saskatchewan.

USFS ECOREGIONS: 331E:CP, 331F:CC, 332A:PP
CONSERVATION REGIONS: 26:C
STATES: ND **PROVINCES:** MB SK

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Betula papyrifera / Clematis occidentalis* Habitat Type (Girard et al. 1989) =, Paper birch community stands (Wali et al. 1980) =

USNVC HIERARCHY: BETULA PAPYRIFERA WOODLAND ALLIANCE (II.B.2.N.a)

Betula papyrifera / Juniperus horizontalis Shale Woodland

Paper Birch / Creeping Juniper Shale Woodland

Paper Birch / Creeping Juniper Woodland CEGL002129

DESCRIPTION: Little is known about this type.

COMMENTS: *3, MCS*. Review is needed from North Dakota ecologists.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This paper birch type has been reported in the northeastern Great Plains of the United States from North Dakota.

USFS ECOREGIONS: 251Ab:CCC, 331:?, 332:?
CONSERVATION REGIONS: 34:C
STATES: ND **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: BETULA PAPYRIFERA WOODLAND ALLIANCE (II.B.2.N.a)

Populus tremuloides / Prunus virginiana Woodland

Quaking Aspen / Choke Cherry Woodland

Aspen / Chokecherry Woodland CEGL002130

DESCRIPTION: Across its range, the dominant canopy species in this community is *Populus tremuloides*, often associated with *Fraxinus pennsylvanica*. *Betula papyrifera* is sometimes present or even codominant (Girard et al. 1989). In the eastern portion of its range, *Quercus macrocarpa* and *Populus grandidentata* are also typical canopy associates. *Populus tremuloides* spreads by root suckering and this can result in high stem density, especially in younger stands. Girard et al. (1989) found 722 stems/ha in southwestern North Dakota. There is a significant shrub layer that is dominated by *Prunus virginiana*. Other common shrub species include *Ribes aureum var. villosum, Amelanchier alnifolia, Symphoricarpos occidentalis, Corylus* spp., and *Rosa* spp. The herbaceous layer is not as well-developed as the shrub layer but is still significant. *Maianthemum stellatum, Galium boreale*, and *Aralia nudicaulis* are typically found in the herbaceous layer.

In southwestern North Dakota, this community is largely limited to gentle (0-20%) slopes on the fringes of other woodlands. The soils are deep (>40 cm) loam, with a pH of 7.2 to 8.0 (Girard et al. 1989). At the eastern edge of its range, this community can be found on dry-mesic to wet-mesic sites and on flat to rolling topography.

The occurrence of these stands on the top of north-facing slopes may result in increased snow catch as the winds blow across the tops of other buttes, while the downslope portions are more sheltered. In the spring, the soils on these tops sometimes remain frozen after the frost has gone out downslope. The cold, wet conditions, which are unfavorable for seed germination, may favor *Populus tremuloides*, which can reproduce by sprouting. Similarly, in the wetter slope positions, the soil may be so saturated as to be unstable for some species. *Populus tremuloides* may act to stabilize these positions, and thereby be succeeded by *Fraxinus pennsylvanica* stands.

COMMENTS: *3, MCS*. This type should be compared with the *Populus tremuloides / Corylus spp. / Andropogon gerardii* Woodland (CEGL005205) in the aspen parkland tallgrass region. Drier aspen stands in the Great Plains are tracked as *Populus tremuloides / Corylus cornuta* Forest (CEGL000583).

CONSERVATION RANK: *G4G5.*

DISTRIBUTION: This aspen / choke cherry woodland type is found in the north-central Great Plains of the United States and Canada extending from southwestern North Dakota north into southern Manitoba and possibly Saskatchewan.

USFS ECOREGIONS: 331:P, 332:P
CONSERVATION REGIONS: 26:C, 34:C
STATES: ND **PROVINCES:** MB SK

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Populus tremuloides / Prunus virginiana* Habitat Type (Girard et al. 1989) F, *Populus tremuloides / Betula papyrifera* Community Type (Girard et al. 1989) F. The *Populus tremuloides / Betula papyrifera* Community Type sampled by Girard *et al*. (1989) is considered to be a variant of the *Populus tremuloides / Prunus virginiana* Woodland, even though the canopy is codominated by *Betula papyrifera* and the understory contains more *Cornus sericea ssp. sericea* than *Prunus virginiana*., Populus tremuloides/Betula occidentalis Habitat Type (Hansen et al. 1984) =

USNVC HIERARCHY: POPULUS TREMULOIDES WOODLAND ALLIANCE (II.B.2.N.a)

Quercus stellata - Quercus marilandica - (Carya texana) Forest

Post Oak - Blackjack Oak - (Black Hickory) Forest

Cross Timbers Post Oak - Blackjack Oak Forest CEGL002074

DESCRIPTION: The vegetation is dominated by relatively closed-canopy forest. Stands are dominated by *Quercus stellata* and *Quercus marilandica*. *Carya texana* is often present. Other associates include *Carya cordiformis, Quercus prinoides* and *Quercus velutina*. Common shrubs include *Rhus copallinum* and *Rhus glabra*. Ground layer species may include *Schizachyrium scoparium* (Lauver et al. 1999).

Stands occur on ridgetops and nearly level to steep hillsides. Soils are shallow to moderately deep, sandy and loamy in texture, derived from sandstone bedrock (Lauver et al. 1999).

COMMENTS: *2, SCS.* This association was created for the Western Crosstimbers forests. It needs further research. This association has been well described at a broad level in the Crosstimbers region of Kansas and Oklahoma (see especially Kuchler 1974). It may, however, extend eastward towards and into western Missouri.

CONSERVATION RANK: *G4.*

DISTRIBUTION: This post oak - black jack oak type is found in the cross timbers region of the southeastern Great Plains, from Kansas to Texas.

USFS ECOREGIONS: 231:?, 251:C, 255Ad:CCC
CONSERVATION REGIONS: 32:C, 37:C
STATES: AR? KS OK TX **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS STELLATA - QUERCUS MARILANDICA FOREST ALLIANCE (I.B.2.N.a)

Quercus stellata - Quercus marilandica / Schizachyrium scoparium Woodland

Post Oak - Blackjack Oak / Little Bluestem Woodland

Post Oak - Blackjack Oak Cross Timbers Woodland CEGL002147

DESCRIPTION: The vegetation structure is an open canopy of trees. Dominant species include *Quercus stellata* and *Quercus marilandica*, with occasional *Quercus prinoides* and *Celtis tenuifolia*. The shrub layer is often absent. The ground layer consists of *Schizachyrium scoparium, Andropogon gerardii*, and *Sorghastrum nutans* (Lauver et al. 1999).

Stands are found on ridgetops and gently to steeply sloping hillsides. Soils are shallow to moderately deep, sandy to loamy, and somewhat poorly drained to well-drained. The parent material is typically sandstone (Lauver et al.1999).

COMMENTS: *2, MCS*. Type has been described in the Cross Timbers region of Kansas and Oklahoma by Kuchler (1974). Distinctions between the forest type, *Quercus stellata - Quercus marilandica - (Carya texana)* Forest (CEGL002074), and this woodland type need review. *Quercus stellata - Quercus marilandica - Quercus velutina - Carya texana / Schizachyrium scoparium* Woodland (CEGL002149) occurs further east in the Ozarks.

CONSERVATION RANK: *G4.*

DISTRIBUTION: This post oak - blackjack oak woodland type is found in the southeastern Plains and tallgrass prairie areas of the United States, occupying the Cross Timbers region of central Kansas, western and central Oklahoma, and Texas.

USFS ECOREGIONS: 231Em:CCC, 231En:CCC, 251:C, 255Ai:CCC, 255Aj:CCC, 255Ba:CCC, 255Ca:CCC, 255Cf:CCC
CONSERVATION REGIONS: 28:C, 29:C, 32:C, 37:C, 40:C
STATES: KS OK TX **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS STELLATA - QUERCUS MARILANDICA WOODLAND ALLIANCE (II.B.2.N.a)

Pinus ponderosa / Arctostaphylos uva-ursi Woodland

Ponderosa Pine / Kinikinnick Woodland

Ponderosa Pine / Bearberry Woodland CEGL000844

DESCRIPTION: *Pinus ponderosa* is the dominant tree in this woodland community. *Pinus ponderosa* reproduces successfully in this community and is found as seedlings and saplings as well as mature trees. There may be seedlings of *Populus tremuloides* and *Quercus macrocarpa*. In northern New Mexico and southern Colorado, *Pseudotsuga menziesii* may also be present, but elsewhere rarely do any species except *Pinus ponderosa* grow larger than saplings. Shrubs are prominent in this community. Hoffman and Alexander (1987) found that in 10 stands in the Black Hills, shrubs averaged 43.9% cover, while the herbaceous stratum averaged 19.3% cover. The most abundant shrub was *Arctostaphylos uva-ursi*, which covered an average of 33% (range of 10-85%) of the surface. Other shrubs that are likely to be present are *Spiraea betulifolia, Juniperus communis*, and *Symphoricarpos albus*. Typical herbaceous species are *Achillea millefolium, Fragaria virginiana, Lathyrus ochroleucus*, and *Oryzopsis asperifolia*.

This community is found on flat to gently sloping terrain (3-21%) in the Black Hills and surrounding areas (Hoffman and Alexander 1987). It has been found from 1540-3000 m (4250-9100 feet). The slopes are more likely to be facing northward than southward. Soils are sandy loams and clay loams.

Fire was likely an important factor in the regulation of stand structure historically.

COMMENTS: *1, MCS*. Variation between southern and northern U.S. stands should be assessed. Stands in the Black Hills are described by Marriott and Faber-Langendoen (2000).

CONSERVATION RANK: *G4.*

DISTRIBUTION: This ponderosa pine/bearberry community type is found in the Black Hills region, adjacent Great Plains and northern Rocky Mountain front range, extending from Montana, Wyoming and South Dakota south to New Mexico and possibly Utah.

USFS ECOREGIONS: M331F:CC, M331G:CC, M331I:CC, M334A:CC
CONSERVATION REGIONS: 10:C, 20:C, 25:C
STATES: CO MT NM SD UT? WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Pinus ponderosa / Arctostaphylos uva-ursi* Habitat Type (Alexander 1988) =, *Pinus ponderosa / Arctostaphylos uva-ursi* Habitat Type (Hoffman and Alexander 1987) =, *Pinus ponderosa / Arctostaphylos asenotrica* Plant association (Johnston 1987)

USNVC HIERARCHY: PINUS PONDEROSA WOODLAND ALLIANCE (II.A.4.N.a)

Pinus ponderosa / Carex inops ssp. heliophila Woodland

Ponderosa Pine / Sun Sedge Woodland

Ponderosa Pine / Sedge Woodland CEGL000849

DESCRIPTION: The tree canopy and subcanopy are dominated by *Pinus ponderosa*. *Juniperus scopulorum* and *Quercus macrocarpa* are occasionally found in the subcanopy. Shrubs are infrequent in this type. The herbaceous layer is dominated by *Carex inops ssp. heliophila* (sun sedge), with inclusions of *Danthonia spicata, Schizachyrium scoparium* and *Pseudoroegneria spicata*, generally in areas with more open canopies. At Wind Cave National Park, herbaceous cover is most commonly in the 25-50% range and occasionally greater, with sun sedge dominant. Other common herbaceous species include *Artemisia ludoviciana, Danthonia spicata, Piptatherum micranthum (= Oryzopsis micrantha), Nassella viridula*, and *Poa pratensis* (H. Marriott pers. comm. 1999).

This community is often found on gentle and moderate south- to west-facing slopes (Hansen and Hoffman 1988, Hoffman and Alexander 1987).

This type probably develops from little bluestem prairie as pines become established. Disturbances such as fire convert stands back to prairies (Marriott and Faber-Langendoen 2000). The canopy in this type is usually moderately open due to occasional fires, but can become nearly closed in stands where the natural fire disturbance regime has been disrupted.

COMMENTS: *1, WCS*. The stands used by Hoffman and Alexander (1987) and Hansen and Hoffman (1988) to document the *Pinus ponderosa / Carex inops ssp. heliophila* Woodland habitat type had very high basal area and densities for a woodland, possibly due to their sampling procedure. The dense structure may have affected the floristic makeup of the stands. This type is expected to have an open canopy where natural fire disturbances occur.

CONSERVATION RANK: *G3G4.*

DISTRIBUTION: This ponderosa pine / sedge woodland community type is found in the Black Hills region, adjacent Great Plains and northern Rocky Mountain front range from Montana, Wyoming and South Dakota south to Colorado.

USFS ECOREGIONS: 331D:CC, 331E:C?, 331F:CC, 331G:CC, M331F:CC, M331G:CC, M331I:CC, M334A:CC
CONSERVATION REGIONS: 10:C, 20:C, 25:C
STATES: CO MT SD WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Pinus ponderosa / Carex heliophila* Habitat Type (Hansen et al. 1984) =, *Pinus ponderosa / Carex heliophila* Habitat Type (Hoffman and Alexander 1987)

USNVC HIERARCHY: PINUS PONDEROSA WOODLAND ALLIANCE (II.A.4.N.a)

Pinus ponderosa / Juniperus scopulorum Woodland

Ponderosa Pine / Rocky Mountain Juniper Woodland

Ponderosa Pine / Rocky Mountain Juniper Woodland CEGL000861

DESCRIPTION: This community has a dense to moderately open canopy of *Pinus ponderosa* that is typically 10-20 m high. Most of the trees in the canopy are 20-40 cm dbh (Hoffman and Alexander 1987). *Juniperus scopulorum* forms a subcanopy that is 2-4 m high and is also moderately dense to open. There is usually a shrub layer that contains *Cercocarpus montanus, Rhus trilobata, Symphoricarpos occidentalis*, and *Yucca glauca*. *Prunus virginiana* is common in Nebraska stands. The herbaceous layer can be sparse or nearly absent, especially under areas of dense canopy or on very steep, eroding slopes. Total vegetation cover averaged 33% in seven stands in southeastern Montana (Brown 1971). Litter can accumulate to a depth of 10 cm or more where conifers are dense (Thilenius et al. 1995). Where the herbaceous layer is well-developed it is dominated by prairie graminoids. These include *Bouteloua curtipendula, Bouteloua gracilis, Carex filifolia, Piptatherum micranthum (= Oryzopsis micrantha), Poa pratensis, Pseudoroegneria spicata*, and *Schizachyrium scoparium*.

This community has been found primarily on slopes between 16-45% with a variety of aspects. In the central and southern portions of its range, it is predominantly on dry-mesic north- or east-facing slopes. In more mesic local climates or with heavier soils this community can exist on south-facing slopes. In North Dakota, Girard et al. (1989) found *Pinus ponderosa* stands on level to gently sloping (0-15%) mostly south-facing slopes. Throughout its range, the type can be found on bedrock of sandstone, limestone, or shale. Soils are usually well-drained, shallow, very stony, clay loams, silt loams, and sandy loams.

COMMENTS: *1, MCS*. Type needs a thorough regional review. Stands in the Black Hills have been described by Marriott and Faber-Langendoen (2000).

CONSERVATION RANK: *G4.* This type is fairly widespread across 4 of the states where it occurs, though it is not known to be very extensive in any of its range. Protection status across the range of this type is not known.

DISTRIBUTION: This community is found along the eastern edge of the Rocky Mountains and on escarpments into the adjacent Great Plains, extending from the United States-Canadian border in Montana and North Dakota south to New Mexico.

USFS ECOREGIONS: 331D:CC, 331F:CC, 331G:CC, 332C:PP, M332D:??, M334A:CC
CONSERVATION REGIONS: 25:C, 26:C, 27:C
STATES: CO? MT ND NE NM SD WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE mixed coniferous woodland =

OTHER SYNONYMY: *Pinus - Juniperus* Community (Brown 1971) =, *Pinus ponderosa / Juniperus scopulorum* (Girard et al. 1989) =, *Pinus ponderosa / Juniperus scopulorum* (Hoffman and Alexander 1987) B, *Pinus ponderosa / Schizachyrium scoparium - Elytrigia smithii* Plant Association (Johnston 1987) =, *Pinus ponderosa - Juniperus scopulorum / Symphoricarpos occidentalis* Plant Association (Johnston 1987) =, *Pinus ponderosa - Juniperus scopulorum* Coniferous Forest (Thilenius et al. 1995)

USNVC HIERARCHY: PINUS PONDEROSA WOODLAND ALLIANCE (II.A.4.N.a)

Pinus ponderosa / Mahonia repens Forest

Ponderosa Pine / Creeping Oregon-grape Forest

Ponderosa Pine / Oregon Grape Forest CEGL000187

DESCRIPTION: Few stands of this community have been studied, and rangewide information is limited. The overstory is dominated by *Pinus ponderosa*. In central Montana, the low shrub layer was dominated by *Mahonia repens*, with *Spiraea betulifolia* and *Juniperus communis* also common (Pfister et al. 1977). In several stands at Devils Tower, Wyoming, the overstory was dominated by *Pinus ponderosa,* with tree cover in the 25-60% range (Salas et al. 1998). Though a range of tree sizes was present, it was difficult to identify two distinct strata. *Juniperus scopulorum* and *Quercus macrocarpa* were present but sparse. Shrub cover was less than 25%. *Mahonia repens* often dominated the shrub stratum but was sometimes sparse. *Symphoricarpos albus* was sometimes present but sparse. Herbaceous cover was in the 25-100% range, with a diverse mix of grassland and woodland species. *Nassella viridula* was a common graminoid. (Marriott and Faber-Langendoen 2000).

In the vicinity of Lewiston and Roundup, Montana, this vegetation type has been reported from gentle slopes and benches, on silt loam to clay loam soils derived from limestone (Pfister et al. 1977). In the Black Hills, this community has been found on northerly and westerly, moderate to somewhat steep slopes in areas underlain by sandstone and buried talus. Elevational range of the few stands surveyed is 1250-1275 m (4040-4120 feet) (Marriott and Faber-Langendoen 2000).

In Montana, post-fire seral conditions can be dominated by almost pure stands of *Populus tremuloides* with scattered *Pinus ponderosa* in the seedling-sapling layer. Seral stands may also have relatively few, veteran, fire-scarred *Pinus ponderosa,* with *Populus tremuloides* in the understory. Stands undisturbed by fire (at least for several hundred years) may be pure pine.

COMMENTS: 3*, WCS*. This association has been described for only the Little Rocky Mountains of north-central Montana and the Black Hills (original name *Pinus ponderosa / Berberis repens*), and is based on only 5 plots established in 1980. It has not been recorded subsequently, though localized inventories have taken place in the north-central and/or northeastern Montana region. There is considerable overlap with some *Pinus ponderosa* associations that have a tall-shrub component well represented; in the area for which this type was originally defined, high cover values for *Mahonia repens* were given diagnostic precedence over tall shrubs that were less well represented. This association is very similar to *Pinus ponderosa / Prunus virginiana* Forest (CEGL000192), *Populus tremuloides / Mahonia repens* Forest (CEGL000594), and to the *Mahonia repens* phase of *Pinus ponderosa / Symphoricarpos albus* Forest (CEGL000203). Though the composition of *Pinus ponderosa / Mahonia repens* Forest (CEGL000187) appears only superficially like that of *Pinus ponderosa / Amelanchier alnifolia* Woodland (CEGL000840), some of the stands within *Pinus ponderosa / Mahonia repens* Forest (CEGL000187) would key to this type based on *Amelanchier alnifolia* being well represented.

CONSERVATION RANK: *G3Q.* The rank for this association has been changed, from G3 to G3Q, based on the fact that it has received very little inventory attention and is substantiated by only five plots. There are also significant questions as to how it differs from a number of other *Pinus ponderosa*- and *Populus tremuloides*-dominated types. Were a vegetation key to be written that covered just Montana, virtually all the plots assigned to this type by the original investigator would be allocated to other types based on the indicator value of species in the tall shrub layer. This type is under no threats at this time, though two of the tall shrubs are preferred browse and heavily hedged by large ungulates.

DISTRIBUTION: This association has been described for only the Little Rocky Mountains of north-central Montana, and the Black Hills of eastern Wyoming.

USFS ECOREGIONS: 331D:CC, 331G:C?, M332D:??, M334A:CC
CONSERVATION REGIONS: 25:C, 26:C
STATES: MT WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: PINUS PONDEROSA FOREST ALLIANCE (I.A.8.N.b)

Pinus ponderosa / Pascopyrum smithii Woodland

Ponderosa Pine / Western Wheatgrass Woodland

Ponderosa Pine / Western Wheatgrass Woodland CEGL000188

DESCRIPTION: At Wind Cave National Park, stands are characterized by a somewhat-open canopy of *Pinus ponderosa*, with coverage in the 25-50% range. A subcanopy of smaller pines may be present. The shrub stratum is usually sparse, with *Amorpha canescens, Artemisia frigida, Rhus trilobata*, and *Toxicodendron pubescens* the most frequently found species. Herbaceous cover is typically greater than 75% and graminoid-dominated. Species composition is quite variable. On northerly aspects and in stands with greater tree cover, the more mesophytic graminoids have greater cover, such as *Hesperostipa spartea (= Stipa spartea), Nassella viridula, Elymus canadensis, Muhlenbergia racemosa, Pascopyrum smithii*, and *Sporobolus heterolepis*. *Schizachyrium scoparium, Carex inops ssp. heliophila* and *Hesperostipa comata (= Stipa comata)* are the common dominants on drier sites. *Piptatherum micranthum (= Oryzopsis micrantha)* is dominant at some sites (H. Marriott pers. comm. 1999).

At Wind Cave National Park, this type is best developed on gentle to moderately steep slopes of all aspects except south. On northerly aspects, and in stands with greater tree cover, the more mesophytic graminoids have greater cover. Drier sites may contain a more xerophytic mix of species (H. Marriott pers. comm. 1999).

This type probably develops from several mixed grass prairie types as pines become established. Disturbances such as fire convert stands back to prairies (Marriott and Faber-Langendoen 2000). At Wind Cave NP, stands are maintained through an active fire management program, on a 5- to 10-year rotation (H. Marriott pers. comm. 1999).

COMMENTS: *2, WCS*. This type has some similarities to *Pinus ponderosa / Schizachyrium scoparium* Woodland (CEGL000201), but that type may occur on more steep and rocky slopes, and lacks the mesic graminoids present in this type.

CONSERVATION RANK: *G3G4.* This type has a limited distribution. Perhaps some of the best occurrences are found at Wind Cave National Park, South Dakota, where stands are managed with fire.

DISTRIBUTION: This ponderosa pine woodland type is found in the northwestern Great Plains and Black Hills foothills of the United States.

USFS ECOREGIONS: 331F:CC, 331G:C?, M334A:CC
CONSERVATION REGIONS: 25:C, 26:C
STATES: SD WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: PINUS PONDEROSA WOODLAND ALLIANCE (II.A.4.N.a)

Pinus ponderosa / Physocarpus monogynus Forest

Ponderosa Pine / Mountain Ninebark Forest

Ponderosa Pine / Mountain Ninebark Forest CEGL000190

DESCRIPTION: The overstory of this forest community is almost exclusively dominated by *Pinus ponderosa*. The canopy can be moderately closed to closed. Sufficient light penetrates the canopy to allow the growth of a vigorous shrub layer. *Physocarpus monogynus*, which grows to approximately 1 m, is the dominant shrub. In three stands in the Black Hills of Wyoming this species had an average cover of 42% (Hoffman and Alexander 1987). Other shrubs that occur in this community are *Mahonia repens, Arctostaphylos uva-ursi*, and *Symphoricarpos albus*. The herbaceous layer is dominated by forbs and nonvascular plants. *Antennaria rosea, Cerastium arvense, Galium boreale, Pulsatilla patens*, and mosses and lichens are typically found in this community.

This community is one of the more mesic of the ponderosa pine forests in the Black Hills. It is found on north-facing slopes (Johnston 1987). On three stands in eastern Wyoming the slopes ranged from 27-46% (Hoffman and Alexander 1976, 1987). It has been observed at elevations of 1400-1800 m (4300-5900 feet) (Jones 1992) but may occur at other elevations. The soils are loam.

Lack of natural disturbance (e.g., fire) over the last 100 years has led to increased densities and coverage in the subcanopy.

COMMENTS: *1, MCS*. There is some ambiguity between this type as a forest or woodland; in increasingly dense stands, this type has >60% canopy closure.

CONSERVATION RANK: *G3.*

DISTRIBUTION: This ponderosa pine community type is found in the Black Hills and surrounding areas of the western United States, particularly in the Black Hills region of Wyoming and South Dakota. It has also been reported in northeastern Colorado (Johnston 1987), but this has not been well documented.

USFS ECOREGIONS: 331F:??, 331G:??, M331B:CC, M334A:CC
CONSERVATION REGIONS: 10:C, 20:C, 25:C, 26:?
STATES: SD WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Pinus ponderosa / Physocarpus monogynus* Habitat Type (Hoffman and Alexander 1976) =, *Pinus ponderosa / Physocarpus monogynus* Plant Association (Johnston 1987) =, *Pinus ponderosa / Physocarpus monogynus* Community (Jones 1992) =

USNVC HIERARCHY: PINUS PONDEROSA FOREST ALLIANCE (I.A.8.N.b)

Pinus ponderosa / Pseudoroegneria spicata Woodland

Ponderosa Pine / Bluebunch Wheatgrass Woodland

Ponderosa Pine / Bluebunch Wheatgrass Woodland CEGL000865

DESCRIPTION: This community is dominated by the tree and herbaceous strata. On three stands in the eastern portion of its range, Hansen and Hoffman (1988) found that total cover by understory strata was 55%. Shrubs made up only 1.3% of this total. *Pinus ponderosa* is often the only tree in the overstory. The tree coverage can vary from open to moderately closed. In northeastern Wyoming, most of the trees were less than 15 m tall and 60 cm dbh (Thilenius et al. 1995). The herbaceous stratum is also open to moderately dense. *Pseudoroegneria spicata* is the dominant species. Other species that are often found in the central and eastern portions of its range are *Achillea millefolium var. occidentalis, Carex filifolia, Carex inops ssp. heliophila, Koeleria macrantha*, and *Hesperostipa comata (= Stipa comata)*. In the western portion of the range of this community *Festuca idahoensis* may be present (Daubenmire 1952). When shrubs are present they typically include *Rhus aromatica* and, especially on sandy soils, *Ericameria nauseosa (= Chrysothamnus nauseosus)*.

This community occurs mostly on steep southerly aspects. It is found on coarse soils derived from sandstone, porcillenate, or limestone (Thilenius et al. 1995). These include sandy alluvium, gravelly or sandy till, and loams with high stone content. Rock and mineral soil are commonly exposed.

Fire likely occurred at regular intervals in this type; documentation on fire frequency is not available.

COMMENTS: *1, WCS*. The stands used to document the *Pinus ponderosa / Pseudoroegneria spicata* Woodland Habitat Type described by Hansen and Hoffman (1988) and Hoffman and Alexander (1976) had very high basal area and densities for a woodland, possibly due to their sampling procedure. The dense structure may have affected the floristic makeup of the stands and made the list of dominant species a poor reflection of the community as a whole.

CONSERVATION RANK: *G4.*

DISTRIBUTION: This ponderosa pine woodland is one of the drier ponderosa pine woodlands found in the northern Rocky Mountains, Intermountains, and extreme northwestern Great Plains of the United States and Canada, extending from the Black Hills of South Dakota and Wyoming west to Oregon, Washington, and British Columbia.

USFS ECOREGIONS: 331A:CC, 331F:C?, 331G:CC, 342C:CC, 342I:CC, M242C:??, M331B:CC, M331I:C?, M332A:CC, M332G:CC, M333A:CC, M334A:CC
CONSERVATION REGIONS: 10:C, 20:C, 25:C, 26:C, 6:C, 9:C
STATES: ID MT ND OR SD WA WY **PROVINCES:** BC

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Pinus ponderosa / Agropyron spicatum* Association (Daubenmire 1952) =, *Pinus ponderosa / Agropyron spicatum* Habitat Type (Cooper and Pfister 1985) =, *Pinus ponderosa / Roegneria spicata* Plant Association (Daubenmire and Daubenmire 1968) =, *Pinus ponderosa / Roegneria spicata* Plant Association (Hansen et al. 1984) =, *Pinus ponderosa / Roegneria spicata* Plant Association (Hoffman and Alexander 1976) =, *Pinus ponderosa / Roegneria spicata* Plant Association (Pfister et al. 1977), *Pinus ponderosa / Roegneria spicata* Plant Association (Johnston 1987), *Pinus ponderosa / Agropyron spicata* Community (Jones 1992), *Pinus ponderosa / Agropyron spicatum* Coniferous Forest (Thilenius et al. 1995), *Pinus ponderosa / Festuca idahoensis* (Daubenmire and Daubenmire 1968). similar in structure and composition, *Pseudoroegneria spicata / Bouteloua gracilis* (Hansen et al. 1984). similar to this type, but without the pine canopy, *Rhus aromatica / Pseudoroegneria spicata* (Hansen et al. 1984). similar to this type, but without the pine canopy

USNVC HIERARCHY: PINUS PONDEROSA WOODLAND ALLIANCE (II.A.4.N.a)

Pinus ponderosa / Schizachyrium scoparium Woodland

Ponderosa Pine / Little Bluestem Woodland

Ponderosa Pine / Little Bluestem Woodland CEGL000201

DESCRIPTION: This community is dominated by *Pinus ponderosa* in the overstory and dry prairie graminoids in the understory. *Juniperus scopulorum* may be present as a tall shrub or small tree, but typically only as scattered individuals. Other shrubs that are typically found are *Rhus aromatica, Symphoricarpos* spp., and *Yucca glauca*. *Schizachyrium scoparium* is the most abundant graminoid, often accompanied by *Pascopyrum smithii, Bouteloua curtipendula, Bouteloua gracilis, Hesperostipa comata (= Stipa comata), Poa pratensis, Andropogon gerardii*, and *Carex siccata (= Carex foenea)*. Common forbs include *Achillea millefolium, Phlox hoodii*, and *Allium* spp.

This community is usually found on south-facing slopes and in rocky breaks. The soils are derived from limestone and sandstone (Johnston 1987, McAdams et al. 1998). Slopes are usually moderately inclined.

This type probably develops from little bluestem prairie as pines become established. Disturbances such as fire convert stands back to prairies (Marriott and Faber-Langendoen 2000). Fire was likely an important factor in the regulation of stand structure historically, particularly during drought years.

COMMENTS: *2, MCS*. Steinauer and Rolfsmeier (2000) suggest that, in Nebraska, stands dominated by *Schizachyrium scoparium* are more savanna-like. The savanna structure (10-25% tree canopy cover was formerly treated as a separate type (CEGL002019), but is now treated as a savanna phase of this woodland type, which typically has 25-60% canopy cover. Nebraska's woodland stands may best fit with *Pinus ponderosa / Carex inops ssp. heliophila* Woodland (CEGL000849).

CONSERVATION RANK: *G3G4*. There are probably more than 100 occurrences of this community rangewide. It is reported from Nebraska (where it is ranked S3S4, and is common in much of the Wildcat Hills and Pine Ridge), South Dakota (S?), Wyoming (S2?), and Montana (S2?); it may also occur in Oklahoma, Colorado, and New Mexico. One occurrence is currently documented from Nebraska. Historical acreage and trends are unknown, but its persistence is dependent on a combination of drought and fires.

DISTRIBUTION: This ponderosa pine / little bluestem community type is a dry woodland found in the Great Plains of the United States, from South Dakota and Montana south to possibly New Mexico and Oklahoma.

USFS ECOREGIONS: 321A:C?, 331F:CC, 331G:CC, 332C:CP, M313:?, M334A:CC
CONSERVATION REGIONS: 24:?, 25:C, 26:C, 27:C
STATES: CO? MT NE NM? OK? SD WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE western coniferous woodland =

OTHER SYNONYMY: *Pinus ponderosa - Schizachyrium scoparium - Elytrigia smithii* Plant Association (Johnston 1987) ?, *Pinus ponderosa - Schizachyrium scoparium* Community (Jones 1992) =, *Pinus ponderosa / Andropogon scoparius* Habitat type (Pfister et al. 1977) =, *Pinus ponderosa / Andropogon scoparius* Habitat Unit (Thilenius 1970) =

USNVC HIERARCHY: PINUS PONDEROSA WOODLAND ALLIANCE (II.A.4.N.a)

Pinus ponderosa / Juniperus communis Woodland

Ponderosa Pine / Common Juniper Woodland

Ponderosa Pine / Common Juniper Woodland CEGL000859

DESCRIPTION: This community is dominated by *Pinus ponderosa* in the overstory. Other tree species that may be present are *Picea glauca* and *Populus tremuloides*. The canopy is usually moderately closed but can become nearly closed in stands that are not disturbed for long periods. There is a prominent low-shrub layer whose most abundant component is *Juniperus communis*. This species covered an average of 25% (range of 4-42%) in 7 stands in the Black Hills of South Dakota and Wyoming (Hoffman and Alexander 1987). Other shrub species found in this community across its range are *Arctostaphylos uva-ursi, Mahonia repens, Spiraea betulifolia*, and *Symphoricarpos albus*. Total average cover by the shrub layer was 51% and by the herb layer was 8%. Typical herbaceous species are *Achillea millefolium, Carex inops ssp. heliophila, Schizachyrium scoparium, Fragaria* spp., and *Lathyrus ochroleucus* (McAdams et al. 1998).

This community is most often found on moderate north- and west-facing slopes (Hansen and Hoffman 1988, Hoffman and Alexander 1987, Hoffman and Alexander 1976). The soils are shallow and loamy. They develop from limestone or igneous rock.

The canopy in this type is usually moderately closed but can become nearly closed in undisturbed stands (i.e., where the natural fire disturbance regime has been disrupted).

COMMENTS: *2, MCS*. This type may grade into *Pinus ponderosa / Arctostaphylos uva-ursi* Woodland (CEGL000844).

CONSERVATION RANK: *G4?.*

DISTRIBUTION: This ponderosa pine / common juniper community type is found on moderate north- and west-facing slopes in the northern Rocky Mountain foothills and adjacent Great Plains of the United States, extending from the Big Horn Mountains of northern Wyoming and portions of the Missouri Plateau in eastern Montana, to the Black Hills of eastern Wyoming and western South Dakota.

USFS ECOREGIONS: 331G:CC, M331B:??, M334A:CC
CONSERVATION REGIONS: 10:C, 25:C, 26:C
STATES: MT SD WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Pinus ponderosa / Juniperus communis* Habitat Type (Hansen et al. 1984) =, *Pinus ponderosa / Juniperus communis* (Hoffman and Alexander 1987) =, *Pinus ponderosa / Juniperus communis* (Hoffman and Alexander 1976) =, *Pinus ponderosa / Juniperus communis* (Johnston 1987) =, *Pinus ponderosa / Juniperus communis* Community (Jones 1992)

USNVC HIERARCHY: PINUS PONDEROSA WOODLAND ALLIANCE (II.A.4.N.a)

Pinus ponderosa / Oryzopsis asperifolia Woodland

Ponderosa Pine / Roughleaf Ricegrass Woodland

Ponderosa Pine / Rough-leaf Ricegrass Woodland CEGL002123

DESCRIPTION: This community is dominated by *Pinus ponderosa* in the overstory and *Oryzopsis asperifolia* in the herbaceous layer. Shrubs are scattered but readily apparent, particularly *Spiraea betulifolia, Arctostaphylos uva-ursi*, and *Symphoricarpos albus*. *Carex siccata (= Carex foenea), Danthonia spicata, Galium boreale*, and *Schizachne purpurascens* are present in the herb layer. In the stands in the Black Hills on which this description is based, shrubs had 10% cover and herbaceous species 20-25% cover (Hoffman and Alexander 1987).

This community has been found on flat to moderately sloping topography (2-24%) (Hoffman and Alexander 1987). The soils range from sandy loams to silt loams. This type is generally found on north aspects.

Fire likely played an important role in the dynamics of this woodland type. Fire scars are apparent on may of the older trees.

COMMENTS: *3, MCS*. This community is described on the basis of four stands in the Black Hills National Forest. This type was originally described as a phase of *Pinus ponderosa / Symphoricarpos albus* Forest (CEGL000203) and recent analyses suggest that that is probably the best way to treat these stands, but see Marriott and Faber-Langendoen (2000).

CONSERVATION RANK: *G3G4Q*. Type is known only from the Black Hills, but appears to be common there (Marriott et al. 1999).

DISTRIBUTION: This ponderosa pine community is found in the Black Hills of western South Dakota, in the United States.

USFS ECOREGIONS: M334A:CC
CONSERVATION REGIONS: 25:C
STATES: SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Pinus ponderosa / Symphoricarpos albus* Habitat Type, *Oryzopsis asperifolia* Phase (Hoffman and Alexander 1987) =

USNVC HIERARCHY: PINUS PONDEROSA WOODLAND ALLIANCE (II.A.4.N.a)

Pinus ponderosa / Prunus virginiana Forest

Ponderosa Pine / Choke Cherry Forest

Ponderosa Pine / Chokecherry Forest CEGL000192

DESCRIPTION: This forest community has a closed canopy made up of *Pinus ponderosa*. Hansen and Hoffman (1988) found that the basal area ranged from 36.6-63.5 m2/ha in five stands in southeastern Montana. Seedlings and saplings of *Crataegus succulenta* and *Fraxinus pennsylvanica* are often scattered in the understory. These species may grow to be mature trees near streams. There are two shrub layers in this community. Together they had an average cover of 87% in five stands sampled by Hansen and Hoffman (1988). The most prominent layer is approximately 1 m tall and dominated by *Prunus virginiana*. *Amelanchier alnifolia* also contributes significantly to this layer. The lower shrub layer is approximately 50 cm tall. It is dominated by *Mahonia repens* with lesser amounts of *Juniperus communis, Ribes missouriense, Rosa woodsii, Symphoricarpos albus*, and *Toxicodendron rydbergii*. The diversity of forbs is moderate, but most of the coverage of the herbaceous layer is provided by graminoids. *Apocynum androsaemifolium, Elymus caninus, Galium boreale, Schizachne purpurascens*, and *Maianthemum stellatum* are typical components of the herbaceous layer.

This is one of the most mesic ponderosa pine communities. It occurs on gentle to moderate (2-40%) north-facing slopes and close to streams (Hansen and Hoffman 1988). A few stands are on rolling uplands. The soils are sandy loam or loam.

Signs of fire were noted by Hansen and Hoffman (1988). This community may be regularly affected by ground fires.

COMMENTS: *1, MCS*. In Nebraska see comments in Steinauer and Rolfsmeier (2000). In the Black Hills see Marriott and Faber-Langendoen (2000).

CONSERVATION RANK: *G3.*

DISTRIBUTION: This community type is found in the Black Hills and northeastern Rocky Mountains, and western Great Plains escarpments of the United States, ranging from eastern Montana south to western Nebraska.

USFS ECOREGIONS: 331F:C?, 331G:CC, 332C:CC, M334A:CC
CONSERVATION REGIONS: 25:C, 26:C, 27:C
STATES: MT NE SD WY? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE western coniferous forest =

OTHER SYNONYMY: *Pinus ponderosa / Prunus virginiana* Habitat Type (Hoffman and Alexander 1987) =, *Pinus ponderosa / Prunus virginiana* Habitat Type (Hansen et al. 1984) =

USNVC HIERARCHY: PINUS PONDEROSA FOREST ALLIANCE (I.A.8.N.b)

Pinus ponderosa / Quercus macrocarpa Woodland

Ponderosa Pine / Bur Oak Woodland

Ponderosa Pine / Bur Oak Woodland CEGL000873

DESCRIPTION: *Pinus ponderosa* is the only species found in the canopy in most stands of this community. Hoffman and Alexander (1987) sampled 4 stands of this type and found an average basal area of 36.2 m2/ha and an average density of 587 trees/ha. *Quercus macrocarpa* forms a discontinuous subcanopy with an average cover of 18%. The shrub strata had 60% cover and the herbaceous strata had 18% cover. Common shrubs are *Amelanchier alnifolia, Mahonia repens, Prunus virginiana*, and *Spiraea betulifolia*. Typical herbaceous species are *Carex siccata (= Carex foenea), Apocynum androsaemifolium, Galium boreale, Maianthemum stellatum, Oryzopsis asperifolia, Lupinus argenteus*, and *Vicia americana*.

This community is found on rolling hills and ridgetops on calcareous substrates (Hoffman and Alexander 1987, Johnston 1987). Hoffman and Alexander report that it may also occur on soils derived from igneous substrates. The soils are sandy loams to clayey loams with a pH of 5.3-6.0.

Fire scars indicate that these areas have burned in the past. Fire likely aided the regeneration of *Quercus macrocarpa*.

COMMENTS: *1, MCS*. This type may be restricted to the Black Hills, but its distribution in Montana should be checked (Marriott and Faber-Langendoen 2000).

CONSERVATION RANK: *G3.*

DISTRIBUTION: This ponderosa pine / bur oak community type occurs mainly in the Black Hills of the western United States, including Wyoming and South Dakota, but is also possible in southeastern Montana.

USFS ECOREGIONS: 331:C, M334A:CC
CONSERVATION REGIONS: 25:C
STATES: MT SD WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Pinus ponderosa/ Quercus macrocarpa* Habitat Type (Hoffman and Alexander 1987) =, *Pinus ponderosa / Quercus macrocarpa* Plant Association (Johnston 1987) =, *Pinus ponderosa - Quercus macrocarpa / Prunus virginiana / Symphoricarpos albus / Mahonia repens* (Thilenius 1972) F, *Pinus ponderosa - Quercus macrocarpa / Prunus virginiana / Symphoricarpos albus / Scizachne purpuescens - Carex foena* (Thilenius 1972) F

USNVC HIERARCHY: PINUS PONDEROSA WOODLAND ALLIANCE (II.A.4.N.a)

Pinus ponderosa / Symphoricarpos albus Forest

Ponderosa Pine / Common Snowberry Forest

Ponderosa Pine / Snowberry Forest CEGL000203

DESCRIPTION: The overstory of this community is dominated by successfully reproducing *Pinus ponderosa*. There are lesser amounts of *Populus tremuloides, Betula papyrifera, Quercus macrocarpa, Juniperus scopulorum, Picea glauca, Pinus flexilis*, and *Pseudotsuga menziesii*. Hoffman and Alexander (1987) sampled 12 stands of this type that averaged 35.8 m2/ha basal area. The shrub layer is prominent, with cover approaching 100% in some stands (Daubenmire 1952). The common shrubs in this community are *Amelanchier alnifolia, Symphoricarpos albus, Shepherdia canadensis, Mahonia repens, Spiraea betulifolia, Juniperus communis*, and *Prunus virginiana*. The herbaceous layer is also well-developed. Typical species found in this layer are *Achillea millefolium, Campanula rotundifolia, Galium* spp., and *Euthamia occidentalis (= Solidago occidentalis)*. Periodic ground fires move through the lower strata of this community. Regeneration after these events is rapid. Within a few years the signs of a fire may be difficult to detect (Daubenmire 1952).

This community is found on moderate slopes with non-calcareous soils (Johnston 1987). The soils are usually loams with a high water-holding capacity, but they can be stony or sandy. If they are the latter, they tend to occur on north-facing slopes with more mesic microclimates (Daubenmire 1952).

Fire was likely an important factor in the regulation of stand structure historically. Periodic ground fires have been reported to move through the lower strata of this community.

COMMENTS: *1, MCS*. Hoffman and Alexander (1987) described two phases of this type, *Oryzopsis asperifolia* phase which is now (at least tentatively) identified as *Pinus ponderosa / Oryzopsis asperifolia* Woodland (CEGL002123) and the *Balsamorhiza sagittata* phase which remains part of this type (see Marrriott and Faber-Langendoen 2000). Additionally, there is some ambiguity between this type as a forest or woodland; in increasingly dense stands, this type has >60% canopy closure. Johnston (1987) reports that this community is also in Nebraska, but its presence there seems doubtful.

CONSERVATION RANK: *G4?.*

DISTRIBUTION: This ponderosa pine community type occurs from the mountains of the northwestern United States (eastern cascades and northern Sierras) to the Rocky Mountains and Black Hills, extending from eastern Washington south to northern California, east to South Dakota and north to Montana.

USFS ECOREGIONS: 331A:CC, 331D:CC, M242C:CC, M261G:CC, M331B:CC, M332A:CC, M332B:CC, M332D:CC, M332E:CC, M332G:CC, M333A:CC, M333B:CC, M333D:CC, M334A:CC
CONSERVATION REGIONS: 25:C, 26:C, 6:C
STATES: CA ID MT OR SD WA WY **PROVINCES:** AB?

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Pinus ponderosa / Symphoricarpos rivularis* Association (Daubenmire 1952) =. *Symphoricarpos rivularis* is synonymous with *Symphoricarpos albus*, *Pinus ponderosa / Symphoricarpos albus* Habitat Type (Hoffman and Alexander 1987) =, *Pinus ponderosa / Symphoricarpos albus* Plant Association (Johnston 1987) =, *Pinus ponderosa / Shepherdia canadensis / Symphoricarpos albus / Arctostaphylos uva-ursi* Habitat Unit (Thilenius 1972) F, *Pinus ponderosa / Symphoricarpos albus / Arctostaphylos uva-ursi* Habitat Unit (Thilenius 1972) F

USNVC HIERARCHY: PINUS PONDEROSA FOREST ALLIANCE (I.A.8.N.b)

Picea glauca / Linnaea borealis Forest

White Spruce / American Twinflower Forest

White Spruce / Twinflower Forest CEGL000382

DESCRIPTION: The vegetation is a closed canopy evergreen forest. The tree layer is dominated by *Picea glauca*. It is the only tree species with significant reproduction in this community. Other trees, such as *Populus tremuloides* and *Pinus ponderosa* may remain from earlier successional phases (Hoffman and Alexander 1987). The shrub layer is prominent in this community. In five stands sampled by Hoffman and Alexander (1987) the shrub layer had an average cover of 37%. Herbaceous species covered 24% and mosses and lichens covered 17%. *Linnaea borealis* is the dominant understory species. *Juniperus communis, Mahonia repens, Rosa acicularis, Shepherdia canadensis*, and *Symphoricarpos albus* are common shrub associates. In the herbaceous layer *Galium boreale, Hedysarum alpinum, Lathyrus ochroleucus*, and *Viola adunca* are common.

This community has been identified in the Cathedral Spires area of the Black Hills. Five stands that were sampled by Hoffman and Alexander (1987) were on northwest- to northeast-facing slopes ranging from 16-32%. Johnston (1987) reports that this type can occur on steeper slopes as well. The soils are loamy and acidic. This community has been found to occur from 1768 to 1958 m (Hoffman and Alexander 1987).

COMMENTS: *1, MCS*. This type is only known from the Black Hills (Marriott and Faber-Langendoen 2000). The relationship of this type to more boreal types in western Canada (Alberta in particular)is unclear. In the Black Hills, this type overlaps floristically and spatially with *Picea glauca / Vaccinium scoparium* Forest (CEGL000382), often occurring on lower and moister slopes below stands of that type.

CONSERVATION RANK: *G2G3.* There maybe fewer than 100 occurrences in the Black Hills, its only known location.

DISTRIBUTION: This white spruce community type is known only from the Black Hills of South Dakota and Wyoming in the United States.

USFS ECOREGIONS: M334A:CC
CONSERVATION REGIONS: 25:C
STATES: SD WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Picea glauca/Linnea borealis* Habitat Type (Hoffman and Alexander 1987), *Picea glauca/Linnea borealis* Plant Association, except *Vaccinium scoparium* Phase (Johnston 1987)

USNVC HIERARCHY: PICEA GLAUCA FOREST ALLIANCE (I.A.8.N.c)

Picea glauca / Vaccinium scoparium Forest

White Spruce / Grouseberry Forest

White Spruce / Grouseberry Forest CEGL000383

DESCRIPTION: The overstory of this community is dominated by *Picea glauca*. This species is the only tree species that successfully reproduces. Mature *Populus tremuloides* and *Pinus ponderosa* are often present as remnants from earlier successional stages. There is a conspicuous shrub layer that is usually dominated by *Vaccinium scoparium*. In some stands other shrubs may be more abundant, with *Vaccinium scoparium* only present in scattered locations. Other shrubs that are typically found are *Arctostaphylos uva-ursi, Juniperus communis, Mahonia repens, Spiraea betulifolia*, and *Symphoricarpos albus*. Major herbaceous species are *Achillea millefolium, Galium boreale, Fragaria virginiana, Lathyrus ochroleucus*, and *Oryzopsis asperifolia*. Mosses and lichens are rare to common. Hoffman and Alexander (1987) measure five stands and found the coverage by strata to be shrubs 50%, herbaceous 30%, mosses and lichens 12%.

This community has been identified in the Cathedral Spires area of the Black Hills. The sites it occupies are cool and moist and usually higher than other forests in the Black Hills. The soils are loamy and often calcareous. This community has been found to occur from 1737 m to 2040 m (Hoffman and Alexander 1987).

COMMENTS: *1, MCS*. This type is only known from the Black Hills. Its relationship to more boreal types in western Canada (especially Alberta) is unclear. In the Black Hills, this type overlaps floristically and spatially with *Picea glauca / Linnaea borealis* Forest (CEGL000382), often occurring on upper, drier slopes above stands of that type.

CONSERVATION RANK: *G1G2.* There may be fewer than 20 occurrences in the Black Hills, its only known location.

DISTRIBUTION: This white spruce community type is found in the Black Hills region of South Dakota and Wyoming in the United States.

USFS ECOREGIONS: M334A:CC
CONSERVATION REGIONS: 25:C
STATES: SD WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Picea glauca / Vaccinium scoparium* Habitat Type (Hoffman and Alexander 1987), *Picea glauca / Juniperus communis* Plant *Vaccinium scoparium* Forest.Association (Johnston 1987), *Picea glauca / Linnea borealis* Plant Association, *Vaccinium scoparium* Phase (Johnston 1987)

USNVC HIERARCHY: PICEA GLAUCA FOREST ALLIANCE (I.A.8.N.c)

Populus tremuloides / Corylus cornuta Forest

Quaking Aspen / Beaked Hazelnut Forest

Aspen / Beaked Hazel Forest CEGL000583

DESCRIPTION: This deciduous forest community can have a moderately closed to closed canopy. Basal areas of 28-52 m2/ha have been reported (Potter and Moir 1961, Hoffman and Alexander 1987). *Populus tremuloides* is the dominant tree. *Betula papyrifera* is very common and can be codominant. Scattered *Quercus macrocarpa, Fraxinus pennsylvanica* and, in the Black Hills, *Picea glauca* or *Pinus ponderosa* can be found in this community. There is a conspicuous understory of shrubs and forbs; few graminoids achieve prominence. The shrub layer is 1-2 m tall and dominated by *Corylus cornuta*. Other species found with it are *Amelanchier alnifolia, Mahonia repens, Prunus virginiana, Symphoricarpos* spp., and *Rubus idaeus*. In the western part of its range *Spiraea betulifolia* is also common. The herbaceous layer has *Aralia nudicaulis, Lathyrus ochroleucus, Maianthemum canadense, Galium triflorum, Maianthemum stellatum, Viola* spp., and *Sanicula marilandica*. In the eastern part of its range this community can have significant amounts of *Carex pensylvanica*.

This community is usually found on gently sloping or rolling topography. In the Black Hills, it is typically on northeast- to northwest-facing slopes (Hoffman and Alexander 1987). Farther west, it may also be found on slopes with other aspects. The soils are well-developed and deep (Johnston 1987). They can be derived from a variety of sources, including limestone, quartzite, schist, Tertiary volcanics, and glacial till (Potter and Moir 1961, Johnston 1987).

This community can become established after disturbance, usually a fire. It can persist for decades to centuries on suitable sites (Potter and Moir 1961, Hoffman and Alexander 1987).

COMMENTS: *2, WCS*. This type appears to be somewhat drier than *Populus tremuloides / Prunus virginiana* Forest (CEGL000596) (see Marriott and Faber-Langendoen 2000).

CONSERVATION RANK: *G3.* There are probably over 100 occurrences rangewide. Twenty-eight have been documented in North Dakota, where the community is ranked S2?. Although no other occurrences have been documented, the community is also reported from Colorado (S1), South Dakota (S3), Wyoming (S1S2), and Saskatchewan (S?). It is reported from three ecoregional sections.

DISTRIBUTION: This upland forest community is found on gently sloping or rolling topography in the northwestern Great Plains and the Rocky Mountain and Black Hills ranges of the United States and southern Canada. It extends from Colorado and South Dakota north to Saskatchewan.

USFS ECOREGIONS: M331F:CC, M331I:CC, M334A:CC
CONSERVATION REGIONS: 10:C, 20:C, 25:C, 26:C, 34:C, 6:?
STATES: CO ND SD WY **PROVINCES:** SK

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Populus tremuloides / Corylus cornuta* Habitat Type (Hoffman and Alexander 1987) =, *Populus tremuloides / Corylus cornuta* Habitat Type (Johnston 1987) =, Scully's Woods - Burned and Boundary Lake - Burned (Potter and Moir 1961) =

USNVC HIERARCHY: POPULUS TREMULOIDES FOREST ALLIANCE (I.B.2.N.b)

Populus tremuloides / Prunus virginiana Forest

Quaking Aspen / Choke Cherry Forest

Aspen / Chokecherry Forest CEGL000596

DESCRIPTION: This community is dominated by deciduous trees in the canopy, but may have a small component of evergreen trees. *Populus tremuloides* is the most abundant tree species. *Picea glauca* (in the Black Hills) and *Pinus ponderosa* may also be present. The short shrub layer is dominated by *Prunus virginiana*, and it often contains *Amelanchier alnifolia, Ribes* spp., and *Symphoricarpos* spp. (H. Marriott pers. comm. 1999).

In the Black Hills, stands occur along mesic valley bottoms. The slopes can vary from steep (at the bottom of the hillslope) to gentle (along the valley bottom) (H. Marriott pers. comm. 1999).

COMMENTS: *3, MCS*. This type appears to be most common in riparian areas (Marriott and Faber-Langendoen 2000).

CONSERVATION RANK: *G3?Q.*

DISTRIBUTION: This aspen forest type is found in the Rocky Mountains and Black Hills of the western United States, ranging from South Dakota west to Wyoming and Montana.

USFS ECOREGIONS: 331:?, M331D:CC, M334A:CC
CONSERVATION REGIONS: 10:C, 25:C
STATES: MT SD WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: POPULUS TREMULOIDES FOREST ALLIANCE (I.B.2.N.b)

Populus tremuloides / Pteridium aquilinum Forest

Quaking Aspen / Northern Bracken Fern Forest

Aspen / Bracken Fern Forest CEGL000597

DESCRIPTION: In the Black Hills, this community can have a moderately closed to closed canopy (Severson and Thilenius 1976, Steinauer 1981, Hoffman and Alexander 1987, BHCI 1999). *Populus tremuloides* is the dominant tree. *Picea glauca* or *Pinus ponderosa* may occur in this community as emergent trees. Shrub covereage is typically sparse, and herbaceous cover is high, often greater than 50%. Only *Pteridium aquilinum* has been found to be consistent and abundant in the understory in stands of this type, with coverage often greater than 50%. The shrub and herbaceous strata are otherwise variable. Among the more commonly found species are *Corylus cornuta, Amelanchier alnifolia, Melica subulata, Anaphalis margaritacea*, and *Pyrola elliptica* (Marriott and Faber-Langendoen 2000).

In the Black Hills, this community has been found on flat to gently sloping or rolling topography with variable aspect (Severson and Thilenius 1976, Steinauer 1981, Hoffman and Alexander 1987, BHCI 1999). Documented sites range in elevation from 5200 to 5700 feet. This community is most extensive in the wetter, cooler northern Black Hills, including the Bear Lodge Mountains. It has been found in areas underlain by a variety of bedrock, including Tertiary intrusive rocks, limestone and sandstone (Marriott and Faber-Langendoen 2000).

Pteridium aquilinum establishes readily after fire, and may persist for some time. In the Black Hills, some of these *Populus tremuloides* stands are nearly 100 years old, with *Pteridium aquilinum* still vigorous and dominant (Hoffman and Alexander 1987).

COMMENTS: *2, WCS*. This community is equivalent to the *Populus tremuloides / Symphoricarpos albus / Pteridium aquilinum* association of Severson and Thilenius (1976), the *Populus tremuloides - Pteridium aquilinum* habitat type of Steinauer (1981), and the *Pteridium aquilinum* phase of the *Populus tremuloides / Corylus cornuta* habitat type of Hoffman and Alexander (1987). In the last, *Corylus cornuta* is said to be present but not dense. However, this shrub is more often absent in stands with heavy *Pteridium aquilinum* cover.

Classification of aspen communities in the Black Hills remains incomplete and problematic. Aspen stands in the area are highly variable in composition (Severson and Thilenius 1976, Marriott et al. 1999), consistent with the concept of aspen as an early successional dominant species. The community described here and *Populus tremuloides / Corylus cornuta* Forest (CEGL000583) are two of the more consistent and distinctive types. A third more variable and drier type, *Populus tremuloides / Spirea betulifolia* Forest (CEGL000607), also has been recognized (Severson and Thilenius 1976, Marriott et al. 1999). However, there are stands in the Black Hills that do not fit into any of these associations. For example, at higher elevations on the Limestone Plateau, aspen stands are common between Black Hills Montane Grasslands in broad drainage bottoms and conifer stands on slopes above. Little survey of these stands has been done, and they remain unclassified to association. In such stands seen during the Black Hills Community Inventory, *Pteridium aquilinum* was absent. Aspen also can contribute significant cover in stands of white spruce (*Picea glauca*) and ponderosa pine (*Pinus ponderosa*), representing successional stages from aspen to spruce and pine forest types. In the Black Hills Community Inventory, such stands were treated as inclusions in the surrounding coniferous forest type.

CONSERVATION RANK: *G4.*

DISTRIBUTION: This type is found in the Rocky Mountain front range and Black Hills of the United States, extending from Colorado and Utah northward to South Dakota.

USFS ECOREGIONS: M331F:CC, M331G:CC, M331H:CC, M331I:CC, M334A:CC
CONSERVATION REGIONS: 10:C, 19:C, 20:C, 25:C
STATES: CO SD UT **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Populus tremuloides / Symphoricarpos albus / Pteridium aquilinum* association (Severson and Thilenius 1976), *Populus tremuloides - Pteridium aquilinum* habitat type, *Populus tremuloides / Corylus cornuta, Pteridium aquilinum* phase (Hoffman and Alexander 1987)

USNVC HIERARCHY: POPULUS TREMULOIDES FOREST ALLIANCE (I.B.2.N.b)

Populus tremuloides / Spiraea betulifolia Forest

Quaking Aspen / Shiny-leaf Meadowsweet Forest

Aspen / Shiny-leaf Spiraea Forest CEGL000607

DESCRIPTION: The vegetation can have a moderately closed to closed canopy (Severson and Thilenius 1976, Hoffman and Alexander 1987, BHCI 1999). *Populus tremuloides* is the dominant tree. *Picea glauca* or *Pinus ponderosa* may occur in this community as emergent trees. Understory composition was found to be quite variable in stands surveyed. Shrub cover typically is heavy and diverse, with *Spiraea betulifolia* and *Mahonia repens* often codominant. Other shrubs frequently present include *Amelanchier alnifolia, Arctostaphylos uva-ursi, Prunus virginiana, Rosa woodsii, Shepherdia canadensis*, and *Symphoricarpos albus*. The herbaceous stratum also is diverse, and forb cover often is greater than graminoid cover. *Symphyotrichum laeve (= Aster laevis), Lathyrus ochroleucus* and *Monarda fistulosa* are among the more abundant species (Marriott and Faber-Langendoen 2000).

This community has been found on flat to moderately sloping topography (Severson and Thilenius 1976, Hoffman and Alexander 1987, BHCI 1999). Documented sites range in elevation from 5200 to 5700 feet. This community is most extensive in the wetter, cooler northern Black Hills, including the Bear Lodge Mountains. It has been found in areas underlain by a variety of bedrock, including Tertiary intrusive rocks, limestone and sandstone (Marriott and Faber-Langendoen 2000).

COMMENTS: *3, WCS*. This type should be compared with the *Populus tremuloides / Spiraea betulifolia - Calamagrostis rubescens* community type of Mueggler and Steward (1982), and the *Populus tremuloides / Spiraea betulifolia* type of Youngblood and Mueggler (1981). This community is equivalent to the *Populus tremuloides / Spiraea lucida / Lathyrus ochroleucus* association of Severson and Thilenius (1976). No equivalent habitat type was described by Hoffman and Alexander (1987). Classification of aspen communities in the Black Hills remains incomplete and problematic. Aspen stands in the area are highly variable in composition (Severson and Thilenius 1976, Marriott et al. 1999), consistent with the concept of aspen as an early successional dominant species. *Populus tremuloides / Pteridium aquilinum* Forest (CEGL000597) and *Populus tremuloides / Corylus cornuta* Forest (CEGL000583) are relatively consistent and distinctive. This type is more variable and is not clearly circumscribed. Severson and Thilenius (1976) recognized nine aspen associations, some based on data from single stands. For the Black Hills Community Inventory, at least four of these associations were included in this type, the *Populus tremuloides / Spiraea betulifolia* Forest (Marriott et al. 1999, Marriott and Faber-Langendoen 2000).

There remain aspen stands in the Black Hills that do not fit into any of these associations. For example, at higher elevations on the Limestone Plateau, aspen stands are common between Black Hills Montane Grasslands in broad drainage bottoms and conifer stands on slopes above. Little survey of these stands has been done, and they remain unclassified to association. Aspen also can contribute significant cover in stands of white spruce (*Picea glauca*) and ponderosa pine (*Pinus ponderosa*), representing successional stages from aspen to spruce and pine forest types. In the Black Hills Community Inventory, such stands were treated as inclusions in the surrounding coniferous forest type (Marriott and Faber-Langendoen 2000).

CONSERVATION RANK: *G4Q.*

DISTRIBUTION: This aspen forest type is found on gently sloping or rolling topography, at higher elevations in the the Black Hills of the United States.

USFS ECOREGIONS: M331B:CC, M334A:CC
CONSERVATION REGIONS: 25:C, 9:C
STATES: WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Populus tremuloides / Spiraea lucida / Lathyrus ochroleucus* association (Severson and Thilenius 1976)

USNVC HIERARCHY: POPULUS TREMULOIDES FOREST ALLIANCE (I.B.2.N.b)

2.6. Shrublands/Dwarf-Shrublands

Sorbus decora - Acer spicatum / Dryopteris carthusiana Shrubland

Mountain-ash - Mountain Maple / Spinulose Woodfern Shrubland

Mountain Ash-Mountain Maple Shrubland CEGL005253

DESCRIPTION: At Isle Royale National Park in Michigan, mountain ash - mountain maple forest is an unusual type of deciduous forested scrub. Canopy cover varies from 40-90% cover; *Sorbus decora* is the most abundant canopy tree, *Acer spicatum* may be codominant, and other less common trees include *Abies balsamea, Picea glauca*, and *Betula papyrifera*. Cover of shrubs varies from about 10-70% cover; *Oplopanax horridus* may be a common understory shrub (but is absent in some places); other common shrubs are *Rubus idaeus, Sambucus racemosa*, and *Taxus canadensis*. *Dryopteris carthusiana* is the most abundant herb; other common herbs are *Gymnocarpium dryopteris* and *Maianthemum canadense*. Cover of nonvascular plants is about 5-25%; the most abundant nonvascular plant is the epiphytic lichens called 'old man's beard' or 'hairy lichens' (*Usnea* spp.) (C. Reschke pers. comm. 1999).

At Isle Royale National Park in Michigan, this community occupies sites on gentle to moderate slopes at low elevations (under 200 m or 650 feet) on some of the outer islands in Rock Harbor. Soils are loams to sandy loam, moderately well-drained to well-drained (C. Reschke pers. comm. 1999).

COMMENTS: *3, MCS*. This type needs extensive range-wide review. The physiognomy of this type is variable. It may be more tree dominated than shrub-dominated, but at this time *Acer spicatum* is placed in the shrub category. Physiognomy needs to be resolved with Ontario type, *Acer spicatum* Carbonate Talus Shrubland (CEGL005067).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This type is only known from Isle Royale National Park in Michigan, where it is restricted to a few outer islands in Rock Harbor at the northeast end of the park. It may also occur in Ontario.

USFS ECOREGIONS: 212Ib:CCC
CONSERVATION REGIONS: 48:C
STATES: MI? **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI? boreal shrubland

OTHER SYNONYMY:

USNVC HIERARCHY: ACER SPICATUM SHRUBLAND ALLIANCE (III.B.2.N.a)

Taxus canadensis - Viburnum edule - Cornus sericea - Alnus viridis - Oplopanax horridus Shrubland

Canada Yew - Squashberry - Red-osier Dogwood - Green Alder - Devil's-club Shrubland

Canada Yew Mixed Shrubland CEGL005254

DESCRIPTION: At Isle Royale National Park, this Canada yew - squashberry mixed shrubland is a mixture of evergreen and deciduous shrubs that form a dense, nearly impenetrable thicket. There may be a sparse cover (0-10% cover) of trees over 5 m tall including *Thuja occidentalis, Abies balsamea*, or *Sorbus decora*. Cover of tall shrubs varies from 5-50%, the most abundant tall shrubs are *Abies balsamea, Sorbus decora*, and *Alnus viridis* (each usually 1-5% cover). Cover of short shrubs varies from 40-90% cover; the most abundant short shrubs are *Taxus canadensis* (5-50%), *Viburnum edule* (5-25%), *Oplopanax horridus* (5-25%), *Prunus pensylvanica* (5-25%), *Cornus sericea* (1-5%), and *Chamaedaphne calyculata* (1-5%). Cover of dwarf-shrubs varies from 0-70%, the most abundant dwarf-shrubs are *Diervilla lonicera* and *Empetrum nigrum* (each 5-25%). Cover of herbs varies from 10-70% cover; the most abundant herbs are *Lycopodium annotinum, Cornus canadensis, Dryopteris expansa*, and *Clintonia borealis* (each 5-25%). Cover of nonvascular plants is usually less than 10% cover; the most abundant nonvascular plants are foliose and crustose lichens, *Pleurozium schreberi* and *Dicranum polysetum*.

At Isle Royale National Park, there is an uncommon variant of this association; the *Abies balsamea / Taxus canadensis* woodland. Canopy cover of trees over 5 m tall is about 50%; *Abies balsamea* is the single most abundant tree. The shrub layer is a dense thicket with about 70% cover; *Taxus canadensis* is the most abundant shrub (over 50-75%), other characteristic shrubs mixed with the *Taxus* include *Oplopanax horridus, Alnus viridis, Sorbus decora*, and *Viburnum edule*. Cover of herbs is about 20%; the most abundant herbs are *Dryopteris expansa, Cornus canadensis*, and *Lycopodium annotinum*. This variant is only known from ridges on Passage Island; it may also occur in other areas in the northeastern end of the park (C. Reschke pers. comm. 1999).

At Isle Royale National Park, this community occupies gentle to somewhat steep slopes facing southeast, at elevations ranging from 613 to 650 feet. Soils are usually sandy loams. The variant occupies gentle, south-facing slopes at elevations of about 630 feet (C. Reschke pers. comm. 1999).

COMMENTS: *3, MCS*. Type concept is taken from field studies on Isle Royale and needs rangewide review.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This Canada yew shrubland type occurs on Isle Royale, Michigan and perhaps more widely in the boreal regions of the upper midwestern United States and Canada.

USFS ECOREGIONS: 212Ib:CCC
CONSERVATION REGIONS: 48:C
STATES: MI? **PROVINCES:** ON?

MIDWEST HERITAGE SYNONYMY: MI? boreal shrubland

OTHER SYNONYMY:

USNVC HIERARCHY: TAXUS CANADENSIS - MIXED DECIDUOUS SHRUBLAND ALLIANCE (III.C.2.N.a)

Corylus americana - Malus ioensis - Ceanothus americanus Shrubland

American Hazelnut - Prairie Apple - New Jersey-tea Shrubland

Hazelnut - Prairie Apple Loam Shrubland CEGL005073

DESCRIPTION: Shrubs dominate the canopy, forming copses of *Ceanothus americanus, Corylus americana, Prunus americana, Malus ioensis (= Pyrus ioensis), Quercus ellipsoidalis, Quercus macrocarpa*, and *Salix humilis*. The dominant grass was *Schizachyrium scoparium*, with *Danthonia spicata* also present. Typical forbs include *Apocynum androsaemifolium, Helianthus divaricatus, Lathyrus venosus*, and *Polygala senega* (Steffen and Anderson 1997).

Stands occur on well-drained uplands found on glacial moraines, kame complexes, and outwash plains. They are maintained by fires.

Stands are maintained by fires, particularly during droughts, when fires could burn into adjacent woodlands, killing the canopy trees, and reducing them to grubs. The shrubland structure was favored in landscape positions where fire frequencies were reduced from that in prairies, as on the leeward side of wetlands or at a woodland/savanna edge. As a result of variability in fire intensity and frequency, this type could occur in a matrix of prairie, savanna and woodlands (Bowles and McBride 1994).

COMMENTS: *3, MCS*. This type concept is taken from the Illinois state type - shrub prairie (White and Madany 1978), and represents the mesic mineral soil type. It probably occurred elsewhere in Indiana and Iowa. Many prairie remnants contain patchy shrub prairie, but it is not clear if these have increased due to fire suppression. Few extensive prairie landscapes remain today, making it difficult to characterize this type. Potential indicator species for this type, as compared to dry sand prairies, include *Camassia scilloides, Ceanothus americanus, Corylus americana, Helianthus hirsutus, Helianthus divaricatus, Orbexilum onobrychis (= Psoralea onobrychis), Rosa carolina, Rhus glabra, Silene stellata*, and *Smilax lasioneura* (Bowles and McBride 1996). Bowles and McBride (1994) show from the early survey records that this type, even though on rich, productive soil, was referred to as "barrens" because the frequent fire had reduced the trees to grubs and favored a shrub/scrub layer.

CONSERVATION RANK: *G1Q*. The number of occurrences is unknown. Three have been documented in Illinois in pioneer cemetery prairies (Bowles and McBride 1996). Few stands of this type remain, and lack of fire may permit increased tree growth.

DISTRIBUTION: This shrubland community is found in the central tallgrass prairie region of the midwestern United States, where it is currently described in Illinois.

USFS ECOREGIONS: 251:C
CONSERVATION REGIONS: 48:C
STATES: IL **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL shrub prairie +

OTHER SYNONYMY:

USNVC HIERARCHY: CORYLUS AMERICANA - (SPIRAEA TOMENTOSA, MALUS IOENSIS) SHRUBLAND ALLIANCE (III.B.2.N.a)

Corylus americana - Salix humilis / Schizachyrium scoparium Shrubland

American Hazelnut - Prairie Willow / Little Bluestem Shrubland

Hazelnut Sand Barrens CEGL005072

DESCRIPTION: The vegetation may contain scattered grubs of *Quercus velutina* and copses of *Sassafras albidum* interspersed with sand prairie or sand barrens vegetation. Dominant species in the shrub layer include *Corylus americana* and *Salix humilis*. Dominant herbaceous species include *Schizachyrium scoparium, Sorghastrum nutans*. Other characteristic species include *Asclepias amplexicaulis, Lupinus perennis, Opuntia humifusa, Phlox bifida*, and *Staphylea trifolia*. Open patches of sand may occur, and mosses and lichens may be common (Steffen and Anderson 1997).

Stands occur on dune slopes and sandy ridges of glacial lakeplains.

Droughts and fires interacted to maintain the open, scrubby nature of this type (Steffen et al. 1997).

COMMENTS: *2, MCS*. This type is primarily known through historical records, and few stands remain today. This type may be expected on drier, finer-textured and sandy soils. There are serious classification difficulties in applying the concept of this type, as it falls between the black oak barrens type, *Quercus velutina - (Quercus alba) - Quercus ellipsoidalis / Schizachyrium scoparium - Lupinus perennis* Wooded Herbaceous Vegetation (CEGL002492), which can be quite scrubby, and open dry sand prairies, *Schizachyrium scoparium - Danthonia spicata - Carex pensylvanica - (Viola pedata)* Herbaceous Vegetation (CEGL002318), or sand barrens, *Schizachyrium scoparium - Carex tonsa var. rugosperma - Carex muehlenbergii - Lithospermum caroliniense - Opuntia humifusa* Herbaceous Vegetation (CEGL005099). It remains to be determined how necessary a shrubby sand prairie or sand barrens category is. Type may occur in the Kankakee Sands area of Illinois.

CONSERVATION RANK: *G1?.* Little information is currently available about this community. It is reported from Indiana, where it is ranked SH (historical - no extant occurrences known, but some are expected to be found). It is possible this community is also in Illinois. There are no currently documented occurrences. There are probably fewer than 6 occurrences, with a total acreage probably less than 300 acres.

DISTRIBUTION: This type is found in the tallgrass prairie-forest border region of Illinois and Indiana in the United States.

USFS ECOREGIONS: 222:P, 251:C
CONSERVATION REGIONS: 48:C
STATES: IL IN **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	shrub prairie +
IN	dry sand prairie ?

OTHER SYNONYMY:

USNVC HIERARCHY: CORYLUS AMERICANA - (SPIRAEA TOMENTOSA, MALUS IOENSIS) SHRUBLAND ALLIANCE (III.B.2.N.a)

Populus tremuloides - Quercus macrocarpa - Salix spp. / Andropogon gerardii Shrubland

Quaking Aspen - Bur Oak - Willow Species / Big Bluestem Shrubland

Aspen - Oak Brush Prairie CEGL002182

DESCRIPTION: This is a community composed of various amounts of shrubs in a matrix of herbaceous prairie species. The distributions of prairie grass and forb species correlate with changes in soil moisture along a gradient from wet-mesic to dry-mesic. *Andropogon gerardii* and *Sporobolus heterolepis* are common throughout this community. On drier sites *Schizachyrium scoparium* and *Koeleria macrantha* are also important while on wetter sites *Spartina pectinata, Calamagrostis stricta ssp. inexpansa (= Calamagrostis inexpansa)*, and *Muhlenbergia richardsonis* are codominants. The major shrub species are *Populus tremuloides, Salix* spp. (including *Salix humilis*), and *Quercus macrocarpa*. *Amelanchier alnifolia, Amorpha canescens, Prunus pumila*, and *Corylus* spp. are usually present. The brush layer is generally less than 2 m tall with a total cover of 30-50%.

This community occurs on somewhat poorly drained to well-drained, sandy clay loam to loamy fine sandy soils. A sand and gravel subtype occurs on coarse-textured outwash deposits. These soils form in lake-washed glacial till or in sandy lacustrine deposits (of variable thickness) over till. Entisols are common; most soils are strongly calcareous.

COMMENTS: *2, MCS*. Concept of the type is taken from Minnesota state classification type - mesic brush prairie (MNNHP 1993). Type is related structurally to *Populus tremuloides - Quercus (ellipsoidalis, macrocarpa) / Andropogon gerardii* Shrubland (CEGL002197), which occurs in northwestern Wisconsin pine barrens, but the two types are quite distinct floristically.

CONSERVATION RANK: *G2G3.* Most sites of this community have been converted to cropland or have succeeded to woodland because of the suppression of fire. Few occurrences remain in Minnesota (R. Dana pers. comm. 1999).

DISTRIBUTION: This aspen - oak brush prairie shrubland is found in the aspen parkland regions of the United States and Canada, specifically northwest Minnesota and southeast Manitoba.

USFS ECOREGIONS: 222Na:CCC, 251Aa:CCC
CONSERVATION REGIONS: 35:C
STATES: MN **PROVINCES:** MB?

MIDWEST HERITAGE SYNONYMY: MN mesic brush-prairie; mesic brush-prairie sand - gravel subtype -

OTHER SYNONYMY:

USNVC HIERARCHY: POPULUS TREMULOIDES - QUERCUS SPP. - SALIX SPP. SHRUBLAND ALLIANCE (III.B.2.N.a)

Spiraea tomentosa - Salix humilis / Andropogon gerardii - Panicum virgatum Shrubland

Hardhack - Prairie Willow / Big Bluestem - Switchgrass Shrubland

Hardhack Wet-mesic Sand Shrub Meadow CEGL005069

DESCRIPTION: Shrub species include the dominants *Spiraea tomentosa, Salix humilis, Rubus hispidus*, and *Gaylussacia baccata*, along with *Photinia floribunda (= Aronia prunifolia)* and *Vaccinium angustifolium*. Herbaceous species include the dominants *Andropogon gerardii* and *Panicum virgatum*, as well as *Bartonia virginica, Osmunda regalis, Parthenium integrifolium, Pedicularis canadensis*, and *Viola lanceolata* (White and Madany 1978, Steffen and Anderson 1997).

Stands occur in depressions of glacial lakeplains.

Fires may have been necessary to maintain open shrub prairie conditions. Many prairie remnants contain patchy shrub prairie thickets, but it is not clear if these have increased due to fire suppression.

COMMENTS: *3, MCS*. This type concept is taken from the Illinois state type -shrub prairie (White and Madany 1978), and represents the wetter sandy soil type. It probably occurred elsewhere in Indiana and Iowa. Many prairie remnants contain patchy shrub prairie, but it is not clear if these have increased due to fire suppression. Few extensive prairie landscapes remain today, making it difficult to characterize this type.

CONSERVATION RANK: *G1Q.* There are probably fewer than 20 occurrences of this community rangewide. Currently 5 occurrences are documented from Illinois (where it is ranked S2). It may also occur in Indiana. There are probably fewer than 1000 acres of this community rangewide. Currently over 190 acres have been documented in Illinois. This community is currently reported from two ecoregion subsections in two provinces in northeastern Illinois.

DISTRIBUTION: This community is found in the central Midwestern United States in northeastern Illinois.

USFS ECOREGIONS: 222Jj:CCC, 251Dg:CCC
CONSERVATION REGIONS: 36:C, 48:C
STATES: IL IN? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL shrub prairie +
IN? dry-mesic prairie ?

OTHER SYNONYMY:

USNVC HIERARCHY: CORYLUS AMERICANA - (SPIRAEA TOMENTOSA, MALUS IOENSIS) SHRUBLAND ALLIANCE (III.B.2.N.a)

Artemisia filifolia / Calamovilfa longifolia Shrubland

Sand Sagebrush / Prairie Sandreed Shrubland

Sand Sage / Prairie Sandreed Shrubland CEGL002177

DESCRIPTION: Sand sagebrush communities within Badlands National Park have sparse to moderate cover, between 15-50%. Higher sandhills also have a large proportion of bare sand to vegetation between individual shrubs. The only shrub that becomes codominant with *Artemisia filifolia* is *Yucca glauca*, and it typically occurs on lower sand ridges and places where sandhills interface with nearly flat butte tops. Herbaceous cover is sparse to moderate, typically consisting of *Bouteloua gracilis, Calamovilfa longifolia, Sporobolus cryptandrus, Carex filifolia*, and *Andropogon hallii*. Some stands may contain *Schizachyrium scoparium* (Von Loh et al. 1999).

Sand sagebrush shrublands are confined to the highest sand hills and ridges; this type forms a mosaic with yucca shrub grasslands (*Yucca glauca*) on some lower sand ridges and where sand hills/ridges adjoin butte tops (Von Loh et al. 1999).

COMMENTS: *3, MCS*. More information is needed on this type in South Dakota. It appears to be disjunct from the main range of the *Artemisia filifolia* Shrubland Alliance (A.816). It may not deserve separate association status, but may be a variant of *Artemisia filifolia / Andropogon hallii* Shrubland (CEGL001459). Work at Badlands National Park suggests a great deal of similarity with CEGL001459 (Von Loh et al. 1999), though perhaps that type could be split into a more northern Great Plains type that would be combined with this type and a separate more southern Great Plains type (Steinauer and Rolfsmeier 2000). D. Ode (pers. comm. 1999) suggests that differences between Nebraska stands and South Dakota stands could arise from a climatic gradient that is less favorable to *Andropogon hallii* and other species in South Dakota. A further complication is that, according to NRCS Range Site Descriptions, the *Artemisia filifolia / Andropogon hallii* type in Nebraska can be modified to an *Artemisia filifolia / Calamovilfa longifolia* type through heavy grazing, with a moderate increase in shrub cover. A prescribed grazing regime, with perhaps periodic fire, could reverse the trend. For these reasons, D. Ode suggests that these two types be treated as one type, with the possibility that the *Artemisia filifolia* stands dominated by *Calamovilfa longifolia* be assigned a lower condition rank (at least in Nebraska).

CONSERVATION RANK: *G2G3.* This type is very localized in western South Dakota, where it is found in sandy habitats in Badlands National Park on Red Shirt and Blind Man Tables in the park's South Unit. A small amount of sand hills habitat lies within park boundaries southeast of Sheep Mountain Table and on the eastern edge of the Palmer Creek Unit (Von Loh et al. 1999). Other occurrences have not been documented, but stands do occur in Angostura State Recreation Area and elsewhere in Fall River County, South Dakota. While development around the Black Hills is real and growing, these landscapes are not yet threatened (D. Ode pers. comm. 2000).

DISTRIBUTION: This sand sagebrush shrub type is found in the northwestern Great Plains of the United States, particularly in western South Dakota.

USFS ECOREGIONS: 331F:CC
CONSERVATION REGIONS: 26:C
STATES: SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: ARTEMISIA FILIFOLIA SHRUBLAND ALLIANCE (III.A.4.N.a)

Artemisia tridentata - Atriplex confertifolia Shrubland

Big Sagebrush - Shadscale Shrubland

Big Sagebrush – Shadscale Shrubland CEGL000993

DESCRIPTION: The visual aspect of this association, especially where it occurs on badlands and eroded surfaces, is often that of a depauperate shrubland. Though shrub canopy cover for the modal expression of the type is less than the 25% required for a shrubland descriptor, the cover of all other layers is even less, rendering this type a shrubland. *Artemisia tridentata ssp. wyomingensis* and *Atriplex confertifolia* constitute from 5-25% combined cover, with *Artemisia tridentata* strongly dominant. In the Bighorn Basin and Bighorn Sedimentary Mountains Sections of Montana, other shrubs with greater than 50% constancy (but <5% canopy cover) include *Atriplex nuttallii, Sarcobatus vermiculatus, Krascheninnikovia lanata (= Ceratoides lanata)*, and *Ericameria nauseosa (= Chrysothamnus nauseosus)*. Subshrubs *Eriogonum brevicaule* and *Eriogonum pauciflorum* are relatively constant on a regional basis. There is little consistency to the composition of the herbaceous layer, which varies from site to site and across the region. The graminoids constitute the next most abundant component, but their combined cover usually does not exceed 5%; those grasses with the highest constancy are *Achnatherum hymenoides (= Oryzopsis hymenoides), Hesperostipa comata (= Stipa comata)*, and *Aristida purpurea*. *Phlox hoodii, Sphaeralcea coccinea* and *Opuntia polyacantha* appear to have the highest constancy values, but seldom exceed 1% cover.

If one accepts the descriptions and data reported in three separate papers (Brown 1971, Knight et al. 1987, DeVelice and Lesica 1993) as representing variants of one given type, then there is considerable vegetation, habitat and geographic variability manifest within this type. This community usually occurs as small patches but ranges to large patches on less precipitous terrain. The eastern Montana badland expressions, as well as those of Bighorn Canyon National Recreation Area, tend to have lower total canopy cover (13% average) with widely spaced individuals of the diagnostic species *Artemisia tridentata (ssp. wyomingensis*, G.P. Jones pers. comm. 1998) and *Atriplex confertifolia*. Conversely, the Pryor Mountains expressions average upwards of 30% canopy cover for the shrub component alone. A melange of undergrowth forbs is present with the representation depending upon the local flora; however *Opuntia polyacantha* is common to all expressions of the type, as are the grasses *Achnatherum hymenoides, Aristida purpurea* and *Hesperostipa comata*.

Within badlands landscapes this type is found on shallow, heavy-textured, and highly erosive soils, and on terrace/alluvial fan landscapes, it is associated with excessively drained substrates, often of a calcareous nature. Soils have consistently high pH and high conductivity values (within the range found for some *Sarcobatus vermiculatus* communities) and are derived from sedimentary parent materials. In badland settings, occupied slopes range from shallow to steep (>80%) with all aspects represented. For Montana sites the known range of elevation is from 900-1500 m (3000-4700 feet). Landscape position and site parameters have been cursorily described, at best, for the Wyoming and North Dakota occurrences.

COMMENTS: *2, WCS*. With additional review, this type will likely be combined with the more widespread *Artemisia tridentata ssp. wyomingensis - Atriplex confertifolia* Shrubland (CEGL001040). DeVelice and Lesica (1993) provide the only formal key to this type; they may have erred by not stipulating that *Artemisia tridentata* must be present (at any cover value) and noting only that *Atriplex confertifolia* be well-represented (>5% canopy cover). This association is distinguished by the predominance of the shrub layer (*Artemisia tridentata* dominant, *Atriplex confertifolia* subdominant) and the sparse, depauperate nature of the herbaceous component. With additional data, this type may also be appropriately classified in the sparse vegetation class.

CONSERVATION RANK: *G4.* Though the type occurs in small patches and its area of occupancy is small, it is apparently secure due to both its inaccessible landscape position, lack of palatable plants and lack of extractable resources.

DISTRIBUTION: This sagebrush shrubland occurs in the northwestern Great Plains and adjacent basins and mountains of the western United States, especially in badlands regions, ranging from North Dakota west to Wyoming and Montana.

USFS ECOREGIONS: 331D:CC, 342A:CC, M331G:??
CONSERVATION REGIONS: 10:C, 26:C
STATES: MT ND WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Artemisa - Atriplex - Agropyron* community (Brown 1971) F, *Atriplex - Artemisia* (Brown 1971) F

USNVC HIERARCHY: ARTEMISIA TRIDENTATA SSP. WYOMINGENSIS SHRUBLAND ALLIANCE (III.A.4.N.a)

Artemisia tridentata ssp. wyomingensis - Atriplex confertifolia Shrubland

Wyoming Big Sagebrush - Shadscale Shrubland

Wyoming Big Sagebrush-shadscale Shrubland CEGL001040

DESCRIPTION: Stands are dominated by shrubs. Dominants include *Artemisia tridentata ssp. wyomingensis*, with *Atriplex confertifolia* as an associate.

COMMENTS: *2, WCS*. This type needs further characterization. In the Great Plains the type may be synonymous with *Artemisia tridentata - Atriplex confertifolia* Shrubland (CEGL000993).

CONSERVATION RANK: *G3G5.*

DISTRIBUTION: This type is found irregularly in the Great Basin and northwestern Great Plains of the United States, ranging from western North Dakota, southwest to Utah and California.

USFS ECOREGIONS: 331F:PP, 341A:CC
CONSERVATION REGIONS: 11:C, 6:C
STATES: CA MT ND OR UT WY? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: ARTEMISIA TRIDENTATA SSP. WYOMINGENSIS SHRUBLAND ALLIANCE (III.A.4.N.a)

Artemisia tridentata ssp. wyomingensis / Pascopyrum smithii Shrubland

Wyoming Big Sagebrush / Western Wheatgrass Shrubland

Big Sagebrush / Western Wheatgrass Shrubland CEGL001047

DESCRIPTION: The vegetation contains an open short-shrub layer, approximately 0.5 m tall, dominated by microphyllous-leaved shrubs, and a dense herbaceous layer dominated by medium-tall graminoids. Shrub cover averages between 15 and 30% (Hirsch 1985, Hansen and Hoffman 1988, Thilenius et al. 1995). *Artemisia tridentata ssp. wyomingensis* dominates the shrub layer. The dense herbaceous layer has a canopy cover of over 75%. *Pascopyrum smithii* is the leading dominant. Important associates include *Koeleria macrantha, Poa secunda*, and *Nassella viridula (= Stipa viridula)*. In drier or more heavily grazed phases, *Bouteloua gracilis, Hesperostipa comata (= Stipa comata)*, and *Carex filifolia* may be more common, along with the succulent *Opuntia polyacantha*. Forbs contribute low cover, often less than 10%, and are typically of low constancy. More constant species (>50%) include *Artemisia frigida, Sphaeralcea coccinea*, and *Vicia americana*. Grassy leaf litter covers over 75% of the ground; stones and bare soil comprise the remainder. Nonvascular plants are rare (Hirsch 1985, Hansen and Hoffman 1988, Thilenius et al. 1995).

Stands occur on gently rolling uplands or upper parts of stream terraces and drainageways. Drier examples may be on more exposed slope positions. Soils are moderately deep clays, clay loam, silt loam and loam. Soil moisture conditions are relatively mesic. Soil pH ranges from 5.8 to 7.8 (Hirsch 1985, Hansen and Hoffman 1988, Thilenius et al. 1995).

COMMENTS: *2, WCS*.

CONSERVATION RANK: *G4.*

DISTRIBUTION: This Wyoming Big Sagebrush type is found throughout the northern Great Plains and adjacent basins, Black Hills, and Rocky Mountains of the United States, particularly in Colorado and Wyoming.

USFS ECOREGIONS: 341C:CC, 342G:CC, M334A:CC
CONSERVATION REGIONS: 10:C, 20:C, 25:C
STATES: CO ND? WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Artemisia tridentata - Agropyron smithii* Habitat Type (Hansen et al. 1980) =, *Artemisia tridentata - Bouteloua gracilis* habitat type (Hirsch 1985) =, *Artemisia tridentata / Agropyron smithii* (Thilenius et al. 1995) F, *Artemisia tridentata / Agropyron smithii* Habitat Type (Hansen et al. 1984) =, *Artemisia tridentata / Agropyron smithii* habitat type (Hansen et al. 1984) =, *Artemisia tridentata / Bouteloua gracilis - Agropyron smithii* (Thilenius et al. 1995) F

USNVC HIERARCHY: ARTEMISIA TRIDENTATA SSP. WYOMINGENSIS SHRUBLAND ALLIANCE (III.A.4.N.a)

Artemisia tridentata ssp. wyomingensis / Pseudoroegneria spicata Shrubland

Wyoming Big Sagebrush / Bluebunch Wheatgrass Shrubland

Wyoming Big Sagebrush / Bluebunch Wheatgrass Shrubland CEGL001009

DESCRIPTION: Throughout the geographic range of this type, *Artemisia tridentata ssp. wyomingensis* dominates a shrub layer that has at least 25% canopy cover. Rabbitbrushes (*Chrysothamnus* spp.) often are present as well. *Pseudoroegneria spicata* contributes more cover to the herbaceous layer than does any other native species, and *Poa secunda* usually is present. Stands in the eastern part of the geographic range often include *Gutierrezia sarothrae, Artemisia frigida, Bouteloua gracilis*, and *Koeleria macrantha*. The height of the sagebrush ranges from about 35 cm tall in the eastern part of the range to about 1 m tall in the western part (Hironaka et al. 1983).

Stands of this type occupy loamy soils (often with coarse fragments) derived from a variety of parent materials, on middle and lower slopes and in draws. The close relationship between this association and *Artemisia tridentata ssp. wyomingensis / Pseudoroegneria spicata* Shrub Herbaceous Vegetation (CEGL001535) suggests that stands of this type occupy loamy soils (often with coarse fragments) derived from a variety of parent materials, on middle and lower slopes and in draws.

COMMENTS: *2, WCS*. Many stands of this association may be derived by grazing of *Artemisia tridentata ssp. wyomingensis / Pseudoroegneria spicata* Shrub Herbaceous Vegetation (CEGL001535). It may be preferrable to first combine these two types, and then split them geographically. The occurrences from the Great Plains west as far as northwestern Colorado, western Wyoming, and western Montana might belong to one type characterized by the presence of *Bouteloua* spp., *Carex filifolia, Koeleria macrantha, Gutierrezia sarothrae, Artemisia frigida*, and *Opuntia polyacantha*, and by the absence of *Achnatherum thurberianum (= Stipa thurberiana)*. The occurrences from southern Idaho, northern Nevada, eastern Oregon, eastern Washington, and British Columbia could belong to a different type characterized by the presence of *Achnatherum thurberianum*, and by the absence of the other species listed above. The separation between these two types probably would occur in Idaho. Additional research will be required to clarify this issue.

CONSERVATION RANK: *G5?.*

DISTRIBUTION: This is a widespread Wyoming Big Sagebrush shrub type, extending from the western side of the Great Plains on the east to British Columbia on the west, and south as far as northern Nevada.

USFS ECOREGIONS: 331D:CC, 331G:CC, 342A:CC, 342B:CC, 342I:CC, M242C:??, M331B:CC, M332A:CC, M332B:CC, M332C:CC, M332D:CC
CONSERVATION REGIONS: 10:C, 26:C, 6:C
STATES: CO ID MT ND NV UT WA WY **PROVINCES:** BC

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Artemisia tridentata / Pseudoroegneria spicata* Community Type (DeVelice et al. 1991) F, *Artemisia tridentata ssp. wyomingensis / Agropyron spicatum* Community Type (Cooper et al. 1995) F, Sagebrush steppe (Knight et al. 1987) F, *Artemisia tridentata / Roegneria spicata* Plant Association (Johnston 1987) F, *Artemisia tridentata ssp. wyomingensis* / *Agropyron spicatum* Habitat type B. Jensen et al. 1992

USNVC HIERARCHY: ARTEMISIA TRIDENTATA SSP. WYOMINGENSIS SHRUBLAND ALLIANCE (III.A.4.N.a)

Betula occidentalis - Juniperus horizontalis / Calamovilfa longifolia Shrubland

Water Birch - Creeping Juniper / Prairie Sandreed Shrubland

Water Birch - Creeping Juniper / Prairie Sandreed Shrubland CEGL002184

DESCRIPTION: This type is found in the northern Great Plains of the United States and Canada.

COMMENTS: *3, MCS*. Type has been described from Manitoba and North Dakota. More information is needed to clarify the concept of this type.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This type is found in the northern Great Plains of the United States and Canada, particularly North Dakota and Manitoba.

USFS ECOREGIONS: 331:?, 332:?
CONSERVATION REGIONS: 26:C
STATES: ND **PROVINCES:** MB?

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: BETULA OCCIDENTALIS SHRUBLAND ALLIANCE (III.B.2.N.a)

Ceanothus velutinus Shrubland

Tobacco-brush Shrubland

Mountain Balm Shrubland CEGL002167

DESCRIPTION: Typical occurrences are an acre or two in size, and are somewhat isolated. The vegetation is dominated by a uniform layer of 1-m tall shrubs. *Ceanothus velutinus* is the major dominant. There may be a few scattered *Rosa* spp., *Amelanchier* sp., and *Prunus virginiana*, among others. A variety of forbs may be present, including *Campanula rotundifolia*, etc., and may occur in the looser 'openings' in the shrub layer, but *Ceanothus velutinus* can grow together quite densely and pretty much shade out the ground layer (D. Ode pers. comm. 1999).

Stands occur at higher elevations (>1400 m or 4500 feet) in the northern Black Hills only, in the relatively high precipitation zone (>60 cm or 24 inches of rainfall) (D. Ode pers. comm. 1999).

This type is apparently a seral community occurring at the higher, and fairly moist, elevations in the northern Black Hills.

COMMENTS: *3, MCS*. The alliance and association concepts are tentative and need review. This type could be expected in the Rocky Mountains. The information on this type is based on observations by D. Ode (pers. comm. 1999) at three sites in the Black Hills: (1) on the northwest-facing top slope of Terry Peak, present since at least the 1960s; (2) on north-facing slopes of Mt. Theodore Roosevelt located just north of Deadwood; and (3) in a powerline corridor near Spearfish Peak above Spearfish Canyon. The biggest stands might be in the Bear Lodge, but the largest seen is 2-3 acres on Terry Peak, surrounded by aspen; it generally does not occur under the aspen. Thilenius (1971) reports *Ceanothus velutinus* in his aspen type, the *Populus tremuloides / Spiraea betulifolia / Lathyrus ochroleucus* type, as having a constancy of 25%, compared with much higher constancies (>85%) for *Spiraea betulifolia* and *Symphoricarpos albus* (H. Marriott pers. comm. 1999). Thilenius (1971) also describes a *Ceanothus velutinus* shrubland type on old forest burns in the Igneous Cone area of the northern Hills (this refers to the zone of Tertiary igneous features (knobs, buttes, etc.). It also occurs under the *Pinus ponderosa* canopy on unburned sites in the region. It is difficult to know from his report how significant these stands are and whether they constitute an association, as he also recognizes *Pinus flexilis* and *Pinus contorta* pine types for the Black Hills, both of which are really only minor (though unusual) species populations in other *Pinus ponderosa* types.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This mountain balm shrubland is found in the Black Hills of the western United States.

USFS ECOREGIONS: 331:P, M334A:CC
CONSERVATION REGIONS: 25:C, 9:C
STATES: SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: CEANOTHUS VELUTINUS SHRUBLAND ALLIANCE (III.A.2.N.c)

Cercocarpus montanus / Bouteloua curtipendula Shrubland

Mountain-mahogany / Sideoats Grama Shrubland

Mountain Mahogany / Side-oats Grama Shrubland CEGL001086

DESCRIPTION: Throughout its range, this community is a shrub-steppe community. Vegetation cover is sparse to moderate. The dominant shrubs are evenly spaced with herbaceous species occurring in between individual shrubs. The dominant species, *Cercocarpus montanus*, is approximately 1-2 m tall. *Rhus trilobata var. trilobata*, the other common shrub species, also grows over 1 m tall. *Artemisia frigida* is a common dwarf-shrub. The herbaceous species typically are 0.5-1 m tall. *Bouteloua curtipendula* is the most abundant herbaceous species. Other common species in the Black Hills include the forbs *Symphyotrichum oblongifolium (= Aster oblongifolius), Hedeoma hispida*, and the grasses *Aristida purpurea* and *Achnatherum hymenoides (= Oryzopsis hymenoides)* (Hoffman and Alexander 1987).

This community is almost exclusively found on slopes. These slopes are 20-40% with a variety of aspects (Hoffman and Alexander 1987). Drought stress is severe due to relatively little precipitation, moderate to steep slopes, and thin, poorly developed soils. Soils are loams and clay loams. The parent material is sandstone or limestone (Johnston 1987).

COMMENTS: *2, WCS*.

CONSERVATION RANK: *G5.* The type is rare in Nebraska, South Dakota, and Wyoming, but is apparently very common in New Mexico.

DISTRIBUTION: This mountain mahogany shrubland is found in the western and southern Great Plains and Rocky Mountains, ranging from South Dakota and Wyoming south to New Mexico.

USFS ECOREGIONS: 313E:CC, 321A:CC, 331F:CC, 331J:CC, M313A:CC, M313B:CC, M331F:CC, M334A:CC
CONSERVATION REGIONS: 20:C, 25:C, 26:C, 27:C
STATES: NE NM SD WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE mountain mahogany shrubland =

OTHER SYNONYMY: *Cercocarpus montanus - Rhus aromatica / Bouteloua curtipendula* Plant Association (Johnston 1987) =, *Cercocarpus montanus / Bouteloua curtipendula* Habitat Type (Hoffman and Alexander 1987) =

USNVC HIERARCHY: CERCOCARPUS MONTANUS SHRUBLAND ALLIANCE (III.B.2.N.a)

Ericameria nauseosa / Pseudoroegneria spicata Shrubland

Rubber Rabbitbrush / Bluebunch Wheatgrass Shrubland

Common Rabbitbrush / Bluebunch Wheatgrass Shrubland CEGL001330

DESCRIPTION: In the Dakotas, the vegetation has an open structure, with clumps of shrubs around 0.5-1 m tall scattered over a medium-tall herbaceous layer. *Ericameria nauseosa (= Chrysothamnus nauseosus)* is the dominant shrub. Other less common shrubs include *Prunus virginiana* and *Symphoricarpos occidentalis*. The herbaceous layer may contain the graminoids *Elymus trachycaulus ssp. trachycaulus* and *Pascopyrum smithii*. Forbs include *Melilotus officinalis*. Stands may contain a variety of other weedy species, such as *Bromus japonicus* and *Bromus tectorum* (Von Loh et al. 1999). Further west, in Montana, the type may occur in entirely natural habitats, and the dominant graminoid is *Pseudoroegneria spicata*.

As described from South Dakota, stands occur either on dry, steep slopes along roadcuts or in heavily grazed floodplains.

COMMENTS: *3, WCS*. It's possible that the weedy stands in South Dakota should not be assigned to this type, but should be in a separate, weedy type.

CONSERVATION RANK: *G3Q*. Type may be weedy (semi-natural) as well as natural, making ranking difficult.

DISTRIBUTION: This common rabbitbrush shrubland type is found in localized areas across the northern Great Plains of the United States, particularly Montana and western South Dakota.

USFS ECOREGIONS: M332:C
CONSERVATION REGIONS:
STATES: MT ND SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: ERICAMERIA NAUSEOSA SHRUBLAND ALLIANCE (III.A.4.N.a)

Juniperus horizontalis / Carex inops ssp. heliophila Dwarf-shrubland

Creeping Juniper / Sun Sedge Dwarf-shrubland

Creeping Juniper / Sedge Dwarf-shrubland CEGL001393

DESCRIPTION: This community is dominated by the prostrate shrub *Juniperus horizontalis*. Other shrubs, such as *Artemisia frigida* and *Symphoricarpos occidentalis*, are often present but not abundant. Mid grasses, short grasses, and sedges are abundant, especially *Carex inops ssp. heliophila* but also including *Schizachyrium scoparium, Carex filifolia, Koeleria macrantha*, and *Elymus lanceolatus*. Common forbs include *Campanula rotundifolia, Thermopsis rhombifolia, Pulsatilla patens ssp. multifida (= Anemone patens), Galium boreale*, and *Dalea purpurea*.

This community is found on moderate to steep (35-80%) north-facing slopes (Johnston 1987, MTNHP 1988). The soils are sandy loam.

COMMENTS: *1, MCS*. This type may be a seral stage of *Juniperus horizontalis / Schizachyrium scoparium* Dwarf-shrubland (CEGL001394) (D. Ode pers. comm. 1998).

CONSERVATION RANK: *G4.*

DISTRIBUTION: This community type is found in the northwestern Great Plains of the United States, ranging from southeastern Montana to South Dakota.

USFS ECOREGIONS: 331D:CC, 331G:CC
CONSERVATION REGIONS: 26:C
STATES: MT ND SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Juniperus horizontalis / Carex heliophila* Plant Association (Johnston 1987) =, *Juniperus horizontalis / Carex heliophila* Habitat Type (Johnston 1987) =

USNVC HIERARCHY: JUNIPERUS HORIZONTALIS DWARF-SHRUBLAND ALLIANCE (IV.A.1.N.b)

Juniperus horizontalis / Schizachyrium scoparium Dwarf-shrubland

Creeping Juniper / Little Bluestem Dwarf-shrubland

Creeping Juniper / Little Bluestem Dwarf-shrubland CEGL001394

DESCRIPTION: This community is dominated by short shrubs and graminoids. Vegetation cover is moderate to high. In 11 stands in western North Dakota the average cover of shrubs was 44%, graminoids 32%, and forbs 2% (USFS 1992). The dominant species is usually *Juniperus horizontalis*, a mat-forming shrub. Other low shrubs include *Artemisia frigida, Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda), Symphoricarpos occidentalis*, and *Rosa arkansana*. *Rhus trilobata* and *Prunus virginiana* are taller shrubs that may be present. The most abundant graminoid is *Schizachyrium scoparium*. Other common graminoids include *Calamovilfa longifolia, Carex filifolia, Carex inops ssp. heliophila, Carex duriuscula (= Carex eleocharis), Koeleria macrantha*, and *Muhlenbergia cuspidata*. Some of the forbs that are associated with this community are *Pulsatilla patens ssp. multifida (= Anemone patens), Campanula rotundifolia, Comandra umbellata, Echinacea angustifolia, Dalea purpurea, Galium boreale, Packera plattensis (= Senecio plattensis)*, and *Linum perenne*. Bare ground may occupy 25-45% of the surface (Hirsch 1985).

Stands occur on moderate to steep slopes, usually on upper slopes (Hansen et al. 1984, USFS 1992). Typically, in the northern plains, stands occur on north and, rarely, west-facing slopes (Johnston 1987), but in Manitoba it is thought to occur on dry south-facing slopes (Greenall 1995). Parent materials are sandstone, siltstone, claystone, and sandy glacial till (USFS 1992). Soil textures include shallow silty loam, sandy loam, or clay loam soil. Hirsch (1985) reported significant amounts of gravel and scoria near the surface.

COMMENTS: *1, MCS*. *Juniperus horizontalis / Carex inops ssp. heliophila* Dwarf-shrubland (CEGL001393) may be a seral stage of *Juniperus horizontalis / Schizachyrium scoparium* Dwarf-shrubland (CEGL001394) (D. Ode pers. comm. 1998). See also Hansen and Hoffman (1988).

CONSERVATION RANK: *G4.*

DISTRIBUTION: This community type is found in the northwestern Great Plains of the United States and Canada, ranging from Montana and South Dakota to North Dakota and southern Manitoba.

USFS ECOREGIONS: 331D:CC, 331G:CC, M334A:CC
CONSERVATION REGIONS: 25:C, 26:C, 34:C
STATES: MT ND SD **PROVINCES:** MB

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Juniperus horizontalis / Andropogon scoparius* Habitat Type (Hansen et al. 1984) =, *Juniperus horizontalis / Andropogon scoparius* Habitat Type (Hirsch 1985) =, *Juniperus horizontalis / Schizachyrium scoparium* Plant Association (Johnston 1987) =, *Juniperus horizontalis / Andropogon scoparius* Habitat Type (U.S. Forest Service (USFS) 1992) =

USNVC HIERARCHY: JUNIPERUS HORIZONTALIS DWARF-SHRUBLAND ALLIANCE (IV.A.1.N.b)

Artemisia cana / Pascopyrum smithii Shrubland

Silver Sagebrush / Western Wheatgrass Shrubland

Silver Sagebrush / Western Wheatgrass Shrubland CEGL001072

DESCRIPTION: This community is dominated by a combination of shrubs and graminoids. The total vegetation cover is typically moderate, but depends on frequency of flooding. The tallest and most conspicuous stratum is a shrub layer that is usually 0.6-1.2 m (Hansen and Hoffman 1988). In14 stands in western North Dakota shrubs averaged 28% canopy cover, graminoids 59%, and forbs 2% (USFS 1992). Stands in Nebraska often have less than 15% cover. The variation in soils within and between stands of this community results in variable species composition. *Artemisia cana* is the dominant shrub. *Symphoricarpos occidentalis* is frequently present. There are also shorter shrubs such as *Artemisia frigida, Krascheninnikovia lanata, Rosa woodsii*, and *Gutierrezia sarothrae*. The most abundant graminoid is *Pascopyrum smithii*. This species is typically 0.5-1.0 m tall. It is often accompanied by *Nassella viridula* and sometimes *Koeleria macrantha, Poa pratensis*, and *Hesperostipa comata (= Stipa comata)*. *Bouteloua gracilis* is the most abundant short graminoid. Typical forb constituents of this community are *Achillea millefolium, Gaura coccinea, Sphaeralcea coccinea*, and *Lactuca tatarica var. pulchella*.

This community occurs on flat alluvial deposits on floodplains, terraces or benches, or alluvial fans. The soils are moderately deep to deep (USFS 1992) and either silt loam, clay loam, or sandy loam (Johnston 1987, Hansen and Hoffman 1988). The soils may have moderate salt content (Hanson and Whitman 1938). Flooding occurs periodically and this tends to retard soil profile development (Hirsch 1985).

Periodic flooding occurs in many stands of this community.

COMMENTS: *1, WCS*. See Steinauer and Rolfsmeier (2000) for a description of the stands in Nebraska.

CONSERVATION RANK: *G4.*

DISTRIBUTION: This silver or coaltown sagebrush shrubland is found in the northwestern Great Plains and Rocky Mountains of the western United States, ranging from Montana and North Dakota, south to Nebraska.

USFS ECOREGIONS: 251Aa:CCC, 331D:CC, 331F:CC, 331G:CC, M331A:CC, M332B:C?, M332D:CC, M332E:CC, M334A:CC
CONSERVATION REGIONS: 25:C, 26:C, 35:C
STATES: MT ND NE SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE hat creek basin terrace prairie; sideoats-sandreed terrace prairie -

OTHER SYNONYMY: *Artemisa cana / Agropyron smithii* Habitat Type (Hansen et al. 1984) =, *Artemisia cana* Habitat Type (Hirsch 1985) =, Sagebrush Type (Hanson and Whitman 1938) =, *Artemisa cana / Elytrigia smithii* Plant Association (Johnston 1987) B, *Artemisa cana - Symphoricarpos occidentalis / Elytrigia smithii* Plant Association (Johnston 1987) =, *Artemisa cana / Agropyron smithii* Habitat Type (U.S. Forest Service (USFS) 1992) =

USNVC HIERARCHY: ARTEMISIA CANA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (III.A.4.N.c)

Cornus drummondii - (Rhus glabra, Prunus spp.) Shrubland

Roughleaf Dogwood - (Smooth Sumac, Plum Species) Shrubland

Sumac - Dogwood Shrubland CEGL005219

DESCRIPTION: The vegetation consists of bands or patches of shrubs 2-3 m tall. In the shrubland/oak woodland transition, woody tree species may also be present. *Rhus glabra* and *Cornus drummondii* are usually the dominant species, though in places *Corylus americana, Prunus americana, Prunus angustifolia, Symphoricarpos orbiculatus* or *Rhus aromatica* may dominate. Where shrub cover is dense, vines such as *Celastrus scandens* and *Parthenocissus vitacea* may be present. Under the dense canopy, the herbaceous layer may be sparse, consisting of exotic species, such as *Poa pratensis* and *Nepeta cataria*. In open stands, the herbaceous layer is more dense and consists of species of tallgrass and mixedgrass prairie (Hoagland 1998a, Rosburg and Glenn-Lewin 1996, Steinauer and Rolfsmeier 2000).

This community is found in the central Great Plains on level to moderate, well-drained slopes of uplands, usually along the borders of upland woods, but also in grassland ravines. Soils are silty loams formed in loess or glacial till.

Many stands have originated through human disturbance, and this type is probably best treated as a semi-natural type.

COMMENTS: *3, MCS*. This type is probably both a natural and a semi-natural type. Because most stands have originated through human disturbance, the type is probably best treated as a semi-natural type. Rosburg and Glenn-Lewin (1996) describe both a shrub edge type, dominated by *Cornus drummondii* and *Symphoricarpos sp*., and a dogwood/elm woodland type, with *Ulmus rubra* and other woody tree species present. Those types are treated together here.

CONSERVATION RANK: *GM.*

DISTRIBUTION: This sumac - dogwood shrubland community is found in the central Great Plains and western tallgrass regions of the United States, ranging from western Iowa and eastern Nebraska south to Oklahoma and possibly Arkansas.

USFS ECOREGIONS: 222A:??, 251Ca:CCC, 251Cm:CCC, 251Co:CC?, 251Cp:CCC, 251E:C?, 251F:C?, 255Aa:CPP, 255Ab:CPP, 255Ac:CPP, 255Ad:CPP, 255Ae:CPP, 255Af:CPP, 311A:CC, 332E:CC
CONSERVATION REGIONS: 32:P, 33:C, 36:C, 38:?
STATES: AR? IA KS NE OK **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE sumac-dogwood shrubland =

OTHER SYNONYMY:

USNVC HIERARCHY: CORNUS DRUMMONDII SHRUBLAND ALLIANCE (III.B.2.N.a)

Crataegus douglasii - (Crataegus chrysocarpa) Shrubland

Black Hawthorn - (Golden-fruit Hawthorn) Shrubland

Black Hawthorne Shrubland CEGL001093

DESCRIPTION: *Crataegus douglasii* or *Crataegus succulenta (= Crataegus columbiana var. occidentalis*), either alone or together, dominate or codominate the tall (to ca. 2.5 m) shrub layer, which includes a substantial amount of *Prunus virginiana* and may include substantial amounts of *Amelanchier alnifolia* and *Prunus americana*. *Viburnum lentago* may be present. This tall-shrub layer often is so thick as to be all but impenetrable, but it may contain openings. A low to medium-height shrub layer (typically ca. 0.8 m tall) dominated by *Symphoricarpos occidentalis* or *Symphoricarpos albus*, is present in stands with patchy tall-shrub layers, with the lower shrub growing beneath the openings in the taller shrub canopy. The herbaceous layer, present in stands with patchy shrub layers, usually consists of exotic species (*Bromus inermis, Poa pratensis, Phleum pratense, Cirsium arvense*), although several native species (*Carex sprengelii, Elymus glaucus, Elymus virginicus, Elymus trachycaulus ssp. trachycaulus, Galium boreale, Galium aparine, Galium triflorum*) often are present and may have constituted the original understories. Herbaceous species are sparse beneath dense shrub overstories.

Stands of this type grow in mesic draws (Hansen et al. 1995; Thilenius et al. 1995; Wyoming Natural Diversity Database, unpublished data) and on higher surfaces in streamside riparian areas (Hansen et al. 1995).

COMMENTS: *2, WCS*. The role of *Crataegus chrysocarpa* in this type is not clear.

CONSERVATION RANK: *G2Q*.

DISTRIBUTION: This black hawthorn shrubland occurs in the northwestern Great Plains and edges of the Black Hills of the United States, ranging from Montana to western South Dakota.

USFS ECOREGIONS: 331D:CC, 331G:CC, M332B:CC, M332C:CC, M332D:CC, M333B:CC, M333D:CC, M334A:CC
CONSERVATION REGIONS: 25:C, 26:C
STATES: MT SD? WY? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Crataegus succulenta* community type (Hansen et al. 1995) B. The *Crataegus succulenta* community type of Hansen et al. (1995) apparently includes a wider variety of stands than does this association, although that is somewhat unclear., *Crataegus erythropoda - Prunus virginiana* vegetation type (Thilenius et al. 1995) =. Stands of the *Crataegus erythropoda - Prunus virginiana* vegetation type identified by Thilenius et al. (1995) from mesic draws in the northwestern Cheyenne River Basin of Wyoming, belong to this association. (*Crataegus erythropoda* is synonymous with *C. douglasii var. rivularis*.)

USNVC HIERARCHY: CRATAEGUS (DOUGLASII, SUCCULENTA) TEMPORARILY FLOODED SHRUBLAND ALLIANCE (III.B.2.N.d)

Elaeagnus commutata / Pascopyrum smithii Shrubland

American Silverberry / Western Wheatgrass Shrubland

American Silverberry Shrubland CEGL001099

DESCRIPTION: This community occurs as open thickets within mixed grass prairie landscapes. *Elaeagnus commutata* is a short to medium-height shrub, up to 5 m. In North Dakota, *Elaeagnus commutata* is commonly found in shrub-grassland communities dominated by *Pascopyrum smithii, Stipa* spp., and *Festuca altaica (= Festuca scabrella)* (Esser 1994). These thickets are often associated with *Rosa woodsii* and *Symphoricarpos occidentalis* (Williams 1979a). Other plants associated with this type include *Elymus trachycaulus (= Agropyron trachycaulum), Anemone multifida, Symphyotrichum laeve (= Aster laevis), Campanula rotundifolia, Geum triflorum, Heuchera richardsonii*, and *Potentilla arguta* (Hegstad 1973). This shrubland occurs in relatively open stands (Bird 1930, Williams 1979a).

This community occurs on a variety of glacial landforms including kames, eskers, and areas of till and outwash. It is common on north-facing slopes and near aspen stands where moisture is more abundant in a predominantly prairie landscape (Hegstad 1973). It is also found along river valley slopes in portions of its range.

COMMENTS: *2, WCS*. This association has been quantitatively described only in Hill County of northeastern Montana, based on only one sample plot; reconnaissance in Montana indicates that the type exists as small stands in floodplain situations on coarse substrates (mixed gravels and sand), usually in association with *Salix exigua*-dominated communities. The *Elaeagnus commutata*-dominated patches almost invariably are small and stringer-like in shape; perhaps *Elaeagnus commutata* is an inferior competitor to the associated rhizomatous willow (usually *Salix exigua*). The extensive wetlands inventory by the Montana Wetland/Riparian Association makes no mention of *Elaeagnus commutata* types, either as dominance types or community types. From floristic studies in North Dakota and the Canadian Prairie Provinces, this association has been described for uplands, occurring as open thickets, associated with *Symphoricarpos occidentalis*- and *Rosa woodsii*-dominated shrublands, within a matrix of mixedgrass steppe. The occurrences in Montana versus the North Dakota and Canadian Prairie Provinces seem to be at variance in their abiotic parameters and landscape settings.

CONSERVATION RANK: *G3?*. This association is of little and ostensibly reduced areal extent, at least in the U.S. part of its range, and therefore constitutes a rare type, but the reasons for its obscurity are unknown at this time. Its environmental habitats do not appear unique. In the normal course of stream meandering, examples of this type will be obliterated but new ones generated in the course of plant succession. Where it occurs in more upland positions it may be subject to agricultural loss by plowing, but these threats are not expressed at this time. This type is reported as widespread in the Canadian prairies. Classification issues need to be resolved in the U.S. before a better assessment of the rank is possible.

DISTRIBUTION: This silverberry shrubland occurs in the northwestern portion of the Great Plains of the United States and Canada, ranging from North Dakota and Montana northward to Manitoba and Saskatchewan.

USFS ECOREGIONS: 331D:CC, 331G:CC, M332C:PP
CONSERVATION REGIONS: 26:C
STATES: MT ND **PROVINCES:** MB SK

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: ELAEAGNUS COMMUTATA SHRUBLAND ALLIANCE (III.B.2.N.a)

Prunus virginiana - (Prunus americana) Shrubland

Choke Cherry - (American Plum) Shrubland

Choke Cherry - (American Plum) Shrubland CEGL001108

DESCRIPTION: In Colorado, this community type is a medium-height (1.5-2 m) shrubland with dense vegetation that is almost impossible to walk through (CONHP pers. comm. 1998). In southwestern South Dakota, this type is characterized by moderate to dense shrub cover, typically in the 25-75% range. Shrub cover is generally greater in drainage bottoms and on lowermost slopes, and less on slopes. *Prunus virginiana* may be the dominant shrub species, but often other species are codominant or dominant, especially on slopes, including *Prunus americana, Rhus trilobata, Amorpha canescens, Symphoricarpos occidentalis* and *Toxicodendron pubescens*. In drainage bottom situations, herbaceous cover is usually sparse, less than 10%. On slopes, the shrubs typically occur in some grassland type, and graminoid cover can be greater than 75%.

In Colorado, this association grows at the interface between the riparian areas and the adjacent upland. Stands usually occur as small pockets on higher terraces or as narrow bands along the high water mark of steep banks and incised channels. It can also grow at the base of cliffs adjacent to rivers and streams where it forms impenetrable thickets (Colorado NHP pers. comm. 1998). In southwestern South Dakota, stands are found in a variety of habitats. Slope varies from flat to very steep, with variable aspect. Stands are commonly found in the bottoms of draws and drainages. This type also occurs associated with rock outcrops (H. Marriott pers. comm. 1999, Von Loh et al. 1999).

Some stands on slopes are the result of recent fire that killed the overlying canopy, converting *Pinus ponderosa / Prunus virginiana* Forest (CEGL000192) to this *Prunus virginiana* shrubland type.

COMMENTS: *2, WCS*.

CONSERVATION RANK: *G4Q*. This type is widespread, but it represents a broadly defined dominance type, with little information on the associated species or habitats that might help define the type more precisely. If, e.g. a Great Plains type was separated out from the other types, such a type could be relatively rare.

DISTRIBUTION: This shrubland is found primarily in the northern Great Plains and northwestern Rocky Mountain regions of the United States, but may extend into the Great Basin.

USFS ECOREGIONS: 331D:CC, 331G:CC, 331H:CC, 342A:CC, 342F:CC, M331B:CC, M331I:CC, M331J:CC, M332B:CC, M332C:CC, M332D:CC, M332E:CC, M333B:CC, M333C:CC, M333D:CC, M334A:CC
CONSERVATION REGIONS: 10:C, 20:C, 25:C, 26:C, 6:?
STATES: CO ID MT NV? OR SD WA WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: PRUNUS VIRGINIANA SHRUBLAND ALLIANCE (III.B.2.N.a)

Shepherdia argentea Shrubland

Silver Buffaloberry Shrubland

Buffaloberry Shrubland CEGL001128

DESCRIPTION: The vegetation is dominated by a moderate to dense canopy of medium-tall shrubs. The most abundant of these, *Shepherdia argentea*, is typically 1.5-3 m tall. Other species commonly found in the shrub layer are *Juniperus horizontalis, Prunus virginiana, Ribes* spp., *Rhus aromatica, Rosa woodsii*, and *Symphoricarpos occidentalis*. Herbaceous species are not important in this community. Graminoids and forbs may have only half the coverage of the shrub layer (Hansen and Hoffman 1988, USFS 1992). Graminoids include *Poa pratensis, Pascopyrum smithii*, and *Bromus* spp. Common forbs are *Achillea millefolium, Artemisia ludoviciana*, and *Parietaria pensylvanica*. Litter may accumulate in this community (DeVelice et al. 1995).

This community is found on stream terraces, rolling uplands, and badlands. It occurs where moisture is more plentiful than on the surrounding landscape, such as in swales, ravines, near streams, and on northwest- to east-facing slopes (Hansen and Hoffman 1988, DeVelice et al. 1995). This trend is more pronounced in Wyoming where Jones and Walford (1995) only found this community near streams, and it may be less pronounced in Saskatchewan and northern Montana. Soils are loamy sand, sandy loam, silty loam, or loam and are derived from glacial drift, siltstone, or sandstone (USFS 1992, DeVelice et al. 1995). This community does not flood often, but some sites show evidence of a high water table (DeVelice et al. 1995).

COMMENTS: *2, WCS*.

CONSERVATION RANK: *G3G4.* The number of occurrences is unknown. The community is reported from Montana (where it is ranked S3?), Wyoming (?), Colorado (S1), Saskatchewan (S?), and possibly North Dakota (SP).

DISTRIBUTION: This mesic buffaloberry shrubland community is found in the northern Great Plains of the United States and Canada, extending from Colorado northward to the Dakotas and Saskatchewan. This mesic shrubland community is found in the northern Great Plains on stream terraces, rolling uplands, and badlands.

USFS ECOREGIONS: 331D:CC, 331G:CC, 341B:CC, M331G:CC
CONSERVATION REGIONS: 10:C, 19:C, 20:C, 26:C
STATES: CO MT ND SD WY **PROVINCES:** SK

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Shepherdia argentea* Community Type (Hansen et al. 1984) =, *Shepherdia argentea* Habitat Type (U.S. Forest Service (USFS) 1992) =, *Shepherdia argentea* Community Type (DeVelice et al. 1995) =, Silver Buffaloberry Dominance Type (Jones and Walford 1995) =

USNVC HIERARCHY: SHEPHERDIA ARGENTEA TEMPORARILY FLOODED SHRUBLAND ALLIANCE (III.B.2.N.d)

Symphoricarpos occidentalis Shrubland

Western Snowberry Shrubland

Western Snowberry Shrubland CEGL001131

DESCRIPTION: Throughout its range this community is dominated by shrubs approximately 1 m tall. Shrub cover is typically greater than 50%, and in places it can approach 100%. These shrubs form dense clumps that exclude most other species. *Symphoricarpos occidentalis* is the most common shrub, but *Rhus aromatica* (or *Rhus trilobata*) and *Prunus virginiana* can be locally abundant and can grow to 2-3 m in places. *Toxicodendron rydbergii* may also be present. Herbaceous species and smaller shrubs are most abundant at the edges of this community and in gaps between the clumps of taller shrubs where the shading is less complete. *Rosa woodsii* is a typical smaller shrub. Common graminoids include *Pascopyrum smithii* and *Poa pratensis*. *Achillea millefolium, Artemisia ludoviciana, Galium boreale*, and *Solidago* spp. are common forbs of this community. Woody vines sometimes occur, including *Parthenocissus vitacea*.

This community is found in mesic swales, depressions, ravines and floodplains. Some examples of this community experience intermittent and brief flooding. The soils are fertile and well-drained to imperfectly drained silts and loams. The upper soil horizon is usually deep, although a thin layer of sand may be present if the site has been recently flooded (Jones 1995).

Stands may occasionally be flooded (Jones 1995). *Symphoricarpos occidentalis* seems to thrive in disturbed areas (Hansen and Hoffman 1988), especially those subject to disturbance by fire and cattle grazing.

COMMENTS: *3, WCS*. This type often occurs in heavily disturbed areas in conjunction with exotic species such as *Poa pratensis* and *Cirsium arvense*. Because it occurs in mesic swales, depressions, ravine bottoms and floodplains, some stands are occasionally flooded whereas others are just very moist. Thus it tends to fall on both sides of the upland/wetland division.

CONSERVATION RANK: *G4G5.* This type is common throughout the northern Great Plains. Historically, it may never have been very extensive. It has been observed to grow out from forest or woodland edges and shade out the grasses. It is tolerant of both grazing and fire (Hansen and Hoffman 1988), and is under no threat from human activities. In some cases, heavily grazed pastures may favor this types. Many examples are somewhat weedy; thus the type is not demonstrably secure.

DISTRIBUTION: This western snowberry shrubland is found in the western tallgrass and northern Great Plains of the United States and Canada.

USFS ECOREGIONS: 251Bb:CPP, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:CC, 332A:CP, 332B:CP, 332C:CP, 332D:CP, 342A:CC, M331B:??, M332B:CC, M332D:CC, M332E:CC, M334A:CC
CONSERVATION REGIONS: 10:C, 20:C, 25:C, 26:C, 27:C, 35:C
STATES: CO IA? MT ND NE SD WY **PROVINCES:** MB? SK

MIDWEST HERITAGE SYNONYMY: NE buckbrush shrubland =

OTHER SYNONYMY: *Symphoricarpos ocidentalis* Community (Hansen et al. 1984) =, Low Shrub (Meyer 1985) =, *Symphoricarpos occidentalis / Elytrigia smithii* Plant Association (Johnston 1987) =, *Symphoricarpos occidentalis* Community (Hansen et al. 1984) =, *Symphoricarpos occidentalis* Community (Jones and Walford 1995) =, *Symphoricarpos occidentalis* Series (Jones 1992)

USNVC HIERARCHY: SYMPHORICARPOS OCCIDENTALIS TEMPORARILY FLOODED SHRUBLAND ALLIANCE (III.B.2.N.d)

Artemisia filifolia / Andropogon hallii Shrubland

Silver Sagebrush / Sand Bluestem Shrubland

Sand Sagebrush / Sand Bluestem Shrubland CEGL001459

DESCRIPTION: This community has an evenly spaced short-shrub layer that reaches 1 m (Bruner 1939). The shrub layer is dominated by *Artemisia filifolia*. The vegetation can be sparse to moderately dense. Ramaley (1939) reported that *Artemisia filifolia* was the dominant species and covered 10% of the ground in a stand in northeastern Colorado. Other common shrubs are *Artemisia frigida, Opuntia* spp., and *Yucca glauca*. Mid and tall grasses dominate between the shrubs. These include *Andropogon hallii, Bouteloua curtipendula, Bouteloua gracilis, Calamovilfa longifolia, Eragrostis trichodes, Schizachyrium scoparium, Sporobolus cryptandrus*, and *Hesperostipa comata (= Stipa comata)*. In Kansas and Nebraska, *Cyperus schweinitzii, Eragrostis secundiflora, Eriogonum annuum, Paspalum setaceum*, and *Grindelia papposa (= Prionopsis ciliata)* are present. Forbs that are typically found in this community include *Carex duriuscula (= Carex eleocharis), Helianthus petiolaris, Heterotheca villosa, Lathyrus polymorphus*, and *Psoralidium lanceolatum*. (Lauver et al. 1999, Steinauer and Rolfsmeier 2000)

This community is found on gently to moderately sloping hills. Rarely, it occurs on flat ground. The soils range from loamy fine sands to sand and are somewhat excessively to excessively well-drained (Steinauer 1987, Lauver et al. 1999). The parent material is eolian sand. Johnston (1987) wrote that this community developed principally on the leeward side of major drainageways in southeastern Colorado and southwestern Kansas. In the sandhills of northern Colorado and western Nebraska, this community also occurs away from drainageways (Ramaley 1939, Steinauer 1987). Drought stress is great due to little precipitation and sandy soil.

COMMENTS: *1, WCS*. Steinauer and Rolfsmeier (2000) note that in much of western Nebraska shrub canopy cover is more like an open shrub prairie than a shrubland. Dense cover may occur due to overgrazing.

In Texas and Oklahoma this association is a grassland with shrubs. Effects of livestock grazing on vegetation structure need to be studied. This type should be better contrasted with *Artemisia filifolia / Schizachyrium scoparium - Andropogon hallii* Shrubland (CEGL002178).

CONSERVATION RANK: *G3?*. There are probably fewer than 100 occurrences of this community rangewide. It is ranked S2 to S3 in Colorado, Nebraska, Kansas, and Oklahoma, and it is also reported from Texas, New Mexico, and Wyoming. Currently there are no occurrences documented. Historical acreage and trends are unknown; this community has probably been degraded by overgrazing. This community is prominent in the sandhills of western Nebraska and northeastern Colorado.

DISTRIBUTION: This sand sagebrush shrubland is found on flat to moderate slopes in the central and southern Great Plains of the United States, ranging from western Nebraska and possibly Wyoming south to Texas and possibly New Mexico.

USFS ECOREGIONS: 315:C, 321A:CC, 331C:CC, 331H:CC, 331I:CC, 332E:CC
CONSERVATION REGIONS: 24:C, 27:C, 28:C
STATES: CO KS NE NM? OK TX WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE sandsage prairie =

OTHER SYNONYMY: Sand-sage Community (Ramaley 1939) =, Sandsage Prairie (Kuchler 1974) B, *Artemisia filifolia / Andropogon hallii* Plant Association (Johnston 1987) F

USNVC HIERARCHY: ARTEMISIA FILIFOLIA SHRUBLAND ALLIANCE (III.A.4.N.a)

Artemisia filifolia / Bouteloua (curtipendula, gracilis) Shrubland

Sand Sagebrush / (Sideoats Grama, Blue Grama) Shrubland

Sand Sagebrush / Grama Grass Shrubland CEGL002176

DESCRIPTION: The shrub layer is between 0.5 and 1 m tall. The canopy is dominated by *Artemisia filifolia*. Short to medium grasses dominate the ground layer, including *Bouteloua curtipendula* and *Bouteloua gracilis*. Other graminoids include *Andropogon hallii, Cyperus schweinitzii, Paspalum setaceum*, and *Schizachyrium scoparium*. Herbs include *Erigeron annuus, Helianthus petiolaris*, and *Grindelia papposa (= Prionopsis ciliata)* (Lauver et al. 1999).

Stands occur on sandy rolling hills. Soils are loamy fine sand to sandy, excessively drained, and formed in loamy or sandy aeolian sediments (Lauver et al. 1999).

COMMENTS: *2, SCS*.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This community is found in the southern Great Plains of the United States, ranging from Kansas south to Texas.

USFS ECOREGIONS: 315B:CP, 331B:CC
CONSERVATION REGIONS: 27:C, 28:C
STATES: KS OK TX **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: ARTEMISIA FILIFOLIA SHRUBLAND ALLIANCE (III.A.4.N.a)

Artemisia filifolia / Schizachyrium scoparium - Andropogon hallii Shrubland

Sand Sagebrush / Little Bluestem - Sand Bluestem Shrubland

Sand Sagebrush / Little Bluestem Shrubland CEGL002178

DESCRIPTION: The vegetation structure is 0.5-1 m tall shrub layer. The dominant shrub is *Artemisia filifolia*, with *Yucca glauca* an occasional associate. Dominant graminoids are medium tall, and include *Andropogon hallii* and *Schizachyrium scoparium*. Other associates include *Bouteloua curtipendula, Calamovilfa gigantea, Cyperus schweinitzii*, and *Paspalum setaceum*. Herbs include *Eriogonum annuum, Helianthus petiolaris*, and *Grindelia papposa (= Prionopsis ciliata)* (Lauver et al. 1999).

Stands occur on sandy, rolling hills. Soils are loamy fine sand to sands, excessively drained, and formed in loamy or sandy aeolian sediments (Lauver et al. 1999).

COMMENTS: *2, SCS*. This type should be compared with *Artemisia filifolia / Andropogon hallii* Shrubland (CEGL001459).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This sand sagebrush type is found in the southern Great Plains of the United States, ranging from Kansas south to Texas.

USFS ECOREGIONS: 315B:CP, 331B:CC
CONSERVATION REGIONS: 27:C, 28:C
STATES: KS OK TX **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: ARTEMISIA FILIFOLIA SHRUBLAND ALLIANCE (III.A.4.N.a)

Atriplex canescens / Bouteloua gracilis Shrubland

Fourwing Saltbush / Blue Grama Shrubland

Four-wing Saltbush / Blue Grama Shrubland CEGL001283

DESCRIPTION: In Kansas, the vegetation is dominated by shrubs between 0.5 and 1 m tall. The dominant shrub is *Atriplex canescens*, with associated species being *Rhus aromatica, Toxicodendron rydbergii* and *Yucca glauca*. The herbaceous layer of short to medium-tall grasses includes *Bouteloua gracilis* and *Bouteloua curtipendula* (Lauver et al. 1999).

In Kansas, stands occur in dry barren flats, slopes, and bluffs. Soils are shallow, rocky, and alkaline (Lauver et al. 1999).

COMMENTS: *1, WCS*.

CONSERVATION RANK: *G3.* This late-seral shrubland association occurs in the southwestern Great Plains and desert grasslands in Arizona. Sites are restricted to non-saline bottomlands. Stands have declined because of exploitation by humans either by farming (plowing) or overgrazing by livestock. An estimated 21-100 occurrences are left. None are believed to be protected. More survey work in needed to locate examples of this vegetation good condition.

DISTRIBUTION: This saltbush type is found in the southern Great Plains of the United States, from Kansas and Colorado southwest to Arizona and east to Texas.

USFS ECOREGIONS: 313A:CC, 315A:C?, 321:C, 331H:CC, 331I:CC, 341:C
CONSERVATION REGIONS: 19:C, 24:C, 27:C, 28:?, 29:?
STATES: AZ CO KS NM? TX **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: ATRIPLEX CANESCENS SHRUBLAND ALLIANCE (III.A.5.N.b)

2.7. Shrub Grasslands

Artemisia cana / Hesperostipa comata Shrub Herbaceous Vegetation

Silver Sagebrush / Needle-and-thread Shrub Herbaceous Vegetation

Silver Sagebrush/Needle-and-thread Shrub Prairie CEGL001553

DESCRIPTION: *Artemisia cana* (probably *Artemisia cana ssp. cana* (Shultz 1984)) is decidedly the dominant shrub with canopy coverages ranging to 50% on heavily grazed sites, but averaging 27%; *Artemisia frigida* is the only shrub/subshrub with greater than 50% constancy and its cover did not exceed 3%. A number of graminoids have high constancy, including *Bouteloua gracilis, Carex filifolia, Koeleria macrantha*, and *Poa secunda (= Poa sandbergii)*, but only *Hesperostipa comata (= Stipa comata)* exhibits both 100% constancy and the highest cover values (averaging 38%). *Muhlenbergia cuspidata* and *Calamovilfa longifolia* had rather high cover on some sites. Forbs constitute an insignificant component, occurring in trace amounts; those exceeding 50% constancy are *Sphaeralcea coccinea, Pediomelum argophyllum (= Psoralea argophylla)* and *Gaura coccinea*. This association is hypothesized to represent the driest environment capable of supporting *Artemisia cana*; most often this association grades to upland range sites dominated by *Hesperostipa comata (= Stipa comata)* and *Bouteloua gracilis* and to the *Artemisia cana / Pascopyrum smithii* association that occupies more mesic positions on lower floodplain terraces.

This type is found on benches to gently inclined slopes (30% maximum recorded value) of rolling prairie, steeper ravine slopes, and all manner of topography in the vicinity of breaklands. It occurs on various parent materials but mostly well-drained, often sandy, glacial drift. The ground cover is highly variable with some sites (putatively overgrazed) having a sward of *Selaginella densa* and lichens, while others have 70% litter and trace amounts of *Selaginella densa*; only one plot had as much as 10% exposed soil, gravel and rock (combined cover).

The relatively high cover of *Artemisia cana* may be the result of an altered fire regime. During presettlement time, when fires were more frequent, this type might not have attained these shrub densities.

COMMENTS: *1, WCS*. In their vegetation key to this type, DeVelice et al. (1995) allow for the occasional dominance of *Bouteloua gracilis* and/or *Calamovilfa longifolia*, in lieu of *Hesperostipa comata (= Stipa comata)* (which is by far the usual case), to be indicative of the association. The cover of *Artemisia cana* ranges widely, spanning the values defining shrub herbaceous and shrubland categories. The type is described as shrub herbaceous because the preponderance of stands had cover of less than 25%, though the average cover just exceeded this value. This type could probably be combined with *Artemisia cana / Calamovilfa longifolia* Shrub Herbaceous Vegetation (CEGL001555) without compromising the ecological information embedded in either type. This type is less moist than the *Artemisia cana / Pascopyrum smithii* Shrub Herbaceous Vegetation (CEGL001556), which contains rhizomatous wheatgrasses and/or *Nassella viridula* as dominants. In Wyoming's Cheyenne River Basin, stands of *Artemisia cana / Bouteloua gracilis - Calamovilfa longifolia* Shrub Herbaceous Vegetation (not in USNVC) (renamed *Artemisia cana ssp. cana / Calamovilfa longifolia* association by Thilenius et al. (1995), G.P. Jones pers. comm.) occur on well-drained sand dunes and lack, or have low coverages of, *Pascopyrum smithii*, but support *Hesperostipa comata* as 100% constant; *Hesperostipa comata* coverages approach those of the named diagnostic grasses. At least two plots of the *Artemisia cana / Hesperostipa comata* Shrub Herbaceous Vegetation (CEGL001553) having *Calamovilfa longifolia* dominant could be allocated to *Artemisia cana ssp. cana / Calamovilfa longifolia* Shrub Herbaceous Vegetation (CEGL001555).

CONSERVATION RANK: *G3.* This small patch type currently has a narrowly circumscribed geographic distribution, though it may be expected to occur in Saskatchewan and North Dakota. Habitats with the potential to support this type appear to be relatively abundant, but the type itself is comparatively uncommon. This type's affinity for well drained benches and gently inclined landforms in a primarily agricultural landscape puts it at a moderate risk for agriculture conversion. Fortunately this landform also occurs in breakland and badland environments less desirable for agriculture, thus lessening the chances of this uncommon type being converted to agriculture. Its graminoid composition renders it only moderately attractive to cattle, and the scarcity of forbs decrease its value as sheep range.

DISTRIBUTION: This association is well documented from Montana and Alberta, Canada. The same or a closely analogous type occurs in Wyoming, and some permutation of the type is to be expected in northwestern North Dakota and Saskatchewan.

USFS ECOREGIONS: 331D:CC, 331E:CC, 331F:CP, 331G:CP, M332E:CC
CONSERVATION REGIONS: 26:C
STATES: MT ND? WY? **PROVINCES:** AB SK?

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Artemisia cana - Stipa comata* community type (DeVelice et al. 1995) =, Spear Grass - Sagebrush Association =, Sagebrush / Needle & Thread Site Type F, Sagebrush flats B, *Artemisia cana / Bouteloua gracilis - Calamovilfa longifolia* (Thilenius et al. 1995) B, *Artemisia cana ssp. cana / Calamovilfa longifolia* association B

USNVC HIERARCHY: ARTEMISIA CANA SHRUB HERBACEOUS ALLIANCE (V.A.7.N.e)

Artemisia tridentata ssp. wyomingensis / Pseudoroegneria spicata Shrub Herbaceous Vegetation

Wyoming Big Sagebrush / Bluebunch Wheatgrass Shrub Herbaceous Vegetation

Big Sagebrush/Bluebunch Wheatgrass Shrub Prairie CEGL001535

DESCRIPTION: Throughout the range of this association, the vegetation consists of an open to moderately dense shrub layer (about 10-25% canopy cover) dominated by *Artemisia tridentata ssp. wyomingensis*, and a herbaceous layer dominated by *Pseudoroegneria spicata* with lesser amounts of *Poa secunda* (sometimes a codominant grass). Other shrubs (especially *Chrysothamnus* sp.) and herbaceous species (especially *Hesperostipa comata (= Stipa comata)*) usually are present. *Festuca idahoensis* is absent or present in small amounts. The stands in the eastern half of the geographic range often contain small amounts of *Gutierrezia sarothrae, Artemisia frigida, Sphaeralcea coccinea, Phlox hoodii, Koeleria macrantha*, and *Opuntia polyacantha*. Less constant species are *Bouteloua* spp. (especially *Bouteloua gracilis*) *Carex filifolia*, and *Pascopyrum smithii* (Hansen and Hoffman 1988, Thilenius et al. 1995, Mueggler and Stewart 1980, DeVelice and Lesica 1993, Cooper et al. 1995, Tweit and Houston 1980, Fisser 1964, Knight et al. 1987, Baker and Kennedy 1985, Tiedemann et al. 1987). Missing from these stands is *Achnatherum thurberianum (= Stipa thurberiana)*. In the western half of the geographic range, the vegetation generally lacks the associated species listed above (although Tisdale (1947) reports *Artemisia frigida* in British Columbia) and often contains *Antennaria dimorpha* and *Achnatherum thurberianum* (Hironaka et al. 1983, Blackburn 1967, Blackburn et al. 1968, Daubenmire 1988, Tisdale 1947, McLean 1970). In addition, the stands in Washington often contain large amounts of crustose lichens as ground cover. Descriptions and photographs of stands show that shrub height also varies across the range of this type. From the Great Plains westward to eastern Idaho and south to Colorado, the sagebrush seldom exceeds 0.5 m in height, but in western Idaho and Washington, the shrubs typically are 1 m tall.

On the Great Plains of eastern Montana and Wyoming (Hansen and Hoffman 1988, Thilenius et al. 1995), stands of this association occur on moderately steep to steep (16-45%) slopes and on gentle footslopes with various aspects, at 1350-1540 m (4400-5000 feet) elevation. Soils are loams, sandy loams, and sandy clay loams, often with coarse fragments in the upper horizons. Stands on the Wyoming plains often are on slopes of sandstone or porcelanite buttes (Thilenius et al. 1995). In the basins and foothills of south-central Montana (DeVelice and Lesica 1993) and north-central and central Wyoming (Fisser 1964, Knight et al. 1987, Tweit and Houston 1980), this association occupies mainly gentle to moderately steep (<35%) slopes at 1230-1850 m (4000-6000 feet) elevation. Soils are moderately deep, usually loamy (although one stand has been described from a clay soil), may have a considerable volume of coarse fragments, and have low electrical conductivity. In central and northwestern Colorado, stands of this association occupy gentle to steep slopes (to 65%) on a variety of landforms at elevations from about 2150-2525 m (7000-8200 feet). Soils are derived from a variety of parent materials and often are gravelly. In southwestern Montana (Mueggler and Stewart 1980, Cooper et al. 1995), stands grow at elevations from 1230-2300 m (4000-7500 feet), on slopes up to 54% with various exposures. Soils are shallow to moderately deep and derived from a variety of parent materials. In eastern Washington (Daubenmire 1988), this association occupies silt loam and sandy loam soils on gentle to moderately steep (8-38%) slopes with a variety of aspects, up to about 830 m (2700 feet) elevation. In British Columbia, this type grows on relatively warm, dry sites (Tisdale 1947), generally from 400-610 m (1300-1970 feet) elevation with stands on steep, south-facing slopes occurring as high as 910 m (2950 feet) (McLean 1970). Soils are loams, silt loams, and sandy loams.

COMMENTS: *2, WCS*. Vegetation types that fit this association have been described from the Great Plains of western North Dakota, eastern Montana, and northeastern Wyoming on the east to southern interior British Columbia on the west, and as far south as northern Nevada and central Colorado. Based on differences in species composition, this association might be split into two associations or subassociations. The occurrences from the Great Plains west as far as northwestern Colorado, western Wyoming, and western Montana apparently belong to one association characterized by the presence of *Bouteloua* spp., *Carex filifolia, Koeleria macrantha, Gutierrezia sarothrae, Artemisia frigida*, and *Opuntia polyacantha*, and by the absence of *Achnatherum thurberianum (= Stipa thurberiana)*. Occurrences from southern Idaho, northern Nevada, eastern Oregon, eastern Washington, and British Columbia might belong to a different type characterized by the presence of *Achnatherum thurberianum* and by the absence of the other species listed above. The division between these two associations probably would be made in Idaho. This type has a thicker sagebrush layer (generally >25% canopy cover) and less relative cover of herbaceous species. *Artemisia tridentata ssp. wyomingensis / Poa secunda* Shrubland (CEGL001049) has an undergrowth dominated by *Poa secunda* and containing little *Pseudoroegneria spicata*. *Artemisia tridentata ssp. tridentata / Pseudoroegneria spicata* Shrub Herbaceous Vegetation (CEGL001018) and *Artemisia tridentata ssp. vaseyana / Pseudoroegneria spicata* Shrubland (CEGL001030) differ in having shrub layers dominated by those subspecies of big sagebrush.

CONSERVATION RANK: *G4.*

DISTRIBUTION: This association is known from Montana, Wyoming, Colorado, Idaho, Washington, Oregon (apparently), Nevada, and British Columbia, Canada. It probably also occurs in western North Dakota and Utah, and it may occur in South Dakota. This association is known to occur on the Thunder Basin National Grassland and on the Custer National Forest, Ashland District. It may also occur on the Sioux District and the Grand River Districts of the Custer National Forest.

USFS ECOREGIONS: 331A:CP, 331D:CP, 331F:CC, 331G:CC, 331H:CC, 341A:PP, 341B:PP, 341C:PP, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:CC, 342I:CC, M242C:CC, M261G:CC, M331A:CC, M331B:CC, M331D:CC, M331H:CC, M331I:CC, M331J:CC, M332D:CC, M332E:CC, M332F:CC, M332G:CC
CONSERVATION REGIONS: 10:C, 11:C, 19:C, 20:C, 6:C
STATES: AZ? CA CO ID MT ND? NM? NV OR SD? UT? WA WY **PROVINCES:** BC

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Artemisia tridentata - Agropyron spicatum* Habitat Type B, *Artemisia tridentata / Agropyron spicatum* Habitat Type B, *Artemisia tridentata / Agropyron spicatum* Habitat Type (MONT) B, *Artemisia tridentata ssp. wyomingensis / Agropyron spicatum* Habitat Type B, *Artemisia tridentata / Agropyron spicatum* Habitat Types I, *Artemisia tridentata / Agropyron spicatum* Community I, *Artemisia tridentata / Agropyron spicatum* Community Type F, Sagebrush steppe B, Sagebrush/grass type B, *Artemisia tridentata* Zone B, *Agropyron - Artemisia* or the Lower Grassland Zone B, *Artemisia tridentata ssp. wyomingensis / Agropyron spicatum* Association F, *Artemisia wyomingensis / Agropyron spicatum* Habitat Type B, *Artemisia tridentata ssp. wyomingensis / Agropyron spicatum* Community Type B, *Artemisia tridentata / Roegneria spicata* Plant Association B, *Artemisia tridentata / Agropyron spicatum* association ?

USNVC HIERARCHY: ARTEMISIA TRIDENTATA SSP. WYOMINGENSIS SHRUB HERBACEOUS ALLIANCE (V.A.7.N.e)

Dasiphora fruticosa ssp. floribunda / Schizachyrium scoparium Shrub Herbaceous Vegetation

Shrubby-cinquefoil / Little Bluestem Shrub Herbaceous Vegetation

Shrubby-cinquefoil / Little Bluestem Shrub Prairie CEGL002198

DESCRIPTION: This community has a dominant herbaceous layer with scattered low shrubs. The shrub layer rarely has >30% canopy (Hirsch 1985) and does not typically exceed 1 m. The dominant species in this stratum is often *Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda)*, but *Juniperus horizontalis* is very frequent and may have a greater canopy in some stands. Other common shrubs include *Calylophus serrulatus, Rhus trilobata*, and *Rosa woodsii*. The herbaceous layer is moderate to dense and is about the same height as the shrubs. The dominant species in the herbaceous layer is *Schizachyrium scoparium*, with *Calamovilfa longifolia* a common associate. Other graminoids include *Carex filifolia, Elymus lanceolatus, Pascopyrum smithii*, and *Pseudoroegneria spicata*. Forbs do not contribute greatly to the canopy but species richness is high (Hirsch 1985). *Pulsatilla patens ssp. multifida (= Anemone patens), Dalea purpurea, Aster* spp., *Astragalus* spp., *Campanula rotundifolia, Helianthus pauciflorus (= Helianthus rigidus), Solidago mollis*, and *Viola* spp. are some of the species that are commonly found.

This community is found on gentle to moderately steep north-facing slopes. The soils are shallow to deep and sandy loam to loam (Hirsch 1985, USFS 1992). There may be an impermeable layer of scoria, gravel, or sandstone beneath many of these sites.

COMMENTS: *3, MCS*.

CONSERVATION RANK: *G3G4.*

DISTRIBUTION: This shrubby-cinquefoil shrub prairie community is found in the northwestern Great Plains, particularly western North Dakota.

USFS ECOREGIONS: 331:C, 332:?
CONSERVATION REGIONS: 26:C
STATES: ND **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Potentilla fruticosa - Andropogon scoparius* Habitat Type (Hirsch 1985) =, *Potentilla fruticosa - Andropogon scoparius* Habitat Type (U.S. Forest Service (USFS) 1992) =

USNVC HIERARCHY: DASIPHORA FRUTICOSA SSP. FLORIBUNDA SHRUB HERBACEOUS ALLIANCE (V.A.7.N.g)

Krascheninnikovia lanata / Bouteloua gracilis Dwarf-shrub Herbaceous Vegetation

Winter-fat / Blue Grama Dwarf-shrub Herbaceous Vegetation

Winter Fat / Blue Grama Shrub Prairie CEGL001321

DESCRIPTION: The vegetation contains an open shrub and graminoid layer. The dwarf-shrub layer is about 0.5 m tall, containing annual stems from a woody rootstock, and microphyllous leaves. The dominant dwarf-shrub is *Krascheninnikovia lanata*. In Kansas, *Stanleya pinnata*, a subshrubby perennial from a woody base, can be over 1 m tall. The short herbaceous layer is dominated by *Bouteloua gracilis, Echinacea angustifolia*, and *Liatris punctata* (Lauver et al. 1999).

In Kansas, stands occur in areas with sparse vegetation on uplands and flats. Soils are shallow, rocky, and alkaline (Lauver et al. 1999).

COMMENTS: *1, WCS*.

CONSERVATION RANK: *G4.*

DISTRIBUTION: This winter-fat open dwarf-shrub type is found in the southwestern Great Plains and Semi-desert Mountains, extending from Colorado and Kansas south to New Mexico and Arizona.

USFS ECOREGIONS: 315A:??, 321A:CC, M313B:CC, M331F:??
CONSERVATION REGIONS: 20:C, 27:C
STATES: AZ CO KS NM **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: KRASCHENINNIKOVIA LANATA DWARF-SHRUB HERBACEOUS ALLIANCE (V.A.8.N.a)

Rhus trilobata / Carex filifolia Shrub Herbaceous Vegetation

Ill-scented Sumac / Threadleaf Sedge Shrub Herbaceous Vegetation

Ill-scented Sumac / Thread-leaved Sedge Shrub Prairie CEGL001504

DESCRIPTION: This community is dominated by herbaceous vegetation, overtopped by a shrub canopy of 10-25%. The tallest shrubs are typically 0.6 m tall (Hansen and Hoffman 1988). Total coverage is moderate; exposed mineral soil is common. The U.S. Forest Service (1992) found an average vegetation cover of 70% on 10 stands in western North Dakota, most of that graminoids and shrubs. The most abundant shrub is *Rhus trilobata*, with lesser amounts of *Artemisia frigida, Gutierrezia sarothrae, Rosa arkansana*, and *Symphoricarpos occidentalis*. The most abundant herbaceous species is *Carex filifolia*, usually accompanied by *Koeleria macrantha, Muhlenbergia cuspidata*, and *Hesperostipa comata (= Stipa comata)*. *Carex inops ssp. heliophila* and *Elymus lanceolatus* are found in the shade of shrubs. Forbs have very low coverage. Common forbs include *Artemisia dracunculus, Echinacea angustifolia, Dalea purpurea, Opuntia polyacantha*, and *Phlox andicola*.

In Badlands National Park, South Dakota, this open shrub prairie type is found along with a more densely shrubby variant. The dense shrubland variant has moderate to dense vegetative cover, depending on the landscape location. Sites with extra available soil moisture, such as seeps and slumps or old river oxbows, support dense vegetative cover in the 75-100% range. Sites on ridges and hilltops support less vegetative cover, in the 50-75% range. *Rhus trilobata* is typically the overstory dominant, but in terms of vegetative cover, *Symphoricarpos occidentalis, Toxicodendron rydbergii*, and *Prunus virginiana* can contribute nearly equal amounts. Understory grasses often include *Schizachyrium scoparium, Bouteloua curtipendula*, and *Poa pratensis* (Von Loh et al. 1999).

This community occurs on moderate to steep slopes on protected ridgetops and upper slopes of draws (Johnston 1987, USFS 1992). Hansen and Hoffman (1988) found four stands in western South Dakota on sandy loam soil. In Badlands National Park, South Dakota, sparse stands of ill-scented sumac occur most commonly on very steep slopes, where the upper butte cliffs meet the well-vegetated butte top and along the edge of draws. The geologic formation of cliff faces is predominantly Brule siltstone that is rapidly eroding, resulting in small ledges, nearly vertical faces, and steep slopes with rocks and fine sediments. Dense stands of ill-scented sumac occur sporadically within Badlands National Park, but are a regular landscape feature along the breaks of the Cheyenne River, northwest of the park. They typically occupy ridgetops and hillslopes with gravelly to sandy soils, though a few stands are located in old oxbows along the White and Cheyenne Rivers (Von Loh et al. 1999).

COMMENTS: *1, WCS*.

CONSERVATION RANK: *G3.* This community has a relatively restricted range, being found in three states. It is relatively small patch in scale. It was considered to be an infrequent type in National Forest areas sampled in the western Dakotas and southeastern Montana (Hansen and Hoffman 1988), and is infrequent in Badlands National Park (Von Loh et al. 1999).

DISTRIBUTION: This sumac shrub steppe is found in the northern Great Plains of the United States, including eastern Montana and the western Dakotas.

USFS ECOREGIONS: 331D:CC, 331G:CC
CONSERVATION REGIONS: 26:C
STATES: MT ND SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Rhus aromatica / Carex filifolia* Plant Association (Johnston 1987) =, *Rhus aromatica / Carex filifolia* Habitat Type (Hansen et al. 1984) =, *Rhus aromatica / Muhlenbergia cuspidata* (U.S. Forest Service (USFS) 1992) =

USNVC HIERARCHY: RHUS TRILOBATA SHRUB HERBACEOUS ALLIANCE (V.A.7.N.g)

Yucca glauca / Calamovilfa longifolia Shrub Herbaceous Vegetation

Soapweed Yucca / Prairie Sandreed Shrub Herbaceous Vegetation

Soapweed / Prairie Sandreed Shrub Prairie CEGL002675

DESCRIPTION: Stands contain an open to moderately dense (at least 10% cover), low-shrub layer above a species-rich herbaceous layer. Dominance of the shrub layer by *Yucca glauca* is characteristic (average cover in 6 stands was 9.8%). *Artemisia tridentata ssp. wyomingensis* and *Artemisia cana ssp. cana* may be present but are sparse and contribute little cover. In the herbaceous layer, *Hesperostipa comata (= Stipa comata)* and *Calamovilfa longifolia* codominate (16% cover and 8% cover, respectively), and *Bouteloua gracilis* and *Carex filifolia* often are present but contribute much less cover than do *Hesperostipa* or *Calamovilfa*. Forbs are common but contribute little cover; *Artemisia frigida* (dwarf-shrub-like) has the highest constancy, but no forb is characteristic of the association. Litter covers up to about half of the ground surface, and most of the rest of the ground surface is bare soil.

Stands of this type dominated by *Hesperostipa comata (= Stipa comata)* are more typically found only along sandstone outcrop ridgetops and a short distance down the adjacent slopes (the *Yucca glauca / Stipa comata* association of Thilenius et al. 1995). Soils are relatively deep (>1 m), pure sands, with medium- to coarse-textured lower horizons. The substrate is well-drained, but not xeric. Stands of this type with *Calamovilfa longifolia* occur on a broader range of ridgetops and upper slopes (compare with the *Yucca glauca / Calamovilfa longifolia* association of Thilenius et al. 1995).

COMMENTS: *2, WCS*. This association is the result of merging the former *Yucca glauca / Calamovilfa longifolia* Shrub Herbaceous Vegetation (CEGL001456) and former *Stipa comata - Yucca glauca* Herbaceous Vegetation (CEGL001706) following the review of data and descriptive material for these 2 types, which revealed they are similar enough to not warrant recognition as separate associations. See Comer et al. (1999) and Faber-Langendoen et al. (1997) for further comments.

CONSERVATION RANK: *G4.*

DISTRIBUTION: This soapweed association is found on sandstone outcrops and sandy soils in the northern Great Plains of the United States, ranging from western South Dakota and eastern Wyoming, north to Montana.

USFS ECOREGIONS: 331D:C?, 331F:CC, 331G:CC
CONSERVATION REGIONS: 26:C
STATES: MT SD WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: Sands range site, 10"-14" precipitation zone, Eastern Montana Glaciated Plains geographical region (Ross and Hunter 1976) B. These range sites support the larger *Yucca glauca / Calamovilfa longifolia* Association, into which it is suggested the *Stipa comata / Yucca glauca* Association be placed., Sands range site, 10"-14" precipitation zone, Eastern Montana Sedimentary Plains geographical region (Ross and Hunter 1976) B, Sands range site, 10"-14" precipitation zone, Montana Foothills and Mountains geographical region (Ross and Hunter 1976) B, Choppy sands range site, 10"-14" precipitation zone, Wyoming Southern Plains (Soil Conservation Service 1986) B. These range sites support the larger *Yucca glauca / Calamovilfa longifolia* Association, into which it is suggested the *Stipa comata / Yucca glauca* Association be placed., Sands range site, 10"-14" precipitation zone, Wyoming Northern Plains (Soil Conservation Service 1986) B, Sandy and Shallow sandy range sites, 15"-17" precipitation zone, Wyoming Northern Plains (Soil Conservation Service 1986) B, Stable ridge vegetation type. Similar. Described by Barnes et al. (1984) from the Nebraska Sand Hills, and named by Johnston (1987) as the *Stipa comata / Bouteloua hirsuta* plant association, contains *Stipa comata, Calamovilfa longifolia*, and *Bouteloua hirsuta* as the major herbaceous species, but *Yucca glauca* apparently is sparse enough that this type should be considered a grassland, rather than a sparse shrub type. *Stipa comata / Bouteloua hirsuta* (Johnston 1987). Similar. Also described by Barnes et al. (1984) from the Nebraska Sand Hills; contains *Stipa comata, Calamovilfa longifolia*, and *Bouteloua hirsuta* as the major herbaceous species, but *Yucca glauca* apparently is sparse enough that this type should be considered a grassland rather than a sparse shrub type.

USNVC HIERARCHY: YUCCA GLAUCA SHRUB HERBACEOUS ALLIANCE (V.A.7.N.h)

Sarcobatus vermiculatus / Distichlis spicata - (Puccinellia nuttalliana) Shrub Herbaceous Vegetation

Black Greasewood / Saltgrass - (Nuttall's Alkali Grass) Shrub Herbaceous Vegetation

Greasewood Saline Shrub Prairie CEGL002146

DESCRIPTION: The vegetation contains scattered medium-tall (0.5-1 m) shrubs with a cover of 10-25%. The shrub layer is dominated by *Sarcobatus vermiculatus*. Herbaceous species include *Distichlis spicata* and *Puccinellia nuttalliana*.

Stands occur on somewhat saline soils, and salt crusts may occur.

COMMENTS: *2, MCS*. This type closely resembles *Sarcobatus vermiculatus / Pascopyrum smithii - (Elymus lanceolatus)* Shrub Herbaceous Vegetation (CEGL001508). Nebraska applies that type to stands that may fit this type.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This greasewood saline shrub prairie type is found in the northern Great Plains of the United States and Canada, extending from the Dakotas into Saskatchewan.

USFS ECOREGIONS: 331:C
CONSERVATION REGIONS:
STATES: ND SD **PROVINCES:** SK?

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: SARCOBATUS VERMICULATUS SHRUB HERBACEOUS ALLIANCE (V.A.7.N.g)

Sarcobatus vermiculatus / Pascopyrum smithii - (Elymus lanceolatus) Shrub Herbaceous Vegetation

Black Greasewood / Western Wheatgrass - (Streamside Wild Rye) Shrub Herbaceous Vegetation

Greasewood / Western Wheatgrass Shrub Prairie CEGL001508

DESCRIPTION: This community has moderate to dense vegetation cover (Jones and Walford 1995, Thilenius et al. 1995). Medium-tall (0.5-1.5 m) shrubs are scattered throughout, with a total shrub canopy of 10-25% (Hansen and Hoffman 1988, USFS 1992). The shrub layer is dominated by *Sarcobatus vermiculatus*, with *Atriplex confertifolia, Atriplex canescens, Atriplex argentea, Artemisia tridentata*, and *Chrysothamnus viscidiflorus* in smaller amounts. *Symphoricarpos occidentalis* and *Rhus aromatica* are sometimes found in more mesic microhabitats within this community (Hirsch 1985). Herbaceous cover is sparse beneath the shrubs and moderate to dense in between. The dominant species are typically 0.5-1 m tall. The most abundant species is *Pascopyrum smithii*, usually accompanied by *Bouteloua gracilis, Bromus japonicus, Bromus tectorum*, and *Hesperostipa comata (= Stipa comata)*. Few forbs are found in this community. *Achillea millefolium* and *Opuntia polyacantha* are the only species with high constancy. Other species present may include *Grindelia squarrosa*. Overall species diversity in this community is low (Hansen and Hoffman 1988, Von Loh et al. 1999). In Nebraska, shrub species cover may be very low, and saline pockets may contain *Distichlis spicata* and *Sporobolus airoides*. *Astragalus bisulcatus* may be prominent (Steinauer and Rolfsmeier 2000).

This community is found on flat to gently sloping alluvial fans, terraces, lakebeds, and floodplains (Mueggler and Stewart 1978, Hansen and Hoffman 1988). Dodd and Coupland (1966) found *Sarcobatus vermiculatus* in association with *Pascopyrum smithii* only on the most arid parts of southwestern Saskatchewan. The soil is usually deep clay, silty clay, sandy clay, or loam (Hirsch 1985, Jones and Walford 1995), although coarse soils are possible (USFS 1992, Thilenius et al. 1995). They are saline or alkaline, but salt crusts on the surface are absent (Thilenius et al. 1995, but see Steinauer and Rolfsmeier 2000). Parent material is usually alluvium. Flooding during the spring is possible.

COMMENTS: *1, WCS*. Compare this association with *Sarcobatus vermiculatus / Elymus elymoides - Pascopyrum smithii* Shrubland (CEGL001365) from New Mexico.

See Steinauer and Rolfsmeier (2000) for a description of the stands in Nebraska. *Sarcobatus vermiculatus / Distichlis spicata - (Puccinellia nuttalliana)* Shrub Herbaceous Vegetation (CEGL002146) may be a more saline version of this type.

CONSERVATION RANK: *G4.*

DISTRIBUTION: This greasewood shrub prairie is found in saline habitats in the northwestern Great Plains of the United States and Canada, ranging from northwestern Nebraska north to the Dakotas and Saskatchewan.

USFS ECOREGIONS: 331D:CC, 331F:CC, 331G:CC, 342A:CC, 342F:CC, 342G:CC, M332B:CC, M332D:CC, M332E:CC
CONSERVATION REGIONS: 10:C, 26:C
STATES: MT ND NE SD WY **PROVINCES:** SK?

MIDWEST HERITAGE SYNONYMY: NE arvada shrub prairie =

OTHER SYNONYMY: *Agropyron - Sarcobatus* Community (Dodd and Coupland 1966) B, *Sarcobatus* Community (Brown 1971) =. Brown (1971) appears to have grouped the *Sarcobatus vermiculatus/Pascopyrum smithii* Sparse Shrubland and a *Sarcobatus vermiculatus/Pseudoroegneria spicata* Sparse Shrubland into one *Sarcobatus* community. The relationship of the former two communities in the USNVC is unclear., *Sarcobatus vermiculatus / Agropyron smithii* Habitat Type (Mueggler and Stewart 1978) =, *Sarcobatus vermiculatus - Artemisia tridentata* Habitat Type (Hirsch 1985) B, *Sarcobatus vermiculatus - Artemisia tridentata / Elytrigia smithii* Plant Association (Johnston 1987) =, *Sarcobatus vermiculatus / Agropyron smithii* Habitat Type (Hansen et al. 1984) =, *Sarcobatus vermiculatus / Agropyron smithii* Habitat Type (U.S. Forest Service (USFS) 1992) =, Black Greasewood/Western Wheatgrass Community (Jones and Walford 1995) =, *Sarcobatus vermiculatus / Agropyron smithii - Bouteloua gracilis* Shrub Steppe (Thilenius et al. 1995), Greasewood Shrub Prairie (Steinauer and Rolfsmeier 2000) =

USNVC HIERARCHY: SARCOBATUS VERMICULATUS INTERMITTENTLY FLOODED SHRUB HERBACEOUS ALLIANCE (V.A.7.N.n)

2.8. Savannas and Non-Rock Barrens

Pinus banksiana - (Quercus ellipsoidalis) / Schizachyrium scoparium - Prairie Forbs Wooded Herbaceous Vegetation

Jack Pine - (Northern Pin Oak) / Little Bluestem - Prairie Forbs Wooded Herbaceous Vegetation

Jack Pine / Prairie Forbs Barrens CEGL002490

DESCRIPTION: The vegetation is dominated by grasses and forbs with a sparse tree layer. The dominant tree is *Pinus banksiana*, with varying amounts of *Quercus ellipsoidalis, Pinus resinosa, Populus tremuloides*, and *Populus grandidentata*. The composition of all the strata of this community can vary significantly. *Pinus banksiana* is a constant across all sites, but it can be virtually the only tree species present or one of many. *Quercus ellipsoidalis* or *Quercus macrocarpa* can outnumber *Pinus banksiana* on some sites, especially those that have not been burned for many years. *Pinus resinosa* is typically at low densities in most examples of this community. Dry sites tend to have fewer woody shrub species and more herbaceous species with sand prairie affinities. Among these are *Dalea villosa, Koeleria macrantha, Prunus pumila, Schizachyrium scoparium*, and *Calamovilfa longifolia*. Dry-mesic areas have more *Andropogon gerardii, Amorpha canescens, Liatris aspera*, and *Hesperostipa spartea (= Stipa spartea)*. Patches of heath may occur, dominated by shrubby species such as *Arctostaphylos uva-ursi, Comptonia peregrina, Hudsonia tomentosa*, and *Vaccinium angustifolium*. Zimmerman (1956) also noted that stands of this community that are in the center of extensive sandplains have fewer deciduous tree species and shrubs.

The topography is flat to rolling, and stands are formed on sands of glacial, lacustrine, or riverine origin. The sandy soils are acidic, droughty, and infertile. In Michigan, Zimmerman (1956) found all of the soils to be Grayling sands with a pH of 4.5-6.0.

Fire is the most important natural disturbance in this community, keeping the tree canopy very open. Fire is also necessary for the successful germination of the dominant trees, *Pinus banksiana* and *P. resinosa*. *P. banksiana* also needs fire to open its serotinous cones and allow the seeds to be spread. These species are not shade tolerant and fire clears out competing species which otherwise might shade these pines out. Fire frequency and intensity must allow some older trees to survive or else the site will become a grassland or brushland. Fires intervals of 20-40 years are thought to allow for successful regeneration of the dominant species without killing all of the older trees (Vogl 1970). More frequent fires can all but eliminate the pines. Other natural disturbances which contribute to maintaining the open nature of these barrens are windthrow and ice storms.

COMMENTS: *2, MCS*. This community has a well-developed sand prairie flora, which may be a distinguishing feature separating it from *Pinus banksiana - Pinus resinosa - (Quercus ellipsoidalis) / Carex pensylvanica* Wooded Herbaceous Vegetation (CEGL005124), in eastern Wisconsin and Michigan. Further study is needed to resolve this issue. Frequently burned pine barrens sites can become scrubby, forming the *Populus tremuloides - Quercus (ellipsoidalis, macrocarpa) / Andropogon gerardii* Shrubland (CEGL002197). In low-lying areas, frost pockets can also contain this scrubby types.

CONSERVATION RANK: *G2.* Many former sites of this type have been logged or have become forests due to fire suppression. Other sites have been converted to tree plantations. *Pinus resinosa* has often been severely reduced or eliminated due to logging.

DISTRIBUTION: This jack pine barrens type is found in the northern tallgrass and prairie-forest border region of the United States and Canada, ranging from southeastern Manitoba, the upper Mississippi River and St. Croix River in Minnesota, central Wisconsin and east to the High Plains of the interior of lower Michigan and in other scattered locations in upper Michigan.

USFS ECOREGIONS: 212Hb:CCP, 212He:CCP, 212Hk:CCP, 212Hp:CCP, 212Hq:CCC, 212Hr:CC?, 212Hs:CCP, 212Hu:CCC, 212Hv:CCP, 212Hx:CCP, 212Jc:CCP, 212Jh:CCC, 212Jk:CCC, 212Jn:CC?, 212Jo:CC?, 212Jr:CCP, 212Ka:CCC, 212Kb:CCC, 212Nc:CCC, 222Je:CCC, 222Ka:CCC, 222Lb:CCC, 222Lc:CCC
CONSERVATION REGIONS: 46:C, 47:C, 48:C
STATES: MI MN WI **PROVINCES:** MB

MIDWEST HERITAGE SYNONYMY:

MI	pine barren +
MN	jack pine barrens =
WI	pine barrens (jack pine-oak/prairie subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: PINUS BANKSIANA - (PINUS RESINOSA) WOODED HERBACEOUS ALLIANCE (V.A.6.N.f)

Pinus banksiana - Pinus resinosa - (Quercus ellipsoidalis) / Carex pensylvanica Wooded Herbaceous Vegetation

Jack Pine - Red Pine - (Northern Pin Oak) / Pennsylvania Sedge Wooded Herbaceous Vegetation

Jack Pine - Red Pine Barrens CEGL005124

DESCRIPTION: This community consists of a sparse tree layer in a matrix of herbs and short shrubs. The trees are *Pinus banksiana, Pinus resinosa*, and sometimes *Quercus ellipsoidalis*. The shrub layer is discontinuous but includes many species. Young *Pinus banksiana* and *Pinus resinosa*, and grubs of *Quercus ellipsoidalis*, along with *Vaccinium* spp. and *Corylus americana* are common constituents of the shrub layer. *Gaylussacia baccata* can be dominant in central Wisconsin stands (Curtis 1959). The cover by herbaceous plants is often reduced by the number of short shrubs, which may become thick in the absence of fire. *Carex pensylvanica, Euphorbia corollata*, and *Symphyotrichum cordifolium (= Aster cordifolius)* are common herbs in Wisconsin (Curtis 1959, Vogl 1970).

This community is found on dry soils on flat to moderately sloping terrain.

Comptonia peregrina and *Vaccinium* spp. increase in response to fire, despite their woody nature (Vogl 1970).

COMMENTS: *2, MCS*. Type contains less of a prairie flora than does the related type, *Pinus banksiana - (Quercus ellipsoidalis) / Schizachyrium scoparium* - Prairie Forbs Wooded Herbaceous Vegetation (CEGL002490). Stands at Shaky Lake, Michigan (western Upper Peninsula), may belong to this type.

CONSERVATION RANK: *G3G4.* The total number of occurrences is unknown. Eight have been documented: three in Michigan, where the community is ranked S4, and five in Wisconsin (S2).

DISTRIBUTION: This pine savanna is found in the western and central Great Lakes region of the United States, occurring in Wisconsin and Michigan. In Michigan it occurs in both the High Plains of central lower Michigan and in scattered areas of the Upper Peninsula.

USFS ECOREGIONS: 212Hb:CPP, 212He:CPP, 212Hk:CPP, 212Hm:CPP, 212Hp:CPP, 212Hq:CPP, 212Hr:CPP, 212Hs:CPP, 212Hu:CPP, 212Hv:CPP, 212Jb:CC?, 212Jc:CCP, 212Jk:CCC, 212Jl:CC?, 212Jm:CCC, 212Jn:CC?, 212Jr:CCP, 212Ka:CCC, 212Ob:CCC
CONSERVATION REGIONS: 47:C, 48:C
STATES: MI WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MI pine barren +
WI pine barrens (jack pine-oak/sedge subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: PINUS BANKSIANA - (PINUS RESINOSA) WOODED HERBACEOUS ALLIANCE (V.A.6.N.f)

Pinus banksiana - Pinus resinosa / Quercus ellipsoidalis Woodland

Jack Pine - Red Pine / Northern Pin Oak Woodland

Jack Pine - Red Pine / Scrub Oak Woodland CEGL002484

DESCRIPTION: The canopy is open and dominated by *Pinus banksiana*, with large *Pinus resinosa* occasionally codominant or forming a supercanopy. *Quercus macrocarpa* and *Quercus ellipsoidalis* oak grubs and young *Populus tremuloides* may occur in the understory. The shrub layer is tall, dense, and continuous; dominants include *Amelanchier* spp., *Corylus americana, Salix humilis*, and *Viburnum rafinesquianum*. The herbaceous layer is generally sparse and is composed of dry woodland and prairie species (in parts of the range) capable of persisting in partial shade (MNNHP 1993).

Stands are located on outwash plains, on sandy to sandy loam prairie soils (MNNHP 1993).

This type is best known from historical descriptions in Minnesota, where pine woodlands were described adjacent to prairie inclusions in forested regions. The prairie areas were gathering sites for Native Americans, and the woodlands were maintained by fires set in the prairies. The woodlands appear to occur on prairie soils. In the absence of fires, these stands may succeed to mixed oak forests.

COMMENTS: *2, MCS*. This type has not been well described in Michigan and Wisconsin, where a "woodland phase" is generally combined with the "savanna phase," so that the tree canopy can range from 10-60%, and the shrub layer also varies from open to closed. This may well make sense floristically. From a management perspective, a woodland category may be helpful in emphasizing the variability of canopy structure in the pine barrens landscape.

CONSERVATION RANK: *G3G4.*

DISTRIBUTION: This pine barrens community type is typical found in the sand plain regions of the upper midwestern United States, ranging from Minnesota to Michigan.

USFS ECOREGIONS: 212Hb:CPP, 212He:CPP, 212Hi:CPP, 212Hp:CPP, 212Hq:CPP, 212Hr:CPP, 212Hs:CPP, 212Ht:CPP, 212Hu:CPP, 212Hv:CPP, 212Hw:CPP, 212Hy:CPP, 212Ja:CPP, 212Jc:CPP, 212Jf:CPP, 212Jm:CPP, 212Jn:CPP, 212Ka:CPP, 212Nc:C??

CONSERVATION REGIONS: 47:P, 48:C

STATES: MI MN WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

MI	pine barren +
MN	jack pine woodland =
WI	northern dry woodland (jack pine-red pine subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: PINUS (BANKSIANA, RESINOSA) WOODLAND ALLIANCE (II.A.4.N.a)

Pinus strobus - Quercus alba - (Quercus velutina) / Andropogon gerardii Wooded Herbaceous Vegetation

Eastern White Pine - White Oak - (Black Oak) / Big Bluestem Wooded Herbaceous Vegetation

White Pine - White Oak Barrens CEGL005127

DESCRIPTION: Historically the canopy was an open mixture of pines, particularly *Pinus strobus*, and oaks, including *Quercus alba, Quercus ellipsoidalis* and *Quercus velutina*. Current stands may be more heavily dominated by the oaks, with pine regenerating in the understory. *Carex pensylvanica* dominates the herbaceous layer. A variety of prairie species may also be expected (Comer et al. 1995b). Further characterization of the ground layer is needed.

This type is found on sandy glacial lakeplains (Comer et al. 1995b).

COMMENTS: *2, MCS*. It's possible that some stands of *Quercus ellipsoidalis* were historically part of this type, prior to logging (Pat Comer pers. comm. 1996). Such stands will not fit the physiognomy of this type very well and may better fit into *Pinus banksiana - Pinus resinosa - (Quercus ellipsoidalis) / Carex pensylvanica* Wooded Herbaceous Vegetation (CEGL005124), or *Quercus velutina - (Quercus alba) - Quercus ellipsoidalis / Schizachyrium scoparium - Lupinus perennis* Wooded Herbaceous Vegetation (CEGL002492), though conceptually that type does not currently extend as far north as these stands would require. *Quercus velutina* is also present. This type needs further characterization. In Wisconsin, some stands in central Wisconsin and along sand terraces of major rivers (especially Black River and Chippewa River) may fit here, but further verification is needed before listing the type.

CONSERVATION RANK: *G2?.* There are probably fewer than 20 occurrences of this community rangewide. It is reported from Michigan (where it is ranked S2) and Ontario (S?) and possibly Wisconsin (S?). Currently there are three occurrences documented from Michigan. There are probably fewer than 4000 acres rangewide. Currently 465 acres have been documented in Michigan; the average size is about 150 acres. Historical acreage and trends are unknown. This community has somewhat restricted environmental requirements: it occurs on sandy glacial lake plains.

DISTRIBUTION: This pine - oak barrens community is found in the Great Lakes region of the United States and Canada, in Michigan and Ontario, where it is found on sandy glacial lake plains.

USFS ECOREGIONS: 212Hq:CCP, 212Hr:CCP, 212Hs:CCP, 212Hu:CCC, 212Hv:CCP, 212Hw:CCC, 212Hx:CCC, 212Hy:CCP, 222Jb:CCC, 222Jc:CCC, 222Jj:CCC
CONSERVATION REGIONS: 48:C
STATES: MI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI oak-pine barren =

OTHER SYNONYMY:

USNVC HIERARCHY: PINUS STROBUS - QUERCUS (ALBA, RUBRA) WOODED HERBACEOUS ALLIANCE (V.A.6.N.f)

Populus tremuloides - Quercus (ellipsoidalis, macrocarpa) / Andropogon gerardii Shrubland

Quaking Aspen - (Northern Pin Oak, Bur Oak) / Big Bluestem Shrubland

Aspen - Oak Scrub Barrens CEGL002197

DESCRIPTION: The vegetation is comprised of a scrubby, fire tolerant woody layer between 1 and 3 m tall, with a rich herbaceous layer. The scrub or brush layer contains *Quercus macrocarpa, Quercus ellipsoidalis* and *Populus tremuloides*. Various shrub species may also occur, including *Corylus americana, Gaylussacia baccata, Rosa* spp., *Vaccinium angustifolium*, and *Salix* spp. The herbaceous layer resembles that of open pine barrens, with species such as *Comptonia peregrina, Gaultheria procumbens, Pteridium aquilinum*, and other prairie forbs present.

Stands occur on sandy, somewhat acid soils. Frequent fires reduce the woody vegetation to a scrub layer.

Frequent fires maintain the oaks as grubs, and the aspen as young suckers. It's possible that some of these stands may originate from hot crown fires that eliminate the *Pinus banksiana* and *Pinus resinosa* tree layer in a pine barrens, followed by frequent ground fires that prevent their regeneration.

COMMENTS: *3, MCS*. Type occurs in northwestern Wisconsin in pine barrens habitat. Type may have increased due to very frequent burning of pine barrens stands to manage for sharp-tailed grouse (E. Epstein pers. comm. 1997).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This scrub aspen - oak community type occurs in the upper midwestern United States in the pine barrens region of Wisconsin.

USFS ECOREGIONS: 212Jk:C??, 212Ka:CCC, 222:?, 251:?
CONSERVATION REGIONS: 47:C, 48:C
STATES: WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: WI pine barrens (aspen-oak brush prairie subtype?) ?

OTHER SYNONYMY:

USNVC HIERARCHY: POPULUS TREMULOIDES - QUERCUS SPP. - SALIX SPP. SHRUBLAND ALLIANCE (III.B.2.N.a)

Pteridium aquilinum - Bromus kalmii Herbaceous Vegetation

Northern Bracken - Kalm's Brome Herbaceous Vegetation

Bracken Grassland CEGL005142

DESCRIPTION: The vegetation is dominated by ferns and grasses. *Pteridium aquilinum* may form an almost continuous canopy of fronds. Grass dominants include *Elymus trachycaulus (= Agropyron trachycaulum), Bromus kalmii, Danthonia spicata, Oryzopsis asperifolia*, and *Poa compressa*. Forbs of high constancy include *Anaphalis margaritacea, Symphyotrichum ciliolatum (= Aster ciliolatus), Fragaria virginiana,* and *Solidago nemoralis*. Dwarf-shrubs include *Comptonia peregrina* and *Vaccinium angustifolium*. A high number of exotic or weedy species are present, including *Hieracium aurantiacum, Lactuca serriola (= Lactuca scariola), Phleum pratense, Poa compressa, Poa pratensis, Rumex acetosella*, and *Verbascum thapsus* (Curtis 1959).

Stands occur on level plains or rolling uplands and in depressions ("frost pockets") in pitted outwash topography. Soils range from loams to fine sands, and are somewhat acid (pH 4.6). Soil characteristics vary depending on the age of the stand. Soil drainage is generally good (Curtis 1959).

These grasslands probably originated primarily through fire, but some stands occur in frost pockets on pitted outwash plains. Many areas of bracken grassland have scattered pine stumps. These stumps are remnants of logging, followed by severe slash fires that destroyed or reduced the humus in the soil. In some cases the degraded sites were invaded by members of nearby bracken grassland stands, and in other cases, the site may originally have had a pine barrens understory that persisted to some degree. Bracken grasslands appear to be fairly stable communities. They are slowly invaded by *Populus tremuloides* and *Abies balsamea*. Frost may inhibit invasion by trees into depressions in the stand. *Pteridium aquilinum* and *Hieracium aurantiacum* may both inhibit establishment of other species through toxins in their rhizomes and roots (Curtis 1959).

COMMENTS: *2, MCS*. This type may vary from natural to semi-natural, as most stands appear to have originated after clearcutting and intense burns of pine barrens, but some stands occur in frost pockets on pitted outwash plains. In Michigan this type has something of a natural analog in Dry Sand Prairies, *Schizachyrium scoparium - Danthonia spicata - Carex pensylvanica - (Viola pedata)* Herbaceous Vegetation (CEGL002318).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This bracken grassland community type is found in the northern Great Lakes region of the United States and adjacent Canada, ranging from northern Wisconsin to Michigan and Ontario.

USFS ECOREGIONS: 212Hb:CPP, 212Jj:CCP, 212Jk:CCC, 212Jm:CCC, 212Ka:CPP
CONSERVATION REGIONS: 47:C, 48:C
STATES: MI? WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI? pine barren +
WI bracken grassland =

OTHER SYNONYMY: Bracken Grassland (Curtis 1959) =

USNVC HIERARCHY: PTERIDIUM AQUILINUM - BROMUS KALMII HERBACEOUS ALLIANCE (V.B.2.N.a)

Quercus alba - Quercus macrocarpa / Andropogon gerardii Wooded Herbaceous Vegetation

White Oak - Bur Oak / Big Bluestem Wooded Herbaceous Vegetation

White Oak - Bur Oak Openings CEGL005121

DESCRIPTION: The tree canopy may have varied from 10-60% closure. The dominant tree was *Quercus alba*, with some *Quercus macrocarpa, Quercus muehlenbergii, Quercus velutina, Carya ovalis, Carya ovata*, and *Carya glabra*. There is some evidence that *Quercus muehlenbergii* may have been important. Ground layer graminoid species probably were *Andropogon gerardii, Schizachyrium scoparium*, and *Sorghastrum nutans*. Some typical forbs probably included *Amorpha canescens, Anemone cylindrica, Asclepias tuberosa, Symphyotrichum laeve (= Aster laevis), Symphyotrichum pilosum (= Aster pilosus), Desmodium canadense, Erigeron strigosus, Lespedeza hirta, Monarda fistulosa, Rudbeckia hirta, Solidago juncea*, and *Veronicastrum virginicum* (Shanks 1966, Chapman et al. 1989).

Stands historically occurred on level to rolling topography on well-drained outwash plains and coarse-textured end moraines, as well as kames. In other situations it could occur on steeper slopes of ice-contact areas of sandy loam and somewhat richer soils. Soils were sandy loam to loam with a low water-retaining capacity (Chapman et al. 1989). In New York stands occur on thin soils over limestone (Shanks 1966, Reschke 1990).

COMMENTS: *3, MCS*. This type is found mainly in the south-central part of Michigan, being neither the mesic bur oak (*Quercus macrocarpa*) plains type of the southwestern corner of the state, nor the mesic lakeplain oak openings type of southeastern Michigan. Its dry-mesic moisture conditions and dominance by *Quercus alba* (and perhaps historically *Quercus muehlenbergii*) distinguish it floristically from these other types. Part of what has been described as oak openings in central-western New York also fit this type, namely the thin soil, limestone stands, best exemplified by the single remaining site at Rush Oak Openings- though remaining stands are very small and lack a good scattered tree layer. Species descriptions of Rush Oak Openings are available from the New York Natural Heritage Program (G. Edinger pers. comm. 2000). See also *Quercus muehlenbergii / Andropogon gerardii - Anemone cylindrica* Woodland (CEGL006230), which should probably be combined with this type.

CONSERVATION RANK: *G1*. Little is known about this community. It was widespread in south-central Michigan in the presettlement era but only ever occurred in one relatively small area in Monroe County in New York, where it may have once covered hundreds to maybe a few thousand acres. Only one occurrence has been documented in Michigan, and that occurrence is small and in poor condition. The single occurrence in New York is also small and is in fair condition.

DISTRIBUTION: This community occurs in the upper midwestern United States and possibly adjacent Canada, particularly in south-central Michigan and western New York, and possibly southern Ontario.

USFS ECOREGIONS: 212Jk:CCC, 222Ha:CCC, 222Ib:CCC, 222If:CCC, 222Jc:CCC, 222Je:CCC, 222Jg:CCC, 222Jh:CCC
CONSERVATION REGIONS: 48:C
STATES: MI NY **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI inland oak opening +

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS MACROCARPA - (QUERCUS ALBA) WOODED HERBACEOUS ALLIANCE (V.A.6.N.c)

Quercus macrocarpa - (Quercus alba, Quercus stellata) / Andropogon gerardii Wooded Herbaceous Vegetation

Bur Oak - (White Oak, Post Oak) / Big Bluestem Wooded Herbaceous Vegetation

Central Bur Oak Openings CEGL002159

DESCRIPTION: The vegetation is dominated by scattered trees with spreading canopies and a continuous herbaceous layer. This community has an average tree canopy between 10 and 60%, typically strongly dominated by *Quercus macrocarpa*. One study reports that densities of trees >25 cm dbh may have ranged from 40-75 stems/ha (McClain et al. 1998). *Quercus alba* is a common secondary species, whereas *Carya ovata, Quercus imbricaria*, and *Quercus stellata* may be present in low abundance. There may be shrubby areas within the community, but these were, at least historically, relatively sparse. Common species may include *Corylus americana* and *Prunus serotina*. The herbaceous vegetation is thought to be similar to that of mesic prairie, but few extant stands remain. Dominant grasses could include *Andropogon gerardii, Schizachyrium scoparium*, and *Sorghastrum nutans* (Nelson 1985, McClain et al. 1998).

In Missouri, this community was found on gentle to moderate lower- to mid-slopes of hills and ridges. Examples on north- and east-facing slopes tended to be more mesic. In Illinois, these savannas occurred on the slopes or tops of moraine ridges and (rarely) as islands in wetland vegetation. Soils are moderately well-drained to well-drained and deep (40-100+ cm). The parent material is loess sometimes shallow, glacial till, gravel, or deeply weathered rock with no appreciable rock residuum (Nelson 1985, McClain et al. 1998).

Fire and grazing are the two important natural disturbances that shaped this community. Fire appears to be the most important of these two, since woody growth release was not commonly noted until fire-suppression began in the early European-settlement periods, well after the period of massive reduction of bison and elk herds (Pruka 1994).

Fire eliminates intolerant tree species. Fires in areas of oak opening were infrequent enough to allow certain species (*Quercus alba, Quercus macrocarpa, Quercus velutina*, and occasionally *Carya* spp.) to reach a fire-resistant size. Oak openings may have been most typical on morainal ridges that were, at least in part, surrounded by wetlands that would only burn during dry years, thereby allowing tree establishment and persistence. *Quercus alba*, being less fire-tolerant than *Quercus macrocarpa*, is often limited to areas that supported less grass fuel (and hence less intense/frequent fires), and it is usually found on hillier topographies or mesic bottoms that are slightly less prone to fire. In flat, upland, mesic areas, with their higher fuel loads, only *Quercus macrocarpa* was able to persist, if at all.

Before European settlement, fires were frequently and intentionally set by Native Americans to create conditions favorable for travel and for supporting large game. This may have led to larger expanses of savanna than would have occurred without human presence. It also probably encouraged savanna formation farther into the humid east than would have occurred without human-set fire (Pyne 1982). Fires in the central tallgrass prairie region could easily spread across an entire county, and some in east-central Illinois were severe enough to convert savannas to prairie (B. McClain pers. comm. 2000), perhaps forming what farther north in Wisconsin has been called "brush prairie" (Curtis 1959). Several authors have suggested that Native American fires were most often set in the fall (Swink and Wilhelm 1994, Chapman 1984, Schwegman and McClain 1985). Grimm (1984) noted that several early European settlers recorded summer burns ignited by lightning.

COMMENTS: *3, MCS*. This type represents the oak openings of the central tallgrass prairie ecoregion, but it is not entirely clear how this type is different from the more northern bur oak openings type, *Quercus macrocarpa - (Quercus alba, Quercus velutina) / Andropogon gerardii* Wooded Herbaceous Vegetation (CEGL002020). In east-central Illinois, stands appear similar to the more northern oak openings, whereas in west-central Illinois, the presence of species such as *Quercus stellata* become more common (B. McClain pers. comm. 2000). This community has been so widely extirpated in eastern Nebraska and southern Iowa that it is considered extirpated in those states. Most remnants are currently either called oak woodlands or small patches of tallgrass prairie. Inclusion of Ohio stands in this type needs review.

CONSERVATION RANK: *G1*. This community type has virtually been eliminated. Most sites have been converted to cropland or pasture. Other remnants are now so overgrown that the tree canopy structure is very closed, and the ground layers are either very woody or dominated by exotics. Several remnant stands are described from east-central Illinois, some of which are undergoing restoration (McClain et al. 1998, LaGesse et al. 1998), but high-quality ground layers are very rare indeed.

DISTRIBUTION: This bur oak opening community is found in the central midwestern United States, historically extending from northern Missouri and eastern Nebraska east to disjunct outliers in western Ohio, but now reduced to small remnant examples across its range.

USFS ECOREGIONS: 222Ab:C??, 222Gb:CPP, 222He:CCC, 222Hf:CCC, 222If:CCC, 251Be:CCC, 251Ca:CC?, 251Cb:CC?, 251Cc:CCC, 251Cd:CC?, 251Cf:CCC, 251Ch:CCC, 251Cj:CCC, 251Cm:CC?, 251Co:CC?, 251Cp:CC?, 251Dd:CC?, 251De:CC?, 251Df:CCC

CONSERVATION REGIONS: 36:C, 44:C, 45:C

STATES: IA? IL MO NE? OH **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	dry-mesic savanna (N); mesic savanna (N) I
MO	dry-mesic savanna; mesic savanna I
NE?	oak woodland ?
OH	oak savanna =

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS MACROCARPA - (QUERCUS ALBA) WOODED HERBACEOUS ALLIANCE (V.A.6.N.c)

Quercus macrocarpa - (Quercus alba, Quercus velutina) / Andropogon gerardii Wooded Herbaceous Vegetation

Bur Oak - (White Oak, Black Oak) / Big Bluestem Wooded Herbaceous Vegetation

North-central Bur Oak Openings CEGL002020

DESCRIPTION: These savannas exhibit a mosaic of physiognomies, with smaller patches of grassland and forest interdigitating in complex patterns. Typically, there are two main structural layers, tree canopy and herbaceous, though shrubs could be scattered or clumped. Tree densities for stems greater than 10 cm dbh may historically have been between 1 and 40 stems per hectare (Wing 1937, Cottam 1949, Curtis 1959, Brewer and Kitler 1989). The tree layer is composed of *Quercus macrocarpa, Quercus alba*, and *Quercus velutina*, with some *Carya ovata*. *Quercus velutina* is more common on sandier soils. The ground layer is dominated by graminoids, especially *Andropogon gerardii* and *Schizachyrium scoparium*, accompanied by a large diversity of forbs. Shrub cover can range widely from 0-100%, with *Ceanothus americanus* and *Amorpha canescens* being two of the most important shrub species. Understory species typical of oak openings require some direct sunlight throughout the growing season and are quickly reduced when heavily shaded by either tree or shrub canopy. Common shrubs in this community are adapted to the moderate fire frequencies found in oak openings, and resprout vigorously after burning.

This community occurs on level to rolling topography on well-drained outwash plains and coarse-textured end moraines, as well as steep, fire-prone, shallow-to-bedrock hills in the Driftless Area. The pH varies from 6.1-7.3. Soils are excessively to moderately well-drained and range from loams to sandy loams, and include silt loams close to bedrock in the Driftless Area.

Fire and grazing are the two important natural disturbances which encourage savanna formation. Fire appears to be the most important of these two, since woody growth release was not commonly noted until fire-suppression began in the early European-settlement periods, well after the period of massive reduction of bison and elk herds (Pruka 1994).

Fire eliminates intolerant tree species. Fires in areas of oak opening were infrequent enough to allow certain species (*Quercus alba, Quercus macrocarpa, Quercus velutina*, and occasionally *Carya* spp.) to reach a fire-resistant size. *Quercus alba*, being less fire-tolerant than *Quercus macrocarpa*, is limited mostly to more hilly, dry and dry-mesic areas, since these less fertile soils support less grass fuel (and hence less intense/frequent fires) and are less prone to fire. In flatter, mesic areas, with their higher fuel loads, only *Quercus macrocarpa* was able to persist. *Quercus velutina* is less fire-tolerant (but more drought-tolerant) than *Quercus alba* and is favored on the most sandy/least fertile soils (Anderson 1991).

Before European settlement, fires were frequently and intentionally set by Native Americans to create conditions favorable for travel and for supporting large game. This may have led to larger expanses of savanna than would have occurred without human presence. It also probably encouraged savanna formation farther into the humid east than would have occurred without human-set fire (Pyne 1982).

Several authors have suggested that Native American fires were most often set in the fall (Swink and Wilhelm 1994, Chapman 1984, Schwegman and McClain 1985). Grimm (1984) noted that several early European settlers recorded summer burns ignited by lightning.

COMMENTS: *1, MCS*. Traditionally, oak openings (along with oak barrens) have been defined as oak savanna and characterized as partially canopied communities with a canopy cover of 10-50% (Curtis 1959). Recent studies (Pruka 1994, Faber-Langendoen et al. unpubl.) suggest that there is significant turnover in understory composition within this broad canopy range (as well as the traditional oak forest defined as 50-100% canopy) and support the suggestion that partially canopied communities are better understood if classified into two types - savanna (10-30% cover) and woodland (30-80% cover) (Anderson 1991, MNNHP 1993, Packard 1993, Pruka 1994). Forests in this region generally have >80% cover. Before the European-settlement era, this community was found in northeastern Iowa, southern and western Wisconsin, northern Illinois, southwestern Michigan, northern Ohio, southeastern Minnesota, and possibly northern Indiana (Nuzzo 1986). The southern limit of this type overlaps with the central oak openings, *Quercus macrocarpa - (Quercus alba, Quercus stellata) / Andropogon gerardii* Wooded Herbaceous Vegetation (CEGL002159), which covers central Illinois, Iowa, and northern Missouri.

CONSERVATION RANK: *G1*. There are probably fewer than 20 occurrences rangewide. Fourteen have been documented: 3 in Illinois (where the community is ranked S1,S1,), 1 in Indiana (S1), and 10 in Wisconsin (S1). The community is extirpated in Michigan (SX) and possibly in Iowa (SX?). Most examples of this community have been eliminated by cultivation, grazing, or conversion to woodland or forest due to fire suppression. Most of the remaining

examples are relatively small. There are probably fewer than 1000 acres rangewide. Sizes of 10 occurrences range from 4 to 68 acres, totaling 249.

DISTRIBUTION: This dry-mesic to mesic oak opening (or oak savanna) commonly occurs on level to moderately steep, fire-prone landscapes in the upper midwestern United States, ranging from southeast Minnesota to northeastern Iowa east to southwest Michigan.

USFS ECOREGIONS: 222Je:CCC, 222Jj:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222La:CCC, 222Lc:CCC, 222Me:CCC, 251:?
CONSERVATION REGIONS: 46:C, 48:C
STATES: IA IL IN MI MN WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:
IL dry-mesic savanna (N); mesic savanna (N) I
IN mesic savanna =
MI bur oak plain =
MN dry oak savanna (southeast section) hill subtype; mesic oak savanna (southeast section); dry oak savanna (southeast section) sand - gravel subtype -
WI oak openings =

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS MACROCARPA - (QUERCUS ALBA) WOODED HERBACEOUS ALLIANCE (V.A.6.N.c)

Quercus macrocarpa - Quercus palustris - Quercus bicolor / Calamagrostis canadensis Wooded Herbaceous Vegetation

Bur Oak - Pin Oak - Swamp White Oak / Bluejoint Wooded Herbaceous Vegetation

Lakeplain Wet-mesic Oak Openings CEGL005120

DESCRIPTION: Within glacial lakeplains there are two prominent forms of savanna communities. In both types, *Quercus* spp. dominate the tree canopy layer. and grasses and sedges make up the majority of the ground layer. The more mesic to dry-mesic type occurs on droughty beach ridges and is typically dominated by *Quercus velutina* and *Quercus alba*. The wet-mesic type described here is found on flat, poorly drained areas. It is dominated by *Quercus macrocarpa, Quercus palustris*, and *Quercus bicolor* with some *Acer rubrum* and a lakeplain wet prairie ground layer component. Herbaceous species include *Andropogon gerardii, Calamagrostis canadensis, Carex* spp., *Schizachyrium scoparium*, and *Sorghastrum nutans*. The canopy of this community can be very open. In southwestern Ontario, Bakowsky (1988) described the average canopy as 33% cover and average density of trees greater than 6 cm dbh as 92 trees/ha.

This community occurs on sandy or, less commonly, silty/clayey glacial lakeplains with seasonally high water tables. Soils are mildly alkaline (pH 7.4-7.8), very fine sandy loams or loamy very fine sands, rarely sands. These soils have moderate water-retaining capacity and are on flat, poorly drained sites.

COMMENTS: *2, MCS*. Type concept is that of a lakeplain oak opening, distinct from the "inland" bur oak openings, *Quercus macrocarpa - (Quercus alba, Quercus velutina) / Andropogon gerardii* Wooded Herbaceous Vegetation (CEGL002020) or *Quercus alba - Quercus macrocarpa / Andropogon gerardii* Wooded Herbaceous Vegetation (CEGL005121).

CONSERVATION RANK: *G1.* There are probably fewer than 20 occurrences rangewide. Five have been documented in Michigan, where the community is ranked S1, and it also occurs in Ontario (S?). It is found in three ecoregional subsections. Most former occurrences were drained and cleared, and many remaining occurrences have been degraded by alteration to groundwater hydrology and fire suppression, permitting increased dominance by woody species. The community occurs on flat, poorly drained, sandy (sometimes silty/clayey) glacial lakeplains with seasonally high water tables.

DISTRIBUTION: This bur oak - mixed oak savanna or openings community occurs on the lakeplain of the southern Great Lakes, particularly in southeastern Michigan and southwestern Ontario, with a possibly remnant in southeastern Wisconsin.

USFS ECOREGIONS: 212Pb:CCC, 222Je:CCC, 222Qb:CCC
CONSERVATION REGIONS: 48:C
STATES: MI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY: MI lakeplain oak opening +

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS MACROCARPA - (QUERCUS ALBA) WOODED HERBACEOUS ALLIANCE (V.A.6.N.c)

Quercus macrocarpa Northern Tallgrass Wooded Herbaceous Vegetation

Bur Oak Northern Tallgrass Wooded Herbaceous Vegetation

Northern Bur Oak Openings CEGL002158

DESCRIPTION: This community is characterized by scattered mature trees in a graminoid-dominated matrix. *Quercus macrocarpa* is the most abundant tree, although *Populus tremuloides* can be a common invader on northern sites. The herbaceous layer is dominated by *Andropogon gerardii, Sorghastrum nutans*, and *Sporobolus heterolepis*. *Schizachyrium scoparium* and *Hesperostipa spartea (= Stipa spartea)* are often found in drier areas, and *Panicum virgatum* can be common in wetter patches. The shrub layer is variable and contains species such as *Amelanchier* spp., *Corylus americana, Cornus foemina, Prunus virginiana, Salix humilis*, and *Symphoricarpos occidentalis* (MNNHP 1993).

This community is found on rolling to moderately sloping sites on glacial till or outwash. The soils range from clay loam to sandy loam (MNNHP 1993).

Frequent fires (every 2-10 years) associated with the dominant prairie matrix maintained a very open-canopy structure in this type. Type may also originate through more catastrophic fires in oak forests and woodlands during drought years (Grimm 1984). In the absence of fires, *Populus tremuloides* or *Fraxinus pennsylvanica* may invade and stands may develop into the *Quercus macrocarpa - Populus tremuloides / Corylus* spp. Woodland (CEGL002139).

COMMENTS: *2, MCS*. Concept of the type is that of bur oak openings in the northern tallgrass prairie region. It appears that this type may not have occupied extensive areas, unlike the more widespread north-central bur oak openings type, *Quercus macrocarpa - (Quercus alba, Quercus velutina) / Andropogon gerardii* Wooded Herbaceous Vegetation (CEGL002020). Current examples are extremely rare and of poor quality. The Minnesota dry oak savanna hill subtype, dry oak savanna sand-gravel subtype, and the mesic oak savanna type (MNNHP 1993) are treated here together. Quantitative analyses are planned in Minnesota to help assess whether these Minnesota types should each be recognized as distinct associations (R. Dana, pers. comm. 1999).

CONSERVATION RANK: *G1G2.* There are probably fewer than 20 occurrences of this community rangewide. It is reported from southern Manitoba (where it is ranked S1), western Minnesota (S1), eastern North Dakota (S?), western Iowa (S?), and eastern South Dakota (S1). Currently 18 occurrences have been documented. Many occurrences have been lost to agriculture, or degraded by heavy grazing.

DISTRIBUTION: This community type is found in the north-central United States and south-central Canada on rolling to moderately sloping sites on glacial till or outwash.

USFS ECOREGIONS: 222Md:CCC, 222Na:CCC, 251Aa:CCC, 251Ba:CCC, 251Bb:CCC, 251Bd:CCC, 251Be:CCC, 251Cp:CCC
CONSERVATION REGIONS: 35:C, 36:C, 46:C
STATES: IA MN ND SD **PROVINCES:** MB

MIDWEST HERITAGE SYNONYMY: MN mesic oak savanna (southwest section); dry oak savanna (northwest section) hill subtype; dry oak savanna (central section) sand - gravel subtype; dry oak savanna (central section) hill subtype; dry oak savanna (southwest section) hill subtype; mesic oak savanna (central section); dry oak savanna (northwest section) sand - gravel subtype; mesic oak savanna (northwest section) -

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS MACROCARPA - (QUERCUS ALBA) WOODED HERBACEOUS ALLIANCE (V.A.6.N.c)

Quercus macrocarpa - (Quercus ellipsoidalis) / Schizachyrium scoparium - Koeleria macrantha Wooded Herbaceous Vegetation

Bur Oak - (Northern Pin Oak) / Little Bluestem - Prairie Junegrass Wooded Herbaceous Vegetation

Northern Oak Barrens CEGL002160

DESCRIPTION: In the woody strata of this community, both cover and species richness are low. Species richness is high in the herb layer and graminoids are prominent. The dominant trees of this community are *Quercus macrocarpa* and *Quercus ellipsoidalis*, which have a height of 5-15 m and an open canopy (5-60%). Cover in the tall-shrub and low-shrub layers varies from 0-40%. Short-shrub species include *Amorpha canescens, Corylus americana, Rhus glabra*, and *Toxicodendron radicans*. The herb layer is dominated by graminoids, with forbs more prominent in shaded areas. Species found in the herb layer include *Ambrosia psilostachya, Amphicarpaea bracteata, Artemisia ludoviciana, Andropogon gerardii, Calamovilfa longifolia, Carex pensylvanica, Carex* spp., *Comandra umbellata, Sorghastrum nutans, Hesperostipa spartea (= Stipa spartea), Parthenocissus quinquefolia (= var. quinquefolia)*, and *Schizachyrium scoparium* (MNNHP 1993, Faber-Langendoen and Tester 1993).

This community occurs on well-drained, coarse-textured sandy soils derived from glacial outwash or end moraine formations. Soils range from almost pure sand, to loamy sand, to sandy loam. The soils have low fertility, organic matter, and moisture-retention capacity. Factors which affect seasonal soil moisture are strongly related to variation in this type; slope, aspect, topographic position, elevation, depth to water table, and presence or absence of less permeable soil layers are among these factors (MNNHP 1993, Faber-Langendoen and Tester 1993).

Fire was an important factor in maintaining this community. Oak wilt and droughts also reduce tree cover (Grimm 1984, Faber-Langendoen and Tester 1993).

COMMENTS: *2, MCS*. *Quercus ellipsoidalis* is not present in stands in western Minnesota and eastern North Dakota (Sheyenne National Grasslands). Stands on sand-gravel are treated with *Quercus macrocarpa* Northern Tallgrass Wooded Herbaceous Vegetation (CEGL002158), but they may be a separate type. They will be described in more detail pending further analyses (R. Dana pers. comm. 1999).

CONSERVATION RANK: *G2.* There are probably fewer than 100 occurrences rangewide. Sixty have been documented in Minnesota, where the community is ranked S2,S1,S2,S1. It may also be found in North Dakota (SP?). It occurs in 10 ecoregional subsections. There are probably fewer than 10,000 acres rangewide. Sizes of 41 occurrences range from 0 to 450 acres, totaling 3516. Many sites have been cleared for agriculture or grazed; others have succeeded to forest due to fire suppression. This community occurs on well-drained, sandy soils (pure sand to sandy loam) with low organic content, derived from glacial outwash or end moraine formations.

DISTRIBUTION: This oak savanna community is found in the northern tallgrass prairie region of the midwestern United States, particularly in central and western Minnesota and eastern North Dakota.

USFS ECOREGIONS: 212Kb:CCC, 212Mb:CCC, 212Nc:CCC, 222Ma:CCC, 222Mc:CCC, 222Md:CCC, 222Na:CCC, 251Aa:CCC, 251Ab:CCC, 251Bb:CCC
CONSERVATION REGIONS: 35:C, 46:C, 47:C
STATES: MN ND **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MN dry oak savanna (central section) barrens subtype; dry oak savanna (northwest section) barrens subtype -

OTHER SYNONYMY: Eastern Oak Area (Grimm 1984) B

USNVC HIERARCHY: QUERCUS VELUTINA - (QUERCUS ELLIPSOIDALIS) WOODED HERBACEOUS ALLIANCE (V.A.6.N.c)

Quercus velutina - (Quercus alba) - Quercus ellipsoidalis / Schizachyrium scoparium - Lupinus perennis Wooded Herbaceous Vegetation

Black Oak - (White Oak) - Northern Pin Oak / Little Bluestem - Wild Lupine Wooded Herbaceous Vegetation

Black Oak / Lupine Barrens CEGL002492

DESCRIPTION: Canopy structure varies from a dominant herbaceous ground layer with sparse, scattered 'savanna' canopy (5-30%), through oak-dominated scrub, to a more closed 'woodland' canopy (30-80%). The canopy layer is dominated by *Quercus velutina*, with some *Quercus ellipsoidalis* and *Quercus alba*, the latter more common eastward and in woodland conditions. Occasional *Pinus banksiana* can occur in the northern parts of the range. Tree height varies from 5-15 m. A subcanopy layer may be composed of the preceding species or *Prunus serotina, Sassafras albidum*, and *Carya ovata*. Tall shrubs may include *Cornus amomum, Cornus foemina, Corylus americana*, and *Rhus glabra*. The low-shrub/scrub layer typically contains *Ceanothus americanus, Rosa* spp. (such as *Rosa carolina*), and *Rubus allegheniensis*, but may contain ericaceous shrubs, such as *Gaylussacia baccata, Vaccinium angustifolium* and *Vaccinium pallidum*. The herb layer is dominated by graminoids, such as *Andropogon gerardii, Carex pensylvanica*, and *Schizachyrium scoparium*. Typical forbs include *Antennaria neglecta, Antennaria plantaginifolia, Euphorbia corollata, Helianthemum bicknellii, Helianthemum canadense, Lespedeza capitata, Lithospermum caroliniense* (Minnesota), *Lithospermum canescens* (Wisconsin), *Lupinus perennis*, and *Pteridium aquilinum*. Forb dominance may increase as woody cover increases (Anderson 1996, Curtis 1959, MNNHP 1993).

This community generally occurs on well-drained, coarse-textured, sandy, infertile soils derived from glacial outwash, high gravelly/sandy moraines, or lakeplain dune systems. Soils vary from almost pure sand to sandy loam.

COMMENTS: *1, MCS*. A black oak woodland variant or phase may occur, but because *Quercus velutina* can sprout after stems have been killed by fires, stands generally have a somewhat scrubby structure that can vary from 10-60% cover over time. Indiana reports a mesic sand savanna stand. Does it belong here? Oak-pine barrens of Michigan, Wisconsin, and Minnesota are not included in this type.

CONSERVATION RANK: *G3.* Twelve occurrences have been documented in Michigan (where the community is ranked S2), 22 in Illinois (S1,S1), 57 in Indiana (S2,S2S3,S1), 42 in Minnesota (S1,S1?,S2), and 20 in Wisconsin (S2). Although no other occurrences have been documented, the community is also reported in Ohio (S1) and Ontario (S?) and may be extirpated from Iowa (SX?). It is reported in 24 ecoregional subsections. The sizes of 134 occurrences total 10,273 acres. The community occurs on a variety of sandy, well-drained soils derived from glacial outwash, moraines, or lake plain dune systems.

DISTRIBUTION: This black oak - mixed oak barrens community occurs in the central and lower Great Lakes region of the United States and adjacent Canada, extending from Ohio and Ontario west to Iowa and Minnesota.

USFS ECOREGIONS: 212Hb:C??, 212Ka:CCC, 222Ha:CCC, 222Jc:CCC, 222Jd:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ka:CCC, 222Kb:CCC, 222Kd:CCC, 222Kg:CCC, 222La:CCC, 222Lb:CCC, 222Lc:CCC, 222Lf:CCC, 222Mb:CCC, 222Md:CCC, 222Me:CCC, 251Ba:CCC, 251Cf:CCC, 251Ci:CCC, 251Dd:CCC, 251Df:CCC, 251Dg:CCC
CONSERVATION REGIONS: 35:C, 36:C, 45:C, 46:C, 47:C, 48:C
STATES: IA IL IN MI MN OH WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	dry-mesic sand savanna; dry sand savanna -
IN	dry sand savanna; dry-mesic sand savanna; mesic sand savanna -
MI	oak barren +
MN	dry oak savanna (southeast section) barrens subtype -
OH	oak barrens =
WI	oak barrens =

OTHER SYNONYMY: oak barrens (Anderson 1996) =. Uncertain if equivalent; Anderson appears to include black oak forests (CEGL002078) and sand barrens (CEGL005099) in this type.

USNVC HIERARCHY: QUERCUS VELUTINA - (QUERCUS ELLIPSOIDALIS) WOODED HERBACEOUS ALLIANCE (V.A.6.N.c)

Quercus muehlenbergii / Schizachyrium scoparium - Bouteloua curtipendula Wooded Herbaceous Vegetation

Chinquapin Oak / Little Bluestem - Sideoats Grama Wooded Herbaceous Vegetation

Chinquapin Oak Limestone - Dolomite Savanna CEGL005284

DESCRIPTION: The tree canopy is open, sometimes somewhat stunted or limby, and occasionally complex in pattern due to the bedrock influence. Typical tree canopy species include *Quercus muehlenbergii, Fraxinus americana*, and *Juniperus virginiana*. Shrubs may include *Rhus aromatica, Frangula caroliniana (= Rhamnus caroliniana), Crataegus* spp., or more rarely, *Cotinus obovatus*. Dominant ground layer species include *Schizachyrium scoparium, Sorghastrum nutans*, and *Bouteloua curtipendula*. Other characteristic species include *Astragalus crassicarpus var. berlandieri (= Astragalus mexicanus), Galium arkansanum, Ophioglossum engelmannii, Polygala senega, Smilax bona-nox*, and, in more western stands of the Springfield Plateau, *Astragalus distortus, Berlandiera betonicifolia (= Berlandiera texana)*, and *Erysimum capitatum* (Nelson 1985).

Stands occur on moderately steep to steep upper slopes of hills, ridges, and plains, and on steep slopes and bluffs along streams and rivers. Aspect can be in any direction. Soils are rapidly drained to well-drained, and very shallow to shallow (0-100 cm). The parent material is limestone, cherty limestone, or dolomite with bedrock at or near the surface (Nelson 1985).

Stands are influenced by a combination of periodic drought stress, wind and storm damage, and occasional fire. Fire effects can be irregular because of the complexities of exposed bedrock (Nelson 1985).

COMMENTS: *2, MCS*. The concept of this type is taken in part from the Missouri state type - limestone/dolomite savanna (Nelson 1985). *Juniperus virginiana* increases without fire, and its relative dominance in this type can be variable. Woodland stands are tracked as *Quercus muehlenbergii - Fraxinus (quadrangulata, americana) / Schizachyrium scoparium* Woodland (CEGL002143). Closed forest chinquapin oak - red-cedar stands are tracked as *Quercus muehlenbergii - Juniperus virginiana - Acer saccharum / Frangula caroliniana* Forest (CEGL002108). Pure red-cedar woodlands are treated as a distinct type where they occur along the bluffs of cliffs, *Juniperus virginiana* Alkaline Bluff Woodland (CEGL002426). There may be no need in the Ozarks for an association-level distinction between savanna (this type) and woodland (CEGL002143) stands, but this decision should be reviewed in conjunction with the savanna and woodland distinction on acid substrates [see *Quercus stellata - Quercus marilandica / Schizachyrium scoparium* Wooded Herbaceous Vegetation (CEGL002391) and *Quercus stellata - Quercus marilandica - Quercus velutina - Carya texana / Schizachyrium scoparium* Woodland (CEGL002149)].

CONSERVATION RANK: *G2G3.* Small fire-suppressed sites exist, but there are few high-quality sites currently known or reported in the Missouri state databases.

DISTRIBUTION: This thin soil alkaline bedrock savanna type is found in the Ozarks region of the United States.

USFS ECOREGIONS: 222Ab:CC?, 222Ag:CC?, 222Am:CCC
CONSERVATION REGIONS: 38:C
STATES: MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO limestone/dolomite savanna +

OTHER SYNONYMY:

USNVC HIERARCHY: (JUNIPERUS VIRGINIANA) / SCHIZACHYRIUM SCOPARIUM - (BOUTELOUA CURTIPENDULA) WOODED HERBACEOUS ALLIANCE (V.A.6.N.q)

Quercus stellata - Quercus marilandica / Schizachyrium scoparium - Silphium terebinthinaceum Wooded Herbaceous Vegetation

Post Oak - Blackjack Oak / Little Bluestem - Prairie-dock Wooded Herbaceous Vegetation

Post Oak Chert Barrens CEGL005134

DESCRIPTION: Vegetation may be sparse, consisting of xeric species and stunted individuals of species that reach considerable size elsewhere. Graminoids, such as *Schizachyrium scoparium* and *Sorghastrum nutans*, form most of the vegetation cover in this community, but tree canopy species may include *Juniperus virginiana var. virginiana, Quercus alba, Quercus imbricaria, Quercus marilandica, Quercus stellata*, and *Quercus velutina*. Herbaceous species which may be present include *Aconitum uncinatum, Allium cernuum, Andropogon gerardii, Aristida longispica, Asclepias amplexicaulis, Carex meadii, Danthonia spicata, Eryngium yuccifolium, Euphorbia corollata, Helianthus mollis, Helianthus hirsutus, Houstonia* sp., *Liatris cylindracea, Liatris squarrosa, Lobelia spicata, Panicum flexile, Pycnanthemum tenuifolium, Rudbeckia hirta, Salix humilis, Silphium trifoliatum*, and *Sporobolus vaginiflorus* (Anderson 1982, Homoya et al. 1988).

In Indiana, this community occurs in the Mitchell Karst Plain on rolling hill-and-swale topography on a large sinkhole plain over limestone bedrock. There, soils are formed from chert residue left from the erosion of limestone bedrock. These soils are stony, acidic, and excessively well-drained. In Ohio, this community is found in the southern parts of the state only over Crab Orchard Shale, on slight slopes or mounded outcrops. On slopes deep erosion gullies are usually present. Crab Orchard Shale is calcareous and weathers to a light brown to yellowish heavy silt loam, containing scattered pieces of dolomite (Anderson 1982, Homoya et al. 1988, Homoya 1994).

Fire is a factor in the development of this community, especially on the richer sites. Fire inhibits the growth of woody species and allows the sparse woodland character to be retained. Grazing may also have affected successional processes. Grazing may have reduced the number of woody plants, but it also is likely to have lead to increased erosion and the elimination of some characteristic species. On poorer sites, especially in Ohio, this community appears to be stable, even with a very low fire frequency.

COMMENTS: *2, MCS*. In southeastern Ohio, Cedar Barrens also occur on Crab Orchard Shale. The two types are not easily separable because they contain many of the same species. There is some difference in their topographical distribution, however. Cedar Barrens occur on steeper slopes that may have originally been covered by *Acer saccharum*. Cedar Barrens also lack certain species characteristic of this community, such as *Silphium terebinthinaceum*. The post oak chert barrens stands in Ohio also intergrade with a shale glade type, *Quercus marilandica - (Juniperus virginiana) / Schizachyrium scoparium - Danthonia spicata* Wooded Herbaceous Vegetation (CEGL002428); the shale glades tend to be of low diversity, and most are disturbed by relatively recent farming efforts and by erosion, and are overgrown. It may be that these shale glades in Ohio should just be combined with this type (D. Minney pers. comm. 2000). *Schizachyrium scoparium* prairies (limestone glades) are also similar to this community. The prairies or glades have a nearly complete vegetative cover and occur over dolomite rather than shale. They are tracked as *Quercus muehlenbergii - Juniperus virginiana / Schizachyrium scoparium - Manfreda virginica* Wooded Herbaceous Vegetation (CEGL005131), and they also contain a distinctive zone tracked as a separate type, the *Juniperus virginiana / Schizachyrium scoparium - Silphium terebinthinaceum var. luciae-brauniae - Carex juniperorum - Castilleja coccinea* Wooded Herbaceous Vegetation (CEGL004464).

CONSERVATION RANK: *G1*. This community may naturally have a very restricted distribution.

DISTRIBUTION: This barrens or post oak openings community is found in the midwestern United States in southern Indiana and Ohio; it occurs as a prominent community on the Mitchell Karst Plain in south-central Indiana, and occurs in the unglaciated Bluegrass Region, north of West Union in Adams County.

USFS ECOREGIONS: 221Ed:PPP, 221Ef:PPP, 222Db:CCC, 222De:CCC, 222Df:CCC, 222Ek:CCC, 222Fd:CCC, 222Ge:CCC, 222Hc:CCC

CONSERVATION REGIONS: 44:C, 45:C, 49:?

STATES: IN OH **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IN	chert barrens +
OH	post oak opening =

OTHER SYNONYMY:

USNVC HIERARCHY: (QUERCUS STELLATA, QUERCUS MARILANDICA) / SCHIZACHYRIUM SCOPARIUM WOODED HERBACEOUS ALLIANCE (V.A.6.N.q)

Quercus stellata - Quercus marilandica / Schizachyrium scoparium Wooded Herbaceous Vegetation

Post Oak - Blackjack Oak / Little Bluestem Wooded Herbaceous Vegetation

Post Oak Central Dry Barrens CEGL002391

DESCRIPTION: This community consists of a patchy, open layer of stunted, xerophytic oaks and a patchy layer of grass less than 1 m tall. The herbaceous layer is composed of *Danthonia spicata, Carex pensylvanica, Koeleria macrantha*, and *Schizachyrium scoparium*. Tree canopy species include *Quercus marilandica, Quercus stellata, Quercus falcata, Quercus alba*, and *Quercus velutina*. Shrubby areas, often containing *Vaccinium arboreum*, may be present. Other characteristic species include *Clitoria mariana, Liatris squarrosa*, and *Solidago juncea* (TNC 1995a).

This community is found on thin, infertile soils, which are rapidly drained, acidic, and low in organic matter. Soils are predominantly stony and rocky, developed from windblown loess and weathered sandstone. Southern and western aspects have very high temperatures during the summer as well as frequent periods of freezing and thawing during the winter. Droughty conditions prevail throughout most of the year. Soils are subject to erosion, and patches of bare ground are not uncommon. The substrate restricts tree growth and limits herbaceous diversity. In the Cretaceous Hills region of Illinois, the bedrock is sedimentary, formed by the accumulation of minerals, rock debris, and/or organic matter from weathering, erosion, and deposition of rocks present during the Paleozoic Era. Bedrock, which is most frequently sandstone, has a layered appearance due to the accumulation and compression processes. Soil pH is slightly to moderately acidic when underlain or mixed with sandstone, chert, or igneous material (TNC 1995a).

Natural disturbances includes damage from drought, freeze/thaw, ice storms, lightning, wind, insects, and disease (bacteria, fungi). These open stands, as well as associated woodlands, can be managed by fire to retain their openness. Fires may historically have burned every 5-10 years (Nelson 1985).

COMMENTS: *3, MCS*. This community is found in the Shawnee Hills and widely separated areas along major stream valleys in Illinois. It also occurs in Missouri and possibly Kentucky, Indiana, and Arkansas, where it is associated with acid oak woodlands. In Indiana, the chert barrens are primarily tracked as *Quercus stellata - Quercus marilandica / Schizachyrium scoparium - Silphium terebinthinaceum* Wooded Herbaceous Vegetation (CEGL005134). This community is threatened by lack of fire which has resulted in canopy closure, denser undergrowth, and a loss of ground cover. This "savanna" type is closely allied to *Quercus stellata - Quercus marilandica - Quercus velutina - Carya texana / Schizachyrium scoparium* Woodland (CEGL002149). Together with the woodlands, these communities are often referred to as "barrens" (Hutchison 1994).

CONSERVATION RANK: *G2G3.* There are probably more than 20 occurrences rangewide. Thirteen have been documented in Illinois, where the community is ranked S1. Although no other occurrences have been documented, the community is also reported in Missouri (S2) and Arkansas, and it may occur in Indiana and Kentucky (all SP). Numerous degraded sites of this type may occur in the Missouri Ozark border region (M. Leahy pers. comm. 1999). The community is found on thin, rocky, rapidly drained soils developed from windblown loess and weathered sandstone. Lack of fire has resulted in canopy closure, denser undergrowth, and a loss of ground cover.

DISTRIBUTION: This open post oak barrens community is found in the Interior Highlands region of the United States, ranging from the Ozark region of Missouri and Arkansas, east to Illinois, and possibly Indiana and Kentucky.

USFS ECOREGIONS: 221H:PP, 221J:PP, 222Aa:CC?, 222Ad:CC?, 222Ae:CC?, 222Af:CC?, 222Ag:CC?, 222Am:CC?, 222Aq:CCC, 222Ca:CCC, 222Dh:CCC, 222E:CP, 222Ga:CCC, 231A:PP, 231B:PP, 231C:PP, 231D:PP, 231G:PP, M222A:PP, M231A:PP
CONSERVATION REGIONS: 38:C, 39:C, 43:C, 44:C
STATES: AR IL IN KY? MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	dry barren (N); dry barren (S) I
IN	barrens =
MO	acid bedrock savanna (chert savanna, sandstone savanna, igneous savanna) I

OTHER SYNONYMY: Oak Savanna F, Sandstone Savanna F, Oak Barrens F, Dry Barrens F, IB4c. Western Post Oak - Blackjack Oak Woodland, in part (Allard 1990), Acid (Chert, Igneous, Sandstone) Savannah (Nelson 1985)

USNVC HIERARCHY: (QUERCUS STELLATA, QUERCUS MARILANDICA) / SCHIZACHYRIUM SCOPARIUM WOODED HERBACEOUS ALLIANCE (V.A.6.N.q)

Quercus macrocarpa / Mixedgrass Loam Wooded Herbaceous Vegetation

Bur Oak / Mixedgrass Loam Wooded Herbaceous Vegetation

Bur Oak Mixedgrass Loam Savanna CEGL002163

DESCRIPTION: The tree canopy of this community is open, with individual or clumped trees and scattered shrubs in a matrix of graminoid-dominated understory. The most common tree species is *Quercus macrocarpa*. Shrubs may include *Symphoricarpos occidentalis, Prunus virginiana, Rosa woodsii*, and *Amelanchier alnifolia*. Frequent grasses include *Elymus canadensis, Pascopyrum smithii, Elymus caninus (= Agropyron caninum)*, and *Muhlenbergia racemosa*. Forbs may include *Anemone canadensis, Anemone cylindrica, Heuchera richardsonii, Vicia americana, Asclepias verticillata*, and *Galium boreale* (Williams 1979a). Other species may include *Nassella viridula, Hesperostipa comata (= Stipa comata), Schizachyrium scoparium*, and *Andropogon gerardii* (Soil Conservation Service 1975).

This community is generally found along the upper slopes of river valley slopes, ravines, and moraine hills. In North Dakota, this community occurs on nearly level to hilly glacial till uplands along the edge of the Turtle Mountains. Slopes are commonly from 1 to 25%. Soils are deep, well-drained, medium- and moderately fine-textured soils. Permeability of these soils is moderately slow and available water capacity is high (Soil Conservation Service 1975).

COMMENTS: *3, MCS*. This type is very poorly understood. Its range is west of the oak openings type *Quercus macrocarpa* Northern Tallgrass Wooded Herbaceous Vegetation (CEGL002158), which is found in the northern tallgrass region. It grades into *Quercus macrocarpa / Corylus americana - Amelanchier alnifolia* Woodland (CEGL000556), particularly in the Turtle Mountains of North Dakota.

CONSERVATION RANK: *G1Q.* There are probably fewer than 20 occurrences rangewide. This community is reported from North Dakota (where it is ranked S1?) and Manitoba (SU). Currently one small occurrence is documented from North Dakota. There are probably fewer than 500 acres rangewide. This community occurs in the north-central portion of the Great Plains, in at least three ecoregion sections. The one documented occurrence is 5 acres. There has probably been significant decline due to grazing, and loss due to conversion to agriculture.

DISTRIBUTION: This community type is found in the north-central portion of the Great Plains of the United States and Canada, particularly in North Dakota and Manitoba.

USFS ECOREGIONS: 251Aa:C??, 331:?, 332A:CC
CONSERVATION REGIONS: 34:C
STATES: ND **PROVINCES:** MB

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: Savannah range site (Soil Conservation Service 1975) F

USNVC HIERARCHY: QUERCUS MACROCARPA WOODED MEDIUM-TALL HERBACEOUS ALLIANCE (V.A.6.N.g)

Quercus macrocarpa / Mixedgrass Sand Wooded Herbaceous Vegetation

Bur Oak / Mixedgrass Sand Wooded Herbaceous Vegetation

Bur Oak Mixedgrass Sand Savanna CEGL002162

DESCRIPTION: This community has a canopy consisting of open grown trees or clumps of trees, predominantly *Quercus macrocarpa*. The understory is made up of graminoids and forbs with scattered shrubs such as *Prunus virginiana, Symphoricarpos occidentalis*, and *Rosa woodsii*. Common constituents of the understory include *Toxicodendron rydbergii, Hesperostipa comata (= Stipa comata), Andropogon hallii, Carex pensylvanica, Tradescantia occidentalis*, and *Cyperus schweinitzii* (NDNHP 1982).

This community occurs on sandy lacustrine and glacial outwash deposits reworked by wind. Soils are infertile, sandy, and excessively well-drained. In North Dakota, these oak savannas are on the sandy outwash of the Souris Lake Plain.

COMMENTS: *3, MCS*. This type is very poorly understood. Its range is west of the tallgrass prairie region, where the oak barrens, *Quercus macrocarpa - (Quercus ellipsoidalis) / Schizachyrium scoparium - Koeleria macrantha* Wooded Herbaceous Vegetation (CEGL002160), is found. Key understory indicators are needed to distinguish the two types. In North Dakota, these oak savannas are mainly on the sandy outwash of the Souris Lake Plain (D. Lenz pers. comm. 1997). On the Sheyenne Delta, the main type is the oak barrens type (CEGL002160), though stands there may also resemble this type.

CONSERVATION RANK: *G1*. Few extant sites are known due to the effects of clearing and grazing.

DISTRIBUTION: This bur oak sand savanna is found in the northern Great Plains of the United States and Canada, ranging from central South Dakota to southern Manitoba.

USFS ECOREGIONS: 331E:CC, 331F:CC, 332A:CP
CONSERVATION REGIONS: 26:C, 34:C
STATES: ND SD **PROVINCES:** MB

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS MACROCARPA WOODED MEDIUM-TALL HERBACEOUS ALLIANCE (V.A.6.N.g)

Quercus macrocarpa / Mixedgrass Shale Wooded Herbaceous Vegetation

Bur Oak / Mixedgrass Shale Wooded Herbaceous Vegetation

Bur Oak Shale Savanna CEGL002164

DESCRIPTION: The tree canopy of this community is made up of *Quercus macrocarpa*, and *Andropogon gerardii* is present in the herbaceous layer.

Information not available.

COMMENTS: *3, MCS*. Type will probably be lumped into the *Quercus macrocarpa / Carex inops ssp. heliophila* Woodland (CEGL000554).

CONSERVATION RANK: *G1Q*. Very little remains of this community type. Its former extent is unknown.

DISTRIBUTION: This bur oak shale savanna community is found in restricted areas of the northern Great Plains. Currently it is only reported from central South Dakota.

USFS ECOREGIONS: 331F:??, 332D:??
CONSERVATION REGIONS: 26:?
STATES: SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: QUERCUS MACROCARPA WOODED MEDIUM-TALL HERBACEOUS ALLIANCE (V.A.6.N.g)

2.9. Prairies/Grasslands

Andropogon gerardii - Calamagrostis canadensis Sand Herbaceous Vegetation

Big Bluestem - Bluejoint Sand Herbaceous Vegetation

Central Wet-mesic Sand Tallgrass Prairie CEGL005177

DESCRIPTION: Graminoids between 1 and 2 m in height dominate the stand. Trees have less than 10% cover, and shrub cover may vary but is usually lower than the graminoid layer. Dominant grasses include *Andropogon gerardii, Calamagrostis canadensis, Sorghastrum nutans*, and *Spartina pectinata*. *Panicum virgatum* can also be present. Forbs include *Calopogon tuberosus, Helianthus grosseserratus, Osmunda cinnamomea, Osmunda regalis, Pycnanthemum virginianum, Rhexia virginica, Viola lanceolata, Xyris torta*, and *Zizia aurea* (White and Madany 1978, Homoya et al. 1985).

The community occurs in shallow swales or lower slopes of sandy outwash plains, lakeplains and valley trains. Soils are moderately wet (White and Madany 1978, Homoya et al. 1985).

Fires prevent succession of this type to shrub prairies or shrub meadows.

COMMENTS: *2, MCS*. Distinctions between this wet-mesic sand prairie and wet-mesic prairie *Andropogon gerardii - Panicum virgatum - Helianthus grosseserratus* Herbaceous Vegetation (CEGL002024) are not clear and further characterization is needed to justify the split. This type is also separated from Lakeplain wet-mesic prairies, *Andropogon gerardii - Calamagrostis canadensis - Pycnanthemum virginianum - Oligoneuron ohioense* Herbaceous Vegetation (CEGL005095), which also occur on sand.

CONSERVATION RANK: *G2G3*. There are probably fewer than 50 occurrences of this community rangewide. It is reported from Illinois (where it is ranked S2), and Indiana (S2), and it may also occur in Ontario. Currently 13 occurrences of this community are documented from Illinois and Indiana. There are probably fewer than 700 acres of this community rangewide. Currently over 40 acres are documented (several lack size data), with sizes ranging from 1 to 36 acres. Historical acreage is unknown. Many sites are degraded by fire suppression or grazing. There has probably been a substantial reduction in acreage due to agricultural, residential, or commercial development. This community is restricted to wet-mesic sites with sandy soils. It has a somewhat restricted range: it is reported from 5 subsections in 2 ecoregion provinces.

DISTRIBUTION: This community is found in northern and central Indiana and Illinois, and possibly in southern Ontario.

USFS ECOREGIONS: 212Hx:CCC, 222Ge:CCC, 222Jh:CCC, 251Ci:CCC, 251Dd:CCC, 251Dg:CCC, 251Dh:CCC
CONSERVATION REGIONS: 36:C, 45:C, 48:C
STATES: IL IN **PROVINCES:** ON?

MIDWEST HERITAGE SYNONYMY:

IL	wet-mesic sand prairie +
IN	wet-mesic sand prairie +

OTHER SYNONYMY:

USNVC HIERARCHY: ANDROPOGON GERARDII - (CALAMAGROSTIS CANADENSIS, PANICUM VIRGATUM) HERBACEOUS ALLIANCE (V.A.5.N.a)

Andropogon gerardii - Sorghastrum nutans - Schizachyrium scoparium - Aletris farinosa Herbaceous Vegetation

Big Bluestem - Yellow Indiangrass - Little Bluestem - Northern White Colicroot Herbaceous Vegetation

Mesic Sand Tallgrass Prairie CEGL005096

DESCRIPTION: Stands of this community may be dominated by grasses, mixtures of grasses and forbs, forbs, or short shrubs and grasses. Abundant and diagnostic species include *Andropogon gerardii, Calamagrostis canadensis, Pycnanthemum virginianum, Schizachyrium scoparium,* and *Sorghastrum nutans*. *Aletris farinosa* and *Coreopsis tripteris* are typical in this community and can be locally abundant. Other characteristic species include *Carex pensylvanica, Desmodium canadense, Panicum virgatum, Solidago canadensis*, and *Solidago juncea* (Comer et al. 1995b, Faber-Langendoen and Maycock 1994). Species composition varies with soil moisture and pH. Comer et al. (1995b) found five examples of this community in their survey of Michigan lakeplain prairies. The dominant species on the best of these sites were *Schizachyrium scoparium* and *Andropogon gerardii*. Common plants included *Asclepias tuberosa, Baptisia tinctoria, Carex muehlenbergii, Carex swanii, Hieracium longipilum, Liatris scariosa, Lupinus perennis, Rudbeckia hirta*, and *Viola sagittata*.

This community occurs on level sandy glacial outwash, sandy glacial lakeplains, valley trains, and in dune areas. Soils are sandy loams, loamy sands, and sands. They are moderately well-drained to imperfectly or somewhat poorly drained. The soils often have thick, dark surface horizons, a slowly permeable layer within the profile, a high water table, and additions of water through seepage. The water table is highest in the spring and falls through the summer with drought conditions often occurring in the autumn. There is quite a bit of variation in soil moisture from site to site. There is sometimes brief ponding after heavy rains or in the spring. Soil pH ranges from 4.0-8.2 (Faber-Langendoen and Maycock 1994, Comer et al. 1995b).

Fire is important in maintaining this community. In the absence of fire, mesic sand prairies succeed to woodland or forest. *Poa compressa* is a common exotic in disturbed sites.

COMMENTS: *2, MCS*. This type represents the mesic sand prairies in the Upper Midwest that are both off and on the lakeplain area of the Great Lakes. Lakeplain stands may be very similar to wet-mesic lakeplain prairies (Faber-Langendoen and Maycock 1987). In Michigan, Ohio, and Ontario, no distinction is made between mesic sand prairies on the lakeplain or off the lakeplain, as was done for wet-mesic sand prairies, *Andropogon gerardii - Calamagrostis canadensis - Pycnanthemum virginianum - Oligoneuron ohioense* Herbaceous Vegetation (CEGL005095), since the mesic condition is much less connected to lakeplain hydrology (P. Comer pers. comm. 1997). Type needs further review in Wisconsin, where it may occur at Chiwaukee Prairie and Avoca Prairie (E. Epstein pers. comm. 1999).

CONSERVATION RANK: *G2.* Many former sites of this type have been eliminated by agricultural development.

DISTRIBUTION: This community occurs in the southern Great Lakes region of the United States and Canada, ranging from southern Wisconsin and northern Illinois to Ohio and Ontario.

USFS ECOREGIONS: 212Hx:CCC, 212Hy:CCC, 222Ao:CCC, 222Ha:CCC, 222If:CCC, 222Jb:CCC, 222Jg:CCC, 222Jh:CCC, 222Jj:CCC, 222Kg:CCC, 222Ki:CCC, 222Qb:CCC, 251Da:CCC, 251Dd:CCC, 251Dg:CCC
CONSERVATION REGIONS: 36:C, 48:C
STATES: IL IN MI OH WI? **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	mesic sand prairie =
IN	mesic sand prairie =
MI	mesic sand prairie =
OH	big bluestem prairie +
WI?	mesic sand prairie? ?

OTHER SYNONYMY: Mesic sandy loam prairie (Faber-Langendoen and Maycock 1987) =, Mesic sandy loam prairie (Faber-Langendoen and Maycock 1994) =

USNVC HIERARCHY: ANDROPOGON GERARDII - (SORGHASTRUM NUTANS) HERBACEOUS ALLIANCE (V.A.5.N.a)

Schizachyrium scoparium - Bouteloua curtipendula Gravel Herbaceous Vegetation

Little Bluestem - Sideoats Grama Gravel Herbaceous Vegetation

Midwest Dry Gravel Prairie CEGL002215

DESCRIPTION: This community is dominated by grasses or, locally, by low shrubs. Trees may be present but their canopy cover is less than 10%. Grasses are typically less than 1 m tall. *Bouteloua curtipendula, Schizachyrium scoparium, Sorghastrum nutans, Sporobolus heterolepis*, and *Hesperostipa spartea (= Stipa spartea)* dominate this community. There is considerable variation in the composition of the forb component (White and Madany 1978).

This community occurs on steep, gravelly slopes, usually facing south or southwest. These slopes can be kames, eskers, river terraces, or hills. Soils are gravelly, well- to excessively drained, and often excessively aerated. Sites at the bottom of a slope have more soil accumulation, more soil moisture, and are generally more fertile (White and Madany 1978).

COMMENTS: *2, MCS*. Indicator species need to be identified to better determine how distinctive this gravel prairie type is from other dry prairies. *Cirsium hillii* may be a good one, at least in Minnesota. In addition *Hesperostipa comata (= Stipa comata)* and *Bouteloua gracilis* are typically absent from this type compared to *Schizachyrium scoparium - Bouteloua spp. - Hesperostipa spartea* Gravel Herbaceous Vegetation (CEGL002499) (R. Dana pers. comm. 1999).

CONSERVATION RANK: *G3.* There are probably fewer than 200 occurrences of this community rangewide. It is reported from Indiana (where it is ranked S1), Illinois (S1), Wisconsin (S3), Minnesota (S2), and Iowa (S2?). It is restricted to steep, gravelly slopes, usually facing south or southwest. Currently there are 172 occurrences documented. Occurrences of this community are often heavily grazed.

DISTRIBUTION: This bluestem dry gravel prairie is found in the upper midwestern region of the United States, ranging from northern Indiana west to Iowa and east-central Minnesota.

USFS ECOREGIONS: 212Jd:CCC, 212Kb:CCC, 212Mb:C??, 212Nc:CCC, 222Hf:CCC, 222Ke:CCC, 222Kf:CCC, 222Kh:CCC, 222Lb:CCC, 222Lc:CCC, 222Lf:CCC, 222Ma:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 251Ba:CCC, 251Bb:CCC, 251Bd:CCC, 251Be:CCC, 251Cf:CCC, 251Dc:CCC
CONSERVATION REGIONS: 35:C, 36:C, 45:C, 46:C, 47:C, 48:C
STATES: IA IL IN MN WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:
IL dry gravel prairie; gravel hill prairie -
IN gravel slope barrens =
MN dry prairie (central section) sand - gravel subtype; dry prairie (southeast section) sand - gravel subtype -
WI dry prairie (gravel hill subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - BOUTELOUA CURTIPENDULA HERBACEOUS ALLIANCE (V.A.5.N.c)

Schizachyrium scoparium - Bouteloua spp. - Hesperostipa spartea Gravel Herbaceous Vegetation

Little Bluestem - Grama Species - Porcupine Grass Gravel Herbaceous Vegetation

Northern Little Bluestem Gravel Prairie CEGL002499

DESCRIPTION: This community is a grassland dominated by mid grasses. Dominants are *Bouteloua curtipendula, Bouteloua gracilis, Schizachyrium scoparium*, and *Hesperostipa spartea (= Stipa spartea)*. Other common graminoids include *Andropogon gerardii, Bouteloua hirsuta, Calamovilfa longifolia, Carex inops ssp. heliophila, Sporobolus heterolepis*, and *Hesperostipa comata (= Stipa comata)*. Forb diversity is moderate to high. Typical examples include *Artemisia frigida, Astragalus laxmannii var. robustior (= Astragalus adsurgens ssp. robustior), Echinacea angustifolia, Lygodesmia juncea, Potentilla pensylvanica*, and *Solidago missouriensis*. Shrubs are absent to widely scattered. Those present may include *Amorpha canescens, Rosa arkansana*, and *Symphoricarpos occidentalis*. Lichens and mosses often occur on bare soil and gravel (MNNHP 1993).

This community is found on gently to steeply sloping sites on glacial outwash, glacial beaches, or other glacial features that have a high proportion of sand and gravel, such as kames and eskers. Soils are often Mollisols but not deep, and they contain fine to coarse gravel, sand, and often larger rocks (MNNHP 1993). Soil moisture is typically low due to the well- to excessively drained nature of the soils.

COMMENTS: *2, MCS*. This type is based on the concept of the Minnesota state type - sand-gravel prairie (MNNHP 1993). It needs review from North Dakota, South Dakota, Iowa, and Manitoba. In Iowa, the Gravel Prairie may better fit with this type than with the more eastern gravel hill prairies, *Schizachyrium scoparium - Bouteloua curtipendula* Gravel Herbaceous Vegetation (CEGL002215), to which this type should be compared.

CONSERVATION RANK: *G2G3.* There are probably fewer than 100 occurrences of this community rangewide; it is reported from Minnesota (ranked S2), Iowa (S2?), North Dakota (S?), and South Dakota (S?), and it may also occur in Manitoba. Currently 60 occurrences have been documented in Minnesota. There are probably fewer than 5000 acres rangewide; currently over 2300 acres have been documented. Some sites have been destroyed, reduced in size, or degraded by gravel mining and grazing. Some sites have been treated with herbicides to eradicate broad-leaved plants and create more productive pasture. Fire suppression has probably also degraded some sites. This community has a somewhat narrow range, reported only from four subsections in two provinces.

DISTRIBUTION: This bluestem gravel prairie community type is found in the northern tallgrass prairie region of the United States and possibly adjacent Canada, ranging from northwestern Iowa to Minnesota and the Dakotas, and possibly Manitoba.

USFS ECOREGIONS: 222Ma:CCC, 222Na:CCC, 251Aa:CCC, 251Ba:CCC, 251Bb:CCC
CONSERVATION REGIONS: 35:C, 46:C
STATES: IA? MN ND SD **PROVINCES:** MB?

MIDWEST HERITAGE SYNONYMY: MN dry prairie (northwest section) sand - gravel subtype; dry prairie (southwest section) sand - gravel subtype -

OTHER SYNONYMY:

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - BOUTELOUA CURTIPENDULA HERBACEOUS ALLIANCE (V.A.5.N.c)

Schizachyrium scoparium - Carex tonsa var. rugosperma - Carex muehlenbergii - Lithospermum caroliniense - Opuntia humifusa Herbaceous Vegetation

Little Bluestem - Parachute Sedge - Muhlenberg's Sedge - Plains Puccoon - Eastern Prickly-pear Herbaceous Vegetation

Midwest Sand Barrens CEGL005099

DESCRIPTION: Graminoids dominate the herbaceous layer, which is often very open. Dominant and characteristic graminoids include *Carex siccata (= Carex foenea), Carex muehlenbergii, Carex tonsa var. rugosperma (= Carex rugosperma), Cyperus lupulinus, Cyperus schweinitzii, Aristida basiramea, Aristida tuberculosa, Dichanthelium ovale var. addisonii (= Dichanthelium commonsianum), Koeleria macrantha, Schizachyrium scoparium, Sporobolus cryptandrus*, and *Hesperostipa spartea (= Stipa spartea)*. *Calamovilfa longifolia* may be prominent in more open dune ridges. Characteristic forbs include *Antennaria plantaginifolia, Lithospermum caroliniense, Penstemon grandiflorus*, and *Solidago nemoralis*. Other associated herbs include *Asclepias tuberosa, Dalea villosa, Euphorbia corollata, Krigia virginica*, and *Lupinus perennis*. *Hudsonia tomentosa* is more often restricted to local disturbances such as blowouts or slipfaces. Shrubs or shrub-like species include *Salix humilis* and *Opuntia humifusa* (Curtis 1959, MNNHP 1993, Anderson 1996, Schneider and Cochrane 1997).

Stands can occur on steep slopes on sandy outwash, sandy lakeplains, and alluvial deposits along rivers and streams. They may occur on sand ridges (including inland dunes and sandy areas of coarse-textured end moraines), particularly on blowouts. Soils are well-drained to excessively drained, coarse-textured sands, loamy sands, and sandy loams. Gravels are very minor. Soils generally lack a dark A horizon and the upper horizons can be somewhat acidic (Curtis 1959, MNNHP 1993, Anderson 1996).

Windstorms can create blowouts.

COMMENTS: 3*, MCS*. In Minnesota, relation to the Minnesota Dry Prairie, barrens subtype in southeastern and central Minnesota needs clarification. The Minnesota type is currently crosswalked to *Schizachyrium scoparium - Danthonia spicata - Carex pensylvanica - (Viola pedata)* Herbaceous Vegetation (CEGL002318), but appears to be more like a sand barrens type. Separation of this type from sand prairie (CEGL002318) or even sand-gravel prairie, *Schizachyrium scoparium - Bouteloua curtipendula* Gravel Herbaceous Vegetation (CEGL002215), may be difficult. They may represent a later successional stage, with the sand barrens originating when exposed areas of sandy or sandy/gravelly substrates are created, either by wind or human clearing, and the sand prairies and gravel prairies succeeding them (Curtis 1959, Anderson 1996). Thus, it's possible that the sand barrens type can be combined into those two types. In general sand barrens occur on more dune-like habitats, coarse floodplain outwash, or on formerly plowed sand prairies, and sands may still move. Sand prairies occur on more stable sandy soils. Potential diagnostic species for sand prairies may be *Lithospermum canescens* and *Viola pedata*. Potential diagnostic species for sand barrens are *Cyperus lupulinus ssp. lupulinus (= Cyperus filiculmis), Cyperus schweinitzii, Carex muehlenbergii, Lithospermum caroliniense, Opuntia humifusa*, and *Sporobolus cryptandrus*. *Solidago nemoralis* is common, as are lichens.

CONSERVATION RANK: *G2G3.* There are probably fewer than 100 occurrences of this community rangewide. It is reported from Ohio (where it is ranked S2), Indiana (S2), and Wisconsin (SU), and it may also occur in Illinois. Currently 7 occurrences have been documented from Indiana and Ohio. No data on current acreage are available, but there are probably less than 10,000 acres rangewide (assuming most occurrences are less than 100 acres). Historical acreage and trends are unknown, but it seems likely that some areas of this community have been destroyed by agricultural and residential development.

DISTRIBUTION: This community is widespread throughout the midwestern region of the United States, where it is found on a variety of sandy soils, ranging from perhaps southeast and central Minnesota east to Ohio.

USFS ECOREGIONS: 222Hf:CCC, 222If:CCC, 222Ig:CCC, 222Jj:CCC, 251:?
CONSERVATION REGIONS: 45:C, 48:C
STATES: IL? IN MN? OH WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:
IL? dry sand prairie ?
IN sand barrens =
MN? dry prairie (southeast section) barrens subtype; dry prairie (central section) barrens subtype ?
OH sand barren =
WI sand barrens =

OTHER SYNONYMY: Oak Barrens (Anderson 1996) B. Includes the herbaceous sand barrens within it., Sand Barrens (Anderson 1982) =

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - (SPOROBOLUS CRYPTANDRUS) HERBACEOUS ALLIANCE (V.A.5.N.c)

Schizachyrium scoparium - Danthonia spicata - Carex pensylvanica - (Viola pedata) Herbaceous Vegetation

Little Bluestem - Poverty Oatgrass - Pennsylvania Sedge - (Birdfoot Violet) Herbaceous Vegetation

Midwest Dry Sand Prairie CEGL002318

DESCRIPTION: Graminoids dominate the herbaceous layer, which can be open to closed. Dominant species include *Carex pensylvanica, Danthonia spicata, Koeleria macrantha, Schizachyrium scoparium*, and *Hesperostipa spartea (= Stipa spartea)*. Other graminoids include *Bouteloua hirsuta, Digitaria cognata (= Leptoloma cognatum)* and *Dichanthelium acuminatum var. fasciculatum (= Dichanthelium lanuginosum)*. In more open dune-like habitats *Calamovilfa longifolia* may be present. A wide variety of forbs are present, including *Asclepias verticillata, Ambrosia psilostachya, Artemisia frigida, Pseudognaphalium obtusifolium (= Gnaphalium obtusifolium), Euphorbia corollata, Hieracium longipilum, Lechea tenuifolia, Liatris aspera, Liatris cylindracea, Nuttallanthus canadensis (= Linaria canadensis), Lithospermum canescens, Lupinus perennis, Oenothera rhombipetala, Polygala polygama, Packera plattensis (= Senecio plattensis), Solidago nemoralis, Tephrosia virginiana*, and *Viola pedata*. *Hudsonia tomentosa*, and other sand barrens species, are more often restricted to local disturbances such as blowouts or slipfaces (Curtis 1959, White and Madany 1978, Homoya et al. 1985, Chapman et al. 1989, MNNHP 1993).

Stands can occur on steep slopes, sandy outwash, sandy lakeplains, and alluvial deposits. They may occur on sand ridges (including inland dunes and sandy areas of coarse-textured end moraines), where, particularly if blowouts have occurred, they may resemble sand barrens. Soils are well-drained to excessively drained, coarse-textured sands, loamy sands, and sandy loams. Gravels are very minor. They generally lack a dark A horizon, have brownish, yellowish, grayish, or reddish thin B horizons, and no mottling (Curtis 1959, White and Madany 1978, Homoya et al. 1985, Chapman et al. 1989, MNNHP 1993).

Sand blowouts may occur during windstorms, exposing the subsoil layers and converting the type to a sand barrens.

COMMENTS: *2, MCS*. Separation of this type from sand barrens, *Schizachyrium scoparium - Carex tonsa var. rugosperma - Carex muehlenbergii - Lithospermum caroliniense - Opuntia humifusa* Herbaceous Vegetation (CEGL005099), may be difficult, and they may represent a temporal sequence after exposure of sandy substrates, either by wind or human clearing. In general sand barrens occur on more dune-like habitats or on formerly plowed sand prairies, and sands may still move. Sand prairies occur on more stable sandy soils. A proposed descriptive revision to the name of this type, presuming it is combined with CEGL005099, is *Schizachyrium scoparium - Koeleria macrantha - (Aristida spp.) - Carex - (umbellata, muehlenbergii) - Viola pedata* Herbaceous Vegetation (Prairie-Forest Border Ecoregional Planning Team pers. comm. 1999). Potential diagnostic species for sand prairies may be *Lithospermum canescens* and *Viola pedata*. Potential diagnostic species for sand barrens are *Cyperus lupulinus ssp. lupulinus (= Cyperus filiculmis), Cyperus schweinitzii, Carex muehlenbergii, Lithospermum caroliniense, Opuntia humifusa*, and *Sporobolus cryptandrus*. In Minnesota, the dry-mesic stands of this type may better fit with *Schizachyrium scoparium - Sorghastrum nutans - Andropogon gerardii - Lespedeza capitata* Sand Herbaceous Vegetation (CEGL002210). In Illinois distinction of sand prairie and sand hill prairie needs review, but for now they are combined into this type [see also CEGL005099]. In Indiana *Koeleria macrantha* and *Hesperostipa spartea (= Stipa spartea)* may be common (Jackson 1979).

CONSERVATION RANK: *G2G3.* Although the community has a fairly broad distribution, few occurrences have been documented, and most remnants are probably very disturbed, low quality examples. This community is ranked S1S2 or S2 in 5 states, and occurs in at least one more state, possibly several more. It is extirpated from Missouri. Many occurrences have been converted to agriculture, or disturbed by grazing and/or fire suppression.

DISTRIBUTION: This dry sand prairie community is widespread throughout the midwestern region of the United States and adjacent Canada, extending from Indiana, Michigan and southern Ontario, west to Iowa and east-central Minnesota.

USFS ECOREGIONS: 212Hq:CCC, 212Hr:CCP, 212Ht:CCP, 212Hu:CCC, 212Hv:CCP, 212Hx:CCC, 212Hy:CCP, 212Ka:CCC, 222Ge:CCC, 222Jb:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kb:CCC, 222Ke:CCC, 222Kg:CCC, 222Lb:CCC, 222Lc:CCC, 222Lf:CCC, 222Me:CCC, 234Ac:???, 251Be:CCC, 251Cc:CCC, 251Cf:CCC, 251Ch:CCC, 251Da:CCC, 251Df:CCC, 251Dg:CCC, 251Dh:CCC

CONSERVATION REGIONS: 35:C, 36:C, 44:C, 46:C, 47:C, 48:C

STATES: IA IL IN MI MN MO WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	dry sand prairie =
IN	dry sand prairie +
MI	dry sand prairie =
MN	dry prairie (central section) barrens subtype; dry prairie (southeast section) barrens subtype ?;I
MO	dry sand prairie ?
WI	dry sand prairie =

OTHER SYNONYMY:

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - (SPOROBOLUS CRYPTANDRUS) HERBACEOUS ALLIANCE (V.A.5.N.c)

Schizachyrium scoparium - Hesperostipa spartea - Bouteloua (curtipendula, gracilis) Sand Herbaceous Vegetation

Little Bluestem - Porcupine Grass - (Sideoats Grama, Blue Grama) Sand Herbaceous Vegetation

Little Bluestem - Porcupine Grass - Grama Grass Sand Prairie CEGL005204

DESCRIPTION: The vegetation structure can be somewhat open, sometimes less than 50% cover. The major graminoid species include *Bouteloua gracilis, Bouteloua hirsuta, Calamovilfa longifolia, Carex siccata (= Carex foenea), Carex inops ssp. heliophila (= Carex heliophila), Cyperus schweinitzii, Koeleria macrantha, Schizachyrium scoparium, Sporobolus cryptandrus*, and *Hesperostipa spartea (= Stipa spartea)*. Other graminoids that may be present include *Bouteloua curtipendula, Panicum virgatum*, and *Sorghastrum nutans* (in wetter years). Characteristic forbs include *Antennaria plantaginifolia, Artemisia frigida, Dalea villosa (= Petalostemum villosum)*, and less commonly *Penstemon grandiflorus*. Shrubs are sparsely distributed in this type. Species include *Artemisia frigida, Amorpha canescens, Prunus pumila, Rosa arkansana*, and *Salix humilis* (MNNHP 1993).

Stands are located on glacial outwash and post-glacial lake dunes, including on low dunes in swales. Soils are deep coarse sands, with low nutrient levels, low levels of organic matter, and poor water-retaining capacity. In Minnesota, the type occurs on "dune blankets", such as is found on Agassiz Dunes and Skull Lake Dunes (MNNHP 1993).

COMMENTS: *2, MCS*. This sand prairie type extends to the Sheyenne Delta. It has a parallel distribution with the sand savanna type, *Quercus macrocarpa - (Quercus ellipsoidalis) / Schizachyrium scoparium - Koeleria macrantha* Wooded Herbaceous Vegetation (CEGL002160). The absence of *Lithospermum caroliniense* may be a diagnostic character separating this type from *Schizachyrium scoparium - Danthonia spicata - Carex pensylvanica - (Viola pedata)* Herbaceous Vegetation (CEGL002318) or *Schizachyrium scoparium - Carex tonsa var. rugosperma - Carex muehlenbergii - Lithospermum caroliniense - Opuntia humifusa* Herbaceous Vegetation (CEGL005099). *Hudsonia tomentosa* is also more common in CEGL002318.

CONSERVATION RANK: *G2G3*. There are probably fewer than 20 occurrences rangewide. Four occurrences have been documented in Minnesota, where the community is ranked S2,S1, and 3 occurrences have been documented in North Dakota (S?). It is found in 3 ecoregional subsections. There are probably more than 1000 acres rangewide. Sizes of 4 occurrences range from 60 to 240 acres, totaling 680. This community occurs on deep, coarse sands with low levels of organic matter on glacial outwash and post-glacial lakedunes.

DISTRIBUTION: This dry sand prairie or barrens is found in the northern tallgrass region of the midwestern United States, particularly western Minnesota and North Dakota.

USFS ECOREGIONS: 222M:CC, 222Na:CCC, 251Aa:CCC, 251Ab:CCC
CONSERVATION REGIONS: 35:C
STATES: MN ND **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MN dry prairie (northwest section) barrens subtype; dry prairie (central section) barrens subtype -

OTHER SYNONYMY:

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - (SPOROBOLUS CRYPTANDRUS) HERBACEOUS ALLIANCE (V.A.5.N.c)

Schizachyrium scoparium - Sorghastrum nutans - Andropogon gerardii - Lespedeza capitata Sand Herbaceous Vegetation

Little Bluestem - Yellow Indiangrass - Big Bluestem - Roundhead Bushclover Sand Herbaceous Vegetation

Midwest Dry-mesic Sand Prairie CEGL002210

DESCRIPTION: Sparse to moderately dense mid and tall grasses dominate this community. Forbs do not contribute greatly to vegetation cover, but forb diversity is generally moderate to high (MNNHP 1993). The most abundant species in this community are *Andropogon gerardii, Carex* spp., *Schizachyrium scoparium, Sorghastrum nutans*, and *Hesperostipa spartea (= Stipa spartea)*. Other common species include *Liatris aspera, Lespedeza capitata, Lithospermum caroliniense, Symphyotrichum ericoides (= Aster ericoides)*, and *Dalea villosa*. Woody species tolerant of dry conditions, such as *Salix humilis, Populus tremuloides*, and *Acer rubrum*, are sometimes found in this community.

This community is found on flat to moderately sloping sites with sand, loamy sand, or, rarely, sandy loam soils (White and Madany 1978, MNNHP 1993). The deep, well-drained soils formed from eolian or alluvial sand south of the limit of glaciation and also from glacial outwash, old dunes, alluvium, or sandy glacial lakeplains (Nelson 1985, Chapman 1984).

COMMENTS: *2, MCS*. In Minnesota, the distinction between a dry versus dry-mesic sand prairie is not clear; thus their dry prairie, barrens subtype is listed here and with *Schizachyrium scoparium - Danthonia spicata - Carex pensylvanica - (Viola pedata)* Herbaceous Vegetation (CEGL002318). In Minnesota, the NW and Central barrens subtypes are also placed with *Schizachyrium scoparium - Hesperostipa spartea - Bouteloua (curtipendula, gracilis)* Sand Herbaceous Vegetation (CEGL005204). Finally, this type should be compared with *Schizachyrium scoparium - Sorghastrum nutans - Hypoxis hirsuta - Baptisia tinctoria* Herbaceous Vegetation (CEGL006187), found on Long Island, New York. This type could be in northern Missouri in the upper Mississippi River region.

CONSERVATION RANK: *G3.* There are probably fewer than 100 occurrences rangewide. Sixty-three have been documented: 35 in Indiana (where the community is ranked S3), 19 in Illinois (S2), and 9 in Minnesota (S1,S2,S1). Although no other occurrences have been documented, the community is also reported from Michigan (S1), Ontario (S?), and possibly Wisconsin (SP) and has been virtually extirpated from Missouri (database record as SX, but there is now one site - Steyermark sand prairie - that contains this type). It occurs in 13 ecoregional subsections. There are probably fewer than 10,000 acres rangewide. Sizes are known for 40 occurrences, totaling 2600 acres. Lack of fire may permit more woody species to invade this community.

DISTRIBUTION: This dry-mesic sand bluestem prairie community is found in the upper midwestern United States.

USFS ECOREGIONS: 212Hu:CPP, 212Hy:CPP, 212Jg:CCC, 212Kb:CCC, 212Mb:C??, 212Nc:CCC, 222If:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kg:CCC, 222Kh:CCC, 222Ki:CCC, 222Kj:CCC, 222La:CCC, 222Lb:CCC, 222Lc:CCC, 222Lf:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 232:?, 251Cf:CCC, 251Ci:CCC, 251Da:CCC, 251Dd:CCC, 251Df:CCC, 251Dg:CCC, 251Dh:CCC

CONSERVATION REGIONS: 36:C, 45:C, 46:C, 47:C, 48:C

STATES: IL IN MI MN? MO WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	dry-mesic sand prairie =
IN	dry-mesic sand prairie =
MI	dry-mesic sand prairie =
MN?	dry prairie (southeast section) barrens subtype =
MO	dry-mesic sand prairie ?
WI	dry-mesic sand prairie =

OTHER SYNONYMY: Mesic Sand Prairie (Chapman 1984) =

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - SORGHASTRUM NUTANS HERBACEOUS ALLIANCE (V.A.5.N.a)

Schizachyrium scoparium - Sorghastrum nutans - Bouteloua curtipendula Gravel Herbaceous Vegetation

Little Bluestem - Yellow Indiangrass - Sideoats Grama Gravel Herbaceous Vegetation

Midwest Dry-mesic Gravel Prairie CEGL005176

DESCRIPTION: The vegetation of this community is medium-tall (1 m) and moderately open to moderately dense. Graminoids are dominant, but forb diversity is moderate to high. Woody species are rare. The most abundant species are *Bouteloua curtipendula, Schizachyrium scoparium, Sorghastrum nutans*, and *Sporobolus heterolepis*. Other common species include *Andropogon gerardii, Oligoneuron album (= Solidago ptarmicoides)*, and *Hesperostipa spartea (= Stipa spartea)*.

This community is found on moderate to gentle lower slopes. The soils are coarse and well-drained, but sites usually have adequate soil moisture due to runoff from upslope. Many sites have alkaline soils derived from calcareous gravel (White and Madany 1978).

COMMENTS: *3, MCS*. Type concept is taken from the Illinois state type - dry-mesic and mesic gravel prairie (White and Madany 1978); thus the type includes both dry-mesic and mesic gravel prairie, though it is possible that mesic gravel prairies may actually be more similar to mesic loam prairies, *Andropogon gerardii - Sorghastrum nutans - (Sporobolus heterolepis) - Liatris spp. - Ratibida pinnata* Herbaceous Vegetation (CEGL002203). Stands may occur in Wisconsin and Iowa. Indicator species have not been identified that would help distinguish this community from other dry-mesic prairie types.

CONSERVATION RANK: *G2*. There are probably fewer than 20 occurrences of this community rangewide; it is reported only from Illinois, where it is ranked S2. Currently there are 7 occurrences documented in Illinois. There are probably fewer than 500 acres of this community rangewide. Currently over 70 acres are documented from Illinois (several lack acreage data), and the average size documented is about 17 acres. Historical acreage is unknown. Since several are in the greater Chicago metropolitan area, it is likely that many acres have been lost to urban or suburban development. This community has somewhat restricted environmental requirements, it is often found on sites with alkaline soils derived from calcareous gravel.

DISTRIBUTION: This community type is found in the central tallgrass prairie region of the midwestern United States, in Illinois.

USFS ECOREGIONS: 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Ki:CCC, 251:?
CONSERVATION REGIONS: 46:C, 48:C
STATES: IL **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL mesic gravel prairie; dry-mesic gravel prairie -

OTHER SYNONYMY:

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - SORGHASTRUM NUTANS HERBACEOUS ALLIANCE (V.A.5.N.a)

Andropogon gerardii - Panicum virgatum - Schizachyrium scoparium - (Tradescantia tharpii) Herbaceous Vegetation

Big Bluestem - Switchgrass - Little Bluestem - (Tharp's Spiderwort) Herbaceous Vegetation

Dakota Sandstone Tallgrass Prairie CEGL005231

DESCRIPTION: Tall graminoids are the dominant vegetation in this community, although trees and shrubs may be widely scattered. The most abundant species include *Andropogon gerardii, Schizachyrium scoparium*, and *Sorghastrum nutans*. *Bouteloua curtipendula, Bouteloua gracilis*, and *Sporobolus compositus (= Sporobolus asper)* are common graminoid associates. *Amorpha canescens, Symphyotrichum ericoides (= Aster ericoides), Echinacea angustifolia, Calylophus serrulatus (= Oenothera serrulata), Psoralidium tenuiflorum (= Psoralea tenuiflora), Mimosa microphylla (= Schrankia uncinata), Oligoneuron rigidum (= Solidago rigida)*, and *Tradescantia tharpii* are typical forbs of this community (Hladek et al. 1972). *Clematis fremontii, Oenothera macrocarpa* and *Talinum calycinum* are unusual species of this area (see also Lauver et al. 1999).

This community is found on moderate to steep, dry-mesic slopes and ridgetops. The loam soils range from shallow and somewhat excessively well-drained to moderately deep and well-drained, formed in material weathered from sandstone and sandy shale. The parent material is primarily Dakota sandstone (Lauver et al. 1999).

COMMENTS: *3, MCS*. Type concept comes from the Kansas state classification - Dakota Sandstone Prairie (Lauver et al. 1999). This community appears to be mesic to dry-mesic. Hladek et al. (1972) sampled 65 stands in the Smokey Hills region of Kansas. They divided the stands into five classes, very dry, dry, dry-mesic, mesic, and wet-mesic. Their dry-mesic and mesic classes fit best with the concept of this type. See Hladek et al. 1972 for a list of the most abundant species in this community. Dry and wet-mesic classes of Hladek et al. (1972) may also fit into this type, broadly defined. See also *Andropogon gerardii* types in Colorado and Wyoming. This type was originally part of *Andropogon gerardii - Panicum virgatum - Helianthus grosseserratus* Herbaceous Vegetation (CEGL002024). This type is not currently recognized in Nebraska (G. Steinauer pers. comm. 1999).

CONSERVATION RANK: *G3?.*

DISTRIBUTION: This sandstone tallgrass prairie community is found in the eastern central Great Plains of the United States on moderate to steep dry-mesic slopes and ridgetops of the Dakota Sandstone region of north-central Kansas and adjacent Nebraska.

USFS ECOREGIONS: 332E:CC
CONSERVATION REGIONS: 36:C
STATES: KS NE? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE? tallgrass prairie ?

OTHER SYNONYMY: Dry-mesic (Hladek et al. 1972), Mesic (Hladek et al. 1972)

USNVC HIERARCHY: ANDROPOGON GERARDII - (SORGHASTRUM NUTANS) HERBACEOUS ALLIANCE (V.A.5.N.a)

Andropogon gerardii - Sorghastrum nutans - Schizachyrium scoparium Flint Hills Herbaceous Vegetation

Big Bluestem - Yellow Indiangrass - Little Bluestem Flint Hills Herbaceous Vegetation

Flint Hills Tallgrass Prairie CEGL002201

DESCRIPTION: This community has a dense cover of tall grasses with a moderate to high diversity of forbs. Dominant grasses are *Andropogon gerardii, Sorghastrum nutans*, and *Schizachyrium scoparium*. *Bouteloua curtipendula, Panicum virgatum*, and *Sporobolus compositus (= Sporobolus asper)* are common, but less abundant, members of this community. Typical forbs include *Symphyotrichum ericoides (= Aster ericoides), Helianthus grosseserratus, Lespedeza capitata, Psoralidium tenuiflorum, Solidago* spp., and *Viola pedatifida*. Shrubs, such as *Amorpha canescens*, and trees are usually infrequent, but can be more common near watercourses (Lauver et al. 1999).

This community is found on shallow to deep silt, loam, and clay soils. It can be somewhat poorly drained to somewhat excessively drained. The parent material is calcareous clayey shale, limestone, cherty limestone, or interbedded limestone and clayey shale (Lauver et al. 1999).

COMMENTS: *2, MCS*. Also known as Osage Hills. In Oklahoma, vegetation dominated by these species is not limited to the Flint Hills. Indicator species need to be identified to better name this community.

CONSERVATION RANK: *G4?.*

DISTRIBUTION: This tallgrass prairie grassland is found in the Flint Hills region of the central United States, particularly in Kansas and Oklahoma.

USFS ECOREGIONS: 251E:CC, 251Fb:CCC, 251Fd:CCC
CONSERVATION REGIONS: 36:C, 37:C
STATES: KS OK **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: ANDROPOGON GERARDII - (SORGHASTRUM NUTANS) HERBACEOUS ALLIANCE (V.A.5.N.a)

Deschampsia caespitosa - Spartina pectinata - Schizachyrium scoparium - Oligoneuron ohioense Herbaceous Vegetation

Tufted Hairgrass - Prairie Cordgrass - Little Bluestem - Ohio Goldenrod Herbaceous Vegetation

Midwest Wet-mesic Dolomite Prairie CEGL005180

DESCRIPTION: This community has a dense cover of herbaceous vegetation. The most abundant species include *Calamagrostis canadensis, Carex sartwellii, Carex scoparia, Carex sterilis, Arnoglossum plantagineum, Deschampsia caespitosa, Clinopodium arkansanum (= Satureja arkansana), Schizachyrium scoparium, Oligoneuron ohioense (= Solidago ohioensis)*, and *Spartina pectinata*. Woody species are virtually absent (White and Madany 1978).

This community is found on shallow, temporarily flooded or frequently saturated soil over dolomite bedrock (White and Madany 1978).

COMMENTS: *1, MCS*. Type concept was taken from Illinois state classification - wet and wet-mesic dolomite prairie (White and Madany 1978). Type was included as part of an alvar analysis to determine whether it might fit the alvar category. After review the alvar working group decided that although the moisture regime was similar to alvars, the soils were in general deeper. This community also appears to depend on frequent fires and has many distinctive prairie species not found in alvars (Reschke et al. 1998).

CONSERVATION RANK: *G1G2*. There are probably fewer than 20 occurrences of this community rangewide. It is reported only from Illinois, where it is ranked S2. Currently there are 5 occurrences documented from Illinois. There are probably fewer than 500 acres of this community rangewide. Currently 119 acres have been documented, and the average size is about 24 acres. Historical acreage is unknown, but some acreage has been destroyed by dolomite quarry construction. Some sites may have been degraded by fire suppression or by alterations to the hydrologic regime. The range is restricted: this community is found in northeastern Illinois; it may have historically occurred in Indiana.

DISTRIBUTION: This community type is a grassland found in northeastern Illinois on shallow, temporarily flooded or frequently saturated soil over dolomite bedrock.

USFS ECOREGIONS: 222Kg:CCC
CONSERVATION REGIONS: 48:C
STATES: IL **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL wet dolomite prairie; wet-mesic dolomite prairie -

OTHER SYNONYMY:

USNVC HIERARCHY: SPARTINA PECTINATA TEMPORARILY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.j)

Schizachyrium scoparium - Bouteloua curtipendula - Muhlenbergia cuspidata - Symphyotrichum sericeum Alkaline Herbaceous Vegetation

Little Bluestem - Sideoats Grama - Stony-hills Muhly - Silky Aster Alkaline Herbaceous Vegetation

North-central Dry Limestone - Dolomite Prairie CEGL002403

DESCRIPTION: These medium-tall grasslands are composed of a dominant graminoid layer intermixed with abundant forbs. Dominant grasses include *Schizachyrium scoparium* and *Bouteloua curtipendula*. Some forbs that are typical of these calcareous grasslands include *Symphyotrichum sericeum (= Aster sericeus), Blephilia ciliata, Brickellia eupatorioides (= Kuhnia eupatorioides), Desmanthus illinoensis, Lithospermum canescens, Eleocharis compressa, Clinopodium arkansanum (= Satureja arkansana), Muhlenbergia cuspidata, Penstemon hirsutus*, and *Scutellaria parvula* (White and Madany 1978).

This calcareous grassland community occurs on mid and upper slopes of rolling hills. It occupies primarily southern and western aspects, on soils that are very shallow to moderately deep (0-40 cm) and well-drained to somewhat rapidly drained. The soil pH is high due to the calcareous bedrock at or near the surface, which is either limestone, dolomite, or shaley limestone (White and Madany 1978).

This community is influenced by drought stress and fire. The average burn frequency varies between 3 and 5 years.

COMMENTS: *2, MCS*. The concept of the type is derived from the Illinois "dry (limestone/) dolomite prairie" types. This type needs to be compared with bedrock bluff prairies, *Schizachyrium scoparium - Bouteloua curtipendula* Bedrock Bluff Herbaceous Vegetation (CEGL002245), which is primarily found in the "Driftless Area" or "Paleozoic Plateau" region of Minnesota, Wisconsin, Iowa, and Illinois, and which in Illinois is restricted to the northwest corner of the state (222Lc, 22Le). But, as this type occurs in Illinois primarily in 222K, it may be that this type is essentially synonymous with CEGL002245. Reports of the type in Madison County, Iowa (251Cc), need further documentation.

CONSERVATION RANK: *G2.* There are probably fewer than 30 occurrences of this community rangewide. This type has a relatively restricted natural distribution. It is reported from the Rock River Hill country and along the lower Kankakee River in Illinois (where it is ranked S2). Currently over 15 occurrences have been documented. Some occurrences have been destroyed or degraded by quarrying.

DISTRIBUTION: This calcareous grassland community is found in parts of the northern prairie-forest border in the midwestern United States, particularly in Illinois.

USFS ECOREGIONS: 222Kh:CCC, 251Cc:CCC, 251Dd:CCC
CONSERVATION REGIONS: 36:C, 46:C
STATES: IL **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL dry dolomite prairie -

OTHER SYNONYMY:

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - BOUTELOUA CURTIPENDULA HERBACEOUS ALLIANCE (V.A.5.N.c)

Schizachyrium scoparium - Bouteloua curtipendula Bedrock Bluff Herbaceous Vegetation

Little Bluestem - Sideoats Grama Bedrock Bluff Herbaceous Vegetation

Little Bluestem Bedrock Bluff Prairie CEGL002245

DESCRIPTION: The vegetation is dominated by grasses or, locally, low shrubs. Trees may be present, but tree canopy cover is less than 10%. Grasses are less than 1 m tall. *Schizachyrium scoparium, Bouteloua curtipendula, Sporobolus heterolepis*, and *Andropogon gerardii* are abundant grasses across this community's range. Forbs that are common include *Amorpha canescens, Symphyotrichum sericeum (= Aster sericeus), Dalea purpurea var. purpurea, Dichanthelium linearifolium, Euphorbia corollata*, and *Solidago nemoralis* (Curtis 1959, MNNHP 1993). There is a high degree of uniformity among different stands of this community in Wisconsin. The greatest differences are between those prairies on the Mississippi River and those in Dane County and other more eastern locations (Umbanhowar 1992). Although noticeable, these differences are minor and reflect slight changes in importance along an east-west gradient. Species that do best toward the east include *Minuartia michauxii var. michauxii, Asclepias verticillata*, and *Geum triflorum*, while those that do best along the Mississippi River include *Symphyotrichum oblongifolium (= Aster oblongifolius), Bouteloua hirsuta*, and *Scutellaria parvula var. missouriensis (= Scutellaria parvula var. leonardii)*. In addition, *Muhlenbergia cuspidata* and *Pediomelum esculentum* are restricted to the Driftless Area.

This community occurs on very thin soils on limestone ridges and steep hillsides, usually with a southwest aspect. The low water storage capacity of the soil, the strong insolation of southwest slopes, and exposure to high winds make these sites prone to high desiccation. It is likely that these prairies receive significant quantities of water from condensation rather than precipitation. The organic content of the soil acts as a sponge to hold the condensate.

These dry prairie soils occupy the highest position on the moisture catena. The runoff of rainwater is very rapid on the slopes. There is continual movement of soil particles so the soil remains very thin except where dissolution pockets occur in the underlying limestone. The soil may be less than 10 cm deep over extensive areas. Both water retention and nutrient content in the actual soils are very good, but the thinness of the layers means that the total available quantity of either is quite limited. There is great uniformity from prairie to prairie in many of the soil chemical properties. The average pH is 7.8. The soil groups are Brunizem and Melanized Rendzina (Curtis 1959, MNNHP 1993).

This community is structurally very stable and not very dependent on fire. Moisture conditions on these sites are so severe that trees and most woody species cannot grow. However, long-term absence of fire may lead to woody encroachment (MNNHP 1993).

COMMENTS: *2, MCS*.

CONSERVATION RANK: *G3G4.* Three hundred and forty-one occurrences have been documented: 239 in Minnesota (where the community is ranked S3), 57 in Iowa (S2?), 43 in Wisconsin (S3), and 2 in Illinois (S1,S1). The community occurs in 12 ecoregional subsections. There are probably fewer than 10,000 acres rangewide. Sizes of 334 occurrences total 2690 acres. This community is found on very thin soils on limestone ridges and steep hillsides, usually with a southwestern aspect. Lack of fire permits invasion by more woody vegetation.

DISTRIBUTION: This little bluestem bluff prairie community occurs primarily in the Driftless Area of the upper midwestern United States, particularly in southern Wisconsin, northern Illinois, northeastern Iowa, and southeastern Minnesota.

USFS ECOREGIONS: 222Ka:CCC, 222Ke:CCC, 222Kh:CCC, 222Lb:CCC, 222Lc:CCC, 222Ld:CCC, 222Le:CCC, 222Lf:CCC, 222Md:CCC, 222Me:CCC, 251Ch:CCC, 251Da:CCC
CONSERVATION REGIONS: 36:C, 46:C
STATES: IA IL MN WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	dry prairie (N) =
MN	dry prairie (southeast section) bedrock bluff subtype =
WI	dry prairie (bedrock bluff subtype) =

OTHER SYNONYMY:

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - BOUTELOUA CURTIPENDULA HERBACEOUS ALLIANCE (V.A.5.N.c)

Schizachyrium scoparium - Sorghastrum nutans - Andropogon ternarius - Coreopsis grandiflora Sandstone - Shale Herbaceous Vegetation

Little Bluestem - Yellow Indiangrass - Splitbeard Bluestem - Bigflower Coreopsis Sandstone - Shale Herbaceous Vegetation

Midwest Sandstone / Shale Prairie CEGL002212

DESCRIPTION: The vegetative structure of this midgrass prairie is composed of a single layer of dominant graminoids intermixed with abundant forbs. Shrubs may be present; mosses are often common. There are areas of exposed mineral soil or bedrock. *Schizachyrium scoparium, Sorghastrum nutans*, and *Sporobolus heterolepis* are the dominant species. Many other species may be present, including *Andropogon ternarius, Astragalus distortus, Agrostis elliottiana, Liatris pycnostachya, Sabatia campestris, Solidago speciosa, Triodanis leptocarpa, Viola sagittata*, and *Viola pedata* (Nelson 1985, Lauver et al. 1999).

This community occurs on gentle to steep slopes of plains, hills, and ridges. Soils are well-drained to somewhat rapidly drained and very shallow to moderately deep (0-100 cm). The parent material is sandstone or shale. The soil is often intermixed with rock fragments or sandstone bedrock, which may be exposed at the surface. There may be an impermeable to semi-impermeable layer of clay and loam soils (Nelson 1985, Lauver et al. 1999).

This community is influenced by drought and fire. The average burn frequency is every 5 years (Nelson 1985).

COMMENTS: *3, MCS*. Type concept is taken from both the Missouri and Kansas state types - sandstone prairie (Nelson 1985, Lauver et al. 1999). Missouri types include both dry and dry-mesic sandstone/shale prairies, but future revisions to the Missouri state classification may combine dry sandstone/shale prairies with sandstone glades, or treat them as inclusions within dry-mesic sandstone/shale prairies. Floristic patterns that distinguish this type from other dry to dry-mesic prairie types need further investigation.

CONSERVATION RANK: *G3.* Ten occurrences have been documented in Kansas, where the community is ranked SU, and 123 have been documented in Missouri (S2,S3). The community occurs in 5 ecoregional subsections. Sizes for 133 occurrences total 17,000 acres, and there are probably fewer than 100,000 acres rangewide. Many sites of this community have been converted to cropland or pasture, but large tracts remain in western Missouri. Lack of fire may permit more woody species to invade this community.

DISTRIBUTION: This bluestem sandstone/shale prairie community is found in the central-western tallgrass region of the midwestern United States, particularly in southwestern Missouri and southeastern Kansas.

USFS ECOREGIONS: 222Ab:CCC, 222Ac:CCC, 222Am:CCC, 251Ea:CCC, 251Eb:CCC
CONSERVATION REGIONS: 37:C, 38:C
STATES: KS MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO dry sandstone/shale prairie; dry-mesic sandstone/shale prairie -

OTHER SYNONYMY:

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - SORGHASTRUM NUTANS HERBACEOUS ALLIANCE (V.A.5.N.a)

Schizachyrium scoparium - Sorghastrum nutans - Clinopodium arkansanum Alkaline Herbaceous Vegetation

Little Bluestem - Yellow Indiangrass - Low Calamint Alkaline Herbaceous Vegetation

North-central Dry-mesic Limestone - Dolomite Prairie CEGL005179

DESCRIPTION: The vegetation in this community is typically medium dense and dominated by a combination of mid and tall grasses. *Schizachyrium scoparium* and *Sorghastrum nutans* are the most abundant grasses. *Andropogon gerardii* and *Hesperostipa spartea (= Stipa spartea)* may also be present. Other frequently occurring herbaceous species include *Asclepias tuberosa, Carex meadii, Camassia scilloides, Desmanthus illinoensis, Dodecatheon meadia, Echinacea pallida, Eleocharis compressa, Galium boreale, Lithospermum canescens, Dalea purpurea (= Petalostemon purpureus)*, and *Clinopodium arkansanum (= Satureja arkansana)*. Woody species, such as *Cornus foemina* and *Juniperus virginiana*, are sometimes found, especially where fire has not occurred for long periods. Braun (1928a) found *Manfreda virginica* to be abundant in southern Ohio.

Stands of this community are usually found on hillslopes of south to west aspects (Braun 1928a). The soil is typically well-drained, shallow to moderately deep (40-100 cm) and formed over dolomite or limestone (White and Madany 1978, Nelson 1985). The soil is neutral to slightly alkaline (Braun 1928a) and contains numerous stones. Bedrock outcrops are frequently present.

COMMENTS: *2, MCS*. The concept of this type is based on Illinois' dry-mesic dolomite prairie' and 'mesic dolomite prairie.' White and Madany (1978) note that deep-soil prairie species, such as *Baptisia alba var. macrophylla (= Baptisia leucantha), Baptisia bracteata var. leucophaea (= Baptisia leucophaea), Silphium laciniatum*, and *Silphium terebinthinaceum*, are absent from these bedrock-influenced prairies. In Ohio this type may be in Adams County, but see *Juniperus virginiana / Schizachyrium scoparium - Silphium terebinthinaceum var. luciae-brauniae - Carex juniperorum - Castilleja coccinea* Wooded Herbaceous Vegetation (CEGL004464).

CONSERVATION RANK: *G2.* There are probably fewer than 20 occurrences of this community rangewide. It is reported from Illinois (where it is ranked S2), and it may also occur in Ohio. Currently 3 occurrences, totaling 45 acres, are documented from Illinois. There are probably fewer than 500 acres of this community rangewide. Historical acreage is unknown, but some sites have been destroyed by limestone or dolomite quarry construction, and most sites have been degraded by fire suppression. This community has somewhat restricted environmental requirements. It is reported from two ecoregion subsections in two provinces.

DISTRIBUTION: This dry-mesic to mesic alkaline grassland community is found in the northern prairie-forest border region of the midwestern United States, particularly in Illinois and Ohio.

USFS ECOREGIONS: 222Kg:CCC, 251Dd:CCC
CONSERVATION REGIONS: 36:C
STATES: IL OH? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL mesic dolomite prairie; dry-mesic dolomite prairie -
OH? little bluestem prairie ?

OTHER SYNONYMY: *Andropogon - Bouteloua* Association (Braun 1928a) =

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - SORGHASTRUM NUTANS HERBACEOUS ALLIANCE (V.A.5.N.a)

Schizachyrium scoparium - Sorghastrum nutans - Danthonia spicata - Silene regia Chert Herbaceous Vegetation

Little Bluestem - Yellow Indiangrass - Poverty Oatgrass - Royal Catchfly Chert Herbaceous Vegetation

Midwest Chert Prairie CEGL002211

DESCRIPTION: The vegetative structure is composed of a single layer of dominant graminoids intermixed with abundant forbs. This community is a midgrass prairie. The dominant grasses are *Andropogon virginicus, Schizachyrium scoparium*, and *Sorghastrum nutans*. Other typical plants found in this community are *Callirhoe digitata, Danthonia spicata, Helianthus occidentalis, Monarda russeliana, Silene regia*, and *Vernonia arkansana* (Nelson 1985).

This community occurs on hills and plains on gentle to steep slopes and ridges of all aspects, including neutral. The soil is well-drained to somewhat rapidly drained and very shallow to shallow (0-40 cm). The parent material is chert or chert residuum. Chert fragments are common on the surface (Nelson 1985).

COMMENTS: *2, MCS*. Concept of this type is taken from Missouri state type - dry and dry-mesic chert prairies (Nelson 1985). *Silene regia* is characteristic. Most of the original area of this community has been converted to cropland or pasture. This grassland is influenced by drought stress and is maintained by fire. The average burn frequency is one to five years. It is possible that similar sites may occur in Kansas and Oklahoma, but further review is needed. This type represents what is found at Baker Prairie Natural Area, Arkansas (D. Zollner pers. comm. 1999).

CONSERVATION RANK: *G3.* This community is somewhat rare. Over 90 sites have been documented in Missouri. Some sites have been protected. Most of the original area of this community has been converted to cropland or pasture.

DISTRIBUTION: This bluestem chert prairie community is found in central and southwestern Missouri.

USFS ECOREGIONS: 222Ab:CCC, 222Ac:CCC, 222Ai:CCC, 222Am:CCC, 251Ea:CCC, 251Eb:CCC, 251F:C?
CONSERVATION REGIONS: 37:C, 38:C, 39:?
STATES: AR? MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO dry chert prairie; dry-mesic chert prairie -

OTHER SYNONYMY:

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - SORGHASTRUM NUTANS HERBACEOUS ALLIANCE (V.A.5.N.a)

Schizachyrium scoparium - Sorghastrum nutans - Tradescantia bracteata Alkaline Bedrock Herbaceous Vegetation

Little Bluestem - Yellow Indiangrass - Sticky Spiderwort Alkaline Bedrock Herbaceous Vegetation

Central Dry-mesic Limestone - Dolomite Prairie CEGL005280

DESCRIPTION: The vegetation in this community is typically medium dense and dominated by a combination of mid and tall grasses. *Schizachyrium scoparium, Sorghastrum nutans*, and *Andropogon gerardii* are common dominants. Other frequently occurring herbaceous species include *Baptisia australis, Carex meadii, Camassia scilloides, Dodecatheon meadia, Echinacea pallida, Nothocalais cuspidata (= Agoseris cuspidata), Nemastylis geminiflora, Psoralidium tenuiflorum (= Psoralea tenuiflora)*, and *Tradescantia bracteata*. Woody species, such as *Juniperus virginiana*, are sometimes found, especially where fire has not occurred for long periods (Nelson 1985).

Stands of this community are usually found on hillslopes of southern to western aspects. The soil is typically well-drained, shallow to moderately deep (40-100 cm), and formed over dolomite or limestone (Nelson 1985). Bedrock outcrops are frequently present.

COMMENTS: *2, MCS*. The concept of this type is based on Missouri's 'dry-mesic limestone/dolomite prairie' (Nelson 1985). Dry limestone/dolomite prairie is also tracked here, but in future revisions to the Missouri state classification, that type will be merged with either limestone glade or dolomite glade types (M. Leahy pers. comm. 1999).

CONSERVATION RANK: *G1G2*. There are probably fewer than 20 occurrences of this community rangewide. It is reported from Missouri (S1). Eleven occurrences are documented for Missouri, of which at least 2 are not viable. There are probably fewer than 500 acres of this community rangewide. Historical acreage is unknown, but some sites have been destroyed by limestone or dolomite quarry construction, and most sites have been degraded by fire suppression. This community has somewhat restricted environmental requirements.

DISTRIBUTION: This dry-mesic alkaline grassland community is found in the central midwestern United States, in Missouri.

USFS ECOREGIONS: 222Am:CCC, 251Eb:CCC
CONSERVATION REGIONS: 36:?, 37:C, 38:C
STATES: MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO dry limestone/dolomite prairie; dry-mesic limestone/dolomite prairie -

OTHER SYNONYMY:

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - SORGHASTRUM NUTANS HERBACEOUS ALLIANCE (V.A.5.N.a)

Andropogon gerardii - (Panicum virgatum) - Muhlenbergia richardsonis Herbaceous Vegetation

Big Bluestem - (Switchgrass) - Mat Muhly Herbaceous Vegetation

Northern Wet-mesic Tallgrass Prairie CEGL002199

DESCRIPTION: The vegetation is dominated by a dense layer of tall grasses, such as *Andropogon gerardii* and *Panicum virgatum*, with associates of *Calamagrostis canadensis, Calamagrostis stricta*, and *Spartina pectinata*. *Muhlenbergia richardsonis* may be a diagnostic, less dominant species of the northern tallgrass prairie (Diamond and Smeins 1988). In the Sheyenne Delta, this type may form a distinctive wet-mesic sand prairie type.

In South Dakota, soils are moist loams and poorly drained silt loams derived from glacial drift.

COMMENTS: *3, MCS*. In North Dakota, there is a sandy subtype in the Sheyenne Delta that may need to be distinguished from this type. Occurrences there may also match with the wet prairie type, *Spartina pectinata - Calamagrostis stricta - Carex spp*. Herbaceous Vegetation (CEGL002027). This wet-mesic prairie type may also overlap with mesic prairie types in floristic composition.

CONSERVATION RANK: *G3G4.* Much of the former range of this community is now occupied by agriculture.

DISTRIBUTION: This big bluestem wet-mesic prairie type is found in the northern tallgrass prairie region of the United States and Canada, extending from northwestern Iowa and the Dakotas north to Manitoba, and possibly Saskatchewan.

USFS ECOREGIONS: 222Na:CCC, 251Aa:CCC, 251Ab:CCC, 251Ba:CCC, 251Bb:CCC, 251Be:CCC
CONSERVATION REGIONS: 26:C, 35:C
STATES: IA MN ND SD **PROVINCES:** MB SK

MIDWEST HERITAGE SYNONYMY: MN wet prairie (central section); wet prairie (northwest section); wet prairie (southwest section) I

OTHER SYNONYMY:

USNVC HIERARCHY: ANDROPOGON GERARDII - (CALAMAGROSTIS CANADENSIS, PANICUM VIRGATUM) HERBACEOUS ALLIANCE (V.A.5.N.a)

Andropogon gerardii - Calamagrostis canadensis - Pycnanthemum virginianum - Oligoneuron ohioense Herbaceous Vegetation

Big Bluestem - Bluejoint - Virginia Mountain-mint - Ohio Goldenrod Herbaceous Vegetation

Lakeplain Wet-mesic Prairie CEGL005095

DESCRIPTION: The vegetation of this community is dominated by tallgrass species typically 1-2 m high. Trees and shrubs are very rare. There is very little bare ground. *Andropogon gerardii, Carex* spp. (*Carex bicknellii, Carex buxbaumii, Carex pellita (= Carex lanuginosa)), Panicum virgatum, Schizachyrium scoparium*, and *Sorghastrum nutans* are the most abundant species. Diagnostic species include *Andropogon gerardii, Panicum virgatum, Pedicularis lanceolata, Pycnanthemum virginianum, Schizachyrium scoparium, Sorghastrum nutans, Oligoneuron ohioense (= Solidago ohioensis)*, and *Vernonia gigantea ssp. gigantea (= Vernonia altissima)*. *Coreopsis tripteris* and *Aletris farinosa* are also good mesic to wet-mesic indicators (Faber-Langendoen and Maycock 1994, Comer et al. 1995b).

This community occurs on level, sandy glacial outwash, sandy glacial lakeplains, and deposits of dune sand in silty/clayey glacial lakeplains. The soils are sands, sandy loams, loams, or silty clays with poor to moderate water-retaining capacity. In extreme southern Ontario the A horizon of the soils averaged 33 cm deep and 10% organic matter (Faber-Langendoen and Maycock 1994). There may be temporary inundations after heavy rains or in the spring, but due to the rapid drainage, moderate drought conditions are common in the summer.

Wildfires may have played a role in maintaining these systems in the past (Faber-Langendoen and Maycock 1987, 1994, Comer et al. 1995b).

COMMENTS: *2, MCS*. Concept of the type is derived in part from the Michigan state classification type - lakeplain wet-mesic prairie (Chapman et al 1989).

CONSERVATION RANK: *G2*. There are probably fewer than 100 occurrences rangewide. Thirty-seven have been documented: 6 in Illinois (where the community is ranked S2,S1), 13 in Indiana (S2), 17 in Michigan (S1?), and 1 in Ohio (S1). The community is also be found in Wisconsin (S1), where the one and only occurrence is at Chiwaukee Prairie. It is also extensively documented in southwestern Ontario on Walpole Island and at Windsor. It occurs in 8 ecoregional subsections. Sizes of 33 occurrences total 1500 acres. The community has nearly been eliminated in many places, with most sites converted to cropland. Lack of fire may also permit increased dominance by woody species. The community is found on level, sandy glacial outwash and lake plains or on deposits of sand on silty/clayey glacial lake plains.

DISTRIBUTION: This grassland community is found near the southern central Great Lakes of the United States and Canada, from southeastern Wisconsin and northeastern Illinois to southern Michigan and southwestern Ontario.

USFS ECOREGIONS: 222If:CCC, 222Jb:CCC, 222Jd:CCC, 222Je:CCC, 222Jj:CCC, 222Kg:CCC, 222Ki:CCC, 222Qb:CCC
CONSERVATION REGIONS: 48:C
STATES: IL IN MI OH WI **PROVINCES:** ON

MIDWEST HERITAGE SYNONYMY:

IL	wet-mesic sand prairie +
IN	wet-mesic sand prairie +
MI	lakeplain wet-mesic prairie =
OH	big bluestem prairie +
WI	wet-mesic prairie (lakeplain subtype) =

OTHER SYNONYMY: Wet-mesic sandy prairies (Faber-Langendoen and Maycock 1994) F, Wet-mesic sandy loam prairie (Faber-Langendoen and Maycock 1994) F, Lakeplain wet-mesic prairie (Comer et al. 1995b) =

USNVC HIERARCHY: ANDROPOGON GERARDII - (CALAMAGROSTIS CANADENSIS, PANICUM VIRGATUM) HERBACEOUS ALLIANCE (V.A.5.N.a)

Andropogon gerardii - Hesperostipa spartea - Sporobolus heterolepis Herbaceous Vegetation

Big Bluestem - Porcupine Grass - Prairie Dropseed Herbaceous Vegetation

Northern Mesic Tallgrass Prairie CEGL002202

DESCRIPTION: This is a grassland community with dense vegetation dominated by tall grasses 1-2 m tall. Forbs are abundant and often have high local diversity. Clumps of trees and tall brush can often be found along the boundary between wetlands and this community. Otherwise, woody vegetation is rare. *Andropogon gerardii* and *Sorghastrum nutans* are the most abundant species in this community. *Amorpha canescens, Symphyotrichum ericoides (= Aster ericoides)*, and *Solidago canadensis* are common forbs across this community's range.

Soils of this community are black, friable, organic-rich and have surface horizons that are high in bases. Heidel (1984b) found clay loam soils at her two study sites. During the warm season, soils are intermittently dry for long periods or have subsurface horizons in which salts or carbonates have accumulated.

Fire plays an important role in the maintenance of this prairie type (Grimm 1984).

COMMENTS: *1, MCS*. In Iowa, this type is found in the northwestern region, where *Hesperostipa spartea (= Stipa spartea)* may be indicative. Minnesota mesic prairie includes both this type and the wet-mesic prairie, *Andropogon gerardii - (Panicum virgatum) - Muhlenbergia richardsonis* Herbaceous Vegetation (CEGL002199) (MNNHP 1993). Indicator species are needed that would help separate this type from central tallgrass prairies (*Andropogon gerardii - Sorghastrum nutans - (Sporobolus heterolepis) - Liatris spp. - Ratibida pinnata* Herbaceous Vegetation (CEGL002203)). Westward in the Great Plains, this type is replaced by *Andropogon gerardii - Sporobolus heterolepis - Schizachyrium scoparium - Pascopyrum smithii* Herbaceous Vegetation (CEGL002376) (see e.g. Diamond and Smeins 1988, White and Glenn-Lewin 1984).

CONSERVATION RANK: *G2G3*. Much of the former range of this community is now occupied by agriculture.

DISTRIBUTION: This mesic big bluestem prairie community is found in the northern tallgrass prairie region of the United States and Canada, ranging from northwestern Iowa and South Dakota, north to Manitoba.

USFS ECOREGIONS: 222Ma:CCC, 222Me:CCC, 222Na:CCC, 251Aa:CCC, 251Ab:CCC, 251Ba:CCC, 251Bb:CCC, 251Bc:CCC, 251Bd:CCC, 251Be:CCC, 251Bf:CCC, 251Ch:CCC
CONSERVATION REGIONS: 34:C, 35:C, 46:C
STATES: IA MN ND SD **PROVINCES:** MB

MIDWEST HERITAGE SYNONYMY: MN mesic prairie (northwest section); mesic prairie (southwest section); mesic prairie (southwest section) crystalline bedrock subtype; mesic prairie (central section); mesic prairie (central section) carbonate bedrock subtype -

OTHER SYNONYMY:

USNVC HIERARCHY: ANDROPOGON GERARDII - (SORGHASTRUM NUTANS) HERBACEOUS ALLIANCE (V.A.5.N.a)

Andropogon gerardii - Panicum virgatum - Helianthus grosseserratus Herbaceous Vegetation

Big Bluestem - Switchgrass - Sawtooth Sunflower Herbaceous Vegetation

Central Wet-mesic Tallgrass Prairie CEGL002024

DESCRIPTION: This community is an extensive grassland with a tree canopy of less than 10%. There is a single layer of dominant graminoids intermixed with abundant forbs. All of the dominant grasses are tall grasses. *Andropogon gerardii* and *Spartina pectinata* can exceed 2 m in height in this wet-mesic community. *Panicum virgatum* is usually somewhat shorter but still greater than 1 m tall. Other typical plants found in this community in Missouri are *Juncus interior, Tripsacum dactyloides, Helianthus grosseserratus, Potentilla simplex, Eryngium yuccifolium*, and *Carex bicknellii*. *Calamagrostis canadensis* is more common northward. Species diversity does not tend to be as high as in more mesic grassland communities (White and Madany 1978, Nelson 1985, MNNHP 1993, Lauver et al. 1999, Steinauer and Rolfsmeier 2000).

This community occurs in narrow draws of headwaters of small streams, depressions of terraces (sometimes uplands), and on floodplains of larger streams and rivers. The soil is somewhat poorly drained and deep (100 cm or more). The parent material is typically alluvium. In headwater draws loess, glacial till, or deeply weathered rock are likely to be the parent material. Surface water is often present after heavy rains and in the winter and spring.

Some stands occur on sandy outwash plains, lakeplains, and shallow swales. The soils are sands, loamy sands, and sandy loams. They are imperfectly or somewhat imperfectly drained. The soils often have a slowly permeable layer within the profile, a high water table, additions of moisture through seepage, or a combination of several of these conditions. They have deep, acidic, dark A horizons which are high in organic matter. There is faint evidence of gleying immediately beneath the A horizon (White and Madany 1978, Nelson 1985, MNNHP 1993, Lauver et al. 1999, Steinauer and Rolfsmeier 2000).

Fire plays a role in the maintenance of this wet-mesic prairie, with an average fire frequency of every two to five years. Woody species can become more abundant in the absence of fire. (Nelson 1985).

COMMENTS: *2, MCS*. This community has nearly been eliminated because of conversion to cropland. Although Kansas may be expected to have this community type, it is not recognized there (Lauver et al. 1999). The concept of this community is very broad, including both glaciated and unglaciated regions, because it was felt that the influence of alluvium overrode old Kansan glacial effects. Further divisions may be warranted. In Wisconsin, wet-mesic prairies on river terraces, e.g. Avoca Prairie on the lower Wisconsin River, may represent a wet-mesic sand prairie type, namely *Andropogon gerardii - Calamagrostis canadensis* Sand Herbaceous Vegetation (CEGL005177).

CONSERVATION RANK: *G2G3.* One hundred and nineteen occurrences have been documented: 2 in Iowa (where the community is ranked S1), 22 in Illinois (S1,S1), 7 in Michigan (S2), 23 in Missouri (S1), 26 in Nebraska (S2), and 39 in Wisconsin (S2). Although no other occurrences have been documented, the community is reported in Minnesota (S1S2) and Oklahoma (S?), probably occurs in Kansas, and possibly occurs in Arkansas and Indiana (both SP). It occurs in 31 ecoregional subsections. Sizes of 107 occurrences range from 1 to 1000 acres, totaling 5700 acres. Two possible occurrences in Kansas are 15 and 13,000 acres. This community has nearly been eliminated. Most areas have been converted to cropland. Lack of fire may permit increased dominance by woody species. The community is found in shallow depressions, usually near streams or rivers, with deep, poorly-drained, loamy soils. Surface water is often present after heavy rain in winter and spring.

DISTRIBUTION: This wet-mesic tallgrass prairie community is found widely throughout the central midwestern United States, extending from Indiana northwest to Minnesota, south to possibly Kansas and Arkansas, and east to possibly Kentucky.

USFS ECOREGIONS: 212He:CCC, 222Ab:CCC, 222Am:CCC, 222Ao:CCC, 222F:CC, 222Gb:CCC, 222Ha:CCC, 222Jg:CCC, 222Jh:CCC, 222Kb:CCC, 222Kc:CCC, 222Kd:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Ki:CCC, 222Lc:CCC, 222Ld:CCC, 234Ae:CC?, 251Ca:CCP, 251Cb:CCP, 251Cc:CCC, 251Cd:CCP, 251Ce:CCP, 251Cf:CCC, 251Cg:CCC, 251Ch:CCP, 251Ci:CCP, 251Cj:CCC, 251Ck:CCP, 251Cm:CCC, 251Cn:CCC, 251Co:CCP, 251Cp:CCC, 251Cq:CCP, 251Da:CCP, 251Db:CCP, 251Dc:CCC, 251Dd:CCC, 251De:CCP, 251Df:CCP, 251Dg:CCC, 251Ea:CCC, 251Eb:CCC, 251F:C?, 332:P

CONSERVATION REGIONS: 33:C, 36:C, 37:C, 38:C, 39:?, 42:C, 44:P, 46:C, 48:C

STATES: AR IA IL IN KS? KY? MI MN MO NE OK WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	wet-mesic prairie (S); wet-mesic prairie (N) -
IN	mesic prairie +
MI	inland wet-mesic prairie; northern wet-mesic prairie -
MN	wet prairie (central section); wet prairie (southeast section) I
MO	wet-mesic prairie =
NE	wet-mesic tallgrass prairie =
WI	wet-mesic prairie (inland subtype) =

OTHER SYNONYMY: ID4a. Bluestem Tallgrass Prairie, in part (Allard 1990), T5A1aI1b. *Panicum virgatum* (Foti et al. 1994)

USNVC HIERARCHY: ANDROPOGON GERARDII - (CALAMAGROSTIS CANADENSIS, PANICUM VIRGATUM) HERBACEOUS ALLIANCE (V.A.5.N.a)

Andropogon gerardii - Sorghastrum nutans - (Sporobolus heterolepis) - Liatris spp. - Ratibida pinnata Herbaceous Vegetation

Big Bluestem - Yellow Indiangrass - (Prairie Dropseed) - Blazingstar Species - Gray-head Prairie Coneflower Herbaceous Vegetation

Central Mesic Tallgrass Prairie CEGL002203

DESCRIPTION: This is a tallgrass mixed herbaceous community dominated by perennial C4 bunch and sod grasses. Trees are rare to absent. The height of the dominant plants ranges from 0.5-2.0 m. Cover is high, 85-95% is typical. Ninety-five percent of the plant species are perennial. Forb species composition varies more than grass composition from site to site. *Andropogon gerardii, Symphyotrichum ericoides (= Aster ericoides), Dalea candida, Eryngium yuccifolium, Helianthus pauciflorus ssp. pauciflorus, Ratibida pinnata, Rosa carolina, Schizachyrium scoparium, Sporobolus heterolepis, Oligoneuron rigidum (= Solidago rigida)*, and *Sorghastrum nutans* are abundant throughout this community's range. *Amorpha canescens*, a subshrub species, and *Salix humilis* are also typically present.

Soils are characteristically deep (>100 cm) silty clay loams and silty loams, which occur in the glaciated portions of the Midwest. Soils are derived from glacial till or unaltered loess, or are in the Driftless Area. Soil drainage is intermediate and nutrient content is high. The pH ranges from slightly acid to circumneutral. Topography varies from level to moderately sloping on uplands of glacial outwash and till plains.

COMMENTS: *1, MCS*. Note, in Iowa, the Southern Mesic Prairie includes the northeastern part of the state (Iowan Surface). In Ohio this type is found at Castalia Prairie. Characteristic forb of this type in the central part of its range (but absent from Ohio and Michigan) is *Silphium laciniatum*. Relation to tallgrass prairie in Kentucky needs review. Nebraska historically had much more loess tallgrass prairie, *Andropogon gerardii - Sorghastrum nutans - Hesperostipa spartea* Loess Hills Herbaceous Vegetation (CEGL002025), but virtually all of that has been plowed up. Remaining sites are either on heavily eroded loess sites or glacial till sites that are difficult to plow, blurring what distinction there might have been between these two types (G. Steinauer pers. comm. 2000, Steinauer and Rolfsmeier 2000).

CONSERVATION RANK: *G1G2*. This community has nearly been eliminated from its former range. Most former sites have been converted to cropland, pasture, or development. Others are succeeding to forest or woodland in the absence of fire. Many remaining sites are along rights-of-way (roads, railroads, utilities) and long term viability is problematic.

DISTRIBUTION: This mesic tallgrass prairie grassland community is found primarily in the glaciated central midwestern United States, ranging from western Ohio and Michigan west to east-central Minnesota, south to northern Missouri, and east to Indiana.

USFS ECOREGIONS: 222D:C?, 222E:C?, 222Fd:C??, 222Ga:CCC, 222Gb:CCC, 222Ge:CCC, 222Ha:CCC, 222Hb:CCC, 222He:CCC, 222Hf:CCC, 222If:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ka:CCC, 222Kc:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Ki:CCC, 222Kj:CCC, 222Lc:CCC, 222Le:CCC, 222Lf:CCC, 222Ma:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 251Bd:CCC, 251Ca:CCC, 251Cb:CCC, 251Cc:CCC, 251Cd:CCP, 251Ce:CCP, 251Cf:CCC, 251Ch:CCC, 251Ci:CCC, 251Cj:CCC, 251Ck:CCP, 251Cm:CC?, 251Cp:CCC, 251Cq:CCC, 251Da:CCP, 251Db:CCP, 251Dc:CCC, 251Dd:CCC, 251De:CCC, 251Df:CCP, 251Dg:CCC, 251Dh:CCC

CONSERVATION REGIONS: 35:C, 36:C, 44:C, 45:C, 46:C, 48:C

STATES: IA IL IN KS MI MN MO NE? OH WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	mesic prairie (N); mesic prairie (S) -
IN	mesic prairie +
MI	mesic prairie =
MN	mesic prairie (southeast section); mesic prairie (central section) -
MO	mesic prairie +
NE?	tallgrass prairie ?
OH	big bluestem prairie +
WI	mesic prairie =

OTHER SYNONYMY: Mesic, impeded drainage type (White and Glenn-Lewin 1984) F, Wet-mesic, unimpeded drainage type (White and Glenn-Lewin 1984) F

USNVC HIERARCHY: ANDROPOGON GERARDII - (SORGHASTRUM NUTANS) HERBACEOUS ALLIANCE (V.A.5.N.a)

Andropogon gerardii - Sorghastrum nutans - Hesperostipa spartea Loess Hills Herbaceous Vegetation

Big Bluestem - Yellow Indiangrass - Porcupine Grass Loess Hills Herbaceous Vegetation

Central Tallgrass Big Bluestem Loess Prairie CEGL002025

DESCRIPTION: This community is virtually lacking in shrubs and trees. Woody vegetation that is present, such as *Amorpha canescens*, is usually less than 0.5 m tall. The dominant vegetation is tall grasses. Of the dominant species, *Andropogon gerardii, Sorghastrum nutans*, and *Hesperostipa spartea (= Stipa spartea)* typically exceed 1 m. *Schizachyrium scoparium*, also very common, is shorter. In Missouri and Kansas other species that are usually found in this community include *Dalea candida, Echinacea pallida, Potentilla arguta, Psoralidium tenuiflorum, Silphium laciniatum*, and *Sporobolus compositus*.

This community occurs on moderately steep mid- to upper slopes of hills and along ridges. It has been found on several aspects (Nelson 1985, Rosburg and Glenn-Lewin 1996). This dry-mesic community is associated with dry prairie on mesic slopes of steep loess hills. The soil is well-drained, acidic to neutral, and shallow to deep loess (40-100 cm) (Nelson 1985). The parent material is loess or glacial till and other deeply weathered substrates.

This community experiences moderate drought stress. It is maintained by fire with an average burn frequency of 1-3 years.

COMMENTS: *2, MCS.* Nebraska historically had much more loess tallgrass prairie, than loam/glacial till prairie, which is classified as *Andropogon gerardii - Sorghastrum nutans - (Sporobolus heterolepis) - Liatris spp. - Ratibida pinnata* Herbaceous Vegetation (CEGL002203). But virtually all of the loess prairie has been plowed up. Remaining sites are either on heavily eroded loess sites or glacial till sites that are difficult to plow, blurring what distinction there might have been between these two types (G. Steinauer pers. comm. 2000, Steinauer and Rolfsmeier 2000).

CONSERVATION RANK: *G2.* There are probably fewer than 100 occurrences of this community rangewide. It is reported from northwestern Missouri (where it is ranked S1), northeastern Kansas (S1?), eastern Nebraska (S1), western Iowa (S2), and southeastern South Dakota (S1). Currently there are 70 occurrences documented from Missouri, Nebraska, and South Dakota. Where it occurs on loess hills, the lower slopes are often converted to cropland or pasture.

DISTRIBUTION: This big bluestem tallgrass prairie type is found in the west-central tallgrass prairie region of the United States, including the Loess Hills, extending from northwestern Missouri west to northeastern Kansas, north to southeastern South Dakota, and southeast to western Iowa.

USFS ECOREGIONS: 251Ba:CCC, 251Bb:CCC, 251Bd:CCC, 251Bf:CCC, 251Ca:CCC, 251Cb:CCC, 251Cg:CCC, 251Cm:CCC, 251Cn:CCC, 251Co:CCP, 251Cp:CCC, 251Cq:CCC
CONSERVATION REGIONS: 33:C, 34:C, 35:C, 36:C
STATES: IA KS MO NE SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO dry-mesic prairie +
NE tallgrass prairie =

OTHER SYNONYMY: Tall/mid-grass (Rosburg and Glenn-Lewin 1996) =

USNVC HIERARCHY: ANDROPOGON GERARDII - (SORGHASTRUM NUTANS) HERBACEOUS ALLIANCE (V.A.5.N.a)

Andropogon gerardii - Sorghastrum nutans Unglaciated Herbaceous Vegetation

Big Bluestem - Yellow Indiangrass Unglaciated Herbaceous Vegetation

Unglaciated Mesic Tallgrass Prairie CEGL002204

DESCRIPTION: This community is dominated by grasses or, locally, by shrubs. The dominant grasses can grow as tall as 2 m. Trees may be present, but their canopy covers less than 10% of the area. Dominant species of this vegetation type include *Andropogon gerardii, Sorghastrum nutans, Baptisia alba var. macrophylla, Liatris pycnostachya*, and *Vernonia missurica*. Other herbaceous species include *Andropogon virginicus, Dalea candida, Dalea purpurea, Eryngium yuccifolium, Eupatorium altissimum, Eupatorium perfoliatum, Euphorbia corollata, Hedyotis nigricans, Helianthus angustifolius, Helianthus mollis, Liatris aspera, Mimosa nuttallii (= Mimosa quadrivalvis var. nuttallii), Panicum anceps, Panicum virgatum, Psoralidium tenuiflorum, Pycnanthemum tenuifolium, Rudbeckia hirta, Ruellia humilis, Schizachyrium scoparium, Silphium laciniatum, Sporobolus compositus (= Sporobolus asper), Tephrosia virginiana, Tridens flavus, Tripsacum dactyloides*, and *Verbesina alternifolia*. Examples at the southern limit of this association's range (e.g., the Cherokee Prairies of the Arkansas River Valley) additionally include *Baptisia sphaerocarpa, Dichanthelium scoparium, Euthamia leptocephala, Helianthus angustifolius, Rudbeckia grandiflora*, and *Tephrosia onobrychoides*.

This community occurs on plains and the lower slopes of draws, terraces, slopes, and upland depressions. Soils are moderately well-drained, deep (100 cm or more), and fine-textured, usually silt loam or clay loam. They commonly have a slowly permeable layer beneath the solum, a relatively high water table, additions of water through seepage, or some combination of these conditions. The parent material is loess, glacial till, or, rarely, alluvium.

Fire and edaphic factors (drought) play a role in limiting woody vegetation distribution in this community. Without management, woody vegetation could become dense and shade out herbaceous prairie species. The average fire frequency is 1-3 years. Currently, management is required to limit the coverage of woody species. Woody species include *Cercis canadensis var. canadensis, Cornus florida, Diospyros virginiana, Fraxinus americana, Juniperus virginiana var. virginiana, Quercus muehlenbergii, Rhus copallinum, Sassafras albidum, Sideroxylon lanuginosum, Smilax rotundifolia*, and *Berchemia scandens* (in Arkansas), which could occur locally during periods of fire suppression.

COMMENTS: *3, MCS*. This type currently includes eastern Oklahoma, Arkansas's Grand Prairie and Cherokee Prairie, but further review is needed. Possible indicator species need to be identified to better name this community.

CONSERVATION RANK: *G3.* Twenty occurrences have been documented in Missouri (where the community is ranked S1), and 250 have been documented in Kansas (S3). Although no other occurrences have been documented, the community is also reported from Arkansas (S?) and Oklahoma (S?). Known acreage totals 15,400, and there are probably fewer than 100,000 acres rangewide. Lack of fire may permit more woody species to invade this community. It has moderately restrictive environmental requirements.

DISTRIBUTION: This mesic big bluestem prairie community is found in the unglaciated southern midwestern United States, extending from southwest Missouri and southeastern Kansas to northern Arkansas and Oklahoma.

USFS ECOREGIONS: 222Am:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 234Ae:CCC, 251Cb:CCC, 251Cc:CCC, 251Cq:CCC, 251Ea:CCC, 251Eb:CCC, 251Ec:CCC, 251Ed:CCC, 251Fb:CCC, 255Aa:CCC, M231Aa:CCC
CONSERVATION REGIONS: 32:C, 37:C, 38:C, 39:C, 42:C
STATES: AR KS MO OK **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO mesic prairie +

OTHER SYNONYMY:

USNVC HIERARCHY: ANDROPOGON GERARDII - (SORGHASTRUM NUTANS) HERBACEOUS ALLIANCE (V.A.5.N.a)

Schizachyrium scoparium - Bouteloua curtipendula - Agrostis hyemalis - Eleocharis spp. Hardpan Herbaceous Vegetation

Little Bluestem - Sideoats Grama - Winter Bentgrass - Spikerush Species Hardpan Herbaceous Vegetation

Little Bluestem Hardpan Prairie CEGL002249

DESCRIPTION: The vegetation is dominated by medium-tall graminoids and forbs. Although scattered low shrubs and trees may occur, the tree canopy is less than 10%. Vertical root development is restricted by the hardpan subsoil layer. The graminoid layer is typically dominated by *Bouteloua curtipendula, Panicum virgatum*, and *Schizachyrium scoparium*. *Agrostis hyemalis* is characteristic of this type, although not always abundant. *Andropogon gerardii* may be dominant in some parts of this community's range. Forbs include *Camassia scilloides, Cicuta maculata, Desmanthus illinoensis*, and *Polygala verticillata* (Nelson 1985, Lauver et al.1999).

This community occurs on level to gently sloping ground on upland plains, ridges, and terraces. The soil is usually silty loam. There is an impermeable or slowly permeable silty clay subsoil layer. This fine-textured subsoil layer is very hard when dry and firm when moist, so runoff can be great. During the dry season, the hardpan also stops the movement by capillary action of water from deeper, wetter subsoil to near the surface. This results in droughty soils in the summer and autumn. It also restricts the downward growth of plant roots and burrowing by animals (Nelson 1985, Lauver et al.1999).

The hardpan soils often create droughty soils in the summer and autumn (Nelson 1985, Lauver et al. 1999).

COMMENTS: *2, MCS*. Concept of this type is taken from the Missouri and Kansas state types - hardpan or claypan prairies (Nelson 1985, Lauver et al. 1999). It may be present in Oklahoma. Characteristic species that distinguish this type from *Andropogon gerardii - Sorghastrum nutans* Unglaciated Herbaceous Vegetation (CEGL002204) are needed.

CONSERVATION RANK: *G2?*. Most acreage of this community has been converted to cropland or pasture. Several occurrences of this community are on the Osage Plains Natural Division of Missouri, but it is nearly eliminated elsewhere.

DISTRIBUTION: This little bluestem hardpan prairie community is found in the south-central tallgrass prairie region of the United States, extending from western Missouri west to eastern Kansas, and south to possibly Oklahoma.

USFS ECOREGIONS: 222Am:CCC, 251Cd:CCC, 251Ea:CCC, 251Eb:CCC
CONSERVATION REGIONS: 36:C, 37:C, 38:C
STATES: KS MO OK? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO hardpan prairie =

OTHER SYNONYMY:

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - BOUTELOUA CURTIPENDULA HERBACEOUS ALLIANCE (V.A.5.N.c)

Schizachyrium scoparium - Bouteloua curtipendula - Bouteloua hirsuta - (Yucca glauca) Herbaceous Vegetation

Little Bluestem - Sideoats Grama - Hairy Grama - (Soapweed Yucca) Herbaceous Vegetation

Loess Hills Little Bluestem Dry Prairie CEGL002035

DESCRIPTION: The vegetative structure is composed of a single layer of dominant grasses intermixed with forbs. Shrubs are sometimes present. This community is a short to midgrass prairie dominated by the bunch grasses *Andropogon gerardii, Bouteloua curtipendula*, and *Schizachyrium scoparium*. *Bouteloua hirsuta* can be common. *Sporobolus cryptandrus, Dalea leporina, Dalea candida, Dalea enneandra, Astragalus lotiflorus*, and *Astragalus missouriensis* can also be common. Other herbaceous species include *Pulsatilla patens ssp. multifida (= Anemone patens), Symphyotrichum sericeum (= Aster sericeus), Buchloe dactyloides, Bouteloua gracilis, Delphinium carolinianum, Gaura coccinea*, and *Pediomelum argophyllum*, and the lichens *Dermatocarpon lachneum* and *Psora decipiens* (Nelson 1985, Rosburg and Glenn-Lewin 1996).

This community occurs on south and west aspects of moderately steep to steep slopes (45 degrees or greater) of dissected hill or plains, crests of sharp ridges, and bluff tops along larger watercourses. The soil is somewhat rapidly drained and very shallow loess (0-40 cm). The parent material is loess, glacial till, or, less commonly, gravel. The Loess Hills on the Nebraska and Kansas side of the Missouri River generally have an eastern aspect and thus contain few good examples of this type (Nelson 1985, Rosburg and Glenn-Lewin 1996).

This community is maintained by a combination of drought and fire (Nelson 1985).

COMMENTS: *2, MCS*. Rosburg and Glenn-Lewin (1996) appear to separate out several subtypes that all fall within this type, from "bluff colluvium" to "midgrass" types.

CONSERVATION RANK: *G2.* There are probably fewer than 100 occurrences of this community rangewide. It is known from Nebraska (S1), Missouri (S2), and Iowa (S2?). Currently there are 66 occurrences documented from Iowa, Missouri, and Nebraska. It seems to be restricted to south- and west-facing loess bluffs along the Missouri and Kansas rivers. This community has been eliminated in some places by overgrazing, or by quarrying of loess material for road construction. Many sites have been encroached on by woody vegetation.

DISTRIBUTION: This bluestem - grama grass dry prairie type is typically found along the east side of Missouri River in the central midwestern United States, occurring on south- and west-facing loess bluffs in Missouri and Iowa, and less commonly on the west (Nebraska) side of the river.

USFS ECOREGIONS: 222Ap:CCC, 251Bd:CCC, 251Ca:CCC, 251Cg:CCC, 251Cm:CCC, 251Cn:CCC, 251Cp:CC?
CONSERVATION REGIONS: 35:C, 36:C
STATES: IA MO NE **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO dry prairie =
NE loess bluff prairie =

OTHER SYNONYMY:

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - BOUTELOUA CURTIPENDULA HERBACEOUS ALLIANCE (V.A.5.N.c)

Schizachyrium scoparium - Bouteloua curtipendula - Hesperostipa spartea - (Pascopyrum smithii) Herbaceous Vegetation

Little Bluestem - Sideoats Grama - Porcupine Grass - (Western Wheatgrass) Herbaceous Vegetation

Little Bluestem - Porcupine Grass Dry-mesic Prairie CEGL002377

DESCRIPTION: The vegetation of this community consists of grasses and forbs averaging 23 cm tall. It is moderately open with approximately 15% of the ground remaining bare. The most abundant species are *Schizachyrium scoparium, Bouteloua curtipendula, Andropogon gerardii, Pascopyrum smithii*, and *Hesperostipa spartea (= Stipa spartea)*. Other typical grasses include *Elymus canadensis, Aristida purpurea var. longiseta (= Aristida longiseta), Buchloe dactyloides, Calamovilfa longifolia*, and *Sporobolus heterolepis*. Common forbs include *Amorpha canescens, Oligoneuron rigidum (= Solidago rigida), Ambrosia psilostachya, Echinacea angustifolia, Dalea candida (= Petalostemon candidum), Aster* spp., *Mimosa nuttallii (= Schrankia nuttallii), Penstemon grandiflorus, Ratibida columnifera, Astragalus crassicarpus, Anemone cylindrica, Machaeranthera pinnatifida (= Haplopappus spinulosus), Dalea candida var. oligophylla (= Petalostemon occidentalis), Gaura coccinea*, and *Asclepias verticillata*. The shrubs *Symphoricarpos occidentalis, Yucca glauca*, and *Rosa* spp. may be scattered among the herbaceous species (MNNHP 1993).

This community is found on rocky, loamy south-facing slopes with inclines ranging from 20 to 30 degrees. Depending on slope position, angle, and aspect, as well as soil type, conditions vary from dry to dry-mesic. Stands occur on valley sideslopes of glacial till and steeper slopes of moraines. Soils are Mollisols, but with shallower organic-rich horizons. Soil textures vary from clay loam to sandy loam. Cobbles and boulders are common and gravelly inclusions may also be present. Soils are excessively drained to well-drained. (MNNHP 1993)

COMMENTS: *2, MCS*. This type does not appear to occur in the North Dakota Sheyenne Grassland region. It also does not occur in subsections 251Bd and 251Be (Iowa); dry-mesic prairies in those stands have been assigned to *Schizachyrium scoparium - Sorghastrum nutans - Bouteloua curtipendula* Herbaceous Vegetation (CEGL002214). This needs review. Heavily grazed stands may resemble sand-gravel prairie, *Schizachyrium scoparium - Bouteloua spp. - Hesperostipa spartea* Gravel Herbaceous Vegetation (CEGL002499).

CONSERVATION RANK: *G3?.* One hundred and sixty-nine occurrences have been documented: 164 in Minnesota (where the community is ranked S3,S3) and 3 in South Dakota (S?), and it may occur in North Dakota and Iowa. The community is found in nine ecoregional subsections. Sizes of 167 occurrences total 7380 acres. If more occurrences are identified in the Dakotas or Iowa, the total would probably exceed 10,000 acres. Twenty-nine of 159 ranked occurrences are A, AB, or B. The community occurs on glacial lake beaches, outwash deposits, and moraines.

DISTRIBUTION: This little bluestem dry-mesic prairie grassland community is found in the northern tallgrass prairie region of the United States, ranging from western Minnesota to the Dakotas, and possibly Iowa.

USFS ECOREGIONS: 222Ma:CCC, 222Na:CCC, 251Aa:CCC, 251Ab:CCC, 251Ba:CCC, 251Bb:CCC, 251Bc:CCC, 251Be:CC?, 251Bf:CCC, 332:?
CONSERVATION REGIONS: 26:C, 34:C, 35:C, 46:C
STATES: IA? MN ND SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MN dry prairie (southwest section) hill subtype; dry prairie (northwest section) hill subtype -

OTHER SYNONYMY:

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - BOUTELOUA CURTIPENDULA HERBACEOUS ALLIANCE (V.A.5.N.c)

Schizachyrium scoparium - Sorghastrum nutans - Bouteloua curtipendula Herbaceous Vegetation

Little Bluestem - Yellow Indiangrass - Sideoats Grama Herbaceous Vegetation

Midwest Dry-mesic Prairie CEGL002214

DESCRIPTION: The dominant vegetation of this community is mid and tall grasses, 1-2 m tall. Total plant cover is moderate to dense. The most abundant species are *Schizachyrium scoparium, Sorghastrum nutans*, and *Hesperostipa spartea (= Stipa spartea)*. Other common herbaceous species include *Andropogon gerardii, Bouteloua curtipendula, Echinacea pallida, Potentilla arguta*, and *Sporobolus heterolepis*. *Amorpha canescens* is a common subshrubby species. Woody species occur but are not common in high-quality examples of this community (Curtis 1959, MNNHP 1993, Nelson 1985).

This community is found on upper slopes and hillcrests with moderate to steep slopes. Rarely, it can be found on level plains, especially in the southern parts of its range (Nelson 1985). The aspect is most often southern or western, but others are possible (Curtis 1959, Chapman 1984). Soils are 40-100 cm deep (Nelson 1985), well-drained to excessively well-drained, and clay loam, sandy loam, or loamy sand (MNNHP 1993). The sites typically occur over loess, glacial outwash, or glacial till.

Stands depend on fire to prevent woody encroachment (Nelson 1985).

COMMENTS: *2, MCS*. This type is currently reported from subsections 251Bd and 251Be (and subsections east), but these two subsections could also go with *Schizachyrium scoparium - Bouteloua curtipendula - Hesperostipa spartea - (Pascopyrum smithii)* Herbaceous Vegetation (CEGL002377), which occurs primarily in 251A. In Ohio, this type is probably extirpated, except perhaps Buffalo Beats (on clay dome). However, those stands are far east of much of the range of this type, and they should be compared to other eastern prairie openings. Type may closely resemble *Schizachyrium scoparium - Bouteloua curtipendula* Gravel Herbaceous Vegetation (CEGL002215).

CONSERVATION RANK: *G2G3*. This community has a fairly broad and matrix-scale distribution in the Midwest, but current high-quality sites tend to be small patches restricted to upper slopes and hillcrests. This community has probably been substantially reduced by conversion to agriculture, or degraded by grazing and fire suppression.

DISTRIBUTION: This dry-mesic prairie community type is found in the central midwestern United States, ranging from outliers in Ohio west to east-central Minnesota, south to Missouri and possibly Oklahoma, and east to Indiana.

USFS ECOREGIONS: 221Ea:CCC, 221Ed:CCP, 221Eg:CCC, 221Fa:CCC, 222Ai:CCC, 222Ga:CCC, 222Gb:CCC, 222Ge:CCC, 222Ha:CCC, 222Hb:CCC, 222Hf:CCC, 222If:CCC, 222Ja:CCP, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ka:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Kj:CCC, 222Lc:CCC, 222Le:CCC, 222Lf:CCC, 222Ma:CCC, 222Mb:CCC, 222Mc:CCC, 222Me:CCC, 251Aa:CCC, 251Ba:CCC, 251Bb:CCC, 251Bd:CCC, 251Be:CCC, 251Ca:CCC, 251Cc:CCC, 251Cf:CCC, 251Ch:CCC, 251Cj:CCC, 251Ck:CCC, 251Db:CCC, 251Dc:CCC, 251Dd:CCC, 251Dg:CCC, 251Dh:CCC

CONSERVATION REGIONS: 35:C, 36:C, 38:C, 44:C, 45:C, 46:C, 48:C, 49:C

STATES: IA IL IN MI MN MO OH OK WI **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

IL	dry-mesic prairie (S); mesic barren (N); dry-mesic prairie (N) -
IN	dry-mesic prairie =
MI	hillside prairie =
MN	dry prairie (central section) hill subtype; dry prairie (southeast section hill subtype -
MO	dry-mesic prairie +
OH	little bluestem prairie +
WI	dry-mesic prairie =

OTHER SYNONYMY: Dry-mesic Prairie (Curtis 1959) =, Hilltop Prairie (Chapman 1984) =

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - SORGHASTRUM NUTANS HERBACEOUS ALLIANCE (V.A.5.N.a)

Schizachyrium scoparium - Sorghastrum nutans - Bouteloua curtipendula Hill Herbaceous Vegetation

Little Bluestem - Yellow Indiangrass - Sideoats Grama Hill Herbaceous Vegetation

Midwest Glacial Drift - Loess Hill Prairie CEGL005183

DESCRIPTION: This community is dominated by medium-tall graminoids. *Bouteloua curtipendula, Schizachyrium scoparium*, and *Sorghastrum nutans* are the dominant species. *Andropogon gerardii* is also common, especially where moisture is more favorable. Other characteristic species include *Asclepias viridiflora, Brickellia eupatorioides (= Kuhnia eupatorioides), Desmodium ciliare, Euphorbia corollata, Hedyotis nigricans var. nigricans, Lespedeza capitata, Linum sulcatum, Lithospermum incisum, Penstemon pallidus, Psoralidium tenuiflorum (= Psoralea tenuiflora), Sisyrinchium campestre, Spiranthes magnicamporum*, and *Solidago nemoralis*. Woody species are infrequent. *Sassafras albidum, Quercus stellata* (more southern), *Ceanothus americanus, Rhus glabra*, and *Rhus copallinum* may be encountered (White and Madany 1978, TNC 1995a).

This community is found on hills formed from eroded glacial drift or on deep loess deposits. These are usually found above rivers and streams, where a river valley cuts through an end moraine creating many deep, steep-sided tributary ravines. Loess deposits are especially common along the Mississippi and Illinois rivers. The sites are typically on steep, south- or west-facing slopes with well-drained to somewhat excessively drained soil (White and Madany 1978).

Periodic fire and drought may be very important for discouraging woody invasion (TNC 1995a).

COMMENTS: *3, MCS*. Concept of type is taken from Illinois state classification - Glacial Drift Hill Prairie and Loess Hill Prairie (White and Madany 1978). Distinctiveness of this prairie type needs to be determined with respect to other dry-mesic prairies. White and Madany (1978) list no characteristic species for glacial drift hill prairie. Relationship of this type to dry-mesic prairie *Schizachyrium scoparium - Sorghastrum nutans - Bouteloua curtipendula* Herbaceous Vegetation (CEGL002214) should be clarified (particularly in 222Lc, where Illinois stands should be placed with CEGL002214), as well as to those in the Southeast, where composition is similar to Kentucky's Limestone Prairies. It is possible that glacial drift hill prairie should be combined with CEGL002214 and loess hill prairie remain distinct.

CONSERVATION RANK: *G2.* There are probably fewer than 100 occurrences of this community rangewide. It is reported only from Illinois, where it is ranked S1S2. Currently fewer than 70 occurrences have been documented from Illinois. There are probably fewer than 500 acres rangewide. Average size of the Illinois occurrences with size reported is about 3 acres. Historical acreage and trends are unknown, but there has probably been a decline due to conversion to agriculture or degradation by grazing and fire suppression. The environmental requirements are somewhat narrow, and the range seems to be restricted to northeastern and central Illinois. Many of the documented occurrences are in good condition.

DISTRIBUTION: This glacial drift and loess hill prairie is found in the northern and central prairie-forest border region of the United States, in Illinois.

USFS ECOREGIONS: 222Ao:CCC, 222Aq:CCC, 222Dh:CPP, 222Gb:CCC, 222Hf:CCC, 222Kh:CCC, 251Cf:CCC, 251Ci:CCC, 251Cj:CCC, 251Dd:CCC, 251De:CCC, 251Df:CCC
CONSERVATION REGIONS: 36:C, 44:C, 45:C, 46:C, 48:C
STATES: IL **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL glacial drift hill prairie; loess hill prairie -

OTHER SYNONYMY: Hill Prairie (Voigt and Mohlenbrock 1964) B, Hill Prairie (Evers 1955) B

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - SORGHASTRUM NUTANS HERBACEOUS ALLIANCE (V.A.5.N.a)

Schizachyrium scoparium - Sorghastrum nutans - Aristida lanosa - Polypremum procumbens Herbaceous Vegetation

Little Bluestem - Yellow Indiangrass - Woolly-sheath Three-awn - Juniper-leaf Herbaceous Vegetation

Mississippi Embayment Sand Prairie CEGL002397

DESCRIPTION: This community is composed of a single layer of dominant graminoids intermixed with abundant forbs. This sand prairie can be a tallgrass or a midgrass prairie. It is dominated by *Schizachyrium scoparium* and *Sorghastrum nutans*. Other species can include *Lithospermum* sp., *Cyperus* spp. (including *Cyperus grayoides*), *Polypremum procumbens, Desmodium strictum, Digitaria cognata var. cognata, Aristida* spp., and *Callirhoe triangulata* (Nelson 1985).

Both the drier and more moist portions of this community are subject to drought stress (Nelson 1985).

Stands are maintained by fire with an average burn frequency of 1-5 years on the mesic sites and 5 years on the dry-mesic sites (Nelson 1985).

COMMENTS: *3, MCS*. The type concept is taken largely from the Missouri state type - dry sand prairie, and dry-mesic sand prairie, at least for the southeastern Missouri part (Nelson 1985). The two state types may each need their own global type. Stands in northern Missouri along the Mississippi River are tracked with *Schizachyrium scoparium - Danthonia spicata - Carex pensylvanica - (Viola pedata)* Herbaceous Vegetation (CEGL002318). This community is often near sand savanna communities. Type has been extirpated from Arkansas. Name needs revision in Missouri. Stands in Indiana occur in Vigo, Sullivan and Tippecanoe counties and may be a separate type.

CONSERVATION RANK: *G1Q*. This community has been nearly eliminated by conversion to cropland. There is one known 15 ha site in Missouri.

DISTRIBUTION: This bluestem sand prairie is found in the United States in the Mississippi Embayment of Missouri and sand barrens in southwestern Indiana, and at least historically in Arkansas and possibly Illinois.

USFS ECOREGIONS: 222Ca:C??, 234:C, 251Cf:CCC
CONSERVATION REGIONS: 42:C
STATES: AR IL? IN? MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:
IL? dry sand prairie ?
IN? sand barrens ?
MO dry sand prairie; dry-mesic sand prairie ?

OTHER SYNONYMY: Southern Sand Prairie (MCS 1993)

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - SORGHASTRUM NUTANS HERBACEOUS ALLIANCE (V.A.5.N.a)

Andropogon gerardii - Schizachyrium scoparium Northern Plains Herbaceous Vegetation

Big Bluestem - Little Bluestem Northern Plains Herbaceous Vegetation

Northern Plains Big Bluestem Prairie CEGL002205

DESCRIPTION: The vegetation is dominated by moderately dense to dense tall and mid grasses. Most of the species are 0.7-1.5 m tall. Common grasses are *Andropogon gerardii, Bouteloua curtipendula, Schizachyrium scoparium, Sporobolus heterolepis*, and *Hesperostipa spartea (= Stipa spartea)*. Other grasses that may occur include *Carex pensylvanica, Elymus trachycaulus (= Agropyron trachycaulum)*, and *Panicum virgatum*. Forbs, such as *Artemisia ludoviciana, Echinacea angustifolia, Helianthus pauciflorus ssp. pauciflorus, Helictotrichon hookeri, Juncus balticus, Liatris scariosa*, and *Lilium philadelphicum*, are common. Shrubs, especially *Symphoricarpos occidentalis*, are often present but never abundant.

This community is found in unglaciated areas on lower slopes and bottomlands of narrow gullies and draws. It requires more moisture than is generally provided by direct precipitation. The extra water comes from runoff from upslope areas and meltwater from snow which often accumulates in drifts on this community. The soil is loam to sandy loam and moderately deep to deep (Hanson and Whitman 1938).

COMMENTS: *3, MCS*. This type occurs in the unglaciated parts of the northern plains. Compare with the glaciated type *Andropogon gerardii - Sporobolus heterolepis - Schizachyrium scoparium - Pascopyrum smithii* Herbaceous Vegetation (CEGL002376).

CONSERVATION RANK: *G3G5.* Type may be rare, but little information is available.

DISTRIBUTION: This bluestem tallgrass prairie type is found in unglaciated regions of the northwestern Great Plains of the United States, particularly the Dakotas.

USFS ECOREGIONS: 331:C, 332:C, M334A:CC
CONSERVATION REGIONS: 25:C, 26:C
STATES: ND SD **PROVINCES:** SK?

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: Big Bluestem Type (Hanson and Whitman 1938) =, *Andropogon gerardii* Habitat Type (U.S. Forest Service (USFS) 1992) =

USNVC HIERARCHY: ANDROPOGON GERARDII - (SORGHASTRUM NUTANS) HERBACEOUS ALLIANCE (V.A.5.N.a)

Andropogon gerardii - Sorghastrum nutans Western Great Plains Herbaceous Vegetation

Big Bluestem - Yellow Indiangrass Western Great Plains Herbaceous Vegetation

Big Bluestem - Indiangrass Western Great Plains Prairie CEGL001464

DESCRIPTION: The vegetation is dominated by tall grasses, particularly *Andropogon gerardii* and *Sorghastrum nutans*. Other grasses include *Panicum virgatum, Pascopyrum smithii* and *Sporobolus cryptandrus*. Forbs may include *Desmanthus illinoensis* and *Glycyrrhiza lepidota* (Lauver et al. 1999).

Stands occur in valley bottoms and terraces along larger streams and rivers. Soils are deep, somewhat poorly drained loam to sandy loams found in alluvium. Stands require subirrigated soils to persist. It occurs along floodplains of perennial rivers on the plains, or, less frequently, on cobbly loam soils along the Colorado foothills. This mesic prairie association is able to survive along the foothills because the cobbly soils are able to retain adequate moisture.

COMMENTS: *2, WCS*. This type occurs as isolated stands in the western Great Plains, but it is less likely to be recognized as a distinct type in Nebraska or Kansas. Ecologists there just don't get as excited by the presence of *Andropogon gerardii* in an otherwise mixedgrass or shortgrass prairie setting. *Andropogon gerardii* dominance fluctuates with climatic and grazing conditions, and few other indicators appear to be available in those states to help define a type.

CONSERVATION RANK: *G2.* This community is regionally endemic, occurring in a few localized areas of Colorado, Kansas, and western Oklahoma (B. Hoagland pers. comm., S. Kettler pers. comm. 2000). Status in Kansas needs review. Known occurrences of the association are very limited. More than 10 known locations exist for this association in the Colorado Natural Heritage Program Biological and Conservation Data System. Some of these stands are in poor condition, being small or invaded by exotic plant species, but others appear to be in better shape. The total area covered by known stands is well over1000 acres.

This association may have been more extensive along the Colorado Front Range (Livingston 1952). Given the extent to which riparian areas in eastern Colorado have been altered by human activities and invaded by adventive species, it seems probable that this association was historically much more extensively distributed in western Great Plains riparian areas as well. Current threats to this element include residential development, fire suppression, overgrazing, invasion by exotic plant species, and aquifer drawdown (CONHP 1997). With the fast development of the Colorado Front Range and the ongoing use and development of groundwater resources, known and unknown occurrences of this association may be declining.

DISTRIBUTION: This big bluestem prairie is a tallgrass, wet meadow found in the west-central Great Plains of the United States, especially the foothills of Colorado, and extending east to western Kansas and Oklahoma.

USFS ECOREGIONS: 331C:CC, 331I:CC, M331H:CC, M331I:CC
CONSERVATION REGIONS: 20:C, 27:C
STATES: CO KS NE? OK **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE? tallgrass prairie

OTHER SYNONYMY:

USNVC HIERARCHY: ANDROPOGON GERARDII - (SORGHASTRUM NUTANS) HERBACEOUS ALLIANCE (V.A.5.N.a)

Andropogon gerardii - Sporobolus heterolepis - Schizachyrium scoparium - Pascopyrum smithii Herbaceous Vegetation

Big Bluestem - Prairie Dropseed - Little Bluestem - Western Wheatgrass Herbaceous Vegetation

Northern Plains Transition Bluestem Prairie CEGL002376

DESCRIPTION: This community is a grassland dominated by mid and tall grasses. Abundant species include *Andropogon gerardii, Poa pratensis, Carex duriuscula (= Carex eleocharis), Lactuca tatarica, Bouteloua curtipendula*, and *Schizachyrium scoparium*.

This community occurs in glaciated terrain on the crests and upper slopes of knolls in areas of gently rolling topography. It can also occur on north-facing and south-facing slopes with inclinations ranging from 10 to 20 degrees.

COMMENTS: *3, MCS*. This type represents glaciated tallgrass stands in the mixedgrass prairie region, whereas *Andropogon gerardii - Schizachyrium scoparium* Northern Plains Herbaceous Vegetation (CEGL002205) and *Andropogon gerardii - Sorghastrum nutans* Western Great Plains Herbaceous Vegetation (CEGL001464) are unglaciated types. Eastward this type extends somewhat into the northern tallgrass prairie region in the Dakotas only, but *Andropogon gerardii - Hesperostipa spartea - Sporobolus heterolepis* Herbaceous Vegetation (CEGL002202) is the more common type in that region.

CONSERVATION RANK: *G2.* There are probably fewer than 50 occurrences of this community rangewide. Currently 24 occurrences have been documented from Manitoba, North Dakota, and South Dakota; it is also reported from Saskatchewan. S-ranks have not been assigned in any of these states or provinces. There are probably fewer than 10,000 acres rangewide. Currently over 3275 acres have been documented rangewide, with sizes ranging from 2 to 1033 acres. There has been some decline in high-quality sites due to heavy grazing and loss from conversion to agriculture.

DISTRIBUTION: This bluestem tallgrass prairie community is found in glaciated terrain of the northern Great Plains of the United States and possibly adjacent Canada, extending from the Dakotas into Saskatchewan and Manitoba.

USFS ECOREGIONS: 222Na:CCC, 251Aa:CCC, 251Ab:CCC, 331E:CP, 332A:CP, 332D:CP
CONSERVATION REGIONS: 26:C, 34:C, 35:C
STATES: ND SD **PROVINCES:** MB? SK

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: Crests (Tatina 1987) F, Slopes (Tatina 1987) F

USNVC HIERARCHY: ANDROPOGON GERARDII - (SORGHASTRUM NUTANS) HERBACEOUS ALLIANCE (V.A.5.N.a)

* Nonstandard type (needs review)

Blacktailed Prairie Dog Town Grassland Complex*

Blacktailed Prairie Dog Town Grassland Complex

Blacktailed Prairie Dog Town Grassland Complex CECX002003

DESCRIPTION: Blacktailed prairie dog towns are located in open mixedgrass or shortgrass prairie habitat, and their activity has both direct and indirect effects on the vegetation. The blacktailed prairie dogs keep the surrounding vegetation clipped close to the ground, presumably to improve their ability to detect stalking predators. This clipping gives the impression of a mowed lawn or heavily grazed rangeland. Cover averages between 30 and 80%, but some patches may be 100%. Prairie dogs repeatedly clip and graze plants, rarely allowing shoots to reach full size. Thus, canopy height within the colony is about 5-10 cm, compared to 20-50 cm in nearby, uncolonized grassland (Whicker and Detling 1988). Changes in plant species composition may begin as early as 2 or more years after colonization. Shortgrass species, such as *Bouteloua gracilis* and *Buchloe dactyloides*, and annual forbs, become abundant and replace mid-height or tall grasses, such as *Pascopyrum smithii*. Continued heavy grazing may eventually result in complete dominance by a few species of annual forbs, grasses, or dwarf shrubs, such as *Dyssodia papposa, Aristida purpurea*, and *Artemisia frigida* (Whicker and Detling 1988). Grazing may even cause genetic shifts within species. The shorter, more prostrate, growth forms of *Pascopyrum smithii* on prairie dog towns have been shown to be more abundant than those away from towns, suggesting that some genotypes within the species may tolerate grazing better than others (Jaramillo and Detling 1988, Whicker and Detling 1988).

Bison may be attracted to the prairie dog towns, and a series of studies found that bison preferentially graze them (Coppock et al. 1983, Coppock and Detling 1986, Day and Detling 1990). The forage on the colonies is more nutritious than off, with higher nitrogen content and younger shoots, apparently because the animal waste products are deposited there. In turn, the presence of bison waste products further increases the soil fertility and forage quality (Knight 1994). Pronghorns may also prefer the prairie dog towns (Knight 1994). Plant species diversity is increased by the small-scale disturbances caused by the digging of prairie dogs, and animal species diversity may also increase because of the burrow habitat available to the badger, rattlesnake, burrowing owl, black-footed ferret, and cottontail, in addition to the bison and pronghorn (Knight 1994). The prairie dog towns may also attract aerial predators such as the ferruginous hawks, golden eagles, and falcons.

Prairie dog towns also move over time, expanding and contracting, and, as larger towns can cover thousands of hectares at a time, the effect on the prairie landscape is substantial.

The plant community types on a prairie dog colony are roughly indicative of the extent of herbivore disturbance and reflect the cumulative impact of grazing intensity, grazing duration, activities of other animals, soil characteristics, and weather (Whicker and Detling 1988). Early stages of the town may have a typical mixed grass or shortgrass prairie type. With continued grazing and age of the town, the composition may shift to a mix of annual species and dwarf-shrubs. Together these stages have not been classified, but are treated here as a complex. Species richness appears to be highest under moderate levels of disturbance, because grass species have not yet begun to disappear and forb species have begun to increase.

Prairie dog towns are located on a wide variety of soils, including clay, clay loam, silty loam and some sandy loam soils deposited following erosion from adjacent uplands, including badlands formations. Soils are deep, structured and not easily eroded. This type is found on level sites along drainages, in broad valleys, on gentle to moderately sloping hillslopes, and flats on tables and buttes (Von Loh et al. 1999). Prairie dogs create extensive burrows in their towns. Large volumes of soil are moved, improving filtration, hastening the incorporation of organic matter, facilitating nutrient cycling, and increasing the spatial heterogeneity of vegetation, soils, and other ecosystem components (Knight 1994).

The natural disturbances caused by digging and mowing activity of the prairie dogs is the basis of this complex.

COMMENTS: *3, MCS*. Currently no associations have been directly linked to the prairie dog towns, as, apart from the original mixedgrass or shortgrass prairie communities that were present when the town became established, there are no known descriptions of the various community types that occur on these towns. The blacktailed prairie dogs (*Cynomys ludovicianus ludovicianus*) occur on the Great Plains and the whitetailed prairie dogs (*Cynomys leucurus*) occur in the Great Basin (Knight 1994).

CONSERVATION RANK: *G4.* This rank has been assigned based on the G4 rank that is currently assigned to the Blacktailed prairie dog itself. However, more careful review of the rank from a community perspective is needed. Prairie dog towns historically covered millions of hectares in the Great Plains; currently their towns range in size from tens to hundreds of hectares, with an average density of 10 to 55 animals/ha (Whicker and Detling 1988). In Canada, they occur only in Saskatchewan, and then primarily in Grasslands National Park, near the U.S. border.

DISTRIBUTION: Blacktailed prairie dog towns occur widely throughout the short and mixed-grass regions of the Great Plains of the United States and Canada, and this complex ranges from Saskatchewan in Canada south to the southern Great Plains states, including Colorado and Kansas.

USFS ECOREGIONS: 331C:CP, 331D:CP, 331E:CP, 331F:CC, 331G:CP, 331H:CC, 331I:CP, M334A:CC
CONSERVATION REGIONS: 25:C, 26:C, 27:C
STATES: CO? KS MT? ND NE SD WY? **PROVINCES:** SK?

MIDWEST HERITAGE SYNONYMY: NE no state equivalent

OTHER SYNONYMY:

USNVC HIERARCHY: N/A

Festuca altaica - (Hesperostipa spp., Achnatherum spp.) Herbaceous Vegetation

Rough Fescue - (Needlegrass Species, Ricegrass Species) Herbaceous Vegetation

Rough Fescue - Needlegrass Mixedgrass Prairie CEGL002436

DESCRIPTION: This midgrass community is dominated by *Festuca altaica (= Festuca scabrella)* and commonly includes *Elymus trachycaulus, Koeleria macrantha, Pascopyrum smithii, Hesperostipa curtiseta (= Stipa spartea var. curtiseta)*, and *Achnatherum richardsonii (= Stipa richardsonii)*. Important forbs include *Achillea millefolium, Aster* spp., *Monarda fistulosa, Solidago missouriensis, Oligoneuron rigidum (= Solidago rigida), Thalictrum occidentale*, and *Vicia americana*. Shrubs such as *Amelanchier alnifolia, Arctostaphylos uva-ursi*, and *Rosa acicularis* may be present.

Information on environmental factors is not available.

COMMENTS: *2, MCS*. The distribution of the type into the United States is thought to be very marginal, as both *Festuca altaica (= Festuca scabrella)* and *Hesperostipa curtiseta (= Stipa spartea var. curtiseta)* barely extend into the U.S.

CONSERVATION RANK: *G?.* Type is mainly found in Canada, where status is unknown.

DISTRIBUTION: This rough fescue grassland is found in the northern Great Plains of Canada and possibly in adjacent areas of the United States, from Manitoba and Saskatchewan, south possibly to North Dakota.

USFS ECOREGIONS: 331:?, 332:?
CONSERVATION REGIONS:
STATES: ND **PROVINCES:** MB SK

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: FESTUCA ALTAICA HERBACEOUS ALLIANCE (V.A.5.N.d)

Hesperostipa comata - Bouteloua gracilis - Carex filifolia Herbaceous Vegetation

Needle-and-thread - Blue Grama - Threadleaf Sedge Herbaceous Vegetation

Needle-and-thread - Blue Grama Mixedgrass Prairie CEGL002037

DESCRIPTION: The vegetation is dominated by moderately dense graminoids that are usually between 0.5 and 1 m tall. For example, on 19 stands in west-central Montana the cover by the different strata was as follows: shrubs 6%, graminoids 67%, forbs 11%, bryophytes 14%, litter 55%, rock 4%, bare soil 9% (Mueggler and Stewart 1978). Thilenius et al. (1995) found that the average cover on 14 stands in eastern Wyoming was 42%. *Hesperostipa comata (= Stipa comata)* is the tallest of the dominant species, sending seed heads to a maximum height of approximately 1 m. The rhizomatous graminoids *Bouteloua gracilis* and *Carex filifolia*, the other two dominant/codominant species, do not usually exceed 0.5 m. *Calamovilfa longifolia* is often found with high cover values on sandier soils and *Koeleria macrantha* cover increases on degraded sites. There are regionalized expressions of variability with *Carex inops ssp. heliophila* surpassing *Carex filifolia* in Colorado and *Calamagrostis montanensis* being at least as important as the diagnostic species in north-central Montana. *Pascopyrum smithii* is consistently present. For woody species, subshrub forms (*Artemisia frigida, Gutierrezia sarothrae, Rosa arkansana*) have the highest cover and constancy but their total cover does exceed more than 5%, except on overgrazed sites. Cover values for forbs are low throughout the range of the type (the exception being *Selaginella densa*). Geographic setting does influence forb composition to some degree. *Sphaeralcea coccinea, Phlox hoodii, Heterotheca villosa, Gaura coccinea*, and *Liatris punctata*, have high constancy values in northern areas, whereas in the eastern and southern portions of the range *Lygodesmia juncea, Opuntia polyacantha, Artemisia dracunculus* and *Ratibida columnifera* seems to be more constant.

Stands occur on flat to rolling topography with deep (40-100 cm) sandy loam to loam soils. They are typically associated with uplands, though they may also occur lower in the landscape, such as coulee and draw bottoms, if soils are sufficiently coarse (usually sandstone derived). Even though it is a major association in the Northern Plains, it does not occur in areas dominated exclusively by shale and mudstone parent materials, from which heavy soils are derived. This type is found at elevations ranging from 600 to 1700 m (2000-5500 feet); average annual precipitation associated with these elevation parameters ranges from slightly less than 25 cm to over 50 cm (10 to 20 inches).

Vast (singly and in the aggregate) prairie dog (*Cynomys ludovicianus*) "towns" once developed on the favorable substrates of this type and exploited its vegetation. Prairie dog populations have undergone a precipitous decline since settlement, so much of this type could be in various states of secondary succession, returning from a somewhat denuded state and altered composition created by the prairie dogs (and attendant bison that found nutritious forage here). Fire, both aboriginal- and lightening-caused, was a regular part of this landscape. Fire-return intervals have been considerably lengthened since settlement by European-Americans.

This association and *Pascopyrum smithii - Bouteloua gracilis - Carex filifolia* Herbaceous Vegetation (CEGL001579) could be considered the most common plant associations in the Northern Great Plains (Martin et al. 1998). These two associations, cited by many authors as the climatic climax communities for this region, are manifested by matrix or large patch occurrences frequently found dominating whole landscapes. The *Hesperostipa comata (= Stipa comata)* defined community is more associated with uplands and the *Pascopyrum smithii* defined type characterizes sites with higher moisture status, generally occurring at lower positions in the landscape.

COMMENTS: *1, MCS*. *Carex filifolia* is lacking or highly reduced in importance southward. Southern stands were once classified separately (CEGL001699) and further review of their characteristics compared to more northern stands is needed. Weaver and Albertson (1956) also remark on the fact that low sedges are present as far south as Texas but are important only north of Colorado. However, a phase of the *Stipa comata - Bouteloua gracilis* type of Mueggler and Stewart (1980) in western Montana is apparently quite similar to communities of the southern and southeastern portions or the Northern Great Plains, and both lack *Carex filifolia*. There are a welter of named community types, mostly seral representations of grazing or fire impacts, that vary by having one or another of the defining species (or even other graminoids, e.g., *Carex inops ssp. heliophila*) dominant. This assemblage of types is also defined by having relatively low cover of both *Pascopyrum smithii* and *Elymus lanceolatus (= Agropyron dasystachyum)*. To accommodate these permutations within the concept of the type (as lesser-ranked occurrences) or to recognize them as independent vegetation types recognized by existing vegetation composition is one question. Another is, what cover value or degree of dominance of *Pascopyrum smithii* or *Elymus lanceolatus* will serve to establish the distinction between *Pascopyrum smithii - Stipa comata - Carex filifolia* (and allied *Pascopyrum smithii*-"dominated" communities) from the community under consideration.

CONSERVATION RANK: *G5.* This is an exceedingly common type, manifesting any number of permutations, some of which are related to disturbance and some of which appear to be related to the expected geographic distinctions in such a broadly distributed type. The only reason to consider it a G4 is that it has received, and continues to receive, significant grazing pressure which, combined with the surge in alien weed populations, pose a significant threat to its quality.

DISTRIBUTION: This needlegrass - grama grass prairie community is common in the northern and central Great Plains of the United States and Canada, ranging from Manitoba west to Alberta, south to Kansas and possibly Colorado.

USFS ECOREGIONS: 251Ab:CCC, 251Ba:CCC, 331C:CC, 331E:C?, 331F:CC, 331G:CC, 331H:CC, 332C:CC, M334A:CC
CONSERVATION REGIONS: 10:C, 20:C, 25:C, 26:C, 27:C, 34:C, 35:C
STATES: CO? KS MT ND NE SD WY **PROVINCES:** AB MB SK

MIDWEST HERITAGE SYNONYMY: NE western mixedgrass prairie -

OTHER SYNONYMY: *Stipa comata - Carex filifolia* Habitat Type (Hansen et al. 1984) =, Gramagrass - Needlegrass - Sedge (Hanson and Whitman 1938) =, *Stipa-Boutleoua* (Hubbard 1950) =, *Bouteloua-Stipa* (Hubbard 1950) =, *Stipa comata / Bouteloua gracilis* Plant Association (Johnston 1987) B, *Stipa comata / Carex filifolia* Plant Association (Johnston 1987) =, Association *Rumicetum venosi, subassoc. Boutelouetsum* (Looman 1980) =, Mixed prairie (Tolstead 1941) B

USNVC HIERARCHY: HESPEROSTIPA COMATA - BOUTELOUA GRACILIS HERBACEOUS ALLIANCE (V.A.5.N.c)

Pascopyrum smithii - (Elymus trachycaulus) Clay Pan Herbaceous Vegetation

Western Wheatgrass - (Slender Wild Rye) Clay Pan Herbaceous Vegetation

Wheatgrass Clay Flats Mixedgrass Prairie CEGL002239

DESCRIPTION: The vegetation is strongly dominated by *Pascopyrum smithii*. Other information on this type is lacking.

Stands occur on a heavy clay pan, such as can occur along streams and rivers, particularly in western South Dakota in Butte County, where this type is common. In that county, there is a large lobe of dense clay soils that extends into South Dakota from Wyoming, included in an ecoregional unit by Omernik as "Dense Clay Prairie" (43k). Elsewhere in western South Dakota, this type fits a "Range site" for those areas along drainages with dense clay soils, from Butte County extending down into Pennington Co. and westward probably into Wyoming. The majority of uplands are dominated by these soils and vegetation. (D. Ode pers. comm. 2000).

COMMENTS: *2, MCS*. Type concept is of a heavy clay pan, such as can occur along streams and rivers, that tends to promote strong dominance by *Pascopyrum smithii*. Species associates need to be described. Concept may overlap with temporarily flooded upland depression ponds also dominated by *Pascopyrum smithii*.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This western wheatgrass clay flats prairie type is found in the northern Great Plains of the United States and possibly adjacent Canada, ranging from the Dakotas to possibly Saskatchewan.

USFS ECOREGIONS: 331:P, 332:P
CONSERVATION REGIONS:
STATES: ND SD **PROVINCES:** SK?

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: PASCOPYRUM SMITHII HERBACEOUS ALLIANCE (V.A.5.N.c)

Pascopyrum smithii - Bouteloua gracilis - Carex filifolia Herbaceous Vegetation

Western Wheatgrass - Blue Grama - Threadleaf Sedge Herbaceous Vegetation

Western Wheatgrass - Blue Grama - Threadleaf Sedge Prairie CEGL001579

DESCRIPTION: This community is dominated by medium and short graminoids. Total vegetation cover is usually high (Hanson and Dahl 1956, Hansen et al. 1984). *Pascopyrum smithii* or *Elymus lanceolatus* or both (the two species are similar both morphologically and ecologically) and *Bouteloua gracilis* usually contribute the most cover; however, *Bouteloua gracilis* cover may vary from co-dominant to locally absent. *Carex filifolia, Carex duriuscula (= Carex eleocharis)*, and *Carex pensylvanica* are often secondary species, but they also vary from moderate cover to locally absent . *Hesperostipa comata (= Stipa comata)* usually is present as a secondary species, but it often codominates on sandy loam soils. In Alberta and Saskatchewan, *Hesperostipa curtiseta (= Stipa spartea var. curtiseta)* may be as common as *Hesperostipa comata*. *Koeleria macrantha* is present in most stands and may contribute substantial cover. The forbs most likely to be found in this association are *Phlox hoodii, Sphaeralcea coccinea, Polygonum ramosissimum, Plantago patagonica, Opuntia polyacantha, Artemisia frigida, Antennaria microphylla*, and *Hedeoma hispida*. In southeastern Montana, western North Dakota, and northeastern Wyoming, stands of this association often contain *Artemisia tridentata ssp. wyomingensis*. Exotic brome grasses, especially *Bromus commutatus* and *Bromus tectorum*, are present in many stands of this association and they commonly contribute substantial cover (Hanson and Dahl 1956, Coupland 1961, Hansen et al. 1984, Hansen and Hoffman 1988).

This community is found on flat or gently sloping terrain. Many stands are on floodplains or gentle valley slopes, others are on uplands. Surface layers of soils are usually clay loams, although stands of this type may also be found on loams, silt loams, silty clays and clays (Hanson and Whitman 1938, Hansen and Hoffman 1988). In Alberta and Saskatchewan this association grows on solonetzic soils (with an eluvial horizon above a dense clay horizon high in sodium salts) developed on thin glacial till over Cretaceous shale (Coupland 1961). This community does not appear to be found in mountain valleys (Hanson and Dahl 1956, Jones 1992).

In the past, fire likely occurred commonly in this type.

COMMENTS: *2, WCS*. Almost any combination of *Pascopyrum smithii, Bouteloua gracilis, Carex filifolia*, and *Hesperostipa comata (= Stipa comata)* can be found in the northern and northwestern Great Plains, and the relative amounts of these species apparently depend at least in part on soil texture and grazing history. Moreover, drought or wet weather can cause the relative amounts of these species in one stand to change markedly in a few years (Ellison and Woolfolk 1937, Weaver and Albertson 1956). Consequently, differentiating between plant associations based solely on the relative amounts of these species is extremely difficult. This *Pascopyrum smithii - Bouteloua gracilis - Carex filifolia* association is found on soils in textural classes finer than loam in which *Pascopyrum smithii* and/or *Elymus lanceolatus* (which is similar morphologically and ecologically) contribute at least as much cover as does *Hesperostipa comata*. *Bouteloua gracilis, Elymus lanceolatus,* and *Carex filifolia* may be patchily distributed, so areas of several acres should be examined to determine whether the vegetation belongs to this association. This association shares major graminoid species with *Hesperostipa comata - Bouteloua gracilis - Carex filifolia* Herbaceous Vegetation (CEGL002037) but in the latter association, *Hesperostipa comata* contributes more cover than do *Pascopyrum smithii* or *Elymus lanceolatus*, and the latter association grows on soils of loam or coarser textural classes.

CONSERVATION RANK: *G4.* The G4 rank is based on the broad geographic range of this type, and its status as a common vegetation type within that range. Heavy grazing and lack of fire throughout its range may cause many stands to have a high proportion of exotics.

DISTRIBUTION: This western wheatgrass prairie community occurs throughout much of the northwestern Great Plains of the United States and Canada on flat or gently sloping terrain, ranging from Alberta and Saskatchewan in Canada south to Nebraska and possibly Colorado.

USFS ECOREGIONS: 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:CC
CONSERVATION REGIONS: 10:C, 26:C, 27:C
STATES: CO? MT ND NE SD WY? **PROVINCES:** AB SK

MIDWEST HERITAGE SYNONYMY: NE northwestern mixedgrass prairie =

OTHER SYNONYMY: Western Wheatgrass - Grama - Sedge Type (Hanson and Whitman 1938) =. Types previously separated as *Pascopyrum smithii / Bouteloua gracilis* or *Pascopyrum smithii / Carex filifolia* in the literature are now lumped together as *Pascopyrum smithii / Bouteloua gracilis - Carex filifolia* Herbaceous vegetation., *Bromus tectorum - Agropyron smithii - Bouteloua gracilis* Association (Hanson and Dahl 1956) =, *Agropyron smithii / Carex filifolia* Habitat Type (Hansen et al. 1984) =, *Elytrigia smithii / Bouteloua gracilis* Plant Association (Johnston 1987) B, *Elytrigia smithii / Carex filifolia* Plant Association (Johnston 1987) =, *Agropyron smithii / Bouteloua gracilis* Community (Jones 1992) F, *Agropyron smithii / Carex filifolia* Community (Jones 1992) F

USNVC HIERARCHY: PASCOPYRUM SMITHII HERBACEOUS ALLIANCE (V.A.5.N.c)

Pascopyrum smithii - Bouteloua gracilis Herbaceous Vegetation

Western Wheatgrass - Blue Grama Herbaceous Vegetation

Western Wheatgrass - Blue Grama Mixedgrass Prairie CEGL001578

DESCRIPTION: Luxuriant cover that can be dominated by either *Bouteloua gracilis* or *Pascopyrum smithii* typifies this grassland. *Juniperus monosperma* or *Pinus edulis* communities usually surround this swale association. Graminoid diversity is usually low, with scattered grasses such as *Muhlenbergia repens, Koeleria macrantha* and *Elymus elymoides* often present. In Kansas, *Bouteloua curtipendula* and *Buchloe dactyloides* may also be present (Lauver et al. 1999). The shrub layer is very open and moderate in diversity and generally includes *Atriplex canescens* and *Krascheninnikovia lanata* (which both occur as phases and can become dominant in disturbed areas), *Opuntia phaeacantha* and *Opuntia imbricata*. Forb diversity and cover is generally low.

Stands occur within montane swales or along upland valley bottoms. It generally occurs on northerly aspects at elevations between 1900 and 2500 m (6000 and 8000 feet). Slopes are typically gentle with fine-textured and well-developed soils that are predominantly from eroded Paleozoic sandstone and limestone. In Kansas, stands are common on nearly level uplands or shallow depressions in uplands. Soils are silty clay loam with an impermeable or slowly permeable clay pay subsoil layer (Lauver et al. 1999).

COMMENTS: *1, WCS*.

CONSERVATION RANK: *G5.* This western wheatgrass-blue grama prairie was once an extensive grassland of the Southern Great Plains and Chihuahuan Desert. Its current range and condition are not well understood.

DISTRIBUTION: This western wheatgrass - blue grama grassland is found in the Southern Great Plains and Chihuahuan Desert in the United States, ranging from Colorado and Kansas south to New Mexico.

USFS ECOREGIONS: 315A:CC, 321A:PP, 331H:CC, 331I:CC, M313B:CC, M331F:CC
CONSERVATION REGIONS: 20:C, 27:C
STATES: CO KS NM **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY:

USNVC HIERARCHY: PASCOPYRUM SMITHII HERBACEOUS ALLIANCE (V.A.5.N.c)

Pascopyrum smithii - Hesperostipa comata Central Mixedgrass Herbaceous Vegetation

Western Wheatgrass - Needle-and-thread Central Mixedgrass Herbaceous Vegetation

Wheatgrass - Needle-and-thread Mixedgrass Prairie CEGL002034

DESCRIPTION: The dominant vegetation in this community is mid grasses. The vegetation may be moderately open to dense. The most abundant species are *Pascopyrum smithii* and *Hesperostipa comata (= Stipa comata)*. Other graminoids that may be present to abundant are *Aristida purpurea, Aristida basiramea, Bouteloua gracilis, Koeleria macrantha, Calamovilfa longifolia* (on sandy soils), *Hesperostipa spartea (= Stipa spartea), Schizachyrium scoparium, Carex filifolia*, and *Carex duriuscula (= Carex eleocharis)*. Common forbs include *Tragopogon dubius, Helianthus petiolaris, Amorpha canescens*, and *Artemisia campestris*. Shrubs are rare in this community. Scattered *Rosa arkansana, Artemisia frigida*, and occasionally *Symphoricarpos occidentalis* may be present.

This community occurs on many different topographic and soil types. It can be on upland slopes, ridgetops, plateaus, stream terraces, and rolling sandhills (Steinauer 1989, USFS 1992). The soils are fine- to medium-textured (clay to sandy loam) and moderately deep to deep. They are derived from a variety of materials across this community's range. These include eolian sand, sandstone, shale, siltstone, loess, or alluvium.

COMMENTS: *2, MCS*. This type may not occur in Nebraska (Steinauer and Rolfsmeier 2000). This type is somewhat conceptually vague. It potentially includes stands that have more moderately coarse-textured and somewhat drier soils than other *Pascopyrum smithii* types, but not dry enough to shift the dominance toward *Hesperostipa comata (= Stipa comata)* types. A major review of published material is needed in central North and South Dakota to clarify this type. In particular it would be worth examining whether or not more western Great Plains species are absent from the central mixed grass region, and where this type is most common.

CONSERVATION RANK: *G4.* The total number of occurrences is unknown, but 13 have been documented in North Dakota. The community is also reported from Manitoba, Saskatchewan, South Dakota, and maybe Nebraska. It occurs in five ecoregional sections. One out of 9 ranked occurrences is A or B.

DISTRIBUTION: This mixedgrass prairie community type is found throughout the north-central Great Plains of the United States and possibly Canada, ranging from Manitoba and possibly Saskatchewan, south to northern Nebraska.

USFS ECOREGIONS: 251Aa:CCC, 331E:CP, 331F:CC, 332A:CC, 332B:CC, 332D:CC, M334A:CC
CONSERVATION REGIONS: 25:C, 26:C, 34:C, 35:C
STATES: ND NE SD **PROVINCES:** MB SK

MIDWEST HERITAGE SYNONYMY: NE northern sand/gravel prairie =

OTHER SYNONYMY: *Pascopyrum smithii - Stipa comata* Habitat Type (U.S. Forest Service (USFS) 1992) =

USNVC HIERARCHY: PASCOPYRUM SMITHII HERBACEOUS ALLIANCE (V.A.5.N.c)

Pascopyrum smithii - Nassella viridula Herbaceous Vegetation

Western Wheatgrass - Green Needlegrass Herbaceous Vegetation

Western Wheatgrass - Green Needlegrass Mixedgrass Prairie CEGL001583

DESCRIPTION: This community is dominated by mid grasses, generally between 0.6 and 1 m tall. The vegetation cover tends to be moderate to high, with almost all of the canopy provided by graminoids (Redmann 1975, USFS 1992). The dominant species are *Pascopyrum smithii* and *Nassella viridula*, although *Elymus lanceolatus* (another rhizomatous wheatgrass that is similar in morphology and ecology to *Pascopyrum smithii*) is the dominant species in some stands. At least 5% canopy cover of *Nassella viridula* may be diagnostic for this association. Other common grasses are *Hesperostipa comata (= Stipa comata), Koeleria macrantha, Poa secunda (= Poa juncifolia), Poa pratensis, Sporobolus cryptandrus*, and, on sandier soils, *Calamovilfa longifolia*. Shorter graminoids are less common, but may include *Bouteloua gracilis, Carex duriuscula (= Carex eleocharis), Carex filifolia, Carex inops ssp. heliophila*, and *Carex pensylvanica*. These species are present in many stands, but they usually contribute little cover. The wheatgrass basin association of Nebraska (Steinauer and Rolfsmeier 2000), which may belong to this association, also contains *Schizachyrium scoparium*. Cheatgrasses (*Bromus commutatus, Bromus japonicus, Bromus tectorum*) are present in many stands and contribute substantial cover in some. The forbs *Symphyotrichum falcatum (= Aster falcatus), Astragalus* spp., *Achillea millefolium, Sphaeralcea coccinea, Artemisia ludoviciana, Lepidium densiflorum*, and *Vicia americana* are also typical of this community. *Artemisia cana ssp. cana* or *Artemisia tridentata ssp. wyomingensis* may be present, often as scattered shrubs contributing little cover. Stands with denser shrubs are transitional to shrub-herbaceous vegetation.

This community is found at the bottom of narrow valleys, on stream terraces, and on rolling uplands (Jones 1992, USFS 1992). Soils are fine-textured (clays, silty clays, clay loams, or rarely loams) and well-drained. The soil profile is typically well-developed. The parent material is siltstone and mixed sedimentary rock (USFS 1992). This community usually occurs on level or nearly level ground but sometimes may be on moderate slopes of any aspect.

COMMENTS: *1, WCS*. This association includes stands growing on mesic sites and containing substantial cover of plants characteristic of such sites, including *Nassella viridula, Poa secunda (= Poa juncifolia, = Poa nevadensis), Poa pratensis*, and *Achillea millefolium*. The amount of these species that is diagnostic of this association is unknown (pending further analysis of stand data), but they contribute at least 5% of the herbaceous canopy cover. Some of these species (especially *Nassella viridula*) may be present in upland vegetation such as *Pascopyrum smithii - Bouteloua gracilis - Carex filifolia* Herbaceous Vegetation (CEGL001579), but they contribute only trace amounts to the vegetation. In Nebraska this type is recognizable, but forms a close association with other mixedgrass types, and thus is lumped with them. *Nassella viridula* does often strongly dominate with *Pascopyrum smithii* in mesic bottoms, but if grazing pressures were removed from upland slopes dominated by *Pascopyrum smithii* and *Bouteloua gracilis*, it is thought that *Nassella viridula* would recover its dominance on those slopes (G. Steinauer pers. comm. 2000).

CONSERVATION RANK: *G3G4.* The G3G4 rank is based on the broad geographic distribution and the relatively broad environmental requirements of this association. The prevalence of cheatgrass in many stands, though, may necessitate a review of this rank.

DISTRIBUTION: This western wheatgrass - needlegrass community is common across much of the northern Great Plains of the United States and possibly Canada, ranging from Colorado and possibly Nebraska, north to Montana and North Dakota, and possibly Saskatchewan.

USFS ECOREGIONS: 331D:CC, 331G:CC, M332D:??, M334A:CC
CONSERVATION REGIONS: 10:C, 25:C, 26:C, 27:C, 35:C, 9:C
STATES: CO? MT ND NE? SD WY **PROVINCES:** SK?

MIDWEST HERITAGE SYNONYMY: NE? northwestern mixedgrass prairie ?

OTHER SYNONYMY: *Stipa viridula* Community (Redmann 1975) =, *Agropyron smithii - Stipa viridula* Habitat Type (Hirsch 1985) =, *Elytrigia smithii / Stipa viridula* Plant Association (Johnston 1987) ?, *Agropyron smithii / Stipa viridula* Habitat Type (U.S. Forest Service (USFS) 1992) =

USNVC HIERARCHY: PASCOPYRUM SMITHII HERBACEOUS ALLIANCE (V.A.5.N.c)

Pascopyrum smithii Herbaceous Vegetation

Western Wheatgrass Herbaceous Vegetation

Western Wheatgrass Mixedgrass Prairie CEGL001577

DESCRIPTION: This is a midgrass community. Shrubs are rare. The dominant species grow to approximately 1 m. *Pascopyrum smithii* is the only constant dominant species and may have 50% cover. Other species such as *Koeleria macrantha* and *Poa* spp. may be locally abundant. Many other species common in midgrass prairies are also found in this community. These include *Artemisia ludoviciana, Bouteloua gracilis, Nassella viridula*, and *Hesperostipa comata (= Stipa comata)*.

This community occurs on flat to gently sloping topography. Soils are clay, clay loam, and silt loam. It is sometimes found on alluvial fans of small streams. The soils are deep (40-100 cm) and well-developed.

COMMENTS: *3, WCS*. This community is similar to several others that are dominated or codominated by *Pascopyrum smithii*. As currently defined, it represents a western Great Plains and foothills version of the western wheatgrass types in the central Great Plains. Further work needs to be done to refine the differences in composition and environmental characteristics. See recent descriptions by Thilenius et al. (1995, *Pascopyrum smithii* sodgrass steppe, a more playa-like wheatgrass type) and by Steinauer and Rolfsmeier (2000). In Nebraska, Steinauer and Rolfsmeier (2000) suggest that their stands may resemble *Pascopyrum smithii - Nassella viridula* Herbaceous Vegetation (CEGL001583).

CONSERVATION RANK: *G3G5Q.*

DISTRIBUTION: This midgrass prairie type is found in the northern and western Great Plains, Rocky Mountains and western basins of the United States and possibly Canada, ranging from North Dakota and possibly Saskatchewan, south to Nebraska and Colorado, west to Utah, and north to Idaho.

USFS ECOREGIONS: 331D:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 342F:CC, M331A:CC, M332E:CC
CONSERVATION REGIONS: 10:C, 11:C, 26:C, 27:C, 6:C, 9:C
STATES: CO ID MT NE SD UT WY **PROVINCES:** SK

MIDWEST HERITAGE SYNONYMY: NE wheatgrass basin prairie =

OTHER SYNONYMY: Wheatgrass (Aldous and Shantz 1924) =, *Agropyron smithii* Great Basin Grassland (Baker and Kennedy 1985) =

USNVC HIERARCHY: PASCOPYRUM SMITHII HERBACEOUS ALLIANCE (V.A.5.N.c)

Pseudoroegneria spicata - Bouteloua curtipendula Herbaceous Vegetation

Bluebunch Wheatgrass - Sideoats Grama Herbaceous Vegetation

Bluebunch Wheatgrass - Sideoats Grama Mixedgrass Prairie CEGL001663

DESCRIPTION: *Pseudoroegneria spicata* is strongly dominant (canopy cover ranging from 40-60%) with *Bouteloua curtipendula* exhibiting less than one-fourth this cover value. *Pascopyrum smithii (= Agropyron smithii)* and *Schizachyrium scoparium* are consistently present with cover less than 10%. Forbs are a minor component with *Lygodesmia juncea, Echinacea angustifolia* and *Pediomelum argophyllum (= Psoralea argophylla)* having the highest fidelity to the type. The shrubs (subshrubs) *Rhus trilobata, Gutierrezia sarothrae* and *Artemisia frigida* are consistently present with low coverage values (less than 5%).

This type occurs as small to large patches located on foothills and sideslopes along major drainages between the Tongue and Powder rivers of southeastern Montana; known elevations range between 3100 and 3800 feet. This type is considered a topoedaphic climax by Hansen and Hoffman (1988) because it occurs on moderate to steep (>45%) slopes, the surfaces of which are strewn with large amounts of irregularly shaped, iron oxide porcelainite shale (scoria) that has resulted from ancient fires in contiguous coal beds. The soils are conventional loams but shallow and excessively drained.

Given the low cover and patchiness of this type, fires probably burned in a mosaic fashion with reduced intensity. Pronghorn antelope use these sites for grazing and predator detection.

COMMENTS: *2, WCS*. *Pseudoroegneria spicata - Bouteloua curtipendula* appears to be endemic to southeastern Montana, occurring between the Tongue and Powder rivers. Other portions of southeastern Montana and adjacent Wyoming would appear to have appropriate habitat (soils derived from scoria clinker) but lack populations of *Bouteloua curtipendula* or *Pseudoroegneria spicata* because they are at the extreme western and eastern extensions of their respective ranges and consequently sporadically distributed. There would seem to be some sites intermediate between *Rhus trilobata / Pseudoroegneria spicata* Shrub Herbaceous Vegetation (CEGL001120) and this type and for which it would be helpful to have an arbitrary cover cutoff value for *Rhus trilobata* for assigning stands to types. In the Rapid Ecological Assessment of the Northern Great Plains this type was recorded but once (Martin et al. 1998).

Rhus trilobata / Pseudoroegneria spicata Shrub Herbaceous Vegetation (CEGL001120) differs from this community by having *Rhus trilobata* dominant or at least well represented. *Pseudoroegneria spicata - Carex filifolia* Herbaceous Vegetation (CEGL001665) differs from this association by lacking *Bouteloua curtipendula* and having *Carex filifolia* with at least 5% cover, though it may not be the dominant graminoid. *Pseudoroegneria spicata - Bouteloua gracilis* Herbaceous Vegetation (CEGL001664) of western Montana occurs for the most part west of the distribution of *Bouteloua curtipendula* and where *Bouteloua gracilis* is the undergrowth dominant.

CONSERVATION RANK: *G3.* As currently understood, this type is restricted both geographically and with regard to site parameters. However, appropriate habitat in Wyoming overlaps the distribution of the characteristic species, so inventory may yield more occurrences. Threats to this type could potentially come from domestic stock, but sites are generally somewhat removed from water. These sites are generally not conducive to alien *Bromus* species, but their potential to support other weeds is unknown.

DISTRIBUTION: This association has been recorded for only southeastern Montana, though appropriate habitat ostensibly occurs in northeastern Wyoming and westernmost North Dakota.

USFS ECOREGIONS: 331G:CC
CONSERVATION REGIONS: 26:C
STATES: MT ND WY? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Agropyron spicatum - Bouteloua curtipendula* Habitat Type (Hansen and Hoffman 1988) =

USNVC HIERARCHY: PSEUDOROEGNERIA SPICATA HERBACEOUS ALLIANCE (V.A.5.N.d)

Schizachyrium scoparium - Bouteloua (curtipendula, gracilis) - Carex filifolia Herbaceous Vegetation

Little Bluestem - (Sideoats Grama, Blue Grama) - Threadleaf Sedge Herbaceous Vegetation

Northern Great Plains Little Bluestem Prairie CEGL001681

DESCRIPTION: This community is predominantly composed of graminoid species less than 1 m tall. *Pinus ponderosa* may occasionally be present. The vegetation cover is moderate to high. Thilenius et al. (1995) found that vegetation cover was 44% in Wyoming, and Hansen and Hoffman (1988) found 75% cover in North Dakota. The dominant species is *Schizachyrium scoparium*, with *Bouteloua curtipendula, Bouteloua gracilis*, and *Carex filifolia* as associates or codominants. *Andropogon gerardii, Carex inops ssp. heliophila, Carex duriuscula (= Carex eleocharis), Koeleria macrantha* and *Calamovilfa longifolia* are often present. *Calamovilfa longifolia* may be abundant on sandier soils. *Muhlenbergia cuspidata, Hesperostipa comata (= Stipa comata), Pascopyrum smithii*, and *Nassella viridula* may also be present. *Pseudoroegneria spicata* may be found in the western portions of this community (Jones 1992). In Manitoba, the graminoids *Festuca ovina* and *Elymus trachycaulus* and the lichen *Selaginella densa* are more abundant (Greenall 1995). Forbs do not contribute greatly to the canopy, but many species may be found in this community (Hanson and Whitman 1938). Among the forbs that may be found are *Echinacea angustifolia, Symphyotrichum oblongifolium (= Aster oblongifolius), Symphyotrichum ericoides (= Aster ericoides), Gaura coccinea, Lygodesmia juncea, Helianthus pauciflorus ssp. pauciflorus, Rosa arkansana, Liatris punctata, Pediomelum argophyllum (= Psoralea argophylla), Dalea purpurea, Phlox hoodii*, and *Campanula rotundifolia*. There are very few woody species; those that are present are usually short shrubs such as *Artemisia frigida, Juniperus horizontalis*, and *Yucca glauca*. Litter often accumulates and may cover more than 50% of the ground (Hirsch 1985).

This community is usually found on gentle to steep slopes with variable aspects (Hansen et al. 1984, Johnston 1987, Hansen and Hoffman 1988). The soil may be loamy sand, sandy loam, loam, or clay loam. There may be a substantial component of gravel. Hansen et al. (1984) found 7-36% gravel by weight in 16 stands in western North Dakota. The soils are typically shallow and occur over sandstone or limestone (Johnston 1987, Thilenius et al. 1995).

Fire probably played a major role in this type, whereby periodic fires would increase graminoid production and deter tree growth.

COMMENTS: *2, WCS*. Contrast this association with *Schizachyrium scoparium - Bouteloua curtipendula* grasslands in New Mexico. Hansen et al. (1984) report that *Bouteloua gracilis* and *Koeleria macrantha (= Koeleria cristata)* may be prominent in Theodore Roosevelt National Park, North Dakota.

CONSERVATION RANK: *G3G4.*

DISTRIBUTION: This little bluestem mixedgrass prairie type is distributed throughout the northern Great Plains of the United States and Canada, ranging from Manitoba and possibly Saskatchewan, south to South Dakota and Wyoming.

USFS ECOREGIONS: 331F:CC, 331G:CC, M334A:CC
CONSERVATION REGIONS: 25:C, 26:C, 34:C
STATES: MT ND SD WY **PROVINCES:** MB SK

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: Little Bluestem Type (Hanson and Whitman 1938) =, *Andropogon scoparius* Habitat Type (Hirsch 1985) =, *Schizachyrium scoparium / Bouteloua curtipendula* Plant Association (Johnston 1987) I, *Schizachyrium scoparium / Carex filifolia* Plant Association (Johnston 1987) I, *Andropogon scoparius / Carex filifolia* Habitat Type (Hansen et al. 1984) =

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - BOUTELOUA CURTIPENDULA HERBACEOUS ALLIANCE (V.A.5.N.c)

Schizachyrium scoparium - Bouteloua curtipendula - Bouteloua gracilis Central Plains Herbaceous Vegetation

Little Bluestem - Sideoats Grama - Blue Grama Central Plains Herbaceous Vegetation

Central Great Plains Little Bluestem Prairie CEGL002246

DESCRIPTION: The vegetation in this community often forms two layers, a shorter layer of grasses and a taller layer of mixed grasses and forbs (Kuchler 1974). Cover is moderately dense to dense in most stands (Weaver and Albertson 1956). The vegetation is characteristically dominated by three species, *Schizachyrium scoparium, Bouteloua curtipendula*, and *Bouteloua gracilis*. The first two are mid grasses and the latter is a short grass. *Schizachyrium scoparium* is often the tallest dominant grass, reaching 0.5-0.8 m in Oklahoma (Bruner 1931). *Andropogon gerardii, Sporobolus cryptandrus*, and *Sorghastrum nutans* are present, especially on lower slopes. The short grasses *Buchloe dactyloides* and *Bouteloua hirsuta* grow on upper slopes and level ground. Forbs include *Ambrosia psilostachya, Dalea enneandra, Echinacea angustifolia, Liatris punctata, Calylophus serrulatus (= Oenothera serrulata)*, and *Psoralidium tenuiflorum (= Psoralea tenuiflora)*.

This community is primarily found on level to moderately sloping uplands, but is more likely to be on steep ravine slopes in western Kansas (Kuchler 1974). The loam, clay loam, silty loam, or silty soils usually formed over limestone. They are shallow to moderately deep, well-drained, and usually contain a substantial amount of rock fragments (Heitschmidt et al. 1970, Johnston 1987).

COMMENTS: *3, MCS*. Characteristics of this type that distinguish it from other mixedgrass prairie types need to be further studied. This type may be synonymous with *Schizachyrium scoparium - Bouteloua curtipendula* Western Great Plains Herbaceous Vegetation (CEGL001594).

CONSERVATION RANK: *G2G4*. The total number of occurrences is unknown. Seven have been documented in Kansas, where the community is ranked S2(?). Although no other occurrences have been documented, the community is also reported in Oklahoma (S?), where it may be more common.

DISTRIBUTION: This little bluestem - sideoats grama grassland community is found in the south-central Great Plains of the United States, particularly in Kansas and Oklahoma.

USFS ECOREGIONS: 331:P, 332:C
CONSERVATION REGIONS: 27:C, 33:C
STATES: KS OK **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: Little Bluestem Community, Western Kansas (Weaver and Albertson 1956) =. uncertain if equivalent, Mixed Prairie (Bruner 1931) B, *Bouteloua* Community (Heitschmidt et al. 1970) F, *Bouteloua - Andropogon* Community (Heitschmidt et al. 1970) F, *Andropogon* Community (Heitschmidt et al. 1970) F, Bluestem - Grama Prairie (Kuchler 1974) B

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - BOUTELOUA CURTIPENDULA HERBACEOUS ALLIANCE (V.A.5.N.c)

Schizachyrium scoparium - Bouteloua curtipendula Chalkflat Herbaceous Vegetation

Little Bluestem - Sideoats Grama Chalkflat Herbaceous Vegetation

Little Bluestem Chalkflat Mixedgrass Prairie CEGL002247

DESCRIPTION: The vegetation of this community typically consists of dense stands of short to medium-tall graminoids and forbs. *Bouteloua curtipendula* and *Schizachyrium scoparium* are the most abundant. *Andropogon gerardii* and *Buchloe dactyloides* are also typically found in this community. *Sporobolus cryptandrus, Distichlis spicata, Eriogonum effusum, Gutierrezia sarothrae, Oenothera macrocarpa, Stanleya pinnata*, and *Atriplex canescens* are some of the species characteristic of this community (Kuchler 1974, Lauver et al. 1999).

This community occurs on nearly level to gently sloping terraces below chalk or limestone outcrops. It is not flooded or saturated during the year. Soils are well-drained and moderately deep to deep. They are strongly calcareous with silty or loamy surface layers and subsoils. The parent material is chalky shale and soft limestone (Kuchler 1974, Lauver et al. 1999).

COMMENTS: *2, MCS*. Type concept is taken from Kansas state type - chalkflat mixed prairie (Kuchler 1974, Lauver et al. 1999).

CONSERVATION RANK: *G2.* There are probably fewer than 20 occurrences of this community rangewide. It is reported from the west-central part of Kansas (where it is ranked S2), and it may also occur further south into Oklahoma. Currently there are no occurrences documented. Probably many occurrences have been destroyed by conversion to agriculture, or degraded by heavy grazing.

DISTRIBUTION: This little bluestem mixedgrass prairie community is limited to the south-central Great Plains in the United States. In particular it is currently known from the west-central part of Kansas, in the valleys of Hackberry Creek and Smoky Hill River, but it may extend into Oklahoma.

USFS ECOREGIONS: 251:C, 331:P, 332:P
CONSERVATION REGIONS: 27:C, 33:P
STATES: KS OK? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: Little Bluestem Chalkflat Mixedgrass Prairie (MCS)

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - BOUTELOUA CURTIPENDULA HERBACEOUS ALLIANCE (V.A.5.N.c)

Schizachyrium scoparium - Bouteloua curtipendula Loess Mixedgrass Herbaceous Vegetation

Little Bluestem - Sideoats Grama Loess Mixedgrass Herbaceous Vegetation

Little Bluestem Loess Mixedgrass Prairie CEGL002036

DESCRIPTION: This community is dominated by short and mid grasses, with tall grasses scattered to common on the lower slopes. In central South Dakota, stands had a mean vegetation height of about 25 cm. The vegetation, consisting of grasses and forbs, was moderately open with approximately 15% of the ground in a stand as bare soil (U.S. Army Corps of Engineers 1979). Shrubs are uncommon. Herbaceous canopy cover is moderate to dense. *Bouteloua curtipendula* and *Schizachyrium scoparium* are abundant, with *Schizachyrium scoparium* dominant on steeper slopes and *Bouteloua curtipendula* more common on gentle slopes (Tomanek and Albertson 1957). On level uplands and upper slopes *Bouteloua gracilis* increases in abundance (Hulett et al. 1968). On lower slopes and in draws, tall and mid grasses dominate, including *Andropogon gerardii, Bouteloua curtipendula, Panicum virgatum*, and *Pascopyrum smithii*. Other grasses frequently found in this community include *Aristida purpurea, Buchloe dactyloides, Koeleria macrantha, Muhlenbergia cuspidata, Hesperostipa comata (= Stipa comata), Sporobolus compositus var. compositus*, and *Muhlenbergia cuspidata*. *Buchloe dactyloides* is more common on level sites farther west and in heavily grazed sites. Patches of shrubs are often common locally in low places including draws. More common shrub species include *Prunus virginiana, Ribes aureum var. villosum, Symphoricarpos occidentalis*, and *Toxicodendron rydbergii*. *Amorpha canescens* and *Yucca glauca* are common shrubs of uplands. Among the common forb species in this community are *Artemisia dracunculus, Asclepias pumila, Symphyotrichum ericoides (= Aster ericoides), Echinacea angustifolia, Liatris punctata, Lygodesmia juncea, Ratibida columnifera, Solidago missouriensis*, and *Sphaeralcea coccinea*. Many sites have been intensively invaded by *Bromus inermis* and *Poa pratensis*, often to the near exclusion of native species. Other frequent exotic invaders include *Bromus tectorum, Bassia scoparia (= Kochia scoparia)*, and *Salsola collina*. Overall species diversity is moderate to relatively high in well-preserved sites (Lauver et al. 1999, Steinauer and Rolfsmeier 2000).

This community can occur on level to steep uplands in level, rolling and dissected loess plains. The soils are formed from loess and are usually deep (>100 cm) clay, loam, or silt loam textures that are moderately to rapidly well-drained (Lauver et al. 1999, Steinauer and Rolfsmeier 2000). Sand may occur near or above streams. In and around Pierre, South Dakota, the Hill subtype occurs on highly calcareous clay (Dave Ode pers. comm. 1996).

COMMENTS: *2, MCS*. This type is broadly defined regionally, but has been well described in Nebraska by Steinauer and Rolfsmeier (2000, and references therein), who also note compositional variation related to limestone and shale outcrops.

CONSERVATION RANK: *G3?.* Most sites have been converted to cropland. Many remaining sites are overgrazed and extensively invaded by exotic species.

DISTRIBUTION: This little bluestem mixedgrass prairie community is found on loess deposits in the central and northern Great Plains, ranging from North Dakota south to Colorado and Kansas.

USFS ECOREGIONS: 251G:??, 331C:CP, 331E:C?, 332C:CP, 332D:C?, 332E:CC
CONSERVATION REGIONS: 26:?, 27:C, 33:C
STATES: CO KS ND NE SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE loess mixedgrass prairie =

OTHER SYNONYMY: Atwood Prairie, Hillside (Tomanek and Albertson 1957) =, Atwood Prairie, Sharp Breaks (Tomanek and Albertson 1957) =, Loess Hills and Plains, Nebraska (Weaver and Albertson 1956) B, *Andropogon scoparius - Andropogon gerardii - Bouteloua curtipendula* (U. S. Army Corps of Engineers 1979) =. In 1979, Steve Archer and Larry L. Tieszen studied patterns and distributions of upland plant communities along the east bank of the Lake Francis Case Reservoir on the Missouri River in south-central South Dakota. In addition to the *Andropogon scoparius-Andropogon gerardii-Bouteloua curtipendula* community, several other types that they recognized are tentatively combined with this type: 1. *Juniperus virginiana-Andropogon gerardii-Andropogon scoparius* is a savanna-like community with grasses and scattered cedars, which occurs on north-facing and south-facing slopes with inclinations ranging from 20 to 30 degrees. This community may result from invasion by *Juniperus virginiana*, facilitated by fire suppression, into *Andropogon scoparius-Andropogon gerardii-Bouteloua curtipendula* communities. The community's relatively high diversity largely results from this invasion by woodland species. It is very restricted in range and distribution. 2. *Yucca glauca-Bouteloua curtipendula-Agropyron smithii* is a grassland with scattered shrubs, which occurs on steep, rocky, south-facing slopes of 20 to 30 degrees inclination. This community, occurring in the northern part of the study area, occupies the niche exploited by the *Andropogon scoparius-Andropogon gerardii-Bouteloua curtipendula* community in the southern part of the study area.

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - BOUTELOUA CURTIPENDULA HERBACEOUS ALLIANCE (V.A.5.N.c)

Schizachyrium scoparium - Bouteloua curtipendula Red Hills Herbaceous Vegetation

Little Bluestem - Sideoats Grama Red Hills Herbaceous Vegetation

Red Hills Little Bluestem Mixedgrass Prairie CEGL002248

DESCRIPTION: This community is dominated by short and mid grasses. Forbs are abundant. The herbaceous vegetation often forms two distinct layers with the lower one being more dense than the taller (Kuchler 1974). *Andropogon gerardii, Bouteloua curtipendula, Bouteloua gracilis, Bouteloua hirsuta*, and *Schizachyrium scoparium* are the dominant species. Other herbaceous plants that are commonly found in this community are *Ambrosia psilostachya, Symphyotrichum ericoides (= Aster ericoides), Callirhoe involucrata, Gutierrezia sarothrae, Calylophus serrulatus (= Oenothera serrulata), Sporobolus compositus (= Sporobolus asper)*, and *Sporobolus cryptandrus*. There are low *Juniperus virginiana* trees scattered across the landscape of this community. Groves of small deciduous trees and shrubs can be found on north-facing slopes and in valleys. In these groves *Celtis occidentalis, Prunus angustifolia, Rhus glabra*, and *Symphoricarpos occidentalis* are usually the dominant woody plants (Lauver et al. 1999).

This community occurs on gently sloping to strongly dissected hills and escarpments on uplands. Soils consist of silt, loam, or clay. They are well-drained and range from shallow to deep. The parent material is red silty shale, red silty sandstone, red sandstone, or clayey shale. The surface of this community is not flooded or saturated during the year (Lauver et al. 1999).

COMMENTS: *3, MCS*. The type concept is taken from the Kansas state type - Red Hills mixed prairie (Lauver et al. 1999). The type should be compared with the *Juniperus virginiana var. virginiana / Schizachyrium scoparium - Bouteloua curtipendula* Great Plains Herbaceous Vegetation (CEGL004066) which is attributed to several sections and subsections in eastern Oklahoma. Are these two distinct entities, and do they belong in the same formation or two different ones?

CONSERVATION RANK: *G2Q.* This community has a naturally restricted distribution and some sites have been negatively impacted by grazing.

DISTRIBUTION: This little bluestem mixedgrass prairie community is found in the southern Great Plains of the United States, in the Red Hills of southern Kansas and northern Oklahoma.

USFS ECOREGIONS: 332E:CC
CONSERVATION REGIONS: 33:P
STATES: KS OK **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: Hillside Prairie, Ashland (Tomanek and Albertson 1957), Cedar Hills Prairie (Kuchler 1974)

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - BOUTELOUA CURTIPENDULA HERBACEOUS ALLIANCE (V.A.5.N.c)

Schizachyrium scoparium - Bouteloua curtipendula Western Great Plains Herbaceous Vegetation

Little Bluestem - Sideoats Grama Western Great Plains Herbaceous Vegetation

Western Great Plains Little Bluestem Mixedgrass Prairie CEGL001594

DESCRIPTION: The vegetation of this community is dominated by mid grasses, with tall and short grasses present to abundant. The vegetation cover is moderate to dense. Most of the plants in this community are 0.5 m or less, but the tallest species grow to approximately 1 m (Weaver and Albertson 1956). *Schizachyrium scoparium* and *Bouteloua curtipendula* are the dominant species. *Andropogon hallii, Bouteloua gracilis, Bouteloua hirsuta, Koeleria macrantha, Panicum virgatum, Sorghastrum nutans, Hesperostipa neomexicana (= Stipa neomexicana), Sporobolus compositus var. compositus*, and *Sporobolus cryptandrus* are also common grasses. Forbs do not make up a large portion of the canopy, but *Eriogonum* spp. and *Dalea purpurea* are typically present. Woody plants, such as the short shrubs *Gutierrezia sarothrae* and *Yucca glauca*, are uncommon but usually present.

This community is found on shallow sandy or rocky soil. In Kansas and Oklahoma it is often over limestone or other calcareous material (Johnston 1987). This community is usually on level or gently sloping terrain, although it may also occur on moderate slopes (Weaver and Albertson 1956).

COMMENTS: *2, WCS*. This type appears to be similar to *Schizachyrium scoparium - Bouteloua curtipendula - Bouteloua gracilis* Central Plains Herbaceous Vegetation (CEGL002246) and should perhaps be combined with it.

CONSERVATION RANK: *G3.* The number of occurrences is unknown. The community is reported from Oklahoma (where it is ranked S4), Kansas (S?), Colorado (S?), and possibly New Mexico (SP). It is found in seven southwestern Great Plains ecoregional sections.

DISTRIBUTION: This little bluestem grassland community is found in the southwestern Great Plains of the United States, ranging from Kansas and Colorado south to Oklahoma and possibly New Mexico.

USFS ECOREGIONS: 315A:CC, 315B:CC, 321A:CC, 331B:CC, 331I:CC, M313B:CC, M331F:CC
CONSERVATION REGIONS: 20:C, 21:C, 24:C, 27:C, 28:C
STATES: CO KS? NM? OK **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: Mesa and Piedmonts, Bunch-grass Community, Colorado (Weaver and Albertson 1956) =. uncertain if equivalent, Postclimax Plant Communities, Deep Sands, New Mexico (Weaver and Albertson 1956) B, *Bouteloua curtipendula / Schizachyrium scoparium* Plant Association (Johnston 1987) F, Little Bluestem - Side-oats Grama Western Great Plains Grassland

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - BOUTELOUA CURTIPENDULA HERBACEOUS ALLIANCE (V.A.5.N.c)

Schizachyrium scoparium - Muhlenbergia cuspidata Herbaceous Vegetation

Little Bluestem - Stony-hills Muhly Herbaceous Vegetation

Little Bluestem - Plains Muhly Bunchgrass Prairie CEGL001683

DESCRIPTION: This is an herbaceous association dominated by perennial bunch grasses, the most abundant being *Schizachyrium scoparium* and *Muhlenbergia cuspidata*. Other grasses common (to codominant) in some stands include *Elymus lanceolatus, Koeleria macrantha, Hesperostipa comata (= Stipa comata), Nassella viridula (= Stipa viridula), Aristida purpurea var. longiseta (= Aristida longiseta)*, and *Pascopyrum smithii*. Total graminoid cover averages 50-60%. There are a large number of forb species present, but none are abundant. The more common species include *Phlox hoodii, Cerastium beeringianum, Tetraneuris acaulis*, and *Linum perenne*. Total forb cover is less than 20%. There is an open, low-shrub layer, with 10-15% cover. The dwarf-shrub *Gutierrezia sarothrae* and the taller *Chrysothamnus viscidiflorus* are the most common. *Juniperus horizontalis* is infrequent but locally common. Lichens are common on the ground surface, having an average of 8% cover. Litter and bare ground average 50% and 15% cover, respectively (Jorgensen 1979).

This association is found in a small region of central Montana, on the eastern edge of a mountainous uplift. The climate is semi-arid and continental in its characteristics. Winters are very cold, while summers tend to be hot. Much of the annual precipitation falls from May to September; Mean annual precipitation is about 38 cm. This association occurs on moderately steep slopes of the uplands, between 3400 and 4200 feet elevation. Geologic substrate is the Kootenai Formation, which is a ledge-forming Cretaceous formation of metamorphosed sandstone layers interbedded with red shale. Soils are derived from the red shale component of this formation. They are weakly developed, loam- or silt-textured, non-alkaline, well-drained and subject to rapid erosion. There is a significant component of stones in the profile. Most stands suffer from some erosion and may occur where there is above average snow accumulation.

Jorgensen (1979) states that soils in this type are subject to rapid erosion.

COMMENTS: *2, WCS*.

CONSERVATION RANK: *G3?.* Limited geographic range and ecological tolerance keep this type rare.

DISTRIBUTION: This little bluestem - plains muhly prairie type is found in the northern Great Plains of the United States, in Montana and possibly southern Saskatchewan and North Dakota.

USFS ECOREGIONS: 331D:CC, 331G:C?, M332D:CC
CONSERVATION REGIONS: 26:C
STATES: MT ND **PROVINCES:** SK?

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Andropogon scoparius / Muhlenbergia cuspidata* community type (Jorgensen 1979), *Andropogon scoparius / Carex filifolia* Habitat Type (Hansen et al. 1984). Similar. Hansen and Hoffman (1988) and Hansen et al. (1984) describe an *Andropogon scoparius/Carex filifolia* community on coarse-textured soils of slopes in eastern Montana and adjacent North Dakota. Their stands have high cover of *Carex filifolia*, which was only a minor component of Jorgensen's *Andropogon scoparius/Muhlenbergia cupidata* community.

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM BUNCH HERBACEOUS ALLIANCE (V.A.5.N.d)

Bouteloua gracilis - Buchloe dactyloides Herbaceous Vegetation

Blue Grama - Buffalo Grass Herbaceous Vegetation

Blue Grama - Buffalograss Shortgrass Prairie CEGL001756

DESCRIPTION: This community is characterized by a moderate to dense sod of short grasses with scattered mid grasses and forbs. The dominant species are *Bouteloua gracilis* and *Buchloe dactyloides*. The foliage of these species is 7-19 cm tall, while the flowering stalks of *Bouteloua gracilis* may reach 45 cm. The mid grasses are usually stunted by the arid conditions and often do not exceed 0.7 m. Other short graminoids found in this community are *Bouteloua hirsuta, Carex duriuscula (= Carex eleocharis), Carex inops ssp. heliophila*, and *Carex filifolia* (in Nebraska). Several mid grasses occur regularly, such as *Aristida purpurea, Bouteloua curtipendula, Pascopyrum smithii, Schizachyrium scoparium, Elymus elymoides, Sporobolus cryptandrus, Hesperostipa comata (= Stipa comata)*, and *Vulpia octoflora*. Forbs, such as *Astragalus* spp., *Gaura coccinea, Machaeranthera pinnatifida var. pinnatifida, Opuntia polyacantha, Plantago patagonica, Psoralidium tenuiflorum, Ratibida columnifera*, and *Sphaeralcea coccinea*, are common throughout this community. Shrubs are rare except in the southern parts of this community's range where desert shrubs may spread from nearby desert shrub communities (Bruner 1931, Weaver and Albertson 1956, Steinauer and Rolfsmeier 2000). In Oklahoma, this association occurs on clay soils and is the most extensive shortgrass prairie type. Other characteristic species include *Ambrosia artemisiifolia, Aristida oligantha, Machaeranthera tanacetifolia, Melampodium leucanthum, Muhlenbergia torreyi, Sporobolus compositus (= Sporobolus asper), Sporobolus cryptandrus*, and *Zinnia grandiflora*. In Texas, this grassland is known primarily from the central and northern High Plains, but also the Trans-Pecos and Rolling Plains. Associated species include *Prosopis glandulosa, Bouteloua curtipendula*, and *Sporobolus cryptandrus* (Diamond 1993).

This community is found primarily on flat to rolling uplands (Heitschmidt et al. 1970, Johnston 1987). The surface soil may be sandy loam, loam, silt loam, or loamy clay (Johnston 1987, Steinauer 1989). The subsoil is often finer than the surface soil (Weaver and Albertson 1956, Johnston 1987). The combination of the upland position and heavy soils results in much of the precipitation running off and drought conditions prevailing for much of the year. Soils tend to be finer and shallower in the northern part of this community's range. In New Mexico, this community is found primarily where the annual precipitation is 40-45 cm and at elevations below 1700 m (5500 feet) (Weaver and Albertson 1956). In Nebraska, the soils are derived from a variety of sources, including sandstone, siltstone, limestone, loess, and alluvium (Steinauer 1989).

COMMENTS: *2, WCS*. This type is the matrix shortgrass type of the central and southern Great Plains. It extends to north-central and perhaps northwestern Nebraska and southeastern Wyoming. Further north in the Dakotas and Montana, however, similar stands are treated as *Bouteloua gracilis - Buchloe dactyloides* Xeric Soil Herbaceous Vegetation (CEGL002270), a large-patch type in a mixedgrass matrix. These associations need further comparisons to clarify their differences and similarities. In Texas, this grassland is known primarily from the central and northern High Plains, but also the Trans-Pecos and Rolling Plains.

CONSERVATION RANK: *G4.* There may be fewer than 100 occurrences of this community rangewide. It is reported from Colorado (where it is ranked S2?), Kansas (S3), Nebraska (S4), New Mexico (S3S4), Oklahoma (S3), Texas (S?), and Wyoming (S?). Currently there are 14 occurrences documented from Kansas, Nebraska, and Texas. Historical acreage and trends are unknown. This community has probably been degraded by overgrazing.

DISTRIBUTION: This blue grama - buffalograss shortgrass prairie type is common across much of the central and southern Great Plains of the United States, ranging from Nebraska and Colorado, south to Texas and New Mexico.

USFS ECOREGIONS: 311A:CC, 315A:CC, 315B:CC, 315C:CC, 321A:CC, 331B:CP, 331C:CC, 331F:C?, 331H:CC, M313B:??, M331F:??
CONSERVATION REGIONS: 20:C, 21:?, 24:C, 26:?, 27:C, 28:C, 33:C
STATES: CO KS NE NM OK TX WY **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE shortgrass prairie =

OTHER SYNONYMY: *Bulbilis - Bouteloua* Association (Bruner 1931) B, Short-Grass Type (Hopkins 1951) =, Kansas, Short Grass Community (Weaver and Albertson 1956) B, New Mexico, Vegetation of Loamy Textured Upland Soils (Weaver and Albertson 1956) B, *Buchloe - Bouteloua* Community (Heitschmidt et al. 1970) =, Northern Grama-Buffalograss Prairie (Kuchler 1974) F, Southern Grama-Buffalograss Prairie (Johnston 1987) F. is broader, *Bouteloua gracilis / Buchloe dactyloides* Plant Association =

USNVC HIERARCHY: BOUTELOUA GRACILIS HERBACEOUS ALLIANCE (V.A.5.N.e)

Bouteloua gracilis - Buchloe dactyloides Xeric Soil Herbaceous Vegetation

Blue Grama - Buffalo Grass Xeric Soil Herbaceous Vegetation

Blue Grama - Buffalo Grass Xeric Soil Shortgrass Prairie CEGL002270

DESCRIPTION: The blue grama grassland type provides moderate to high vegetative cover, typically between 40-90%. *Bouteloua gracilis* is usually strongly dominant on sandier soils, while *Carex filifolia* is a strong dominant on clay and silty clay soils at the edge of bluffs and tables. In Badlands National Park, South Dakota, common associates on sandier soils include *Pascopyrum smithii, Hesperostipa comata (= Stipa comata), Buchloe dactyloides, Aristida purpurea, Bromus japonicus*, and a variety of forbs, including *Conyza canadensis*. Shrubs that are typically observed in this type include *Artemisia frigida, Opuntia polyacantha, Yucca glauca*, and *Gutierrezia sarothrae*. Species commonly associated with *Carex filifolia* on clay and silty clay soils include *Hesperostipa comata, Bouteloua gracilis, Bromus japonicus*, and *Ratibida columnifera*. Typical shrubs are the same as those listed on sandy soils. (Von Loh et al. 1999). Forbs in Nebraska include *Lomatium foeniculaceum, Monolepis nuttalliana, Musineon divaricatum, Oonopsis multicaulis*, and *Plantago elongata*. Shrubs are sparse to absent, and include *Artemisia tridentata, Artemisia cana, Artemisia frigida*, and, more westward in Nebraska, *Ericameria nauseosa (= Chrysothamnus nauseosus)* and *Sarcobatus vermiculatus* (Steinauer and Rolfsmeier 2000).

This community is found on dry slopes or xeric soils with a high clay content. In Nebraska this type can occur on level to gently sloping ground on stream terraces. Soils are poorly drained silty clay and clay. In Badlands National Park, South Dakota, stands are limited to drier soils within the project area and areas with a consistent grazing regime, including that provided by prairie dogs. Most sites are relatively flat to undulating, typically on the edges of buttes/tables, ridgetops, and hilltops. Flat sites are typically clay and silty clay soils, while ridges and hilltops tend to be sandy soils. Grazing reduces the ground cover provided by western wheatgrass, a mid-grass, allowing the shorter blue grama and its associates to dominate (Von Loh et al. 1999).

COMMENTS: *2, MCS*. This type can often appear as a heavily grazed form of *Pascopyrum smithii - Bouteloua gracilis - Carex filifolia* Herbaceous Vegetation (CEGL001579). Blue grama and its associated species are common understory components of this western wheatgrass grassland. This type is somewhat confusing in the northwestern Nebraska, southwestern South Dakota and Wyoming border region. It is not clear that this type extends into Wyoming, but Thilenius et al. (1995) do describe a "*Bouteloua gracilis* sodgrass steppe" type that shows some resemblance to this type, though it is not on clay soils and does contain some *Pascopyrum smithii*. Their description also includes some sparse shrubs, as in Nebraska. Nebraska's "northwestern mixedgrass prairie" type describes the clay pan type as an inclusion (Steinauer and Rolfsmeier 2000).

CONSERVATION RANK: *G3G5.* The natural distribution of this type may be limited to special xeric soil sites in the northwestern Great Plains. However, it is not clear how these sites compare floristically to similar looking stands on heavily grazed pastures that are widespread n the same region. Hence, the exact rank is uncertain.

DISTRIBUTION: This blue grama - buffalograss shortgrass prairie is found in the northern Great Plains of the United States and possibly adjacent Canada, extending from northwestern Nebraska northward to the Dakotas and possibly Saskatchewan.

USFS ECOREGIONS: 331F:CC
CONSERVATION REGIONS: 26:C
STATES: ND NE? SD **PROVINCES:** SK

MIDWEST HERITAGE SYNONYMY: NE? northwestern mixedgrass prairie ?

OTHER SYNONYMY: Buffalograss Type (Hanson and Whitman 1938) =. uncertain if equivalent

USNVC HIERARCHY: BOUTELOUA GRACILIS HERBACEOUS ALLIANCE (V.A.5.N.e)

Andropogon gerardii - Panicum virgatum Sandhills Herbaceous Vegetation

Big Bluestem - Switchgrass Sandhills Herbaceous Vegetation

Sandhills Wet-mesic Prairie CEGL002023

DESCRIPTION: This community is dominated by a dense layer of mesophytic tall grasses 1-2 m tall, with *Andropogon gerardii* and *Sorghastrum nutans* most abundant in undisturbed sites. In moist swales and wetter areas along the margin of this community, *Calamagrostis canadensis* and *Spartina pectinata* may be abundant. Cool-season Eurasian grasses such as *Agrostis stolonifera, Phleum pratense*, and *Poa pratensis* are commonly seeded in these sites and may dominate. Forbs are usually common, but are seldom mentioned in the literature. Conspicuous forbs species include *Euthamia gymnospermoides, Helianthus nuttallii, Rudbeckia hirta, Solidago canadensis*, and *Solidago gigantea*. Woody plants are uncommon, though scattered thickets of *Salix exigua* may be present. In the eastern portion of its range, this community often contains forbs typical of tall-grass prairie to the east, such as *Sisyrinchium campestre* and *Viola pedatifida*. Species diversity is relatively high in undisturbed sites, and often much lower in sites seeded to exotic cool-season grasses (Steinauer and Rolfsmeier 2000).

This community occurs mostly in interdunal valleys and floodplains of streams and rivers, and on level ground where drainage is poor. Soils are poorly drained sandy loams and sands with considerable organic matter (but no peat accumulation) and are formed in eolian sand or alluvium. These sites are rarely, if ever, flooded but are constantly supplied by high groundwater levels (about 1 m below the surface) (Steinauer and Rolfsmeier 2000).

COMMENTS: *3, MCS*. This type is geographically defined to include areas of the Nebraska (and adjacent South Dakota) Sandhills region.

CONSERVATION RANK: *G3?.* Many sites in the eastern portion of the range of this community have been converted to cropland. Excessive center-pivot irrigation may lower the water table enough to convert some remaining sites to dry prairie communities. Most remaining sites have been seeded to exotic grasses and legumes.

DISTRIBUTION: This big bluestem sandhills community type occurs in the central Great Plains of the United States, particularly in the Sandhills region of Nebraska and adjacent South Dakota.

USFS ECOREGIONS: 251Ab:CCC, 332C:CC
CONSERVATION REGIONS: 34:C
STATES: NE SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE sandhills wet-mesic tallgrass prairie =

OTHER SYNONYMY: Subirrigated subclimax tall-grass area (Frolick and Keim 1933) =, Hay meadow association (Pool 1914) B, Mesophytic tall-grass zone (Tolstead 1942) =

USNVC HIERARCHY: ANDROPOGON GERARDII - (CALAMAGROSTIS CANADENSIS, PANICUM VIRGATUM) HERBACEOUS ALLIANCE (V.A.5.N.a)

Andropogon hallii - Calamovilfa longifolia Herbaceous Vegetation

Sand Bluestem - Prairie Sandreed Herbaceous Vegetation

Sand Bluestem - Prairie Sandreed Sand Prairie CEGL001467

DESCRIPTION: This community is dominated by moderately widely spaced mid to tall grasses. The most abundant species are *Andropogon hallii* and *Calamovilfa longifolia*. Other graminoids that may be found in this community include *Bouteloua gracilis, Bouteloua hirsuta, Carex duriuscula (= Carex eleocharis), Carex filifolia, Carex inops ssp. heliophila, Cyperus schweinitzii, Eragrostis trichodes, Hesperostipa comata (= Stipa comata), Koeleria macrantha, Muhlenbergia pungens, Redfieldia flexuosa*, and *Schizachyrium scoparium*. Forbs and shrubs are a minor component of the total vegetation. Characteristic forbs include *Chenopodium subglabrum, Chamaesyce serpyllifolia (= Euphorbia serpyllifolia), Helianthus pauciflorus, Helianthus petiolaris, Lappula occidentalis var. occidentalis, Liatris punctata, Lithospermum incisum, Lygodesmia juncea, Monarda punctata, Oenothera rhombipetala, Penstemon haydenii* (in Nebraska), and *Psoralidium lanceolatum*. *Artemisia frigida* and *Yucca glauca* are the most common shrubs, especially on wind-blown dune crests and choppy slopes in Nebraska sandhills (Steinauer and Rolfsmeier 2000). On eroding parts of the Nebraska Sandhills a number of different species may occur, including *Chamaesyce geyeri, Chamaesyce missurica, Chenopodium berlandieri, Chenopodium pratericola, Cycloloma atriplicifolium, Erigeron bellidiastrum, Eriogonum annuum, Froelichia floridana var. campestris, Ipomopsis longiflora*, and *Linum rigidum*. *Redfieldia flexuosa* is common in blowouts (Steinauer and Rolfsmeier 2000). In southeastern North Dakota, a subtype containing tallgrass species may be distinct; species include *Andropogon gerardii, Symphyotrichum ericoides (= Aster ericoides), Lithospermum canescens, Solidago nemoralis*, and *Sporobolus heterolepis* (Burgess 1965). In southwestern Kansas, *Calamovilfa gigantea* may be present (Lauver et al. 1999).

This community is usually found on sandy deposits, such as dunes, with gentle to moderate slopes (Johnston 1987). The soil is sand, loamy sand, or sandy loam and often erodible. Hirsch (1985) reported that stands of this type in southwestern North Dakota were small, generally less than 0.05 ha.

Blowouts may occur in this community type, leading to bare soils or subsoils. Blowouts may be related to severe droughts and windstorms, and may occur in conjunction with grazing pressures or fires that reduce the ability of the vegetation cover to stabilize the sand. The *Andropogon hallii - Carex inops ssp. heliophila* Herbaceous Vegetation (CEGL001466) may be an early successional phase on blowouts, at least in the northern states (Burgess 1965). Blowouts may subsequently develop into this type where sands have been stabilized and vegetation cover and diversity are high.

COMMENTS: *1, WCS*. Stands in this association may vary from north to south and east to west. More northern stands may have higher dominance by *Carex filifolia* or *Carex inops ssp. heliophila*. Distinctions between this type and *Andropogon hallii - Carex inops ssp. heliophila* Herbaceous Vegetation (CEGL001466) are not entirely clear. Note that Looman (1980) describes this type for Manitoba, but these northern stands also contain *Carex siccata (= Carex foenea), Danthonia spicata*, and *Festuca ovina*. Currently the North Dakota Heritage Program restricts this type primarily to the tallgrass prairie region of the state, where sands are deep, as described in part by Burgess (1965); however, it is reported farther west in southwestern North Dakota (Hirsch 1985) and Montana. Rangewide application of this type needs further review. In Minnesota, relatively small *Calamovilfa longifolia*-dominated patches can occur in dry sand prairies or barrens, particularly on crests of dunes, but these are treated as part of *Schizachyrium scoparium - Hesperostipa spartea - Bouteloua (curtipendula, gracilis)* Sand Herbaceous Vegetation (CEGL005204). *Andropogon hallii* does not occur as a native species in Minnesota. Steve Kettler (pers. comm. 1998) indicated that this association does not occur in Colorado (although they once tracked it). All of their sandhill types contain *Artemisia filifolia* and are classified (or will be reclassified) as *Artemisia filifolia / Andropogon hallii* Shrubland (CEGL001459). NRCS range site descriptions state that abundance of *Artemisia filifolia* should be low, but Kettler thinks it is always present, otherwise the vegetation and environment are similar. He suggested that the presence or absence of *Artemisia filifolia* seems to make a good split between the southern (Colorado and south and east) and the northern (Nebraska and north) sandhills.

CONSERVATION RANK: *G4G5.* This type has a relatively restricted distribution in terms of site characteristics, but has a wide distribution in the northern Great Plains. The community is reported from 7 ecoregional sections in Kansas, Nebraska, Montana, South Dakota, North Dakota, Manitoba, and Saskatchewan. Stands are typically less than a few hectares in size in the northern parts of the range, but can be quite extensive in the Nebraska Sandhills. Total coverage is over 100,000 acres. Threats are not known.

DISTRIBUTION: This sand prairie community is found in the northern and central Great Plains of the United States and Canada, ranging from Manitoba and Saskatchewan, south to Kansas.

USFS ECOREGIONS: 251Ab:CC?, 331C:CC, 331D:CC, 331E:CC, 331G:CC, 331H:CC, 331I:CC, 332A:C?, 332C:CC, 332D:C?, 332E:C?
CONSERVATION REGIONS: 27:C, 33:C, 35:C, 37:C
STATES: KS MT ND NE SD **PROVINCES:** MB SK

MIDWEST HERITAGE SYNONYMY: NE sandhills dune prairie =

OTHER SYNONYMY: Climax Sandhill Prairie (Burgess 1965) =. Type contains equal amounts of *Andropogon hallii* and *Calamovilfa longifolia*, vegetation cover is high, and diverse, *Andropogon hallii - Calamovilfa longifolia* habitat type (Hirsch 1985) =. Hirsch's type seems to fit this type pretty well, since her type contains equal amounts of *Andropogon hallii* and *Calamovilfa longifolia*, vegetation cover is high (> 90%), species diversity is moderate, and the type occurs on thin, erodable sands.,

USNVC HIERARCHY: ANDROPOGON HALLII HERBACEOUS ALLIANCE (V.A.5.N.a)

Andropogon hallii - Carex inops ssp. heliophila Herbaceous Vegetation

Sand Bluestem - Sun Sedge Herbaceous Vegetation

Sand Bluestem - Sedge Sand Prairie CEGL001466

DESCRIPTION: The vegetation is very open, ranging from 15-50% cover (Burgess 1965). The taller herbaceous stratum of this community is dominated by *Andropogon hallii*, with associates of *Calamovilfa longifolia, Hesperostipa comata (= Stipa comata)*, and *Sporobolus cryptandrus*. In southeastern North Dakota *Koeleria macrantha, Redfieldia flexuosa*, and *Hesperostipa spartea (= Stipa spartea)* are present at low abundance, and *Carex inops ssp. heliophila* is not present (Burgess 1965, Nelson et al. 1981). The lower herbaceous stratum is dominated by *Carex* spp., especially *Carex inops ssp. heliophila*. Other species that may be present are *Artemisia frigida, Carex filifolia, Carex duriuscula (= Carex eleocharis), Dalea villosa (= Petalostemon villosus)*, and *Yucca glauca*.

This type is found on gentle to steep sloping terrain with sand or sandy loam soil. In Montana, it can occur on slopes of any aspect but north is the least likely (MTNHP 1988). In North Dakota, it occurs on steep, choppy sands (Heidl 1984).

Blowouts may occur in this community type, leading to bare soils or subsoils. Blowouts may be caused by severe droughts and windstorms, and may occur in conjunction with grazing pressures that reduce the ability of the vegetation cover to stabilize the sand. This type may be an early successional stage on these blowouts where vegetation cover and diversity are low. It may develop into the *Calamovilfa longifolia - Andropogon hallii* Herbaceous Vegetation type (CEGL001469) (Burgess 1965).

COMMENTS: *1, WCS*. This association occurs only in limited places. Rangewide review is still needed, e.g., distinctions between it and *Andropogon hallii - Calamovilfa longifolia* Herbaceous Vegetation (CEGL001467) are not entirely clear. *Andropogon hallii* occurs in Manitoba, but stands are placed in the *Andropogon hallii - Calamovilfa longifolia* Herbaceous Vegetation (CEGL001467) [see Looman 1980]. Stands in southeastern North Dakota may contain more tallgrass prairie associates, such as *Andropogon gerardii, Symphyotrichum ericoides (= Aster ericoides), Lithospermum canescens, Solidago nemoralis*, and *Sporobolus heterolepis*, than those in Montana.

CONSERVATION RANK: *G3.* This type has a very restricted distribution both geographically, and in terms of site characteristics. Stands are only known from southeastern Montana and southeastern North Dakota, where they are typically less than a hectare in size. A recent rapid ecological assessment of the Northern Great Plains did not turn up any sites for this type, substantiating its restricted nature (Martin et al. 1998). Threats are not known.

DISTRIBUTION: This sand bluestem prairie community type is found in restricted areas of the northern Great Plains of the United States, including southeastern Montana and southeastern North Dakota.

USFS ECOREGIONS: 251Aa:CCC, 251Ab:CCC, 331G:CC
CONSERVATION REGIONS: 26:C, 35:C
STATES: MT ND **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: Transitional Sandhill Prairie (Burgess 1965) F. This type, with a total vegetation cover of 27%, contains more *Andropogon hallii* (>3% cover) than *Calamovilfa longifolia* (<0.7% cover). *Carex inops ssp. heliophila* is not listed for this study, but *Carex pennsylvanica* is, which may have been misidentified., Pioneer Sandhill Prairie (Burgess 1965) F. This type, with a total vegetation cover of 14%, contains more *Andropogon hallii* (>3% cover) than *Calamovilfa longifolia* (<0.7% cover). *Carex inops ssp. heliophila* is not listed for this study, but *Carex pennsylvanica* is, which may have been misidentified.

USNVC HIERARCHY: ANDROPOGON HALLII HERBACEOUS ALLIANCE (V.A.5.N.a)

Calamovilfa longifolia - Carex inops ssp. heliophila Herbaceous Vegetation

Prairie Sandreed - Sun Sedge Herbaceous Vegetation

Prairie Sandreed - Sedge Prairie CEGL001471

DESCRIPTION: The vegetation structure is somewhat open, with cover averaging 65% in parts of its range (USFS 1992). The vegetation is dominated by graminoids, with two strata, one of mid to tall grasses, the other of dense short sedges. In the taller grass layer, the most abundant species is *Calamovilfa longifolia*. Other species found in this layer include *Koeleria macrantha, Schizachyrium scoparium*, and *Hesperostipa comata (= Stipa comata)*. *Pascopyrum smithii* may be present on some stands with finer soil textures. The short-graminoid layer is composed chiefly of *Carex filifolia* and *Carex inops ssp. heliophila*, which may have high cover values. Other upland Carices, such as *Carex duriuscula (= Carex eleocharis)*, as well as *Bouteloua gracilis* and *Muhlenbergia pungens*, may also be present. Forb species diversity is moderate, but they do not contribute greatly to the cover (Hanson and Whitman 1938, USFS 1992). The forbs that are typical of this community include *Artemisia dracunculus, Artemisia frigida* (considered a shrub by some authors), *Artemisia ludoviciana, Chenopodium album, Chenopodium leptophyllum, Lathyrus* spp., *Liatris punctata, Lygodesmia juncea, Phlox hoodii*, and *Psoralidium lanceolatum*. Shrubs are uncommon. When shrubs are present they are short shrubs such as *Yucca glauca, Rosa* spp., and *Artemisia frigida* (considered a forb by some authors).

Stands are found on gently rolling uplands with little to moderate slopes (typically between 0 and 20%, but occasionally as high as 39%, Hirsch 1985, Hansen and Hoffman 1988). The soils are sand, sandy loam, or loamy sand and there is rarely substantial soil horizon development (Hanson and Whitman 1938). The parent material is sandstone (USFS 1992). Moisture levels may be high deep in the profile.

COMMENTS: *2, WCS*. The name of this association should probably be changed to *Calamovilfa longifolia - Carex inops ssp. heliophila - Carex filifolia* Herbaceous Vegetation. *Carex filifolia* occurs on a wider variety of substrates than does *Carex inops ssp. heliophila*, which is more restricted to lighter sands. Steve Cooper (pers. comm. 1998) also notes that *Carex filifolia* occurs farther north and west in Montana than does *Carex inops ssp. heliophila*. In Montana, *Carex inops ssp. heliophila* also occurs on shales that have been weathered to sand particles. In North Dakota, this type is restricted to the western part of the state.

CONSERVATION RANK: *G3.* No occurrences have been documented, but the community is reported in 3 ecoregional subsections in Wyoming, Montana, North Dakota, South Dakota, and Saskatchewan. It is a very uncommon community in Badlands National Park, South Dakota.

DISTRIBUTION: This prairie sandreed grassland is found in the northwestern Great Plains of the United States and Canada, ranging from the western Dakotas to Montana and Saskatchewan.

USFS ECOREGIONS: 331D:C?, 331E:C?, 331F:CC, 331G:CC
CONSERVATION REGIONS: 26:C
STATES: MT ND SD **PROVINCES:** SK

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: *Calamovilfa longifolia* habitat type (Hirsch 1985) =, *Calamovilfa longifolia / Carex heliophila* Habitat Type (Hansen et al. 1984) =

USNVC HIERARCHY: CALAMOVILFA LONGIFOLIA HERBACEOUS ALLIANCE (V.A.5.N.a)

Calamovilfa longifolia - Hesperostipa comata Herbaceous Vegetation

Prairie Sandreed - Needle-and-thread Herbaceous Vegetation

Prairie Sandreed - Needle-and-thread Prairie CEGL001473

DESCRIPTION: The vegetation has an open canopy, dominated by mid to tall grasses. *Calamovilfa longifolia* is the most conspicuous grass. Other common grasses include *Bouteloua gracilis, Bouteloua gracilis, Koeleria macrantha, Achnatherum hymenoides (= Oryzopsis hymenoides), Sporobolus cryptandrus*, and *Hesperostipa comata (= Stipa comata)*. *Pascopyrum smithii (= Agropyron smithii)* and *Nassella viridula (= Stipa viridula)* may occur on more level sites at the base of slopes (Barnes et al. 1984, Steinauer and Rolfsmeier 2000). *Andropogon hallii* may also be present. Sedges are rare but could include *Carex inops ssp. heliophila*. Forb diversity ranges from low to moderate, depending on the site. Dry valley sand prairies may be particularly forb-rich. Silty terraces of intermittent streams may contain *Artemisia frigida, Artemisia ludoviciana, Gutierrezia sarothrae, Psoralidium tenuiflorum*, and *Yucca glauca* (Steinauer and Rolfsmeier 2000). Shrubs are scattered and infrequent to absent, with *Rhus trilobata* the most common species. These areas are highly susceptible to invasion by exotic brome grasses (*Bromus japonicus, Bromus squarrosus, Bromus tectorum*) and may be quite weedy (Heerwagen 1958, USDI 1979, Steinauer and Rolfsmeier 2000).

Stands occur on stabilized sand dunes, as well as in interdunal valleys or draws, colluvial sands, and, less commonly, silty terraces of intermittent streams. Soils are medium to fine sands formed either from eolian or colluvial processes. For example, in Nebraska stands occur below sandstone outcrops and escarpments. More rarely, stands occur on floodplain terraces of intermittent streams, where soils are moderately deep, poorly drained, silty loams and loams (Heerwagen 1958, USDI 1979, Barnes et al. 1984, Steinauer and Rolfsmeier 2000).

Blowouts caused by drought and wind may occur in this type. The type probably represents a later successional stage. Earlier stages may be dominated by *Andropogon hallii* (e.g. CEGL001467). Heavy grazing may increase the likelihood of blowouts.

COMMENTS: *2, WCS*. This type may perhaps be differentiated from other types, such as *Calamovilfa longifolia - Carex inops ssp. heliophila* Herbaceous Vegetation (CEGL001471), by the absence or low abundance of *Carex filifolia* and *Carex inops ssp. heliophila*, though why those species are not abundant in this type is not clear. Further floristic comparisons need to be made to help make the distinction clear between that type and this type. Some floristic variability is to be expected in this type, based on successional patterns following dune blowouts. Steve Kettler (pers. comm. 1998) says they don't have this type in Colorado. It sounds like a version of a locally described *Andropogon hallii - Stipa comata* type, of which Colorado is also not very confident. Kettler suspects that a lot of the variation in grass dominance is from different management (grazing) over the years. The silty terrace stands are reported from the White River drainage in northwestern Nebraska and Badlands National Park, South Dakota (Von Loh et al. 1999, Steinauer and Rolfsmeier 2000).

CONSERVATION RANK: *G3.* No occurrences have been documented, but the community is reported in 2 ecoregional sections in Wyoming, Colorado, and Nebraska. It is restricted primarily to stabilized sand dunes, as well as in interdunal valleys or draws, colluvial sands, and intermittent streams, but it has a moderately wide distribution in the central to northern Great Plains. Stands are typically less than a few hectares in size, but larger stands are found in interdunal valleys in Nebraska, some reaching 100 acres or more (G. Steinauer pers. comm. 1999). In Nebraska, this community can be heavily grazed and subsequently invaded by exotic species (Steinauer and Rolfsmeier 2000).

DISTRIBUTION: This prairie sandreed grassland community type occurs in the central and northern Great Plains region of the United States, ranging from Colorado and Nebraska, north to Wyoming and South Dakota.

USFS ECOREGIONS: 331F:CC, 331G:CC, 342G:CC
CONSERVATION REGIONS: 10:C, 26:C
STATES: CO? NE SD WY **PROVINCES:** AB?

MIDWEST HERITAGE SYNONYMY: NE sandhills dry valley prairie; eastern sandhills needlegrass prairie; pine ridge sandy slope prairie; western sandy slope prairie -

OTHER SYNONYMY:

USNVC HIERARCHY: CALAMOVILFA LONGIFOLIA HERBACEOUS ALLIANCE (V.A.5.N.a)

Schizachyrium scoparium - Aristida basiramea - Sporobolus cryptandrus - Eragrostis trichodes Herbaceous Vegetation

Little Bluestem - Annual Three-awn - Sand Dropseed - Sand Lovegrass Herbaceous Vegetation

Central Plains Sand/Gravel Prairie CEGL005221

DESCRIPTION: Vegetation is dominated by a variety of mid and tall grasses (but not *Andropogon hallii* or *Calamovilfa longifolia*). In eastern Nebraska, dominants on sandy soils include a tallgrass layer of *Andropogon gerardii, Sorghastrum nutans*, and a midgrass layer of *Schizachyrium scoparium, Eragrostis trichodes*, and *Sporobolus cryptandrus*. *Bouteloua gracilis* and *Bouteloua hirsuta* may be present as a shortgrass layer. Other graminoids present include *Aristida basiramea, Digitaria cognata (= Leptoloma cognatum), Carex duriuscula (= Carex eleocharis), Carex praegracilis*, and *Cyperus schweinitzii*. In more western locations in Nebraska, dominant graminoids on sand and gravel include the above species, and also western forbs, such as *Artemisia campestris ssp. caudata, Heterotheca villosa, Hymenopappus tenuifolius, Opuntia macrorhiza*, as well as a variety of annual forbs typical of the Sandhills region prairies. *Yucca glauca* can be a common shrub component (Steinauer and Rolfsmeier 2000).

This community occurs on upland terraces and slopes associated with dissected plains. Soils are very well-drained and vary from sandy loams to coarse sand and gravels formed in old alluvium or glacial till (Steinauer and Rolfsmeier 2000).

COMMENTS: *2, MCS*. This community, according to Steinauer and Rolfsmeier (2000), is a complex of several plant communities that needs further review.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This sand/gravel prairie community is found in the central Great Plains of the United States.

USFS ECOREGIONS: 331C:CC, 332C:CC, 332D:CC, 332E:CC
CONSERVATION REGIONS:
STATES: NE **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE southern sand/gravel prairie =

OTHER SYNONYMY:

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - (SPOROBOLUS CRYPTANDRUS) HERBACEOUS ALLIANCE (V.A.5.N.c)

Sporobolus heterolepis - Achnatherum richardsonii - Danthonia intermedia Herbaceous Vegetation

Prairie Dropseed - Richardson's Needlegrass - Timber Oatgrass Herbaceous Vegetation

Black Hills Montane Grassland CEGL002240

DESCRIPTION: Most stands of this montane grassland type are graminoid-dominated, but forb-rich. Overall herbaceous cover is in the 60-100% range. Even on the driest sites, cover is greater than 50%. The ratio of graminoid cover to forb cover is variable, ranging from 3:1 to 2:1 at most sites surveyed. Several phases can be defined. On the driest sites, such as slopes, ridgecrests, summits and rockier areas in drainage bottoms, overall cover is typically in the 50-75% range. Dominant graminoids include *Sporobolus heterolepis, Achnatherum richardsonii (= Stipa richardsonii)* and *Danthonia intermedia*. Other graminoids commonly present include *Elymus trachycaulus ssp. subsecundus (= Agropyron subsecundum)* and *Hesperostipa spartea (= Stipa spartea)*. On more mesic sites in drainage bottoms, overall cover is often 100%. Dominant graminoids vary, but often include *Poa pratensis, Nassella viridula, Achnatherum richardsonii*, and *Danthonia intermedia*. *Elymus trachycaulus ssp. subsecundus* and *Hesperostipa spartea* may be present and locally common. *Sporobolus heterolepis* generally is absent in these more mesic situations.

Phleum pratense is often present in montane grassland habitat in drainage bottoms, varying from occasional to overwhelmingly dominant. It is less common in the southern part of the study area. The mesic mountain meadow phase described by McIntosh (1930) as dominated by timothy is abundant and extensive in drainage bottoms on the Limestone Plateau from Castle Creek north. Meadows strongly dominated by timothy are not included within the Black Hills Montane Grassland association as currently defined. We have little evidence as to the presettlement composition of vegetation at these sites.

Black Hills Montane Grasslands have been described as being forb-rich since the time of Custer's explorations of the area (Frost 1979). As currently defined, the type includes a range of forb dominance, which may be induced to some degree by grazing. The forb component of stands typically is diverse (often greater than 25 species in a 10x10-m plot), but with a small set of consistent species. These include *Geranium viscosissimum, Erigeron subtrinervis, Geum triflorum, Thalictrum dasycarpum*, and several *Potentilla* spp. *Oligoneuron rigidum* is a native species that is often present, but large populations are indicative of overgrazing. Non-native clovers are the most common exotic forb species found in montane grasslands. They can be locally abundant and extensive.

In the southern part of the study area (south of Castle Creek), shrub cover can be locally high in montane grasslands. Both *Symphoricarpos occidentalis* and *Dasiphora fruticosa ssp. floribunda (= Pentaphylloides floribunda)* are occasional grassland components that increase with heavy grazing. The former appears to be more common in drainage bottoms, the latter on lower slopes.

Two geographical variations of Black Hills Montane Grassland have been documented. Within the Central Core just east of the Limestone Plateau, montane grasslands occur mixed with other prairie types on the rolling rocky uplands of Reynolds and Slate Prairies. In the northwestern Black Hills in Wyoming, extensive grasslands are found on the summits of Cement Ridge and Warren Peaks, in areas underlain by igneous rocks. These stands differ somewhat from montane grasslands on the Limestone Plateau in that *Festuca ovina* is codominant, and *Sporobolus heterolepis* is absent (Marriott and Faber-Langendoen 2000).

Stands occur at higher elevations in the western and northwestern Black Hills, where there usually is significant snow cover from November through April. At the highest elevations (above 6500 feet) patchy snow cover persisting through May is not uncommon. Most of the range of the montane grassland lies above 5900 feet, with the highest documented site at 6900 feet. However, in the northwestern part of the Limestone Plateau in Wyoming, montane grasslands are found in drainage bottoms as low as 5100 feet (in the vicinity of Moskee, for example).

Most montane grasslands occur in the bottoms and on lowermost slopes of broad drainages (100 to 500 m across), on sites ranging from flat to moderately sloping with variable aspect. However, there are some significant exceptions. Slate and Reynolds Prairie northwest of Hill City are large grasslands (greater than 1000 acres each) on rolling uplands. Cement Ridge and Warren Peaks in the northwestern Black Hills in Wyoming are bald (unforested) ridgecrests and summits. More mesophytic stands of this montane grassland type typically occur on deeper soils in drainage bottoms. More xerophytic stands often occur on rockier or thinner soils on slopes, uplands, ridgecrests and summits, and in rocky areas in drainage bottoms.

Stands are most extensive on the Limestone Plateau, on sites underlain by the Paleozoic Pahasapa limestone. Several stands were documented in the adjacent Central Core on sites underlain by Precambrian schist and slate (e.g., Slate and Reynolds Prairies). Similar stands have been found at high elevations at two sites in the northwestern

Black Hills: Cement Ridge southeast of Sundance, and Warren Peaks in the Bear Lodge Mountains northwest of Sundance. These sites are underlain by Tertiary igneous rocks and included Precambrian granites; the stands differ slightly in floristic composition (Marriott and Faber-Langendoen 2000).

Forb dominance may increase with increased grazing pressure. Stands that are strongly forb-dominated probably are artifacts of grazing, as evidenced by the abundance of native increasers such as *Oligoneuron rigidum (= Solidago rigida)*. A single large stand of montane grassland surveyed in Gillette Canyon in the southwestern part of the Limestone Plateau was strongly graminoid-dominated, with forbs contributing less than 20% of the overall cover. It may be that in the absence of grazing, Black Hills Montane Grassland is not as forb-rich as it currently appears to be.

COMMENTS: *2, MCS*. This type is equivalent to the mountain meadow stage of McIntosh (1930), a successional stage found on low ground in mountain valleys in the Limestone District (now called the Limestone Plateau). McIntosh recognized two phases: a lower meadow phase with timothy (*Phleum pratense*) the most abundant grass, and a drier phase found on well-drained slopes with the speargrasses (*Stipa* spp.) and dropseed (*Sporobolus heterolepis*) most conspicuous. The association described here is roughly equivalent to the well-drained slope phase of McIntosh, but includes somewhat more mesic stands in drainage bottoms in the drier southern part of its range. McIntosh's lower meadow phase dominated by timothy is not included within this type; rather it is treated as an exotic timothy grassland type. We have very little evidence as to what the native composition of these stands was prior to timothy introduction.

CONSERVATION RANK: *G1G2.*

DISTRIBUTION: This montane grassland is best developed on the Limestone Plateau in the high western Black Hills. The zone of occurrences extends from the northwestern Black Hills in Wyoming, about 12 air miles southeast of Sundance, southeast and then south to west of Custer, South Dakota. Most of the Limestone Plateau lies east of the Wyoming/South Dakota stateline with the exception of the northwestern part in Wyoming.

USFS ECOREGIONS: M334A:CC
CONSERVATION REGIONS: 25:C
STATES: SD **PROVINCES:**

MIDWEST HERITAGE SYNONYMY:

OTHER SYNONYMY: Mountain meadow stage (McIntosh 1930)

USNVC HIERARCHY: POA (FENDLERIANA, NEMORALIS SSP. INTERIOR) - SPOROBOLUS HETEROLEPIS HERBACEOUS ALLIANCE (V.A.5.N.c)

ADDENDUM I: ADDITIONAL TYPES OF UNCERTAIN STATUS IN THE MIDWEST

The following types are not included in the main appendix because their distribution within the Midwest is very questionable, or they have not been sufficiently reviewed by the state ecologists in whose state they are being proposed for listing.

* Nonstandard type (needs review)

Cladium mariscoides - Carex cryptolepis - Rhynchospora alba - Juncus canadensis Herbaceous Vegetation [Provisional]*

Twig-rush - Northeastern Sedge - Northern White Beaksedge - Canada Rush Herbaceous Vegetation

Twigrush Fen CEGL005103

DESCRIPTION: This community is found in northwestern Ohio and possibly in northeastern Indiana and Ontario, where it is found on mineral/peaty soils. Stands contain *Cladium mariscoides, Carex cryptolepis, Juncus canadensis, Rhynchospora alba*. Further characterization is needed. Currently only one stand is known, from Springville Marsh (in Seneca County near the border with Wyandot), and that site is fairly degraded. It was thought to have been a complex of fen, wet meadow and tallgrass prairie, and was over 30 miles long and a few miles wide. Currently, there are at least 8-10 small meadow/fen openings. They are under serious threat from invasive species, such as *Typha angustifolia*, and from woody species, such as *Cornus amomum*. The site may also suffer from a drop in water table due to adjacent agriculture. Until that stand description can be compared against others, the status of this type is indeterminate.

COMMENTS: *3, MCS*. Further characterization of this type is needed before it can become a national type. Currently only one stand is known, from Springville Marsh (in Seneca County near the border with Wyandot), and that site is fairly degraded. It was thought to have been a complex of fen, wet meadow and tallgrass prairie, and was over 30 miles long and a few miles wide. Currently, there are at least 8 to 10 small meadow/fen openings. They are under serious threat from invasive species, such as *Typha angustifolia*, and from woody species, such as *Cornus amomum*. The site may also suffer from a drop in water table due to adjacent agriculture (Schneider and Cochrane 1997). Until that stand description can be compared against others the status of this type is indeterminate. A historic description of this type is available in Bonzer (1903, reference at the Ohio State Natural Heritage Program, G. Schneider pers. comm. 2000). It may be very closely related to the *Dasiphora fruticosa ssp. floribunda / Carex sterilis - Andropogon gerardii - Arnoglossum plantagineum* Shrub Herbaceous Vegetation (CEGL005139) a more widespread cinquefoil-sedge prairie fen type, and that is the type that Ohio tracks it under (Schneider and Cochrane 1997).

CONSERVATION RANK: *G?Q*.

DISTRIBUTION: This community is found in the southern Great Lakes region of the United States and Canada, particularly in northwest Ohio, and possibly elsewhere.

USFS ECOREGIONS: 222If:CCC
CONSERVATION REGIONS: 48:C
STATES: IN? OH **PROVINCES:** ON?

MIDWEST HERITAGE SYNONYMY: IN? sedge meadow ?
OH sedge-grass meadow +

USNVC HIERARCHY: CLADIUM MARISCOIDES SATURATED HERBACEOUS ALLIANCE (V.A.5.N.m)

Carex lurida - Carex leptalea - Parnassia grandifolia - Juncus brachycephalus - (Xyris tennesseensis) Herbaceous Vegetation

Sallow Sedge - Little Bog Sedge - Largeleaf Grass-of-parnassus - Marl Rush - (Tennessee Yellow-eyed-grass) Herbaceous Vegetation

Highland Rim Parnassia Seepage Fen CEGL004161

DESCRIPTION: The vegetation is dominated by herbaceous plants. Characteristic species include *Carex atlantica, Carex lurida, Carex leptalea ssp. harperi, Parnassia grandifolia, Juncus brachycephalus, Rudbeckia fulgida (var. umbrosa* in Tennessee occurrences, *var. speciosa* in the Kentucky occurrence), *Conoclinium coelestinum (= Eupatorium coelestinum), Cardamine bulbosa, Impatiens capensis, Juncus coriaceus, Juncus effusus, Liparis loeselii, Lobelia puberula, Lobelia cardinalis, Mimulus* sp., *Oxypolis rigidior, Phlox glaberrima, Rhynchospora capitellata, Scirpus atrovirens, Scirpus cyperinus, Solidago patula var. patula*, and *Thelypteris palustris var. pubescens*. Woody species include *Alnus serrulata, Salix humilis, Salix caroliniana, Cornus amomum*, and *Acer rubrum*, which may invade the herbaceous seep. Ohio examples lack *Parnassia grandifolia*, and may contain *Carex*

crawei, Carex cryptolepis, Platanthera clavellata, Helenium autumnale, Packera aurea (= Senecio aureus), Juncus dudleyi, Pedicularis lanceolata, and *Pycnanthemum tenuifolium*.

Examples occur in calcareous seepage on lower slopes associated with streams. Soils contain a thin organic layer over limestone gravel, over a less permeable layer.

Periodic fire may have played a role in the dynamics of this community, but this is not clearly understood.

COMMENTS: *2, SCS*. This community is represented by about ten occurrences in three counties in the Western Highland Rim of Tennessee; all are small in size and vulnerable. A single site in Clinton County, Kentucky (in the Eastern Karst Plain 222Eb), appears to belong to this community, and is tentatively placed here, along with examples in southern Ohio which apparently lack *Parnassia*. This community is closely related to *(Carex interior, Carex lurida) - Carex leptalea - Parnassia grandifolia - Rhynchospora capillacea* Herbaceous Vegetation (CEGL002404) of Arkansas and Missouri.

CONSERVATION RANK: *G1*. This saturated herbaceous association is restricted in range, fragile and vulnerable to threats at different scales, and highly specific in its habitat preference. It is primarily known from calcareous seepage on lower slopes associated with streams in the Western Highland Rim of Tennessee (Lewis, Cheatham, and Williamson counties). Only about ten occurrences in these three counties are known; all are small in size and vulnerable. Occurrences in Kentucky and Ohio are rare and limited in extent. Woody species may invade the herbaceous seep. Threats include overgrazing, damage from off-road vehicles, removal of timber upslope and associated erosion, succession of woody species, and permanent loss of water due to local hydrologic changes.

DISTRIBUTION: This seepage fen is found in the United States in the Highland Rim region of middle Tennessee and southeastern Kentucky, and related areas of southern Ohio.

USFS ECOREGIONS: 222Ea:CC?, 222Eb:CCC, 222Eg:CCC, 222Fd:CCC
CONSERVATION REGIONS: 44:C
STATES: KY OH? TN **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: OH? seep? ?

OTHER SYNONYMY: *Carex lurida (hystericina?) - Carex leptalea - Rhynchospora capillacea* Alkaline Seep (Minney 2000)

USNVC HIERARCHY: CAREX LURIDA - CAREX LEPTALEA - (CAREX ATLANTICA, CAREX INTERIOR, PARNASSIA GRANDIFOLIA) SATURATED HERBACEOUS ALLIANCE (V.A.5.N.m)

Seeps: Appalachian Highlands Forested Acid Seeps

Acer rubrum var. trilobum - Nyssa sylvatica / Rhododendron canescens - Viburnum nudum var. nudum / Woodwardia areolata Forest

Carolina Red Maple - Blackgum / Wild Azalea - Southern Wild Raisin / Netted Chainfern Forest

Interior Forested Acid Seep CEGL004425

DESCRIPTION: This forested acid seep occurs at the base of steep to moderate slopes where water percolates out through Cretaceous or Pennsylvanian sands and gravels. Stands are known primarily from the Upper Coastal Plain of Kentucky and Tennessee, but also reported from Kentucky's Shawnee Hills. Soils are deep, and often gravelly or sandy. Common or characteristic trees include *Acer rubrum, Betula nigra, Liquidambar styraciflua, Fagus grandifolia, Nyssa sylvatica*, and *Quercus pagoda*. Small trees and shrubs characteristic of the seeps include *Styrax americanus, Rhododendron canescens, Ilex opaca, Carpinus caroliniana, Photinia* spp. (= *Aronia* spp.), *Cornus foemina, Itea virginica, Viburnum nudum var. nudum*, and *Vaccinium* spp. (including *Vaccinium fuscatum*). The ground cover consists of herbaceous species such as *Osmunda cinnamomea, Osmunda regalis var. spectabilis, Woodwardia areolata, Thelypteris palustris var. pubescens, Carex* spp., *Juncus* spp., *Rhynchospora capitellata, Rhynchospora globularis, Saururus cernuus, Bartonia virginica*, and many others. Some Tennessee examples contain *Magnolia virginiana*, which is rare in that state. This vegetation occurs at the heads of small streams or on the margins of their floodplains at the upland / wetland interface. Examples from the Shawnee Hills of Kentucky (subsections 222Dc, 222Dg) are reported to be somewhat depauperate, lacking *Rhododendron canescens* and *Viburnum nudum*.

COMMENTS: *2, SCS*. This seep vegetation is distinct from the more Appalachian type, *Acer rubrum var. trilobum - Nyssa sylvatica / Osmunda cinnamomea - Chasmanthium laxum - Carex intumescens / Sphagnum lescurii* Forest (CEGL007443), which occurs on streamhead swales on broad ridges where a perched water table is present. These communities are very limited in extent and are threatened by siltation resulting from upslope timber removal.

CONSERVATION RANK: *G2G3.* This community is restricted in its geographic distribution and occurs in a very specific landtype and environment. This vegetation occurs at the heads of small streams or on the margins of their floodplains at the interface between upland and wetland. As far as is known, it is limited to the Upper East Gulf Coastal Plain of Kentucky and Tennessee and the adjacent Shawnee Hills of Kentucky. These communities are very limited in extent and are threatened by siltation resulting from upslope timber removal. Adjacent upland development would alter the supply of groundwater and would impact the distinctive hydrology of this community.

DISTRIBUTION: This forested acid seep occurs in the southeastern United States. It is apparently restricted to the Upper East Gulf Coastal Plain of Kentucky and Tennessee and the adjacent Shawnee Hills of Kentucky.

USFS ECOREGIONS: 222Ca:CC?, 222Cb:CCC, 222Ce:CCC, 222Cg:CCC, 222Dc:CCP, 222Dg:CCP, 222Eg:C??, 222G:CC
CONSERVATION REGIONS: 43:C, 44:C
STATES: IL? KY TN **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL? acid gravel seep ?

USNVC HIERARCHY: ACER RUBRUM - NYSSA SYLVATICA SATURATED FOREST ALLIANCE (I.B.2.N.g)

Wet Prairies and Wet Meadows: Great Plains Freshwater Wet Prairies and Meadows

* Nonstandard type (needs review)

Schoenoplectus spp. - Poa palustris - Mixed Herbaceous Great Plains Streamside Herbaceous Vegetation*

Bulrush Species - Fowl Bluegrass - Mixed Herbaceous Great Plains Streamside Herbaceous Vegetation

Western Great Plains Streamside Vegetation CEGL005263

DESCRIPTION: The vegetation is dominated by a mix of graminoids and forbs, with herbaceous cover approaching 100% in stands surveyed. Species composition is variable, and dominance is patchy within stands. Local dominants include *Agrostis stolonifera, Glyceria grandis, Poa palustris, Scirpus pallidus, Eleocharis palustris, Leersia oryzoides, Lycopus asper, Cicuta douglasii*, and *Rorippa nasturtium-aquaticum*. *Ranunculus longirostris (= Ranunculus circinatus)* can be abundant in adjacent shallow water (Marriott and Faber-Langendoen 2000).

Stands occur at lower elevations (3500-4800 feet) immediately adjacent to perennial or seasonally intermittent streams. It does not develop along streams with steep banks. It has been documented in the lower Minnekahta Foothills, Red Valley and Hogback Rim in areas underlain by limestone, sandstone and other sedimentary rocks (Marriott and Faber-Langendoen 2000).

This type appears to be an early successional type that develops on narrow bands of sediment along streams and in adjacent shallow water. With continued slow deposition, it may persist for some time. With flooding, it probably is removed, but soon re-establishes in appropriate habitat. This type does not occur along streams with steep banks (Marriott and Faber-Langendoen 2000).

COMMENTS: *3, MCS*. A closely related type, the Black Hills Streamside Vegetation, *Glyceria grandis - Poa palustris* - Mixed Herbaceous Black Hills Herbaceous Vegetation (CEGL005262), is the higher-elevation equivalent of Western Great Plains Streamside Vegetation. The two types appear similar based on existing data, and perhaps should be combined. Neither type has been well-characterized. They typically form a narrow border, perhaps only a few meters wide, along streams, and this scale may be too fine for recognition as associations. Girard (c. 1991) described stands of *Glyceria grandis*, one of the more common streamside dominants, as part of a vegetation complex associated with beaver dams, occurring in shallow water or on saturated soils.

CONSERVATION RANK: *G2G4.*

DISTRIBUTION: This type lines perennial streams at lower elevations in the Black Hills of the United States, and perhaps more widely in the northern Great Plains (Marriott and Faber-Langendoen 2000).

USFS ECOREGIONS: M334A:CC
CONSERVATION REGIONS: 25:C
STATES: SD **PROVINCES:**

USNVC HIERARCHY: POA PALUSTRIS SEMI-NATURAL SEASONALLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.k)

Puccinellia nuttalliana Herbaceous Vegetation

Nuttall's Alkali Grass Herbaceous Vegetation

CEGL001799

DESCRIPTION: This wetland association is described from a high-elevation (2900 m) park in central Colorado and in southwestern and central Montana, but likely occurs elsewhere across the western and northern Great Plains and the western U.S. and Canada. While the dominant species occurs over a broad geographic range, it has quite specific habitat needs requiring moist soils of intermediate salinity in seasonally wet meadow habitats. Site topography is generally flat with poor drainage. In South Park, Colorado, there is often a small microtopography of hummocks which affects the water relations and therefore species composition. The soils are moist, saline and alkaline, derived from calcareous shales. The snow/rain- and groundwater-saturated soils usually dry out during the growing season. Communities form a ring just above the succulent plant associations associated with playas, salt flats and saline lakes, or may occur as patches along intermittent drainages. They exist in saline soils that range from 0.7-1% total salts. The pH levels are commonly very alkaline. The wetland vegetation is characterized by the dominance of *Puccinellia nuttalliana* in the graminoid layer. *Distichlis spicata* or *Hordeum jubatum* may codominate is some stands. The forb layer is relatively sparse and is often composed of *Salicornia rubra* or *Triglochin maritima*. Diagnostic of this herbaceous wetland association is the dominance of *Puccinellia nuttalliana*.

COMMENTS: *2, WCS*.

CONSERVATION RANK: *G3?.* This type occurs over a broad geographic range, but has quite specific habitat needs. The association requires moist soils of intermediate salinity in seasonally wet meadow habitats of South Park, Colorado (Ungar 1974). Cooper (1997) suggests this type is quite common in the state of Colorado, occurring in a diversity of habitats. Occurrences are primarily small, however, and often impacted by livestock grazing in that state (Sanderson pers. comm. 1997). Stands of this association have been noted by researchers in the eastern (Nebraska) and northern plains regions to Saskatchewan and through the intermountain region to Utah and California (Ungar 1974). Saline wetlands which support the association have been impacted by water diversion, livestock grazing, and land conversion in many places. Saline wetland associations of the Great Plains are considered especially vulnerable to habitat fragmentation and loss (Gersib and Steinauer 1991).

DISTRIBUTION: This association occurs on moist soils of intermediate salinity in seasonally wet meadow habitats of South Park, Colorado (Ungar 1974). Possible stands of this association have been noted by researchers in the eastern (Nebraska) and northern plains regions to Saskatchewan and through the intermountain region to Utah and California (Ungar 1974).

USFS ECOREGIONS: 331J:??, M331H:CC
CONSERVATION REGIONS: 20:C
STATES: CO MT NV? SD? UT? **PROVINCES:** SK?

USNVC HIERARCHY: PUCCINELLIA NUTTALLIANA INTERMITTENTLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.i)

* Nonstandard type (needs review)

Glyceria grandis - Poa palustris - Mixed Herbaceous Black Hills Herbaceous Vegetation*

American Mannagrass - Fowl Bluegrass - Mixed Herbaceous Black Hills Herbaceous Vegetation

Black Hills Streamside Vegetation CEGL005262

DESCRIPTION: The vegetation is dominated by forbs and graminoids, with cover in the 60-100% range overall in stands surveyed (BHCI 1999). Composition was found to be variable, and dominance patchy within stands. The most consistent species with significant cover include *Glyceria grandis, Agrostis stolonifera, Poa palustris, Scirpus microcarpus, Scirpus pallidus*, and *Cicuta douglasii*. *Catabrosa aquatica, Mimulus guttatus*, and several species of *Veronica* and *Epilobium* commonly grow in adjacent shallow water (Marriott and Faber-Langendoen 2000).

Stands occupy very narrow bands along perennial streams and in adjacent shallow water (BHCI 1999). It does not develop along streams with steep banks. It is common at higher elevations (4000-6100 feet) in the Central Core in areas underlain by schist, slate and granite. It is occasional on the Limestone Plateau, where perennial streams are less common.

Black Hills Streamside Vegetation is an early successional type that develops on narrow bands of sediment along streams and in adjacent shallow water. With continued slow deposition, it may persist for some time. With flooding, it probably is removed, but soon re-establishes in appropriate habitat. This type does not occur along streams with steep banks (Marriott and Faber-Langendoen 2000).

COMMENTS: *3, MCS*. This type typically forms a narrow border, perhaps only a few meters wide, along streams, and this scale may be too fine for recognition as an association. The Western Great Plains Streamside Vegetation, *Scirpus spp. - Poa palustris* - Mixed Herbaceous Great Plains Streamside Herbaceous Vegetation (CEGL005263), is the lower-elevation equivalent of Black Hills Streamside Vegetation. The two types appear similar based on existing data, and perhaps should be combined. Neither type has been well-characterized. Girard (c. 1991) described stands of *Glyceria grandis*, one of the more common streamside dominants, as part of a vegetation complex associated with beaver dams, occurring in shallow water or on saturated soils (Marriott and Faber-Langendoen 2000).

CONSERVATION RANK: *G2G4.*

DISTRIBUTION: Black Hills Streamside Vegetation lines perennial streams at higher elevations in the Black Hills of the United States. Most occurrences surveyed are within the Central Core, where perennial streams are common. One occurrence was documented from the Limestone Plateau. The type may also occur in the Bear Lodge Mountains in the northwestern Black Hills.

USFS ECOREGIONS: M334A:CC
CONSERVATION REGIONS: 25:C
STATES: SD **PROVINCES:**

USNVC HIERARCHY: POA PALUSTRIS SEMI-NATURAL SEASONALLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.k)

Wooded Swamps and Floodplains: Northern Rich Conifer Swamps

Tsuga canadensis / Rhododendron maximum / Sphagnum spp. Forest

Eastern Hemlock / Great Rhododendron / Peatmoss Species Forest

Eastern Hemlock - Great Laurel Swamp CEGL006279

DESCRIPTION: Hemlock swamp of Central Appalachians (CAP); usually has a prominent shrub layer dominated by *Rhododendron maximum*. These are closed-canopy conifer forest dominated by *Tsuga canadensis* with associates of *Acer rubrum, Nyssa sylvatica, Pinus strobus, Betula alleghaniensis*. The well-developed shrub layer contains *Ilex verticillata, Rhododendron maximum, Rhododendron viscosum, Vaccinium corymbosum, Lyonia ligustrina*. The sparse herb layer includes *Carex folliculata, Carex trisperma, Osmunda* spp., *Viola* spp., *Onoclea sensibilis, Maianthemum canadense, Cornus canadensis, Coptis trifolia*. Sphagnum mosses. These communities occur on saturated acidic muck to imperfectly drained mineral soils in upland valleys, bedrock depressions, low slopes, and adjacent to streams and lakes. Mounds and depressions caused by uprooted trees are typical.

COMMENTS: *2, ECS*.

CONSERVATION RANK: *G?.*

DISTRIBUTION:
USFS ECOREGIONS: 221E:C?, 221F:CC, M221Ac:CCC, M221Bb:CCC, M221Bf:CCC, M221C:C?, M221Da:CCC
CONSERVATION REGIONS: 59:C, 61:C
STATES: MD NJ PA WV **PROVINCES:**

USNVC HIERARCHY: TSUGA CANADENSIS SATURATED FOREST ALLIANCE (I.A.8.N.g)

Wooded Swamps and Floodplains: Northern and Central Great Plains Wooded Riparian Vegetation

Fraxinus pennsylvanica / Mixed Herbs Forest

Green Ash / Mixed Herbs Forest

Ash - Elm / Forb Rich Floodplain Forest CEGL002469

DESCRIPTION: The tree canopy is dominated by *Fraxinus pennsylvanica*. The ground layer contains a rich mix of herbaceous species (J. Greenall pers. comm. 1994).

Stands occur on rich floodplain terraces (J. Greenall pers. comm. 1994).

COMMENTS: *3, MCS*. This type was proposed at a Manitoba CDC meeting on November 3, 1994. Further work is needed to determine how this type is different from other green ash floodplain types, *Fraxinus pennsylvanica - (Ulmus americana) / Symphoricarpos occidentalis* Forest (CEGL002088) and *Fraxinus pennsylvanica - Ulmus americana - (Acer negundo, Tilia americana)* Northern Forest (CEGL002089).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This green ash floodplain terrace type is found in Manitoba, Canada, and possibly elsewhere.

USFS ECOREGIONS: 222:?, 251:?
CONSERVATION REGIONS:
STATES: **PROVINCES:** MB

USNVC HIERARCHY: FRAXINUS PENNSYLVANICA - ULMUS AMERICANA - CELTIS (OCCIDENTALIS, LAEVIGATA) TEMPORARILY FLOODED FOREST ALLIANCE (I.B.2.N.d)

Populus deltoides / Distichlis spicata Woodland

Eastern Cottonwood / Saltgrass Woodland

Cottonwood/Inland Saltgrass Floodplain Woodland CEGL000939

DESCRIPTION: This association is characterized by a relatively open canopy of the broad-leaved deciduous tree *Populus deltoides ssp. monilifera*, with cover varying from roughly 20% to over 70%. In most stands the trees are large and uniformly sized, but density varies from 45 to 115 trees per hectare. Other deciduous trees are occasionally present, including the natives *Salix amygdaloides* and *Acer negundo*, and several introduced species such as *Fraxinus pennsylvanica, Ulmus americana*, and *Elaeagnus angustifolia*. The shrub layer is poorly developed or entirely absent, but broad-leaved deciduous shrubs occasionally occur. Species can include *Ribes aureum, Rosa woodsii, Salix exigua, Symphoricarpos orbiculatus*, and *Toxicodendron radicans*. The herbaceous layer is dominated by the perennial grass *Distichlis spicata*, with highly variable cover (from 6% to over 70%). This variation is apparently related to the degree of tree canopy closure, in that more open stands of *Populus* have denser graminoid cover in the understory. *Sporobolus cryptandrus* and *Pascopyrum smithii (= Agropyron smithii)* are other common perennial grasses, but with less cover. The remainder of the herbaceous layer typically is a mix of graminoid and forb species, and in most stands includes many introduced species, both annual and perennial. Total herbaceous cover is highly variable. Cryptograms are very uncommon.

This type occurs on floodplains of major streams and rivers within the eastern portion of the Great Plains, where they slope up to meet the Rocky Mountains. The climate of the region is semi-arid and continental. Annual precipitation can fluctuate widely, varying from less than 10 inches to over 16 inches. Roughly 75% falls as intermittent rainshowers from March to September, as a result of thunderstorm activity. Winters are short, with extreme variations in temperatures. Summers are long and hot.

Geologically, the region is underlain by relatively flat-lying sedimentary rock, which in some areas approaches the surface. Overlying layers, both on the uplands and within the river valleys, are primarily unconsolidated sediments deposited as glacial outwash during the Pliocene, with some areas of loess and sandhills. Elevations of the river valleys near the Rocky Mountain front are about 5000 feet, and fall to 3350 feet in the eastern portion of the region. Both river valleys have gentle slopes, falling an average of 7 to 9 feet per mile.

The floodplains of these rivers are typically wide and flat. A variety of depositional and erosional features are present within the floodplain, such as active channels, terraces or benches, and alluvial fans. This association occurs on higher terraces away from the active floodplain, where the soil surface is drier, but trees are able to tap the deeper water table. Flooding is infrequent on these terraces. Soils are derived from alluvium, aeolian deposits and some shales. They are not well-developed and have a typical structure of bands or lenses of sand, clay, silt and gravel. They are well-drained, low in organic matter, and often have high lime content, making them very alkaline.

COMMENTS: *2, WCS*.

CONSERVATION RANK: *G2.* This association occurs along low-elevation rivers in a semi-arid region where agricultural activities have had great impacts. Existing occurrences are restricted to the high plains east of the Rocky Mountain front in Colorado. Similar associations have been reported for eastern Wyoming and western Nebraska (Steinauer pers. comm. 1997, Jones and Walford 1995). Water impoundments have altered the natural flood regimes; floodplains are used for pastures, hay fields and livestock grazing; introduced species have invaded and, in the case

of *Tamarix*, have increased soluble salts in the soils. The area of *Populus deltoides / Distichlis spicata* Woodland (CEGL000939) on the Arkansas River is small and apparently is decreasing due to the above reasons. The acreages of this association along the Arkansas and South Platte rivers are 2761 and 17,166, respectively (1970 data). Most stands on the South Platte are composed of older trees.

DISTRIBUTION: This association restricted to the high plains east of the Rocky Mountain front in Colorado. Similar associations have been reported for eastern Wyoming and western Nebraska (Steinauer pers. comm. 1997, Jones and Walford 1995)

USFS ECOREGIONS: 331I:CC
CONSERVATION REGIONS: 27:C
STATES: CO NE? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: NE? no state equivalent

USNVC HIERARCHY: POPULUS DELTOIDES TEMPORARILY FLOODED WOODLAND ALLIANCE (II.B.2.N.b)

Shoreline Sand/Mud Strands, Beaches and Dunes: Midwestern Sand and Gravel Strands

Midwest Gravel Wash River Sparse Vegetation

Midwest Gravel Wash River Sparse Vegetation

Riverine Gravel Wash CEGL002408

DESCRIPTION: This gravel wash river type is currently reported only from southern Ontario but may occur elsewhere in the central and upper Midwest. The type may be expected in rocky riverine areas with sedimentary rocks, but it is not clear how frequent such riverine gravel washes may be. Further characterization of the type is needed.

COMMENTS: *3, MCS*. This gravel wash river type is currently reported only from southern Ontario but may occur elsewhere in the central and upper Midwest. The type may be expected in rocky riverine areas with sedimentary rocks, but it is not clear how frequent such riverine gravel washes may be. Further characterization of the type is needed. This type does not extend into the Interior Highlands, where, e.g., *Hamamelis vernalis - Cornus obliqua - Hypericum prolificum* Shrubland (CEGL003898) is found in the Ozarks region.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This gravel wash type is reported from southern Ontario, Canada, and may be expected in various parts of the central Midwestern United States.

USFS ECOREGIONS: 222Aa:CCC, 222Ad:CCP, 222Ae:CCC, 222Af:CCP
CONSERVATION REGIONS: 38:C
STATES: **PROVINCES:** ON?

USNVC HIERARCHY: GRAVEL WASH SPARSE VEGETATION ALLIANCE (VII.B.2.N.b)

Rocky Uplands (Glades, Rock Barrens, Outcrops & Alvars): Appalachian Highlands Carbonate Glades & Barrens

Juniperus virginiana / Schizachyrium scoparium - Silphium terebinthinaceum var. luciae-brauniae - Carex juniperorum - Castilleja coccinea Wooded Herbaceous Vegetation

Eastern Red-cedar / Little Bluestem - Smooth Prairie-dock - Cedar Sedge - Eastern Indian-paintbrush Wooded Herbaceous Vegetation

Bluegrass Cat Prairie CEGL004464

DESCRIPTION: These 'Cat prairies' occur in the Interior Low Plateau region of the United States. Stands are known from Lewis County, Kentucky (Outer Bluegrass region), and also perhaps Adams County, Ohio, on slopes of Middle Silurian calcareous clay shale (upper part of the Crab Orchard Formation). This small-scale, prairie-like vegetation is dominated by *Schizachyrium scoparium var. scoparium, Sporobolus vaginiflorus* (and/or *Sporobolus neglectus, Sporobolus vaginiflorus var. ozarkanus (= Sporobolus ozarkanus)), Sorghastrum nutans, Danthonia spicata, Castilleja coccinea, Silphium terebinthinaceum var. luciae-brauniae*, and *Ratibida pinnata*. Other species include *Sabatia angularis, Gentianella quinquefolia, Dichanthelium depauperatum, Panicum virgatum, Physostegia virginiana ssp. praemorsa, Gaura biennis, Carex juniperorum, Carex crawei, Liatris cylindracea, Bouteloua curtipendula,*

Maianthemum stellatum (= Smilacina stellata), Manfreda virginica, Prenanthes alba, Polygala senega, Phlox pilosa, Oligoneuron rigidum var. glabratum (= Solidago rigida ssp. glabrata), Symphyotrichum oblongifolium (= Aster oblongifolius), Liatris aspera, and *Cypripedium candidum*. Examples may become invaded by *Juniperus virginiana var. virginiana* because of lack of fire.

This small-scale, prairie-like association represents the `Cat prairies' of Lewis County, Kentucky (Outer Bluegrass region), and also perhaps Adams County, Ohio, on slopes of Middle Silurian calcareous clay shale (upper part of the Crab Orchard Formation).

Examples may become invaded by *Juniperus virginiana var. virginiana* because of lack of fire.

COMMENTS: *2, SCS*. This type may need to be merged with *Quercus stellata - Quercus marilandica / Schizachyrium scoparium - Silphium terebinthinaceum* Wooded Herbaceous Vegetation (CEGL005134), formerly in the V.A.6.N.g *Schizachyrium scoparium - Danthonia spp*. Deciduous Wooded Herbaceous Alliance. Compare also with *Schizachyrium scoparium - Sorghastrum nutans - Clinopodium arkansanum* Alkaline Herbaceous Vegetation (CEGL005179)

CONSERVATION RANK: *G1Q*. This herbaceous vegetation is a type of small-scale, prairie-like vegetation which has a very local distribution. It is restricted to Lewis County, Kentucky (Outer Bluegrass region), and also perhaps Adams County, Ohio, on slopes of Middle Silurian calcareous clay shale (upper part of the Crab Orchard Formation). Examples may become invaded by *Juniperus virginiana var. virginiana* because of lack of fire. Threats include pasturing, clearing, severe erosion, and fire suppression. There is some uncertainty about the distinctiveness of this vegetation type; it may simply be a local variant of more widspread small-scale grassland types.

DISTRIBUTION: This thin soil grassland or glade is found in restricted locations of the northeastern part of the Interior Low Plateau of the United States.

USFS ECOREGIONS: 222Fa:CCC
CONSERVATION REGIONS: 44:C
STATES: KY OH? **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: OH? little bluestem prairie ?

USNVC HIERARCHY: (JUNIPERUS VIRGINIANA) / SCHIZACHYRIUM SCOPARIUM - (BOUTELOUA CURTIPENDULA) WOODED HERBACEOUS ALLIANCE (V.A.6.N.q)

Forests and Woodlands: Northern Hardwood Forests

* Nonstandard type (needs review)

Betula alleghaniensis - (Acer saccharum, Picea glauca) Forest*

Yellow Birch - (Sugar Maple, White Spruce) Forest

Yellow Birch - (White Spruce) Forest [Provisional] CEGL005245

DESCRIPTION: At Isle Royale National Park, the vegetation forms a closed-canopy deciduous forest. Canopy cover is usually about 70-80% cover (sometimes less); the most abundant trees are *Betula alleghaniensis* (20-60% cover), *Picea glauca* (5-50% cover) and *Betula papyrifera* (5-25% cover). There is often a subcanopy with 5-30% cover (same species as in the canopy). Cover of tall shrubs is about 5-10% cover; the most abundant tall shrubs are saplings of *Picea glauca* and *Abies balsamea*, and *Sambucus racemosa*. Cover of short shrubs varies from 10-70% cover; the most abundant short shrubs are *Rubus parviflorus, Sorbus decora, Diervilla lonicera* (each with 5-25% cover), *Lonicera canadensis* and *Rubus idaeus* (each with 1-5% cover). There is a sparse cover of dwarf-shrubs, mainly *Rubus pubescens*. Cover of herbs varies from 40-80% cover; the most abundant herbs are *Aralia nudicaulis* (5-25% cover), *Cornus canadensis* (5-25% cover), *Clintonia borealis, Lycopodium annotinum, Streptopus lanceolatus var. roseus, Athyrium filix-femina*, and *Oxalis montana* (each with 1-5% cover). Cover of nonvascular plants is sparse (0-10% cover); *Pleurozium schreberi* is characteristic (less than 1% cover) (C. Reschke pers. comm. 1999).

At Isle Royale National Park, this community occupies gentle to steep slopes at elevations from 190 to 240 m (630 to 780 feet). Soils are moderately well-drained to rapidly drained sandy loams (C. Reschke pers. comm. 1999).

COMMENTS: *3, MCS*. Type needs rangewide review. This community is distinguished from sugar maple - yellow birch - northern hardwood forest, *Acer saccharum - Betula alleghaniensis - (Tilia americana)* Forest (CEGL002457), by the absence or very low cover of *Acer saccharum* in either the canopy or as seedlings and saplings in the ground layer, but it may just be a variant of that type.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This type is reported from Isle Royale, Michigan; its rangewide distribution is unclear, but it may extend to the east, until *Picea rubens* enters into the range.

STATES: MI? **PROVINCES:** ON?

MIDWEST HERITAGE SYNONYMY: MI? mesic northern forest - sugar maple-yellow birch-(balsam fir)

USNVC HIERARCHY: ACER SACCHARUM - BETULA ALLEGHANIENSIS - (FAGUS GRANDIFOLIA) FOREST ALLIANCE (I.B.2.N.a)

Forests and Woodlands: Midwestern Mesic Oak and Oak-Maple Forests

Quercus alba - Quercus rubra - Acer saccharum Sand Forest

White Oak - Northern Red Oak - Sugar Maple Sand Forest

Midwest Oak-maple Mesic Sand Forest CEGL005187

DESCRIPTION: The dominant species in the tree canopy may be *Acer saccharum, Quercus alba* and *Quercus rubra* (White and Madany 1978).

Stands are thought to have occurred mainly on the slopes of sandy river terraces along the Illinois and Mississippi Rivers (White and Madany 1978).

COMMENTS: *3, MCS*. This type is no longer listed in the Illinois classification on which it was based; it therefore needs review and may be archived. The type concept is taken from Illinois state classification type 'mesic sand forest' (White and Madany 1978), which is restricted to Subsection 251Cf of Keys et al. (1995), and more particularly within that subsection to the Mississippi and Illinois River Sand Division (No. 6) of Schwegman (1973). No extant occurrences are known to exist, but it may occur at White Oak Creek Woods in Mason County, Illinois (Bill McClain pers. comm. 1996). Further characterization of this type may be difficult. Type may have been described by General Land Office Survey notes (M. Hutchison pers. comm. 1996). In terms of habitat, the type is conceptually similar to Missouri's 'mesic sand forest,' *Fagus grandifolia - Acer saccharum - Liriodendron tulipifera* Unglaciated Forest (CEGL002411), which is part of a beech-maple type found in southeastern Missouri and farther east. Given that there may be no way to determine how distinctive an association this type was, it may be best to treat it as a variant of the *Quercus alba - Quercus rubra - Acer saccharum - Carya cordiformis / Lindera benzoin* Forest (CEGL002058).

CONSERVATION RANK: *G2Q.* Few, if any, examples of this community still occur (B. McClain pers. comm. 1996).

DISTRIBUTION: This mesic sand forest may possibly be foundin the midwestern United States in central Illinois.

USFS ECOREGIONS: 251Cf:???
CONSERVATION REGIONS: 48:C
STATES: IL **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: IL mesic sand forest ? [oak-maple]

USNVC HIERARCHY: QUERCUS RUBRA - (ACER SACCHARUM) FOREST ALLIANCE (I.B.2.N.a)

Forests and Woodlands: Interior Highlands Shortleaf Pine Forests and Woodlands

* Nonstandard type (needs review)

Pinus echinata Crowley's Ridge Forest [Provisional]*

Shortleaf Pine Crowley's Ridge Forest

CEGL007919

DESCRIPTION: Stands are dominated by *Pinus echinata*. Further characterization is needed.

Stands occur on the northern parts of Crowley's Ridge.

COMMENTS: *3, SCS*. Further characterization is needed to characterize this type and to distinguish it from other shortleaf pine communities (to be provided by Tom Foti).

CONSERVATION RANK: *G3G4.*

DISTRIBUTION: This shortleaf pine forest is found in the United States on the northern parts of Crowley's Ridge in Arkansas and possibly Missouri.

USFS ECOREGIONS: 234Ab:CCC
CONSERVATION REGIONS: 42:C
STATES: AR MO **PROVINCES:**

MIDWEST HERITAGE SYNONYMY: MO no state equivalent

USNVC HIERARCHY: PINUS ECHINATA FOREST ALLIANCE (I.A.8.N.b)

Shrublands/Dwarf-Shrublands: Northern Acid Rocky Shrublands

* Nonstandard type (needs review)

Rubus parviflorus Shrubland*

Thimbleberry Shrubland

Thimbleberry Shrubland CEGL005248

DESCRIPTION: At Isle Royale National Park, thimbleberry shrubland is a deciduous shrubland. There may be a sparse tree layer with 10-20% cover; the most common trees are *Betula papyrifera, Picea glauca*, and *Populus tremuloides*. A tall-shrub layer may be present, and cover of tall shrubs varies from 0-40%; the most abundant tall shrubs are saplings or browsed scrub of *Abies balsamea*. The short-shrub layer (including dwarf-shrubs) has from 40-80% cover; *Rubus parviflorus* is the most abundant shrub (usually 25-50% cover); *Rubus idaeus* may also be present. Cover of the herbaceous layer varies from 20-90% cover; the most abundant herbs are *Aralia nudicaulis, Streptopus lanceolatus (= Streptopus roseus), Eurybia macrophylla (= Aster macrophyllus), Clintonia borealis, Equisetum arvense, Galium triflorum, Gymnocarpium dryopteris*, and *Linnaea borealis*. There may be up to about 10% cover of lichens. This shrubland seems to be a successional type following disturbance (for example, disturbance by fire or clearing) that will develop into a mixed or deciduous woodland or forest. Standing dead snags of *Betula papyrifera* are common in several examples (C. Reschke pers. comm. 1999).

At Isle Royale National Park, this community occupies gentle to moderate slopes at fairly low elevations (from 190-230 m; 620-750 feet) (C. Reschke pers. comm. 1999).

At Isle Royale NP, this type seems to be successional following disturbance by burning or clearing. It is probably a fairly short-lived successional stage (C. Reschke pers. comm. 1999).

COMMENTS: *3, MCS*. Type concept is taken from studies on Isle Royale and needs rangewide review.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This thimbleberry shrubland type occurs on Isle Royale, Michigan, and perhaps more widely in the boreal regions of the upper midwestern United States and Canada.

USFS ECOREGIONS: 212Ib:CCC
CONSERVATION REGIONS: 48:C
STATES: MI? **PROVINCES:** ON?

MIDWEST HERITAGE SYNONYMY: MI? boreal shrubland

USNVC HIERARCHY: RUBUS PARVIFLORUS SHRUBLAND ALLIANCE (III.B.2.N.b)

Shrublands/Dwarf-Shrublands: Northern and Central Great Plains Dry Shrublands

Artemisia cana ssp. cana - Sarcobatus vermiculatus - (Ericameria nauseosa) Shrubland

Silver Sagebrush - Black Greasewood - (Rubber Rabbitbrush) Shrubland

Big Sagebrush – Greasewood - (Rabbit Brush) Shrubland CEGL002175

COMMENTS: *3, MCS*. More information is needed on this type.

CONSERVATION RANK: *G?.*

DISTRIBUTION: This silver sagebrush shrubland is found in the northern Great Plains of the United States.

USFS ECOREGIONS: 331:C
STATES: ND **PROVINCES:**

USNVC HIERARCHY: ARTEMISIA CANA SHRUBLAND ALLIANCE (III.A.4.N.a)

Shrublands/Dwarf-Shrublands: Northern and Central Great Plains Mesic Shrublands

Amelanchier alnifolia Shrubland

Saskatoon Serviceberry Shrubland

Saskatoon Serviceberry Shrubland CEGL002183

COMMENTS: *3, MCS*. Compare with *Amelanchier alnifolia / Pseudoroegneria spicata* Shrubland (CEGL001065).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This saskatoon serviceberry type is found in the northern Great Plains of the United States and Canada.

USFS ECOREGIONS: 251Aa:CCC, 332:P
CONSERVATION REGIONS: 34:C, 35:C
STATES: ND **PROVINCES:** SK

USNVC HIERARCHY: AMELANCHIER ALNIFOLIA SHRUBLAND ALLIANCE (III.B.2.N.a)

Shrub Grasslands: Great Plains Sagebrush-Steppe

Artemisia tridentata ssp. wyomingensis / Bouteloua gracilis Shrubland

Wyoming Big Sagebrush / Blue Grama Shrubland

Big Sagebrush/Blue Grama Shrubland CEGL001041

COMMENTS: *2, WCS*.

CONSERVATION RANK: *G5.*

DISTRIBUTION: This Wyoming big sagebrush type is found in the Great Basin region of the western United States, and possibly into the Great Plains.

USFS ECOREGIONS: 331F:??, 341:C, 342:C
CONSERVATION REGIONS: 10:C, 11:C
STATES: MT? ND? UT WY **PROVINCES:**

USNVC HIERARCHY: ARTEMISIA TRIDENTATA SSP. WYOMINGENSIS SHRUBLAND ALLIANCE (III.A.4.N.a)

Prairies/Grasslands: Great Plains Mixedgrass Prairies

Festuca altaica - Pseudoroegneria spicata Herbaceous Vegetation

Rough Fescue - Bluebunch Wheatgrass Herbaceous Vegetation

Rough Fescue - Bluebunch Wheatgrass Mixedgrass Prairie CEGL001629

DESCRIPTION: This midgrass community is heavily dominated by *Festuca altaica (= Festuca scabrella)*. *Pseudoroegneria spicata* is abundant while *Festuca idahoensis* is common. Other graminoids that may be found are *Bouteloua gracilis, Muhlenbergia cuspidata*, and *Hesperostipa comata (= Stipa comata)*. Forbs may include *Heterotheca villosa, Liatris punctata*, and *Lupinus sericeus*. The short shrubs *Artemisia frigida* and *Gutierrezia sarothrae* are also common.

This community has been described in Montana between 900-1800 m (3000-4000) on both level topography and steep slopes of all aspects (Mueggler and Stewart 1978). Soils were loamy and moderately deep.

COMMENTS: *1, WCS*.

CONSERVATION RANK: *G4.*

DISTRIBUTION: This community is found in Montana.

USFS ECOREGIONS: 331D:CC, M331A:??, M332B:CC, M332C:CC, M332D:CC, M332E:C?, M333B:CC, M333C:CC
CONSERVATION REGIONS: 34:C
STATES: MT ND? **PROVINCES:** AB?

OTHER SYNONYMY: *Festuca scabrella / Agropyron spicatum* Habitat Type (Mueggler and Stewart 1978) =

USNVC HIERARCHY: FESTUCA CAMPESTRIS HERBACEOUS ALLIANCE (V.A.5.N.d)

Prairies/Grasslands: Great Plains Mixedgrass Prairies

Hesperostipa curtiseta - Elymus lanceolatus Herbaceous Vegetation

Western Porcupine Grass - Streamside Wild Rye Herbaceous Vegetation

Western Porcupine Grass - Thickspike Wheatgrass Mixedgrass Prairie CEGL002253

COMMENTS: *2, MCS*. At the Manitoba CDC meeting on Nov. 3, 1994, this type was thought not to occur in Manitoba (J. Greenall pers. comm. 1994). Type concept needs be verified with information from Saskatchewan. In the U.S. *Heterostipa curtiseta* has been documented from northwestern North Dakota (Great Plains Flora Association 1986), but it is unclear whether the species is dominant enough to warrant a separate type. Stands would otherwise probably fit with *Hesperostipa comata - Bouteloua gracilis - Carex filifolia* Herbaceous Vegetation (CEGL002037).

CONSERVATION RANK: *G?.*

DISTRIBUTION: This mixedgrass prairie type is found in the northern Great Plains of Canada, and possibly extends southward into the U.S.

USFS ECOREGIONS: 331E:C?, 332A:C?
CONSERVATION REGIONS: 34:C
STATES: ND? **PROVINCES:** SK

USNVC HIERARCHY: HESPEROSTIPA CURTISETA - ELYMUS LANCEOLATUS HERBACEOUS ALLIANCE (V.A.5.N.c)

Prairies/Grasslands: Great Plains Mixedgrass Prairies

Juniperus virginiana var. virginiana / Schizachyrium scoparium - Bouteloua curtipendula Great Plains Herbaceous Vegetation

Eastern Red-cedar / Little Bluestem - Sideoats Grama Great Plains Herbaceous Vegetation

CEGL004066

DESCRIPTION: Stands are described as a mixedgrass prairie type, with a scattered tree layer. The dominant tree species is *Juniperus virginiana*. Dominant grasses include *Schizachyrium scoparium* and *Bouteloua curtipendula*.

COMMENTS: *3, MCS*. In Oklahoma this type is treated as a savanna or grassland with scattered trees, although currently the global type is treated strictly as a grassland type. Its placement in the hierarchy needs review. Compare to *Schizachyrium scoparium - Bouteloua curtipendula* Red Hills Herbaceous Vegetation (CEGL002248), which may be synonymous with this type. Needs to be distinguished from more eastern similar entities. This type is not recognized in Kansas (Lauver et al. 1999).

CONSERVATION RANK: *G2.* There are probably fewer than 20 occurrences of this community rangewide. This community is reported from Oklahoma, from 10 sections in 8 ecoregion provinces. It is ranked S? in Oklahoma. No occurrences are currently documented. Historic acreage and trends are unknown. This community has probably been degraded by grazing.

DISTRIBUTION: This community is reported in the southern Great Plains of the United States, particularly in Oklahoma.

USFS ECOREGIONS: 222A:CC, 231E:CC, 231G:CC, 251E:CC, 251F:CC, 255A:CC, 311A:CC, 332E:CC, M222A:CC, M231A:CC
CONSERVATION REGIONS: 32:C
STATES: KS? OK **PROVINCES:**

USNVC HIERARCHY: SCHIZACHYRIUM SCOPARIUM - BOUTELOUA CURTIPENDULA HERBACEOUS ALLIANCE (V.A.5.N.c)

ADDENDUM II: A LIST OF ASSOCIATIONS FOR THE MIDWEST IN ORDER OF GLOBAL ELCODE

The description for an association can be found by looking up the Level 4 Ecological Group Code in the Table of Contents to Association Descriptions on page 7.

Elcode	Global name	Level 4 Ecological Group Code
CECX002000	Great Lakes Wooded Dune and Swale Complex	2.1.1.2
CECX002002	Great Lakes Coastal Wetlands Complex	1.4.1.3
CECX002003	Blacktailed Prairie Dog Town Grassland Complex	2.9.3.2
CECX002004	Great Plains Badlands Sparse Vegetation Complex	2.4.4.3
CECX002005	Northern Prairie Pothole Wetland Complex	1.5.5.3
CECX002006	Northern Patterned Poor Fen Complex	1.1.1.3
CECX002007	Northern Patterned Rich Fen Complex	1.1.1.3
CEGL000187	Pinus ponderosa / Mahonia repens Forest	2.5.6.1
CEGL000188	Pinus ponderosa / Pascopyrum smithii Woodland	2.5.6.1
CEGL000190	Pinus ponderosa / Physocarpus monogynus Forest	2.5.6.1
CEGL000192	Pinus ponderosa / Prunus virginiana Forest	2.5.6.2
CEGL000201	Pinus ponderosa / Schizachyrium scoparium Woodland	2.5.6.1
CEGL000203	Pinus ponderosa / Symphoricarpos albus Forest	2.5.6.2
CEGL000382	Picea glauca / Linnaea borealis Forest	2.5.6.3
CEGL000383	Picea glauca / Vaccinium scoparium Forest	2.5.6.3
CEGL000554	Quercus macrocarpa / Carex inops ssp. heliophila Woodland	2.5.5.2
CEGL000555	Quercus macrocarpa / Ostrya virginiana Forest	2.5.5.2
CEGL000556	Quercus macrocarpa / Corylus americana - Amelanchier alnifolia Woodland	2.5.5.2
CEGL000583	Populus tremuloides / Corylus cornuta Forest	2.5.6.4
CEGL000596	Populus tremuloides / Prunus virginiana Forest	2.5.6.4
CEGL000597	Populus tremuloides / Pteridium aquilinum Forest	2.5.6.4
CEGL000607	Populus tremuloides / Spiraea betulifolia Forest	2.5.6.4
CEGL000628	Acer negundo / Prunus virginiana Forest	1.6.5.1
CEGL000643	Fraxinus pennsylvanica - Ulmus americana / Prunus virginiana Woodland	2.5.5.3
CEGL000658	Populus deltoides - Fraxinus pennsylvanica Forest	1.6.5.1
CEGL000659	Populus deltoides - (Salix amygdaloides) / Salix exigua Woodland	1.6.5.1
CEGL000660	Populus deltoides / Symphoricarpos occidentalis Woodland	1.6.5.1
CEGL000747	Juniperus scopulorum / Piptatherum micranthum Woodland	2.5.5.1
CEGL000813	Pinus flexilis / Pseudoroegneria spicata Woodland	2.5.5.1
CEGL000844	Pinus ponderosa / Arctostaphylos uva-ursi Woodland	2.5.6.1
CEGL000849	Pinus ponderosa / Carex inops ssp. heliophila Woodland	2.5.6.1
CEGL000859	Pinus ponderosa / Juniperus communis Woodland	2.5.6.2
CEGL000861	Pinus ponderosa / Juniperus scopulorum Woodland	2.5.6.1
CEGL000865	Pinus ponderosa / Pseudoroegneria spicata Woodland	2.5.6.1
CEGL000873	Pinus ponderosa / Quercus macrocarpa Woodland	2.5.6.2
CEGL000878	Pinus ponderosa Scree Woodland	2.4.5.3
CEGL000939	Populus deltoides / Distichlis spicata Woodland	1.6.5.1
CEGL000947	Salix amygdaloides Woodland	1.6.5.1
CEGL000993	Artemisia tridentata - Atriplex confertifolia Shrubland	2.6.3.1
CEGL001009	Artemisia tridentata ssp. wyomingensis / Pseudoroegneria spicata Shrubland	2.6.3.1
CEGL001040	Artemisia tridentata ssp. wyomingensis - Atriplex confertifolia Shrubland	2.6.3.1
CEGL001041	Artemisia tridentata ssp. wyomingensis / Bouteloua gracilis Shrubland	2.7.1.1
CEGL001047	Artemisia tridentata ssp. wyomingensis / Pascopyrum smithii Shrubland	2.6.3.1
CEGL001072	Artemisia cana / Pascopyrum smithii Shrubland	2.6.3.2
CEGL001086	Cercocarpus montanus / Bouteloua curtipendula Shrubland	2.6.3.1
CEGL001093	Crataegus douglasii - (Crataegus chrysocarpa) Shrubland	2.6.3.2
CEGL001099	Elaeagnus commutata / Pascopyrum smithii Shrubland	2.6.3.2
CEGL001108	Prunus virginiana - (Prunus americana) Shrubland	2.6.3.2
CEGL001128	Shepherdia argentea Shrubland	2.6.3.2
CEGL001131	Symphoricarpos occidentalis Shrubland	2.6.3.2
CEGL001161	Betula occidentalis / Cornus sericea Shrubland	1.6.6.1
CEGL001173	Salix bebbiana Shrubland	1.6.6.1
CEGL001188	Salix candida / Carex rostrata Shrubland	1.2.5.1
CEGL001197	Salix exigua Temporarily Flooded Shrubland	1.6.5.1
CEGL001203	Salix exigua / Mesic Graminoids Shrubland	1.6.5.1
CEGL001283	Atriplex canescens / Bouteloua gracilis Shrubland	2.6.3.3
CEGL001321	Krascheninnikovia lanata / Bouteloua gracilis Dwarf-shrub Herbaceous Vegetation	2.7.1.2
CEGL001330	Ericameria nauseosa / Pseudoroegneria spicata Shrubland	2.6.3.1
CEGL001367	Sarcobatus vermiculatus / Pseudoroegneria spicata Shrubland	2.4.4.3
CEGL001393	Juniperus horizontalis / Carex inops ssp. heliophila Dwarf-shrubland	2.6.3.1
CEGL001394	Juniperus horizontalis / Schizachyrium scoparium Dwarf-shrubland	2.6.3.1

BIBLIOGRAPHY FOR DESCRIPTIONS

ABI Ecology - Southeast United States. Unpublished data. Association for Biodiversity Information, Durham, NC.

Abrams, M. D. 1985. Fire history of oak gallery forests in a northeast Kansas tallgrass prairie. The American Midland Naturalist 114:188-191.

Abrams, M. D. 1986. Historical development of gallery forests in northeast Kansas. Vegetatio 65:29-37.

Abrams, M. D. 1988. Effects of prescribed fire on woody vegetation in a gallery forest understory in northeastern Kansas. Transactions of the Kansas Academy of Science 9:63-70.

Abrams, M. D. and A. K. Knapp. 1986. Seasonal water relations of three gallery forest hardwood species in northeast Kansas. Forest Science 32:687-696.

Ahlgren, C. E. 1974. Effects of fires on temperate forests: North central United States. In: T. T. Kozlowski and C. E. Ahlgren, editors. Fire and ecosystems. Academic Press, New York. 542 pp.

Alban, D. H., D. A. Perala, M. F. Jurgensen, M. E. Ostry, and J. R. Probst. 1991. Aspen ecosystem properties in the Upper Great Lakes. USDA Forest Service, North Central Forest Experiment Station. Research Paper NC-300. St. Paul, MN. 47 pp.

Albert, D. A., P. J. Comer, R. A. Corner, D. Cuthrell, M. Penskar, and M. Rabe. 1995. Bedrock shoreline survey of the Niagaran Escarpment in Michigan's Upper Peninsula: Mackinac County to Delta County. Michigan Natural Features Inventory for Land and Water Management Division (grant # CD-0.02).

Albertson, F. W. and G. W. Tomanek. 1965. Vegetation changes during a 30-year period in grassland communities near Hays, Kansas. Ecology 46:714-720.

Aldous, A. E. and H. L. Shantz. 1924. Types of vegetation in the semiarid portion of the United States and their economic significance. Journal of Agricultural Research 28:99-128.

Aldrich, J. R. and M. A. Homoya. 1986. Natural barrens and post oak flatwoods in Posey and Spencer counties, Indiana. Unpublished report. Indiana Natural Heritage Program.

Alexander, R. M. 1986. Classification of the forest vegetation of Wyoming. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Research Note RM-466. Fort Collins, CO. 10 pp.

Alexander, R. R. 1985. Major habitat types, community types, and plant communities in the Rocky Mountains. USDA Forest Service General Technical Report RM-123. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 105 pp.

Alexander, R. R. 1988. Forest vegetation on national forests in the Rocky Mountain and Intermountain region: Habitat types and community types. General Technical Report RM-162. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 47 pp.

Allard, D. J. 1990. Southeastern United States ecological community classification. Interim report, Version 1.2. The Nature Conservancy, Southeast Regional Office, Chapel Hill, NC. 96 pp.

Almendinger, J. C. 1986. The natural history of the Paul Bunyan Arboretum. Unpublished paper. Department of Ecology and Behavioral Biology, University of Minnesota.

Ambrose, J. 1990. Georgia's natural communities--A preliminary list. Unpublished document. Georgia Natural Heritage Inventory. 5 pp.

Anderson, D. M. 1982. Plant communities of Ohio: A preliminary classification and description. Division of Natural Areas and Preserves, Ohio Department of Natural Resources, Columbus, OH. 182 pp.

Anderson, D. M. 1996. The vegetation of Ohio: Two centuries of change. Draft. Ohio Biological Survey.

Anderson, L. E. 1990. A checklist of *Sphagnum* in North America north of Mexico. The Bryologist 93:500-501.

Anderson, L. E., H. A. Crum, and W. R. Buck. 1990. List of mosses of North America north of Mexico. The Bryologist 93:448-499.

Anderson, R. C. 1983. The eastern prairie-forest transition: An overview. Pages 86-92 in: R. Brewer, editor. Proceedings of the 8th North American Prairie Conference. Western Michigan University, Kalamazoo.

Anderson, R. C. 1991. Presettlement forests of Illinois. Pages 9-19 in: G. V. Burger, J. E. Ebinger, and G. S. Wilhelm, editors. Proceedings of the Oak Woods Management Workshop. Eastern Illinois University, Charleston.

Anderson, R. D. and J. E. Schwegman. 1991. Twenty years of vegetational change on a Southern Illinois Barren. Natural Areas Journal 11:100-107.

Armstrong, D. M. 1972. Distribution of Mammals in Colorado. University of Kansas Museum of Natural History Monograph 3:26-31.

Armstrong, P. 1994. Vegetation survey of a quartzite glade in Sauk County, Wisconsin. In: J. Fralish. Proceedings of the North American Conference on Savannas and Barrens. Illinois State University, Normal.

Badaracco, R. J. 1971. An interpretive resource analysis of Pawnee Buttes, Colorado. Unpublished dissertation. Colorado State University, Fort Collins. 341 pp.

Bailey, R.G., P.E. Avers, T. King, W.H. McNab, eds. 1994. Ecoregions and subregions of the United States (map). Washington, DC: U.S. Geological Survey. Scale 1: 7,500,000; colored. Accompanied by a supplementary table of map unit descriptions compiled and edited by McNab, W.H., and Bailey, R.G. Prepared for the U.S. Department of Agriculture, Forest Service.

Baker, W. L. 1982. Natural vegetation of the Piceance Basin, Colorado. Appendix D, pages 1-113 in: J. S. Peterson and W. L. Baker, editors. Inventory of the Piceance Basin, Colorado. Unpublished report for the Bureau Land Management, Craig, CO.

Baker, W. L. 1983c. Natural vegetation of part of northwestern Moffat County, Colorado. Unpublished report prepared for the State of Colorado Natural Areas Program, Department of Natural Resources, Denver by Colorado Natural Heritage Inventory, Denver.

Baker, W. L. and S. C. Kennedy. 1985. Presettlement vegetation of part of northwestern Moffat County, Colorado, described from remnants. Great Basin Naturalist 45:747-777.

Bakowsky, W. 1988. The phytosociology of midwestern savanna in the Carolinian Region of Southern Ontario. M.S. thesis. University of Toronto. 118 pp. plus appendices.

Bakowsky, W. D. 1990. Vegetation of Pinery Provincial Park. Prepared for Ontario Ministry of Natural Resources Pinery Provincial Park.

Bakowsky, W. D. 1996-1997. Rare communities of Ontario: Glacière Talus. NHIC Newsletter 3(2):2-3.

Bakowsky, W. D. and H. T. Lee. 1996. Vegetation communities of southern Ontario (draft). Ontario Natural Heritage Information Centre and Southern Region STTU, Ontario Ministry of Natural Resources, Peterborough, Ontario. 87 pp.

Barden, L. S. 1977. Self-maintaining populations of *Pinus pungens* Lam. in the southern Appalachian Mountains. Castanea 42:316-323.

Barlow, K. J. 1987. Vascular flora of LaMoure and Dickey counties, North Dakota. M.S. thesis. North Dakota State University, Fargo.

Barnes, B. V. 1991. Deciduous forests of North America. Chapter 10 in: E. Rohrig and B. Ulrich, editors. Ecosystems of the World 7: Temperate deciduous forests. Elsevier Scientific Publishing Company, New York.

Barnes, P. W., A. T. Harrison, and S. P. Heinisch. 1984. Vegetation patterns in relation to topography and edaphic variation in Nebraska Sandhills prairie. Prairie Naturalist 16:145-158.

Barnes, P. W. and L. L. Tieszen. 1978. A phytosociological study of 14 selected communities at the Samuel H. Ordway Prairie. Unpublished Paper. Undergraduate Research Project, Augustana College, Sioux Falls, SD.

Baskin, J. M. and C. C. Baskin. 1982. Draft of chapter for Kentucky's Natural Heritage Program. University of Kentucky, Lexington.

Baskin, J. M., C. C. Baskin, and E. W. Chester. 1994. The Big Barrens Region of Kentucky and Tennessee: Further observations and considerations. Castanea 59:226-254.

Beals, E. and G. Cottam. 1960. The forest vegetation of the Apostle Islands, Wisconsin. Ecology 41:743-751.

Bear Creek Uranium Mine Application. No date. Unpublished report No. 399 prepared for Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne, WY.

Bellah, R. G. and L. C. Hulbert. 1974. Forest succession on the Republican River floodplain in Clay County, Kansas. Southwestern Naturalist. 19:155-166.

Benyus, J. M. 1989. The field guide to wildlife habitats of the eastern United States. A Fireside Book. Simon and Schuster, Inc. 336 pp.

Bergman, H. L. and M. D. Marcus, editors. 1976. Final environmental assessment, Black Thunder Mine Site, Campbell County, Wyoming. Volume II (Text) and Volume III (Appendix). University of Wyoming Black Thunder Research Team.

Betz, R. F. 1978. The prairies of Indiana. In: D. C. Glenn-Lewin and R. Q. Landers, Jr., editors. Proceedings of the Fifth North American Prairie Conference. Iowa State University, Ames.

Bighorn Coal Mine. No date. Application No. 213-T2, on file at Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne.

Bird, R. D. 1930. Biotic communities of the aspen parkland of central Canada. Ecology 11:356-431.

Black Hills Community Inventory. 1999. Unpublished element occurrence and plot data collected during the Black Hills Community Inventory. Available upon request from the South Dakota Natural Heritage Program, Pierre, and Wyoming Natural Diversity Database, Laramie.

Black, R. A. and R. N. Mack. 1976. *Tsuga canadensis* in Ohio: Synecological and phytogeographical relationships. Vegetatio 32:11-19.

Blackburn, W. H. 1967. Plant succession on selected habitat types in Nevada. Unpublished thesis. University of Nevada, Reno. 162 pp.

Blackburn, W. H., P. T. Tueller, and R. E. Eckert, Jr. 1968. Vegetation and soils of the Crowley Creek Watershed. Nevada Agricultural Experiment Station Bulletin R-42. Reno. 60 pp.

Blackburn, W. H., P. T. Tueller, and R. E. Eckert, Jr. 1968a. Vegetation and soils of the Mill Creek Watershed. Nevada Agricultural Experiment Station Bulletin R-43. Reno. 69 pp.

Blackburn, W. H., P. T. Tueller, and R. E. Eckert, Jr. 1969a. Vegetation and soils of the Cow Creek Watershed. Nevada Agricultural Experiment Station Bulletin R-49. Reno. 80 pp.

Blackburn, W. H., P. T. Tueller, and R. E. Eckert, Jr. 1969c. Vegetation and soils of the Churchill Canyon Watershed. Nevada Agricultural Experiment Station Bulletin R-45. Reno. 157 pp.

Blackburn, W. H., P. T. Tueller, and R. E. Eckert, Jr. 1971. Vegetation and soils of the Rock Springs Watershed. Nevada Agricultural Experiment Station Bulletin R-83. Reno. 116 pp.

Blair, W. F. 1938. Ecological relationships of the mammals of the Bird Creek region, northeastern Oklahoma. The American Midland Naturalist 20:473-526.

Bleed, A. and M. Ginsberg. 1990. Lakes and wetlands. Pages 115-122 in: A. Bleed and C. Flowerday, editors. An atlas of the Sand Hills, resource atlas No. 5a. Institute of Agriculture and Natural Resources, University of Nebraska, Lincoln.

Bliss, L. C. and G. W. Cox. 1964. Plant community and soil variation within a northern Indiana prairie. The American Midland Naturalist 72:115-128.

Boettcher, J. F. and T. B. Bragg. 1989. Tallgrass remnants of eastern Nebraska. In: T. B. Bragg and J. Stubbendieck, editors. Proceedings of the Eleventh North American Prairie Conference. University of Nebraska Printing, Lincoln.

Boldt, C. E., D. W. Uresk, and K. E. Severson. 1978. Riparian woodlands in jeopardy on northern high plains. Pages 184-198 in: National Symposium on Strategies for Protection and Management of Floodplain Wetlands and other Riparian Ecosystems, December 11-13, Atlanta, GA.

Bonham, C. D. and A. Lerwick. 1976. Vegetation changes induced by prairie dogs on shortgrass range. Journal of Range Management 29:221-225.

Bonham, C. D. and J. S. Hannan. 1978. Blue grama and buffalograss patterns in and near a prairie dog town. Journal of Range Management 31:63-65.

Borowitz, V. A. and A. G. Stephenson. 1985. Fruit composition and patterns of fruit dispersal of two *Cornus* spp. Oecologia 67:435-441.

Bourgeron, P. S. and L. D. Engelking, editors. 1994. A preliminary vegetation classification of the western United States. Unpublished report. The Nature Conservancy, Western Heritage Task Force, Boulder, CO. 175 pp. plus appendix.

Bourgeron, P. S., L. D. Engelking, H. C. Humphries, E. Muldavin, and W. H. Moir. 1993b. Assessing the conservation value of the Gray Ranch: Rarity, diversity and representativeness. Unpublished report prepared for The Nature Conservancy by the Western Heritage Task Force, Boulder, CO. (Volume I and II).

Boutton, T. W., A. T. Harrison, and B. N. Smith. 1980. Distribution of biomass of species differing in photosynthetic pathway along an altitudinal transect in southwestern Wyoming grasslands. Oecologia 45:287-298.

Bowles, M. L. and J. L. McBride. 1994. Presettlement barrens in the glaciated prairie region of Illinois. Submitted to the North American Conference on Savannas and Barrens, 1994, Illinois State University.

Bowles, M. L., M. D. Hutchison, and J. L. McBride. 1994. Landscape pattern and structure of oak savanna, woodland, and barrens in northeastern Illinois at the time of European settlement. North American Conference on Savannas and Barrens, Illinois State University. Unpaginated.

Bowles, M. and J. McBride. 1995. Results of a survey for savanna and woodland natural communities in northern Illinois. Unpublished draft paper. 17 pp.

Bowles, M. and J. McBride. 1996. Evaluation and classification of savanna, woodland, and barrens natural areas in northern Illinois. Morton Arboretum, Lisle, IL. 21 pp.

Bowles, M., R. Flakne, K. McEachern, and N. Pavlovic. 1993. Recovery planning and reintroduction of the federally threatened Pitcher's thistle (*Cirsium pitcheri*) in Illinois. Natural Areas Journal 13:164-176.

Bragg, T. B. and L. C. Hulbert. 1976. Woody plant invasion of unburned Kansas bluestem prairie. Journal of Range Management 29:19-24.

Bragg, W. K., A. K. Knapp, and J. M. Briggs. 1993. Comparative water relations of seedling and adult *Quercus* species during gallery forest expansion in tallgrass prairie. Forest Ecology and Management 56:29-41.

Branson, F. A., R. F. Miller, and I. S. McQueen. 1961. Soil-water availability and use by grasslands on adjacent stony and shale-derived soils in Colorado. Short papers in geologic and hydrologic sciences. U.S. Geological Survey Professional Paper 424C:251-253.

Branson, F. A., R. F. Miller, and I. S. McQueen. 1964. Effects of two kinds of geologic materials on plant communities and soil moisture. American Society of Agronomy Special Publication 5:165-175.

Branson, F. A., R. F. Miller, and I. S. McQueen. 1965. Plant communities and soil moisture relationships near Denver, Colorado. Ecology 46:311-319.

Braun, E. L. 1928a. The vegetation of the mineral springs region of Adams County, Ohio. The Ohio State University Bulletin, Volume 32, No. 30. Ohio Biological Survey, Bulletin 15. 3:383-517.

Braun, E. L. 1936. Forests of the Illinoian till plain of southwestern Ohio. Ecological Monographs 6:90-149.

Braun, E. L. 1950. Deciduous forests of eastern North America. Hafner Press, New York. 596 pp.

Bray, J. R. 1955. The savanna vegetation of Wisconsin and an application of the concepts order and complexity to the field of ecology. Ph.D. thesis. University of Wisconsin, Madison.

Bray, J. R. 1958. The distribution of savanna species in relation to light intensity. Canadian Journal of Botany 36:671-681.

Brewer, R. 1966. Vegetation of two bogs in southwestern Michigan. The Michigan Botanist 5:36-46.

Brewer, R. and S. Kitler. 1989. Tree distribution in southwestern Michigan bur oak openings. The Michigan Botanist 28:73-79.

Brodowicz, W. W. 1989. Report on the Coastal Plain flora of the Great Lakes region. Prepared for the Michigan Natural Features Inventory.

Brotherson, J. D. 1969. Species composition, distribution, and phytosociology of Kaslow Prairie, a mesic tallgrass prairie in Iowa. Unpublished Ph.D. dissertation. Iowa State University, Ames. 196 pp.

Brotherson, J. D. and S. J. Barnes. 1984. Habitat relationships of *Glaux maritima* in central Utah. Great Basin Naturalist 44:299-309.

Brotherson, J. D. and W. T. Brotherson. 1981. Grazing impacts on the sagebrush communities of central Utah. Great Basin Naturalist 41:335-340.

Brown, R. W. 1971. Distribution of plant communities in southeastern Montana badlands. The American Midland Naturalist 85:458-477.

Bruner, W. E. 1931. The vegetation of Oklahoma. Ecological Monographs 1:99-188.

Bryant, W. S. 1978. An unusual forest type, hydro-mesophytic, for the Inner Bluegrass region of Kentucky. Castanea 43:129-137.

Buell, M. F. and F. H. Bormann. 1955. Deciduous forests of Ponemah Point, Red Lake Indian Reservation, Minnesota. Ecology 36:646-658.

Bujakiewicz, A. 1975. Vegetational zonation in the Front Range of the Rocky Mountains, Colorado. USA. Fragmenta Floristica et Geobotanica 21:99-142.

Bunin, J. E. 1975. Aspen forests of the west slope of the Park Range, north-central Colorado. Unpublished paper presented at the 1975 AIBS/ESA Meetings, 17-22 August 1975, Oregon State University, Corvallis. 22 pp.

Bunin, J. E. 1975c. The vegetation of the west slope of the Park Range, Colorado. Unpublished dissertation. University of Colorado, Boulder. 235 pp.

Bunin, J. E. 1985. Vegetation of the City of Boulder, Colorado open space lands. Report prepared for the City of Boulder, Real Estate/Open Space, Boulder, CO. 114 pp.

Bureau of Indian Affairs. 1979. The secretarial land use plan for the addition to the Havasupai Indian Reservation. Unpublished draft Environmental Statement INT DES 79-42. Prepared by USDI Bureau of Indian Affairs, Phoenix Area Office with the assistance of Office of Arid Land Studies, University of Arizona, Tucson.

Bureau of Land Management. 1974. Final environmental impact statement, eastern Powder River coal basin of Wyoming.

Bureau of Land Management. 1979. Final environmental impact statement, proposed development of coal resources in Eastern Powder River, WY. 67 pp.

Burgess, R. L. 1965. A study of plant succession in the sandhills of southeastern North Dakota. Proceedings of the North Dakota Academy of Science 19:62-80.

Burgess, R. L., W. C. Johnson, and W. R. Keammerer. 1973. Vegetation of the Missouri River floodplain in North Dakota. Department of Botany, North Dakota State University, Fargo.

Burns, R. M. and B. H. Honkala, technical coordinators. 1990. Silvics of North America. Volume 2: Hardwoods. Agriculture Handbook 654. USDA Forest Service, Washington, DC. 877 pp.

Burns, R. M. and B. H. Honkala, technical coordinators. 1990a. Silvics of North America: Volume 1. Conifers. USDA Forest Service. Agriculture Handbook 654. Washington, DC. 675 pp.

Butler, J. and H. Goetz. 1986. Vegetation and soil-landscape relationships in the North Dakota Badlands. The American Midland Naturalist 116:278-386.

Caballo Rojo Mine Application. No date. Application No. 511-T3, on file at Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne.

Cacek, T. L. 1973. An ecological interpretation of north central Colorado. Unpublished dissertation. Colorado State University, Fort Collins. 261 pp.

Cahayla-Wynne, R. and D. C. Glenn-Lewin. 1978. The forest vegetation of the driftless area, northeast Iowa. The American Midland Naturalist 100:307-319.

Caicco, S. L. and C. A. Wellner. 1983n. Research Natural Area recommendation for Little Jacks Creek. Unpublished report prepared for USDI Bureau of Land Management, Boise District, Idaho by Idaho Natural Areas Coordinating Committee. 14 pp.

Cain, S. A. 1935. Studies on virgin hardwood forest: III. Warren's Woods, a beech-maple climax forest in Berrien County, Michigan. Ecology 16:500-513.

Campbell, J. J. N. 1980. Present and presettlement forest conditions in the Inner Bluegrass region of Kentucky. Ph.D. dissertation. University of Kentucky, Lexington. 109 pp. [excerpts only]

Campbell, J. J. N. 1988. Natural vegetation types. Pages 153-171 in: B. Palmer-Ball, Jr., J. N. N. Campbell, M. E. Medley, D. T. Towles, J. R. MacGregor, and R. R. Cicerello. Cooperative inventory of endangered, threatened, sensitive and rare species, Daniel Boone National Forest, Somerset Ranger District. USDA Forest Service, Winchester, KY.

Campbell, J. J. N. 1989. Historical evidence of forest composition in the Bluegrass Region of Kentucky. Pages 231-246 in: Proceedings of the Seventh Central Hardwood Forest Conference, Southern Illinois University, Carbondale.

Campbell, J. J. N. 1989a. Natural vegetation types. Pages 185-200 in: J. J. N. Campbell, D. T. Towles, J. R. MacGregor, R. R. Cicerello, B. Palmer-Ball, Jr., M. E. Medley, and S. Olson. Cooperative inventory of endangered, sensitive, and rare species, Daniel Boone National Forest, Stanton Ranger District. USDA Forest Service, Winchester, KY.

Campbell, J. J. N. and J. Grubbs. 1992. Natural plant communities of Hopkins County, Kentucky. Transactions of the Kentucky Academy of Science 53:29-38.

Campbell, J. J. N., S. Walker, and D. Zollner. 1996. Technical assessment to: An ecological assessment of forest lands in Arkansas and Oklahoma proposed for inclusion into the Ouachita National Forest and Cossatot National Wildlife Refuge. Unpublished report by The Nature Conservancy. 114 pp.

Campbell, Julian J. N. Personal communication. Kentucky Field Office, The Nature Conservancy.

Catana, A. J. 1967. Forests of the Harvey N. Ott Preserve. The American Midland Naturalist 78:496-507.

Catling, P. M. and S. M. McKay. 1980. Halophytic plants in southern Ontario. Canadian Field Naturalist 94:248-258.

CDM Consultants. No date. Dave Johnston Mine Application No. 291-T2, on file at Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne.

Chambers, B. A., B. J. Naylor, J. Nieppola, B. Merchant, and P. Uhlig. 1997. Field Guide to Forest Ecosystems of Central Ontario. Southcentral Science Section (SCSS) Field Guide FG-01, Ontario Ministry of Natural Resources, North Bay, Ontario, Canada. 200 pp.

Chapman, A. G. 1942. Forests of the Illinoian till plain of southeastern Indiana. Ecology 23:189-198.

Chapman, K. A. 1984. An ecological investigation of native grassland in southern Lower Michigan. Unpublished Master thesis. Western Michigan University, Kalamazoo. 235 pp.

Chapman, K. A., D. A. Albert, and G. A. Reese. 1989. Draft descriptions of Michigan's natural community types. Michigan Department of Natural Resources, Lansing, MI. 35 pp.

Chapman, K. A., M. A. White, M. R. Huffman, and D. Faber-Langendoen. 1994. Element stewardship abstract. The Nature Conservancy, Midwest Regional Office, Minneapolis, MN.

Chapman, K. A., V. L. Dunevitz, and H. T. Kuhn. 1985. Vegetation and chemical analysis of a salt marsh in Clinton County, Michigan. The Michigan Botanist 24:135-144.

Chappell, C., R. Crawford, J. Kagan, and P. J. Doran. 1997. A vegetation, land use, and habitat classification system for the terrestrial and aquatic ecosystems of Oregon and Washington. Unpublished report prepared for Wildlife habitat and species associations within Oregon and Washington landscapes: Building a common understanding for management. Prepared by Washington and Oregon Natural Heritage Programs, Olympia WA, and Portland, OR. 177 pp.

Chester, E. W. and A. F. Scott. 1980. *Pinus strobus* in Middle Tennessee: Fifty-four years after discovery. Journal of the Tennessee Academy of Science 55:85-86.

Christensen, E. M. and S. L. Welsh. 1963. Presettlement vegetation of the valleys of western Summit and Wasatch counties, Utah. Proceedings of the Utah Academy of Science, Arts and Letters 40:163-174.

Christy, S. 1973. An analysis of the woody vegetation on the South Platte River flood plain in northeastern Colorado. Unpublished thesis. University of Northern Colorado, Greeley. 82 pp.

Churchill, S. P., C. C. Freeman, and G. E. Kantak. 1988. The vascular flora of the Niobrara Valley Preserve and adjacent areas in Nebraska. Transactions of the Nebraska Academy of Sciences 16:1-15.

Clark, B. F. and J. G. Hutchinson, editors. 1994. Central hardwood notes. USDA Forest Service: Northeastern Area State and Private Forestry, Northeastern Forest Experiment Station, Southern Forest Experiment Station.

Clark, J. R. and J. Benforado, editors. 1980. Wetlands of Bottomland Hardwood Forests: Proceedings of a Workshop on Bottomland Hardwood Forest Wetlands of the S.E. U.S. (1980: Lake Lanier, GA). Elsevier Scientific Publishing Company, Amsterdam, 1981.

Clark, S. J. V. 1977b. The vegetation of Rocky Flats, Colorado. Unpublished thesis. University of Colorado, Boulder.

Clark, S. V., P. J. Webber, V. Komarkova, and W. A. Weber. 1980. Map of mixed prairie grassland vegetation-Rocky Flats, Colorado. University of Colorado, Institute of Arctic and Alpine Research Occasional Paper 35. 66 pp.

Clausen, J. J. 1957. A phytosociological ordination of the conifer swamps of Wisconsin. Ecology 38:638-645.

Clausnitzer, R. R. and B. A. Zamora. 1987. Forest habitat types of the Colville Indian Reservation. Unpublished report prepared for the Department of Forest and Range Management, Washington State University, Pullman. 110 pp.

Cleland, D. T., J. B. Hart, G. E. Host, K. S. Pregitzer, and C. W. Ramm. 1994. Field guide to the ecological classification and inventory system of the Huron-Manistee National Forest. USDA Forest Service, North Central Forest Experiment Station.

Clements, F. E. and G. W. Goldsmith. 1924. Climaxes and climates of the Pike's Peak region. Pages 14-16 in: The phytometer method in ecology: The plant and community as instruments. Carnegie Institute of Washington Publication No. 356.

Coenenberg, J. G. and E. J. Depuit. 1979. Baseline wildlife studies, Crow Coal Lease, Southeastern Montana, 1975-1978. Montana Agricultural Experiment Station, Reclamation Research Unit, Bozeman, MT. 133 pp.

Coffin, B. and L. Pfannmuller, editors. 1988. Minnesota's endangered flora and fauna. University of Minnesota Press, Minneapolis.

Coffman, M. S. and G. L. Willis. 1977. The use of indicator species to classify climax sugar maple and eastern hemlock forests in upper Michigan. Forestry and Ecology Management 1:149-168.

Cogan, D., H. Marriott, J. Von Loh, and M.J. Pucherelli. 1999. USGS-NPS Vegetation Mapping Program, Wind Cave National Park, South Dakota. USDI Bureau of Reclamation, Technical Memorandum No. 8260-99-03, Denver, CO.

Comer, P. (editor), L. Allen, S. Cooper, D. Faber-Langendoen, and G. Jones. 1999. Selected shrubland and grassland communities of the northern Great Plains. Report to the Nebraska National Forest. The Nature Conservancy.

Comer, P. J., D. A. Albert, H. A. Wells, B. L. Hart, J. B. Raab, D. L. Price, D. M. Kashian, R. A. Corner, and D. W. Schuen. 1995a. Michigan's Native Landscape, as Interpreted from the General Land Office Surveys 1816-1856. Michigan Natural Features Inventory, Lansing, MI. 78 pp. plus digital map.

Comer, P. J., W. A. MacKinnon, M. L. Rabe, D. L. Cuthrell, M. R. Penskar, and D. A. Albert. 1995b. A survey of Lakeplain Prairie in Michigan. CZM Project 94D-0.04. Michigan Natural Features Inventory, Lansing, MI.

Comer, P. and D. Albert. 1991. A survey of wooded dune and swale complexes in the northern lower and eastern upper peninsulas of Michigan. Michigan Natural Features Inventory, Natural Heritage Program, Lansing, MI.

Comer, P. and D. Albert. 1993. A survey of wooded dune and swale complexes in Michigan. Michigan Natural Features Inventory, Natural Heritage Progam. Lansing, MI. May 1993. 158 pp.

Cooper, A. W. 1963. A survey of the vegetation of the Toxaway River Gorge with some remarks about early botanical explorations and an annotated list of the vascular plants of the gorge area. Journal of the Elisha Mitchell Scientific Society 79:1-22.

Cooper, D. J. 1984. Vegetation of the mountain parks. Pages 5-12 in: D. J. Cooper, editor. Ecological Survey of the City of Boulder, Colorado Mountain Parks. Unpublished report prepared for the City of Boulder, CO. 180 pp.

Cooper, D. J. 1986a. Ecological studies of wetland vegetation, Cross Creek Valley, Holy Cross Wilderness Area, Sawatch Range, Colorado. Holy Cross Wilderness Defense Fund, Technical Report No. 2. 24 pp.

Cooper, D. J. 1988. Advanced identification of wetlands in the City of Boulder Comprehensive Planning Area. Unpublished technical report prepared for U.S. Environmental Protection Agency, Region VIII and the City of Boulder, CO.

Cooper, D. J. and T. R. Cottrell. 1990. Classification of riparian vegetation in the northern Colorado Front Range. Unpublished report prepared for The Nature Conservancy, Colorado Field Office, Boulder. 115 pp.

Cooper, S. V. and R. D. Pfister. 1985. Forest habitat types of the Crow and Northern Cheyenne Indian Reservations. Unpublished termination report prepared for Bureau of Indian Affairs, Billings Area Office by USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, UT. 118 pp.

Cooper, S. V., C. Jean, and B. L. Heidel. 1999. Plant associations and related botanical inventory of the Beaverhead Mountains Section, Montana. Unpublished report to Bureau of Land Management. Montana Natural Heritage Program, Helena.

Cooper, S. V., K. E. Neiman, R. Steele, and D. W. Roberts. 1987. Forest habitat types of northern Idaho: A second approximation. USDA Forest Service, Intermountain Research Station. General Technical Report INT-236. Ogden, UT. 135 pp.

Cooper, S. V., P. Lesica, R. L. DeVelice, and T. McGarvey. 1995. Classification of southwestern Montana plant communities with emphasis on those of Dillon Resource Area, Bureau of Land Management. Montana Natural Heritage Program, Helena, MT. 154 pp.

Cooper, S., C. Jean, and B. Heidl. 2000. Plant associations and related botanical inventory of the Beaverhead Mountains Section, Montana. Montana Natural Heritage Program, Helena, MT.

Copeland, W. N. 1980a. The Lawrence Memorial grassland preserve, a biophysical inventory with management recommendations. June 1980. Unpublished report prepared by The Nature Conservancy Field Office, Portland, Oregon. 161 pp.

Coppock, D. L. et al. 1983. Plant-herbivore interactions in a North American mixed-grass prairie. Oecologia (Berlin) 56:1-9.

Coppock, D. L. and J. K. Detling. 1986. Alteration of bison and black-tailed prairie dog grazing interaction by prescribed burning. Journal of Wildlife Management 50:452-455.

Costello, D. F. 1944. Important species of the major forage types in Colorado and Wyoming. Ecological Monographs 14:107-134.

Costello, D. F. and G. T. Turner. 1944. Judging condition and utilization of short-grass ranges on the central Great Plains. USDA Farmer's Bulletin 1949. 21 pp.

Cottam, G. 1949. The phytosociology of an oak woods in southwestern Wisconsin. Ecology 30:271-287.

Cotter-Ferguson Project. No date. Application No. 490, on file at Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne.

Crouch, G. L. 1961. Inventory and analysis of wildlife populations and habitat, South Platte River Valley. Final report, Federal Aid in Wildlife Restoration, Project W-104-R-1-2, Colorado Game and Fish Department. 68 pp.

Crouch, G. L. 1961a. Wildlife populations and habitat conditions on grazed and ungrazed bottomlands in Logan County, Colorado. Unpublished thesis. Colorado State University, Fort Collins.

Crouch, G. L. 1978. Effects of protection from livestock grazing on a bottomland wildlife habitat in northeastern Colorado. Pages 118-125 in: Lowland river and stream habitat in Colorado: A symposium. Greeley, CO. 4-5 October 1978.

Crouch, G. L. 1979. Changes in the vegetation complex of a cottonwood ecosystem on the South Platte River. Pages 19-22 in: Riparian and wetland habitats of the Great Plains: Proceedings of the 31st annual meeting. Great Plains Agricultural Council Publication 91. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.

Crouch, G. L. 1979a. Long-term changes in cottonwoods on a grazed and an ungrazed plains bottomland in northeastern Colorado. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Research Note RM-370. Fort Collins, CO. 4 pp.

Crowe, E. A. and R. R. Clausnitzer. 1997. Mid-montane wetland plant associations of the Malheur, Umatilla, and Wallowa-Whitman national forests. USDA Forest Service, Pacific Northwest Region. Technical Paper R6-NR-ECOL-TP-22-97.

Culwell, L. D. and K. L. Scow. 1982. Terrestrial vegetation inventory: Dominy Project Area, Custer County, Montana 1979-1980. Unpublished technical report for Western Energy Company by Westech, Helena, MT. 144 pp. plus 15 pp. appendix.

Currier, P. J. 1982. The floodplain vegetation of the Platte River: Phytosociology, forest development, and seedling establishment (Nebraska).

Curtis, J. T. 1959. The vegetation of Wisconsin: An ordination of plant communities. University of Wisconsin Press, Madison, WI. 657 pp.

Dahl, B. and J. J. Norris. 1965. The effect of grazing intensity on native sandhill ranges, Eastern Colorado Range Station. Colorado Agricultural Experiment Station Progress Report 162. 2 pp.

Daley, R. H. 1972. The native sand sage vegetation of eastern Colorado. Unpublished thesis. Colorado State University, Fort Collins. 62 pp.

Damman, A. W. H., and T. W. French. 1987. The ecology of peat bogs of the glaciated northeastern United States: A community profile. USDI Fish & Wildlife Service Biological Report 85(7.16). 100 pp.

Dana, Robert. 1995. Personal communication. County Biological Survey ecologist, Minnesota Department of Natural Resources, St. Paul, MN.

Darton, N.H. 1905. Description of the Sundance quadrangle, Wyoming and South Dakota: U.S. Geol. Surv. Geol. Atlas, Folio 127.

Daubenmire, R. 1952. Forest vegetation of northern Idaho and adjacent Washington, and its bearing on concepts of vegetation classification. Ecological Monographs 22:301-330.

Daubenmire, R. 1988. Steppe vegetation of Washington. Washington State University Cooperative Extension Service Publication EB1446. (Revised from and replaces Washington Agricultural Experiment Station Publication XT0062.) 131 pp.

Daubenmire, R. F. 1936. The "Big Woods" of Minnesota: Its structure and relation to climate, fire, and soils. Ecological Monographs 6:233-268.

Daubenmire, R. F. 1970. Steppe vegetation of Washington. Washington State University Agricultural Experiment Station Technical Bulletin No. 62. 131 pp.

Daubenmire, R. F. and J. B. Daubenmire. 1968. Forest vegetation of eastern Washington and northern Idaho. Washington State University Agricultural Experiment Station Technical Bulletin No. 60. 104 pp.

Davidson, U. M. 1950. The original vegetation of Lexington, Kentucky and vicinity. M.S. thesis. University of Kentucky, Lexington. 45 pp.

Day, T. A. and J. K. Detling. 1990. Grassland patch dynamics and herbivore grazing preference following urine deposition. Ecology 71:180-188.

DeLeuw, Cather & Company. 1977. Vegetation sampling (Glenwood Canyon). Unpublished report prepared by DeLeuw, Cather & Company, Consulting Engineers and Planners, Chicago, Illinois for Colorado Division of Highways, Glenwood Springs, CO.

Dennis, J. V. 1988. The great cypress swamps. Louisiana State University Press. 142 pp.

DeVelice, R. L. 1983. Forest vegetation of northern New Mexico and southern Colorado. Unpublished dissertation. New Mexico State University, Las Cruces. 191 pp.

DeVelice, R. L. and P. Lesica. 1993. Plant community classification for vegetation on BLM lands, Pryor Mountains, Carbon County, Montana. Unpublished report by Montana Natural Heritage Program, Helena, MT. 78 pp.

DeVelice, R. L., J. A. Ludwig, W. H. Moir, and F. Ronco, Jr. 1986. A classification of forest habitat types of northern New Mexico and southern Colorado. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. General Technical Report RM-131. Fort Collins, CO. 59 pp.

DeVelice, R. L., J. Lichthardt, and P. S. Bourgeron. 1991. A preliminary classification of the plant communities of northeastern Montana. Prepared for the Montana Natural Heritage Program. Helena, MT. 144 pp.

DeVelice, R. L., S. V. Cooper, J. T. McGarvey, J. Lichthardt, and P. S. Bourgeron. 1995. Plant communities of northeastern Montana: A first approximation. Montana Natural Heritage Program, Helena, MT. 116 pp.

Diamond, D. D. 1993. Classification of the plant communities of Texas (series level). Unpublished document. Texas Natural Heritage Program, Austin. 25 pp.

Diamond, D. D. and F. E. Smeins. 1988. Gradient analysis of remnant true and upper coastal prairie grasslands of North America. Canadian Journal of Botany 66:2152-2161.

Dick-Peddie, W. A. 1986. Draft manuscript for book on vegetation of New Mexico to be published by University of New Mexico Press.

Dick-Peddie, W. A. 1993. New Mexico vegetation: Past, present, and future. University of New Mexico Press, Albuquerque. 244 pp.

Dickson, J. G. and C. A. Segelquist. No date. Winter bird populations in pine and pine-hardwood forest stands in east Texas. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies 31:134-137.

Dix, R. L. and F. E. Smeins. 1967. The prairies, meadows, and marsh vegetation of Nelson County, North Dakota. Canadian Journal of Botany 45:21-58.

Dodd, J. D. and R. T. Coupland. 1966. Vegetation of saline areas in Saskatchewan. Ecology 47:958-968.

Dodds, D. L. 1966. Phytosociological study of the vegetation of Hawk's Nest Butte. M.S. thesis. North Dakota State University, Fargo, ND.

Dodge, S. L. and J. R. Harman. 1985. Soil, subsoil, and forest composition in south-central Michigan, USA. Physical Geography 6:85-101.

Donart, G. B., D. D. Sylvester, and W. C. Hickey. 1978. Potential natural vegetation-New Mexico. New Mexico Interagency Range Commission Report 11.

Donart, G. B., D. Sylvester, and W. Hickey. 1978a. A vegetation classification system for New Mexico, USA. Pages 488-490 in: Rangeland Congress, Denver, CO, 14-18 August 1978. Society for Range Management, Denver.

Duever, L. and S. Brinson. 1984a. Florida Natural Areas Inventory community element abstracts. Florida Natural Areas Inventory, Tallahassee. Approx. 200 pp.

Duncan, W. H. and M. B. Duncan. 1988. Trees of the southeastern United States. The University of Georgia Press. 322 pp.

Dusek, G. L. 1980. An inventory of vegetation, wildlife, and recreational resources of the Long Pines, Montana: Final report. Unpublished report prepared for Montana Department of Fish, Wildlife and Parks, Ecological Services Division. 158 pp.

Duxbury, A. 1987. Fens: Our glacial relicts. North Dakota Outdoors. June 1987. North Dakota Game and Fish Department, Bismarck, ND.

Earth Resource Technology. No date. Vanguard II Mine Application No. 334-T2, on file at Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne.

Ebinger et al. 1997. [Incomplete]

Eckert, R. E. 1957. Vegetation soil relationships in some *Artemisia* types in northern Harney and Lake counties, Oregon. Unpublished dissertation. Oregon State University, Corvallis, OR. 208 pp.

Egan, R. S. 1987. A fifth checklist of the lichen-forming, lichenicolous and allied fungi of the continental United States and Canada. The Bryologist 90:77-173.

Egan, R. S. 1989. Changes to the "Fifth checklist of the lichen-forming, lichenicolous and allied fungi of the continental United States and Canada," edition I. The Bryologist 92:68-72.

Egan, R. S. 1990. Changes to the "Fifth checklist of the lichen-forming, lichenicolous and allied fungi of the continental United States and Canada," edition II. The Bryologist 93:211-219.

Eggers, S. D. and D. M. Reed. 1987. Wetland plants and plant communities of Minnesota and Wisconsin. U.S. Army Corps of Engineers, St. Paul District, St. Paul, MN. 201 pp.

Eggler, W. A. 1938. The maple-basswood forest type in Washburn County, Wisconsin. Ecology 19:243-263.

Ellis, S. L., T. Shoemaker, and R. Sanz. 1979. Inventories of plants birds, mammals, reptiles, and amphibians of the Unaweep Canyon Springs, Mesa County, Colorado. Unpublished report prepared for Colorado Natural Areas Program, Department of Natural Resources, Denver.

Ellis, S. and P. Hackney. 1981. Vegetation baseline report: Clear Creek property. Unpublished report prepared for Chevron Shale Oil Co., Denver, CO, by Environmental Research and Technology Inc., Fort Collins, CO.

Ellis, W. H. and E. W. Chester. 1989. Upland swamps of the Highland Rim of Tennessee. Journal of the Tennessee Academy of Science 64:97-101.

Ellison, L. and E. J. Woolfolk, 1937. Effects of drought on vegetation near Miles City, Montana. Ecology 18:329-336.

Esser, L. L. 1994. *Elaeagnus commutata*. In: W. C. Fisher, compiler. The Fire Effects Information System (Data base). USDA Forest Service, Intermountain Research Station, Intermountain Fire Sciences Laboratory, Missoula, MT.

Esslinger, T. L., and R. S. Egan. 1995. A sixth checklist of the lichen-forming, lichenicolous, and allied fungi of the continental United States and Canada. The Bryologist 98:467-549.

Evans, K. E. 1964. Habitat evaluation of the greater prairie chicken in Colorado. Unpublished thesis. Colorado State University, Fort Collins. 98 pp.

Evans, M. 1991. Kentucky ecological communities. Draft report to the Kentucky Nature Preserves Commission. 19 pp.

Evans, Marc. Personal communication. Ecologist. Kentucky Natural Heritage Program, Kentucky State Nature Preserves Commission, Frankfort.

Evans, S. 1989a. Riparian survey of Washington's Columbia Basin. Unpublished report prepared for The Nature Conservancy Washington Natural Heritage Program, Olympia, Washington.

Evenden, A. G. 1990. Ecology and distribution of riparian vegetation in the Trout Creek Mountains of southeastern Oregon. Ph.D. dissertation. Oregon State University, Corvallis. 156 pp.

Evers, R. A. 1955. Hill prairies of Illinois. Bulletin of the Illinois Natural History Survey 26:367-446.

Ewel, K. C. and H. T. Odum, editors. 1984. Cypress swamps. University of Florida Press, Gainesville.

Ewing, J. 1924. Plant successions of the brush-prairie in northwestern Minnesota. Journal of Ecology 12:238-265.

Eyre, F. H., editor. 1980. Forest cover types of the United States and Canada. Society of American Foresters, Washington, DC. 148 pp.

Faber-Langendoen, D. and J. R. Tester. 1993. Oak mortality in sand savannas following drought in east-central Minnesota. Bulletin of the Torrey Botanical Club 120:248-256.

Faber-Langendoen, D. and M. A. Davis. 1995. Effects of fire frequency on tree canopy cover at Allison Savanna, Eastcentral Minnesota, USA. Natural Areas Journal 15:319-328.

Faber-Langendoen, D. and P. F. Maycock. 1987. Composition and soil-environment analysis of prairies on Walpole Island, southwestern Ontario. Canadian Journal of Botany 65:2410-2419.

Faber-Langendoen, D. and P. F. Maycock. 1989. Community patterns and environmental gradients of buttonbush, *Cephalanthus occidentalis*, ponds in lowland forests of southern Ontario. The Canadian Field-Naturalist 103:479-485.

Faber-Langendoen, D. and P. F. Maycock. 1994. A vegetation analysis of tallgrass prairie in southern Ontario. Pages 17-32 in: R. G. Wickett, P. D. Lewis, A. Woodliffe, and P. Pratt, editors. Proceedings of the Thirteenth North American Prairie Conference, Windsor, Ontario.

Faber-Langendoen, D., J. Drake, and B. Pruka. No date. A re-analysis of modal species patterns in the prairie-forest transition of southern Wisconsin. Unpublished report. Midwest Conservation Science Department. Minneapolis, MN.

Faber-Langendoen, D., J. Drake, G. Jones, D. Lenz, P. Lesica, and S. Rolfsmeier. 1997. Rare plant communities of the northern Great Plains. Report to Nebraska National Forest, The Nature Conservancy. 155 pp.

Faircloth, W. 1971. The vascular flora of central south Georgia. University microfilms. Ph.D. dissertation. University of Georgia, Athens.

Farrar, J. and R. Gersib. 1991. Nebraska salt marshes: Last of the least. Nebraska Game and Parks Commission, Lincoln, NE. 23 pp.

Faulkner, S. P. and W. H. Patrick, Jr. No date. Characterization of bottomland hardwood wetland transition zones in the lower Mississippi Valley. Unpublished document.

Faust, M. E. and N. R. Roberts. 1983. The salt plants of Onondaga Lake, Onondaga County, New York. Bartonia 49:20-26.

Fehrenbacher, J. B., J. D. Alexander, I. J. Jansen, R. A. Pope, M. A. Flock, W. F. Andrews, L. J. Bushue, J. W. Scott, and E. E. Voss. 1982. General soil map of Illinois, 1:500,000 scale. University of Illinois, College of Agriculture, Agricultural Experiment Station, and USDA Soil Conservation Service, Champaign, IL.

Ferren, W. R., P. L. Fiedler, R. A. Leidy, K. D. Lafferty, and L. A. K. Mertes. 1996. Key to and catalogue of wetlands of central and southern California coast and coastal watersheds. Madrono 43:183-233.

Fike, J. 1999. Terrestrial and palustrine plant communities of Pennsylvania. Pennsylvania Natural Diversity Inventory. Pennsylvania Department of Conservation and Recreation. Bureau of Forestry. Harrisburg, PA. 86 pp.

Fink, B. 1907. A round trip between Iowa and Puget Sound. I. Westward bound. Plant World 10:49-58.

Fisser, H. G. 1964. Range survey in Wyoming's Big Horn Basin of Wyoming. Wyoming Agricultural Experiment Station Bulletin 424.

Fisser, H. G. 1970. Exclosure studies with transects of permanent plots, 1969 results. University of Wyoming Cooperative Research Report to the USDI Bureau of Land Management, sections I-IV. Wyoming Agricultural Experiment Station. Science Report 240. Laramie, WY. 128 pp.

Fisser, H. G., J. R. Wight, J. R. Flesland, and L. D. Robinson. 1965. Halogeton research, 1964 results. University of Wyoming Cooperative Research Report to the USDI Bureau of Land Management, Sections I-VI. Wyoming Agricultural Experiment Station. Mimeographed Circular pages 1-82. University of Wyoming, Laramie.

Fitzgerald, J. P. 1978. Vertebrate associations in plant communities along the South Platte River in northeastern Colorado. Pages 73-88 in: W. D. Graul and J. Bissell, editors. Lowland River and Stream Habitat in Colorado: A symposium, Greeley, Colorado, October 4-5, 1978. Colorado Chapter of the Wildlife Society and Colorado Audubon Council.

Flaccus, E. and L. F. Ohmann. 1964. Old-growth northern hardwood forests in northeastern Minnesota. Ecology 45:448-459.

Fleming, G. P. 1999. Plant communities of limestone, dolomite, and other calcareous substrates in the George Washington and Jefferson national forests, Virginia. Natural Heritage Technical Report 99-4. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond. Unpublished report submitted to the USDA Forest Service. 218 pp. plus appendices.

Fleming, Gary P. Personal communication. Ecologist, Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA.

Flinchum, D. M. 1977. Lesser vegetation as indicators of varying moisture regimes in bottomland and swamp forests of northeastern North Carolina. Ph.D. dissertation. North Carolina State University, Raleigh. 105 pp.

Florida Natural Areas Inventory. 1990. Guide to the natural communities of Florida. Florida Natural Areas Inventory and Florida Department of Natural Resources, Tallahassee. 111 pp.

Florida Natural Areas Inventory. 1992a. Natural communities. Unpublished document. The Nature Conservancy, Florida Natural Areas Inventory, Tallahassee. 6 pp.

Flowers, S. 1962. Vegetation of Morrow Point and Blue Mesa Reservoir basins of the upper Gunnison River, Colorado. Pages 47-102 in: A. M. Woodbury, editor. Ecological studies of the flora and fauna of the Curecanti Reservoir Basins, western Colorado. University of Utah, Anthropological Papers No. 59 (Upper Colo. Series No. 8).

Foti, T. and J. M. Guldin. 1994. Multivariate analysis of the ground cover layer, shrub layer, midstory and overstory of the Ouachita/Ozark national forests. Pages 61-73 in: J. B. Baker, compiler. Proceedings of the Symposium on Ecosystem Management Research in the Ouachita Mountains: Pretreatment conditions and preliminary findings. USDA Forest Service. General Technical Report SO-112.

Foti, T., compiler. 1994. Natural vegetation classification system of Arkansas, draft five. Unpublished document. Arkansas Natural Heritage Commission, Little Rock. 8 pp.

Foti, T., M. Blaney, X. Li, and K. G. Smith. 1994. A classification system for the natural vegetation of Arkansas. Proceedings of the Arkansas Academy of Science 48:50-53.

Foti, Tom. Personal communication. Ecologist. Arkansas Natural Heritage Commission, Little Rock.

Fountain, M. S. and J. M. Sweeney. 1985. Ecological assessment of the Roaring Branch Research Natural Area. USDA Forest Service, Southern Forest Experiment Station. Research Paper SO-213. New Orleans, LA. 15 pp.

Fountain, M. S. and J. M. Sweeney. 1987. Ecological assessment of the Lake Winona Research Natural Area. USDA Forest Service, Southern Forest Experiment Station. Research Paper SO-235. New Orleans. 14 pp.

Fralish, J. S. 1976. Forest site-community relationships in the Shawnee Hills region, southern Illinois. Pages 65-87 in: J. Fralish, G. Weaver, and R. Schlesinger, editors. Proceedings of the first central hardwood conference. Southern Illinois University, Carbondale.

Fralish, J. S. 1987. Forest stand basal area and its relationship to individual soil and topographic factors in the Shawnee Hills. Transactions of the Illinois Academy of Science 80:183-194.

Fralish, J. S. 1988. Predicting potential stand composition from site characteristics in the Shawnee Hills Forest of Illinois. The American Midland Naturalist 120:79-101.

Fralish, J. S., F. B. Crooks, J. L. Chambers, and F. M. Harty. 1991. Comparison of presettlement, second-growth and old-growth forest on six site types in the Illinois Shawnee Hills. The American Midland Naturalist 125:294-309.

Francis, R. E. 1983. Sagebrush-steppe habitat types in northern Colorado: A first approximation. Pages 67-71 in: Proceedings of the Workshop on Southwestern habitat types. USDA Forest Service, Southwestern Region, Albuquerque, NM.

Francis, R. E. 1986. Phyto-edaphic communities of the Upper Rio Puerco Watershed, New Mexico. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Research Paper RM-272. Fort Collins, CO. 73 pp.

Franklin, S. Personal communication.

Freckmann, R. W. 1966. The prairie remnants of the Ames area. Proceedings of the Iowa Academy of Science 73:126-136.

Frederick, C. M. 1974. A natural history study of the vascular flora of cedar bog, Champaign County, Ohio. Ohio Journal of Science 74:65-116

Frelich, L. E. 1992. The relationship of natural disturbances to white pine stand development. Presented at the White Pine Symposium: History, Ecology, Policy and Management, Duluth, Minn., Sept. 16-18, 1992.

Frelich, L. E. and C. G. Lorimer. 1991a. Natural disturbance regimes in hemlock-hardwood forests of the upper Great Lakes region. Ecological Monographs 61:145-164.

Frelich, L. E. and C. G. Lorimer. 1991b. A simulation of landscape-Level stand dynamics in the northern hardwood region. Journal of Ecology 79:223-233.

Frelich, L. E., R. R. Calcote, M. B. Davis, and J. Pastor. 1993. Patch formation and maintenance in an old-growth hemlock-hardwood forest. Ecology 74:513-527.

Frest, T. 1991. Summary status reports on eight species of candidate land snails from the Driftless Area (paleozoic plateau), upper Midwest. Contract no. 30181-01366, USFWS Region 3.

Froiland, S. G. 1990. Natural history of the Black Hills and Badlands. The Center for Western Studies, Augustana College, Sioux Falls, SD. 224 pp.

Frolick, A. L. and F. D. Keim. 1933. Native vegetation in the prairie hay district of north central Nebraska. Ecology 14:298-305.

Frost, L. A., editor. 1979. With Custer in '74: James Calhoun's diary of the Black Hills Expedition. Brigham Young University, Provo, UT.

Funk, V. A. 1975. A floristic and geologic survey of selected seeps in Calloway County, Kentucky. M.S. thesis. Murray State University, Murray, KY. 84 pp.

Funk, V. A. and M. J. Fuller. 1978. A floristic survey of the seeps of Calloway County, Kentucky. Castanea 43:162-172.

Gettman, R. W. 1974. A floristic survey of Sumter National Forest--The Andrew Pickens Division. M.S. thesis. Clemson University, Clemson, SC. 131 pp.

Gettman, R. W. 1989. A floristic survey of Sumter National Forest: The Andrew Pickens Division. M.S. thesis. Clemson University, Clemson, SC. 131 pp.

Girard, M. [1991]. ECODATA survey of riparian communities of Black Hills National Forest, 1986-1990. Unpublished files, field forms, notes, data analyses and type descriptions. Supervisor's Office, Black Hills National Forest, Custer, SD.

Girard, M. M. 1985. Native woodland ecology and habitat type classification of southwestern North Dakota. Ph.D. thesis. North Dakota State University, Fargo.

Girard, M. M., H. Goetz, and A. J. Bjugstad. 1987. Factors influencing woodlands of southwestern North Dakota. Prairie Naturalist 19:189-198.

Girard, M. M., H. Goetz, and A. J. Bjugstad. 1989. Native woodland habitat types of southwestern North Dakota. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Research Paper RM-281. Fort Collins, CO. 36 pp.

Given, D. R. and J. H. Soper. 1981. The arctic-alpine element of the vascular flora of Lake Superior. National Museums of Canada Publications in Botany 10:1-70.

Glaser, P. H. 1992a. Raised bogs in eastern North America - regional controls for species richness and floristic assemblages. Journal of Ecology 80:535-554.

Glaser, P. H. 1992b. Vegetation and water chemistry. Pages 15-26 in: H. E. Wright, Jr., B. A. Coffin, and N. E. Aaseng, editors. The patterned peatlands of Minnesota. University of Minnesota Press, Minneapolis, MN.

Glaser, P. H. 1983. Vegetation patterns in the North Black River peatland, northern Minnesota. Canadian Journal of Botany 61:2085-2104.

Gleason, H. A. and A. Cronquist. 1991. Manual of vascular plants of northeastern United States and adjacent Canada. New York Botanical Garden, Bronx, NY. 910 pp.

Godfread, C. 1994. The vegetation of the Little Missouri Badlands of North Dakota. Pages 17-24 in: Proceedings of the Leafy Spurge Strategic Planning Workshop, March 29-30, Dickinson, ND.

Godfread, C. S. 1976. Vascular flora of Barnes and Stutsman counties, North Dakota. Ph.D. thesis. North Dakota State University, Fargo. 225 pp.

Golet, F. C., A. J. K. Calhoun, W. R. DeRagon, D. J. Lowry, and A. J. Gold. 1993. Ecology of red maple swamps in the glaciated Northeast: A community profile. USDI Fish & Wildlife Service, Washington, DC. 151 pp.

Gordon, R. B. 1969. The natural vegetation of Ohio in pioneer days. Bulletin of the Ohio Biological Survey Volume III, No. 2. Ohio State University Press, Columbus. 113 pp.

Great Plains Flora Association. 1986. Flora of the Great Plains. University Press of Kansas, Lawrence. 1402 pp.

Green, N. E. 1969. Occurrence of small mammals on sandhill rangelands in eastern Colorado. Unpublished thesis. Colorado State University, Fort Collins. 39 pp.

Greenall, J. A. 1995. Draft element descriptions for natural communities of southern Manitoba (prairie and parkland regions). Manitoba Conservation Data Centre, Winnipeg. 17 pp.

Greenall, J. A. 1996. Manitoba's Terrestrial Plant Communities. Manitoba Conservation Data Centre MS Report 96-02.

Gregg, R. E. 1963. Pages 74-119 in: The ants of Colorado. University of Colorado Press, Boulder.

Grigal, D. F. and L. F. Ohmann. 1975. Classification, description, and dynamics of upland plant communities within a Minnesota wilderness area. Ecological Monographs 45:389-407.

Grimm, E. C. 1984. Fire and other factors controlling the big woods vegetation of Minnesota in the mid-nineteenth century. Ecological Monographs 54:291-311.

Grossman, D. H., K. Lemon Goodin, and C. L. Reuss, editors. 1994. Rare plant communities of the conterminous United States: An initial survey. The Nature Conservancy. Arlington, VA. 620 pp.

Gysel, L. W. 1960. An ecological study of the winter range of elk and mule deer in the Rocky Mountain National Park. Journal of Forestry 58:696-703.

Hadley, R. F. and F. A. Branson. 1965. Surficial geology and microclimatic effects on vegetation, soils and geomorphology in the Denver, Colorado, area. Pages 56-63 in: Guidebook for 1-day field conferences-Boulder area, CO. 7th International Association for Quaternary Research Congress. Nebraska Academy of Science.

Haefner, R. A. 1983. A survey of sinkhole pond natural communities in Missouri. M.S. thesis. University of Missouri, Columbia. 83 pp.

Hall, F. C. 1967. Vegetation-soil relations as a basis for resource management on the Ochoco National Forest of central Oregon. Unpublished dissertation. Oregon State University, Corvallis. 207 pp.

Hall, F. C. 1973. Plant communities of the Blue Mountains in eastern Oregon and southeastern Washington. USDA Forest Service, Pacific Northwest Region. R6 Area Guide 3-1. 62 pp.

Hall, R. B. 1970. History of Hardin County, Illinois. Published by Ruby Franklin Hall, Carbondale. 99 pp.

Hamner, R. W. 1964. An ecological study of *Sarcobatus vermiculatus* communities of the Big Horn Basin, Wyoming. Unpublished thesis. University of Wyoming, Laramie.

Hanley, T. A. and J. L. Page. [1981]. Differential effects of livestock use on habitat structure and rodent populations in Great Basin communities. California Fish and Game 68:160-174.

Hansen, H. L., L. W. Krefting, and V. Kurmis. 1973. The forest of Isle Royale in relation to fire history and wildlife. University of Minnesota, Agricultural Experiment Station, Technical Bulletin 294, Forestry Series 13.

Hansen, P. L. 1985. An ecological study of the vegetation of the Grand River/Cedar River, Sioux, and Ashland districts of the Custer National Forest. Unpublished dissertation. South Dakota State University. 257 pp.

Hansen, P. L. and G. R. Hoffman. 1986. Selected habitat types of the Custer National Forest. Pages 79-81 in: G. K. Clambey and R. H. Pemble, editors. The prairie: Past, present and future. Proceedings of the Ninth North American Prairie Conference. Tri-College University Center for Environmental Studies, Fargo, ND. 264 pp.

Hansen, P. L. and G. R. Hoffman. 1988. The vegetation of the Grand River/Cedar River, Sioux, and Ashland districts of the Custer National Forest: A habitat type classification. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. General Technical Report RM-157. Fort Collins, CO. 68 pp.

Hansen, P. L., G. R. Hoffman, and A. J. Bjugstad. 1984. The vegetation of Theodore Roosevelt National Park, North Dakota: A habitat type classification. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. General Technical Report RM-113. Fort Collins, CO. 35 pp.

Hansen, P. L., G. R. Hoffman, and G. A. Steinauer. 1985. Upland forest and woodland habitat types of the Missouri Plateau, Great Plains Province. In: D. L. Noble and R. P. Winokur, editors. Wooded draws: Characteristics and values for the northern Great Plains. Proceedings of the symposium; 1984 June 12-13; Rapid City, SD: South Dakota School of Mines and Technology: 15-26.

Hansen, P. L., K. Bogs, R. Pfister, and J. Joy. 1990. Classification and management of riparian and wetland sites in central and eastern Montana. Draft version 2. Montana Riparian Association, Montana Forest and Conservation Experiment Station, School of Forestry. University of Montana, Missoula, MT. 279 pp.

Hansen, P. L., R. B. Hopkins, and G. R. Hoffman. 1980. An ecological study of Theodore Roosevelt National Park: Habitat types and their animal components. Department of Biology, University of South Dakota, Vermillion. 182 pp.

Hansen, P. L., R. D. Pfister, K. Boggs, B. J. Cook, J. Joy, and D. K. Hinckley. 1995. Classification and management of Montana's riparian and wetland sites. Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Miscellaneous Publication No. 54. 646 pp.

Hansen, P. L., S. W. Chadde, and R. D. Pfister. 1988. Riparian dominance types of Montana. University of Montana Miscellaneous Publication 49. Montana Forest and Conservation Experiment Station, Missoula. 411 pp.

Hansen, P., K. Boggs, and R. Pfister. 1991. Classification and management of riparian and wetland sites in Montana. Unpublished draft version prepared for Montana Riparian Association, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula. 478 pp.

Hansen, P., R. Pfister, J. Joy, D. Svoboda, K. Boggs, L. Myers, S. Chadde, and J. Pierce. 1989. Classification and management of riparian sites in southwestern Montana. Unpublished draft prepared for the Montana Riparian Association, School of Forestry, University of Montana, Missoula. 292 pp.

Hanson, H. C. 1957. The use of basic principles in the classification of range vegetation. Journal of Range Management 10:26-33.

Hanson, H. C. and E. Dahl. 1956. Some grassland communities in the mountain-front zone in northern Colorado. Vegetatio 7:249-270.

Hanson, H. C. and W. S. Ball. 1928. An application of Raunkiaer's law of frequence to grazing studies. Ecology 9:467-473.

Hanson, H. C. and W. Whitman. 1938. Characteristics of major grassland types in western North Dakota. Ecological Monographs 8:58-114.

Hanson, H. C., L. D. Love and M. S. Morris. 1931. Effects of different systems of grazing by cattle upon a western wheat grass type of range near Fort Collins, Colorado. Colorado Agricultural Experiment Station Bulletin 377. 82 pp.

Harner-White Consultants. No date. Dry Fork Mine Application, No. 599-T1, on file at Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne.

Harris, A. G., S. C. McMurray, P. W. C. Uhlig, J. K. Jeglum, R. F. Foster, and G. D. Racey. 1996. Field guide to the wetland ecosystem classification for northwestern Ontario. Ontario Ministry of Natural Resources, Northwest Science and Technology, Thunder Bay, Ontario. Field guide FG-01. 74 pp. plus appendix.

Harrison, A. T. 1980. The Niobrara Valley Preserve: Its biogeographic importance and description of its biotic communities. A working report to the Nature Conservancy. Minneapolis, MN. 116 pp.

Harrison, W. F. 1988. Endangered and threatened wildlife and plants: Determination of threatened status for *Cirsium pitcheri*. Federal Register 53(137):27137-27141.

Harvey, S. J. 1982. Vegetation of Musselshell and Petroleum counties, Montana. Unpublished report to USDA Soil Conservation Service, Roundup, MT. 27 pp.

Hayward, H. E. 1928. Studies of plants in the Black Hills of South Dakota. Botanical Gazette 85:353-412.

Hazlett, B. T. 1986. The vegetation and flora of the Nordhouse dunes, Manistee National Forest, Mason County, Michigan. The Michigan Botanist 25:74-93.

Heerwagen, A. 1958. Management as related to range site in the central plains of eastern Colorado. Journal of Range Management 11:5-9.

Hefley, H. M. 1937. Ecological studies on the Canadian River floodplain in Cleveland County, Oklahoma. Ecological Monographs 7:347-402.

Hegstad, G. D. 1973. Vascular flora of Burke, Divide, Mountrail, and Williams counties in northwest North Dakota. Ph.D. thesis. North Dakota State University, Fargo. 253 pp.

Heidel, B. 1984b. Bluestem prairie inventory in the Red River Valley, North Dakota. Pages 160-162 in: Proceedings of the Ninth North American Prairie Conference.

Heidel, B. 1984a. Proposed North Dakota natural inventory community classification structure. Memo, North Dakota Parks and Recreation Department, Bismarck, ND. 19 pp.

Heikens, A. L. and P. A. Robertson. 1994. Barrens of the Midwest: A review of the literature. Castanea 59:184-194.

Heikens, A. L., K. A. West, and P. A. Robertson. 1994. Short-term response of chert and shale barrens vegetation to fire in southwestern Illinois. Castanea 59:274-285.

Heineke, T. E. 1987. The flora and plant communities of the middle Mississippi River Valley. Ph.D. dissertation. Southern Illinois University, Carbondale. 653 pp.

Heinselman, M. L. 1973. Fire in the virgin forests of the Boundary Waters Canoe Area, Minnesota. Journal of Quaternary Research 3:329-382.

Heinselman, M. L. 1996. The Boundary Waters Wilderness Ecosystem. University of Minnesota Press, Minneapolis, MN. 334 p.

Heinze, D. H., R. E. Eckert, and P. T. Tueller. 1962. The vegetation and soils of the Steptoe Watershed. Unpublished report prepared for the USDI Bureau of Land Management. 40 pp.

Heitschmidt, R. K., G. K. Hulett, and G. W. Tomanek. 1970. Vegetational map and community structure of a west central Kansas prairie. Southwestern Naturalist 14:337-350.

Hess, K. 1981. Phyto-edaphic study of habitat types of the Arapaho-Roosevelt National Forest, Colorado. Unpublished dissertation. Colorado State University, Fort Collins. 558 pp.

Hess, K. and C. H. Wasser. 1982. Grassland, shrubland, and forest habitat types of the White River-Arapaho National Forest. Unpublished final report 53-82 FT-1-19. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Fort Collins, CO. 335 pp.

Hiebert, R. D., D. A. Wilcox, and N. B. Pavlovic. 1986. Vegetation patterns in and among pannes (calcareous intradunal ponds) at the Indiana Dunes National Lakeshore, Indiana. The American Midland Naturalist 116:276-281.

Hironaka, M., M. A. Fosberg, and A. H. Winward. 1983. Sagebrush-grass habitat types of southern Idaho. Forestry, Wildlife, and Range Experiment Station Bulletin No. 15, University of Idaho, Moscow. 44 pp.

Hirsch, K. J. 1985. Habitat type classification of grasslands and shrublands of southwestern North Dakota. Ph.D. thesis. North Dakota State University, Fargo.

Hladek, K. L., G. K. Hulett, and G. W. Tomanek. 1972. The vegetation of remnant shale-limestone prairies in western Kansas. Southwestern Naturalist 17:1-10.

Hoagland, B. W. 1997. Preliminary plant community classification for Oklahoma. Unpublished draft document, version 35629. University of Oklahoma, Oklahoma Natural Heritage Inventory, Norman. 47 pp.

Hoagland, B. W. 1998a. Classification of Oklahoma vegetation types. Working draft. University of Oklahoma, Oklahoma Natural Heritage Inventory, Norman. 43 pp.

Hoagland, B. W. 1998b. The vegetation of Oklahoma: A classification for landscape mapping and conservation planning. Oklahoma Biological Survey. University of Oklahoma, Norman.

Hoagland, Bruce W. Personal communication. Ecologist. University of Oklahoma, Oklahoma Natural Heritage Inventory, Norman.

Hoffman, G. R. and R. R. Alexander. 1976. Forest vegetation of the Bighorn Mountains, Wyoming: A habitat type classification. USDA Forest Service Research Paper RM-170. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo. 38 pp.

Hoffman, G. R. and R. R. Alexander. 1980. Forest vegetation of the Routt National Forest in northwestern Colorado: A habitat type classification. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. General Technical Report RM-221. Fort Collins, CO. 41 pp.

Hoffman, G. R. and R. R. Alexander. 1983. Forest vegetation of the White River National Forest in western Colorado: A habitat type classification. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Research Paper RM-249. Fort Collins, CO. 36 pp.

Hoffman, G. R. and R. R. Alexander. 1987. Forest vegetation of the Black Hills National Forest of South Dakota and Wyoming: A habitat type classification. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Research Paper RM-276. Fort Collins, CO. 48 pp.

Holpp, F. A. 1977. Vegetative composition and soil analysis of selected playas of Campbell County, Wyoming. M.S. thesis. Range Management Section, University of Wyoming, Laramie.

Homoya, Michael. Personal communication. Indiana Natural Heritage Data Center. Division of Nature Preserves, Department of Natural Resources, 402 West Washington Street, Room W267, Indianapolis, IN 46204. 317/232-4052. Personal communication with S. L. Neid, MRO, March/April, 1997.

Homoya, M. A. 1994. Indiana barrens: Classification and description. Castanea 59:204-213.

Homoya, M. A., D. B. Abrell, J. R. Aldrich, and T. W. Post. 1985. The natural regions of Indiana. Proceedings of the Indiana Academy of Science 94:245-268.

Homoya, M. A., J. Aldrich, J. Bacone, L. Casebere, and T. Post. 1988. Indiana natural community classification. Indiana Natural Heritage Program, Indianapolis, IN. Unpublished manuscript.

Hopkins, H. H. 1951. Ecology of the native vegetation of the Loess Hills in central Nebraska. Ecological Monographs 21:125-147.

Host, G. E. and K. S. Pregitzer. 1991. Ecological species groups for upland forest ecosystems of northwestern Lower Michigan. Forest Ecology and Management 43:87-102.

Hubbard, W. A. 1950. The climate, soils, and soil-plant relationships of an area in southwestern Saskatchewan. Scientific Agriculture 30:327-342.

Hughes, R. H. 1966. Fire ecology of canebrakes. Proceedings of the Tall Timbers Fire Ecology Conference 5:149-158.

Hulett, G. K., et al. 1968. The vegetation of remnant grasslands in the loessial region of northwestern Kansas and southwestern Nebraska. Southwestern Naturalist 13:377-391.

Hutchison, M. D. 1994. The barrens of the Midwest: An historical perspective. Castanea 59:195-203.

Hutchison, M. D., S. Olson, and T. Vogt. 1986. A survey of the barrens region in Massac and Pope counties, Illinois. Unpublished survey. 63 pp.

Hyatt, P. Personal communication.

Hyder, D. N., R. E. Bement, E. E. Remmenga, and C. Terwilliger, Jr. 1966. Vegetation-soils and vegetation-grazing relations from frequency data. Journal of Range Management 19:11-17.

Illinois Nature Preserve Commission. 1973. Comprehensive plan for the Illinois nature preserves system, part 2: The natural divisions of Illinois, J. E. Schwegman, principal author. 32 pp.

Jackson, J. R. 1972. Vegetation of the flood plain of the South Platte River in the proposed Narrows Reservoir site. Unpublished thesis. University of Northern Colorado, Greeley. 83 pp.

Jackson, J. R. and I. E. Lindauer. 1978. Vegetation of the flood plain of the south Platte River in the proposed Narrows Reservoir site. Transactions of the Mississippi Academy of Science 12:37-46.

Jackson, M. T. 1979. A classification of Indiana plant communities. Proceedings of the Indiana Academy of Science 89:159-171.

Jackson, S. T. and D. K. Singer. 1997. Climate change and the development of coastal plain disjuncts in the central Great Lakes region. Rhodora 99:101-117.

Jameson, D. A. 1969. Rainfall patterns on vegetation zones in northern Arizona. Plateau 41:105-111.

Janssen, C. R. 1967. A floristic study of forests and bog vegetation, northwestern Minnesota. Ecology 48:751-765.

Jaramillo, V. J. and J. K. Detling. 1988. Grazing history, defoliation, and competition: Effects on shortgrass production and nitrogen accumulation. Ecology 69:1599-1608.

Jeffries, D. L. 1985. Analysis of the vegetation and soils of glades on Calico Rock sandstone in northern Arkansas. Bulletin of the Torrey Botanical Club 112:70-73.

Jeffries, D. L. 1987. Vegetation analysis of sandstone glades in Devil's Den State Park, Arkansas. Castanea 52:9-15.

Jenkins, M. A. and S. G. Pallardy. 1993. A comparison of forest dynamics at two sites in the southeastern Ozark mountains of Missouri. Pages 327-341 in: Proceedings of the 9th Central Hardwood Forest Conference. Purdue University, West Lafayette, IN.

Johnson, C. G. and R. R. Clausnitzer. 1992. Plant associations of the Blue and Ochoco Mountains. USDA Forest Service, Pacific Northwest Region, Wallowa-Whitman National Forest R6-ERW-TP-036-92. 163 pp. plus appendices.

Johnson, C. G. and S. A. Simon. 1985. Plant associations of the Wallowa Valley Ranger District, Part II: Steppe. USDA Forest Service, Pacific Northwest Region, Wallowa-Whitman National Forest. 258 pp.

Johnson, C. G., Jr. and S. A. Simon. 1987. Plant associations of the Wallowa-Snake Province Wallowa-Whitman National Forest. USDA Forest Service, Pacific Northwest Region, Wallowa-Whitman National Forest. Technical Paper R6-ECOL-TP-255A-86. 399 pp. plus appendices.

Johnson, F. L. 1986. Oak-hickory savannahs and transition zones: Preservation status and management problems. Pages 345-347 in: D. L. Kulhavy, and R. N. Conner. Wilderness and natural areas in the eastern United States: A management challenge. Center for Applied Studies, School of Forestry, Stephen F. Austin State University, Nacogdoches, TX.

Johnson, F. L. and D. T. Bell. 1976. Tree growth and mortality in the streamside forest. Castanea 41:34-40.

Johnson, P., K. Boggs, R. Pfister, and J. Joy. 1990a. Classification and management of riparian and wetland sites in central and eastern Montana. Draft version 2. Montana Riparian Association, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, MT.

Johnson, S. R. and A. K. Knapp. 1995. The influence of fire on *Spartina pectinata* wetland communities in a northeastern Kansas tallgrass prairie. Canadian Journal of Botany 73:84-90.

Johnson, W. C. 1971. The forest overstory vegetation on the Missouri River floodplain in North Dakota. Ph.D. thesis. North Dakota State University, Fargo, ND.

Johnson, W. C. 1994. Woodland expansion in the Platte River, Nebraska: Patterns and causes. Ecological Monographs 64:45-84.

Johnson, W. C., T. L. Sharik, R. A. Mayes, and E. P. Smith. 1987. Nature and cause of zonation discreteness around glacial prairie marshes. Canadian Journal of Botany 65:1622-1632.

Johnson-Groh, C. L. 1985. Vegetation communities of Ledges State Park, Boone County, Iowa. Proceedings of the Iowa Academy of Science 92:125-128 and map.

Johnson-Groh, C. L., D. Q. Lewis, and J. F. Shearer. 1987. Vegetation communities and flora of Dolliver State Park, Webster County, Iowa. Proceedings of the Iowa Academy of Science 94:84-88 plus maps.

Johnston, B. C. 1987. Plant associations of Region Two: Potential plant communities of Wyoming, South Dakota, Nebraska, Colorado, and Kansas. R2-ECOL-87-2. USDA Forest Service, Rocky Mountain Region. Lakewood, CO. 429 pp.

Jones, G. 1992. Wyoming plant community classification (Draft). Wyoming Natural Diversity Database, Laramie, WY. 183 pp.

Jones, G. P. 1997. Ecological evaluation of the potential Playas Research Natural Area within the Thunder Basin National Grassland, Campbell County, Wyoming. Unpublished report prepared for the Nebraska National Forest, USDA Forest Service by the Wyoming Natural Diversity Database.

Jones, G. P. and G. M. Walford. 1995. Major riparian vegetation types of eastern Wyoming. Submitted to Wyoming Department of Environmental Quality, Water Quality Division. Wyoming Natural Diversity Database, Laramie, WY. 245 pp.

Jorgensen, H. E. 1979. Vegetation of the Yellow Water Triangle, Montana. Montana Dep. of Fish and Game, in cooperation with the Bureau of Land Management. Helena, MT. 57 pp.

Kahler, L. J. 1973. Correlation of slope exposure with differences in the composition of the vegetation community at 7000 feet in Clear Creek Canyon west of Golden, Colorado. Unpublished thesis. University of Colorado, Boulder. 105 pp.

Kangas, P. 1989. Comparison of two northern white cedar (*Thuja*) forests. The Michigan Botanist 28:59-68.

Kantak, G. E. 1995. Terrestrial plant communities of the middle Niobrara Valley, Nebraska. The Southwestern Naturalist 40:129-138.

Kantrud, H. A., J. B. Millar, and A. G. Van der Valk. 1989. Vegetation of wetlands of the prairie pothole region. Pages 132-187 in: A. Van der Valk, editor. Northern Prairie Wetlands. Iowa State University Press, Ames, IA.

Karlin, E. 1988. Report on New Jersey conifer swamp study. Unpublished report to the New Jersey Natural Heritage Program.

Kartesz, J. T. 1994. A synonymized checklist of the vascular flora of the United States, Canada, and Greenland. Second edition. Volume 1--Checklist. Timber Press, Portland, OR. 622 pp.

Kartesz, J. T. 1999. A synonymized checklist and atlas with biological attributes for the vascular flora of the United States, Canada, and Greenland. First Edition. In: J. T. Kartesz and C. A. Meacham. Synthesis of the North American Flora, Version 1.0. North Carolina Botanical Garden, Chapel Hill, NC.

Kaul, R. 1990. Plants and communities. In: A. Bleed and C. Flowerday, editors. An atlas of the Sand Hills, Resource Atlas No. 5a. Conservation and Survey Division, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln.

Kaul, R. B., Challaiah, and K. H. Keeler. 1983. Effects of grazing and juniper-canopy closure on the prairie flora in Nebraska high-plains canyons. Pages 95-105 in: Proceedings of the Seventh North American Prairie Conference (1980).

Kaul, R. B., G. E. Kantak, and S. P. Churchill. 1988. The Niobrara River Valley, a postglacial migration corridor and refugium of forest plants and animals in the grasslands of central North America. The Botanical Review 54:45-65.

Keammerer, W. R. 1972. The understory vegetation of the bottomland forests of the Missouri River in North Dakota. Ph.D. thesis. North Dakota State University, Fargo. 234 pp.

Keammerer, W. R. 1987. Bentonite regional vegetation study. Prepared for Crook County Bentonite Producers and Wyoming Department of Environmental Quality, Land Quality Division, by Stoeker-Keammerer and Associates, Boulder, CO.

Keammerer, W. R. and R. E. Stoecker. 1975. Vegetation and wildlife studies along proposed corridors for oil shale tract C-b. Unpublished report prepared for Shell Oil Co., Denver, by Stoecker-Keammerer and Associates, Boulder, CO. 86 pp.

Keammerer, W. R., W. C. Johnson, and R. L. Burgess. 1975. Floristic analysis of the Missouri River bottomland forests in North Dakota. Canadian Field Naturalist 89:5-19.

Keddy, C. J. and M. J. Sharp. 1989. Atlantic coastal plain flora conservation in Ontario. Prepared for the Natural Heritage League and World Wildlife Fund.

Kelly, P. E. and D. W. Larson. 1997. Dendroecological analysis of the population dynamics of an old-growth forest on cliff-faces of the Niagara Escarpment, Canada. Journal of Ecology 85:467-478.

Kennedy, R. K. 1973. An analysis of selected Oklahoma upland forest stands including both overstory and understory. Ph.D. dissertation. University of Oklahoma, Norman.

Kettler, S. Personal communication. Colorado Natural Heritage Program, Colorado State University, Fort Collins.

Kettler, S. and A. McMullen. 1996. Routt National Forest riparian vegetation classification. Report prepared for Routt National Forest by the Colorado Natural Heritage Program, Colorado State University, Fort Collins.

Keys, Jr., J. C. Carpenter, S. Hooks, F. Koenig, W.H. McNab, W.E. Russell, and M.L. Smith. 1995. Ecological units of the eastern United States - first approximation (map and booklet of map unit tables). Atlanta, Georgia, U.S. Department of Agriculture, Forest Service, presentation scale 1:3,500,000, colored.

Kittel, G. M. 1994. Montane vegetation in relation to elevation and geomorphology along the Cache la Poudre River, Colorado. Unpublished thesis. University of Wyoming, Laramie.

Kittel, G. M. and N. D. Lederer. 1993. A preliminary classification of the riparian vegetation of the Yampa and San Miguel/Dolores river basins. Unpublished report prepared for Colorado Department of Health and the Environmental Protection Agency by The Nature Conservancy, Colorado Field Office, Boulder.

Kittel, G., E. Van Wie, and M. Damm. 1998. *Cornus sericea* plant association. Characterization abstract. In: R. Osborn, G. Kittel, and M. Reid. 1998. Colorado Riparian Plant Associations and Western States Vegetation Classification. CDROM. U.S. Geological Survey, Mid-Continent Ecology Research Center, Fort Collins, CO.

Kittel, G., E. Van Wie, M. Damm, R. Rondeau, S. Kettler, A. McMullen, and J. Sanderson. 1999a. A classification of riparian and wetland plant associations of Colorado: A user's guide to the classification project. Colorado Natural Heritage Program, Colorado State University, Fort Collins CO. 70 pp. plus appendices.

Kittel, G., E. Van Wie, M. Damm, R. Rondeau, S. Kettler, and J. Sanderson. 1999b. A classification of the riparian plant associations of the Rio Grande and Closed Basin watersheds, Colorado. Unpublished report prepared by the Colorado Natural Heritage Program, Colorado State University, Fort Collins.

Kittel, G., R. Rondeau, and A. McMullen. 1996. A classification of the riparian vegetation of the Lower South Platte and parts of the Upper Arkansas River basins, Colorado. Submitted to Colorado Department of Natural Resources and the Environmental Protection Agency, Region VIII. Prepared by Colorado Natural Heritage Program, Fort Collins. 243 pp.

Kittel, G., R. Rondeau, and S. Kettler. 1995. A classification of the riparian vegetation of the Gunnison River Basin, Colorado. Submitted to Colorado Department of Natural Resources and the Environmental Protection Agency. Prepared by Colorado Natural Heritage Program, Fort Collins. 114 pp.

Kittel, G., R. Rondeau, N. Lederer, and D. Randolph. 1994. A classification of the riparian vegetation of the White and Colorado River basins, Colorado. Final report submitted to Colorado Department of Natural Resources and the Environmental Protection Agency. Colorado Natural Heritage Program, Boulder. 166 pp.

Klimas, C. V., C. O. Martin, and J. W. Teaford. 1981. Impacts of flooding regime modification on wildlife habitats of bottomland hardwood forests in the lower Mississippi. U.S. Army Corps of Engineers, Waterways Experimental Station and Environmental Lab. Technical Report EL-81-13. Vicksburg, MS. 137 pp. plus appendix.

Kline, V. M. and G. Cottam. 1979. Vegetation response to climate and fire in the driftless area of Wisconsin. Ecology 60:861-868.

Klipple, G. E. 1964. Early- and late-season grazing versus season-long grazing of short-grass vegetation on the central Great Plains. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Research Paper RM-11. Fort Collins, CO. 16 pp.

Klipple, G. E. and D. F. Costello. 1960. Vegetation and cattle responses to different intensities of grazing on short-grass ranges of the central Great Plains. USDA Forest Service Technical Bulletin 1216. 82 pp.

Knight, D. H. 1994. Mountains and plains: Ecology of Wyoming landscapes. Yale University Press, New Haven, MA. 338 pp.

Knight, D. H., G. P. Jones, Y. Akashi, and R. W. Myers. 1987. Vegetation ecology in the Bighorn Canyon National Recreation Area. Unpublished report prepared for the USDI National Park Service and University of Wyoming-National Park Service Research.

Knopf, F. L. 1985. Significance of riparian vegetation to breeding birds along an altitudinal cline. Pages 105-111 in: R. R. Johnson, et al., editors. Riparian ecosystems and their management. USDA Forest Service General Technical Report RM-120.

Komarkova, V. 1976. Alpine vegetation of the Indian Peaks Area, Front Range, Colorado Rocky Mountains. Unpublished dissertation. University of Colorado, Boulder. 655 pp.

Komarkova, V. 1986. Habitat types on selected parts of the Gunnison and Uncompahgre national forests. Unpublished final report prepared for USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Fort Collins, CO. 270 pp. plus appendices.

Komarkova, V., A. Peters, G. Kamani, W. Jones, V. Howard, H. Gordon, and K. Southwick. 1988a. Natural recovery of plant communities on disturbance plots and history of land use in the Niwot Ridge/Green Lakes Valley, Front Range, Colorado. University of Colorado Longterm Ecological Research Working Paper 88/1. Boulder, CO. 46 pp.

Kooiman, M. and Y. B. Linhart. 1986. Structure and change in herbaceous communities of four ecosystems in the Front Range Colorado, USA. Arctic and Alpine Research 18:97-110.

Kotar, J. and T. L. Burger. 1989. Forest habitat type classification for the Menominee Indian Reservation. Department of Forestry, University of Wisconsin, Madison. 90 pp.

Kotar, J. and T. L. Burger. 1996. A guide to forest communities and habitat types of central and southern Wisconsin. Department of Forestry, University of Wisconsin-Madison, Madison, WI.

Kotar, J., J. A. Kovach, and C. T. Locey. 1988. Field guide to forest habitat types of northern Wisconsin. Department of Forestry, University of Wisconsin and Department of Natural Resources.

Kovalchik, B. L. 1987. Riparian zone associations - Deschutes, Ochoco, Fremont, and Winema national forests. USDA Forest Service Technical Paper 279-87. Pacific Northwest Region, Portland, OR. 171 pp.

Kovalchik, B. L. 1993. Riparian plant associations on the national forests of eastern Washington - Draft version 1. USDA Forest Service, Colville National Forest, Colville, WA. 203 pp.

Kral, R. 1983a. A report on some rare, threatened, or endangered forest-related vascular plants of the South: Volume I. Isoetaceae through Euphorbiaceae. USDA Forest Service. Technical Publication R8-TP2. Atlanta. 718 pp.

Kuchler, A. W. 1956. Notes on the vegetation of southeastern Mount Desert Island, Maine. University of Kansas Science Bulletin 38:335-392.

Kuchler, A. W. 1964. Potential natural vegetation of the conterminous United States. American Geographic Society Special Publication 36. 116 pp.

Kuchler, A. W. 1974. A new vegetation map of Kansas. Ecology 55:586-604 (with map supplement).

Kurmis, V., S. L. Webb, and L. C. Merriam. 1986. Plant communities of Voyageurs National Park, Minnesota, U.S.A. Canadian Journal of Botany 64:531-540.

La Roi, G. H. 1967. Ecological studies in the boreal spruce-fir forests of the North American taiga. I. Analysis of the vascular flora. Ecological Monographs 37:229-253.

Labaugh, J. W. 1989. Chemical characteristics of water in northern prairie wetlands. Pages 56-91 in: A. Van der Valk, editor. Northern prairie wetlands. Iowa State University Press, Ames, IA.

Ladd and Heumann. 1994. [Incomplete]

LaGesse, V., W. McClain, and J. Ebinger. 1998. Woody vegetation survey of Sibley Burr Oak Grove Nature Preserve, Ford County, Illinois. Transactions of the Illinois Academy of Science 86:111-117.

Lange, K. I. 1990. A postglacial vegetational history of Sauk County and Caledonia Township, Columbia County, South Central Wisconsin. Wisconsin Department of Natural Resources. Technical Bulletin No. 168. Madison, WI.

Larson, D. W. and P. E. Kelly. 1991. The extent of old-growth *Thuja occidentalis* on cliffs of the Niagara Escarpment. Canadian Journal of Botany 69:1628-1636.

Larson, D. W., U. Matthes, and P. E. Kelly. 1999. Cliffs as natural refuges. American Scientist 87:410-418.

Larson, D. W., U. Matthes, J. A. Gerrath, J. M. Gerrath, J. C. Nekola, G. L. Walker, S. Porembski, A. Charlton, and N. W. K. Larson. 1999. Ancient stunted trees on cliffs. Nature 398:382-383.

Larson, G. E. 1993. Aquatic and wetland vascular plants of the northern Great Plains. USDA Forest Service General Technical Report RM-238. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 681 pp.

Larson, L. L. 1974. Discriminant and hierarchical analyses in vegetation classification. Unpublished thesis. Colorado State University, Fort Collins. 103 pp.

Lautenschlager, L. F. 1964. A floristic survey of Ward County, northwestern North Dakota. M.S. thesis. North Dakota State University, Fargo, ND.

Lauver, C. L. 1989. Preliminary classification of the natural communities of Kansas. Unpublished report. Kansas Natural Heritage Program, Kansas Biological Survey, University of Kansas, Lawrence.

Lauver, C. L., K. Kindscher, D. Faber-Langendoen, and R. Schneider. 1999. A classification of the natural vegetation of Kansas. Southwestern Naturalist 44: 421-443.

Lea, C. 2000. Plant communities of the Potomac Gorge and their relationship to fluvial factors. M.S. thesis. George Mason University. Fairfax, VA. 219 pp.

Leahy, Mike. Personal communication. Missouri Natural Heritage Database, Missouri Department of Conservation, Jefferson City.

Lee, H., W. Bakowsky, J. Riley, J. Bowles, M. Puddister, P. Uhlig, and S. McMurray. 1998. Ecological land classification for southern Ontario: First approximation and its application. Ontario Ministry of Natural Resources, Southcentral Science Section, Science Development and Transfer Branch. SCSS Field Guide FG-02.

Leitner, L. A., C. P. Dunn, G. R. Guntenspergen, F. Stearns, and D. M. Sharpe. 1991. Effects of site, landscape features, and fire regime on vegetation patterns in presettlement southern Wisconsin. Landscape Ecology 5:203-217.

Leoschke, M. J. 1997. The Prairie Coteau natural areas inventory: Day, Marshall, and Roberts counties, South Dakota. Unpublished report to The Nature Conservancy. Department of Biology and Microbiology, South Dakota State University, Brookings, SD.

Leoschke, M. J. and J. A. Pearson. 1987. Inventory of fen communities and rare fen plant species in Iowa - 1987. Iowa Dept. of Natural Resources, Des Moines, Iowa.

Lesica, P. 1989. The vegetation and flora of glaciated prairie potholes of the Blackfeet Indian Reservation, Montana. Final report to The Nature Conservancy, Montana Field Office, Helena, MT. 26 pp.

Lesica, P. 1992. Autecology of the endangered plant *Howellia aquatilis*: Implications for management and reserve design. Ecological Applications 2:411-421.

Lesica, P. 1993. Using plant community diversity in reserve design for pothole prairie on the Blackfeet Indian Reservation, Montana, USA. Biological Conservation 65:69-75.

Lesica, P. 1994. The distribution of plant community diversity associated with glacial wetlands in the Ovando Valley, Montana. Final report to The Nature Conservancy Montana Field Office, Helena, MT. 24 pp.

Lesica, P. and R. L. DeVelice. 1992. Plant communities of the Pryor Mountains. Preliminary report prepared by the Montana Natural Heritage Program, Helena, MT.

Lewis, M. E. 1975. Plant communities of the Jarbidge Mountain Complex, Humboldt National Forest. Unpublished report compiled for USDA Forest Service, Region IV, Ogden, UT. 22 pp.

Lichter, J. 1998. Primary succession and forest development on coastal Lake Michigan sand dunes. Ecological Monographs 68:487-510.

Lindauer, I. E. 1970. The vegetation of the flood plain of the Arkansas River in southeastern Colorado. Unpublished dissertation. Colorado State University, Fort Collins. 92 pp.

Lindauer, I. E. 1978. A comparison of the vegetative communities of the South Platte and Arkansas River drainages in eastern Colorado. Pages 56-72 in: W. D. Graul and S. J. Bissel, editors. Lowland River and Stream Habitat in Colorado: A Symposium, 4-5 October 1978. Colorado Chapter of Wildlife Society and Audubon Council.

Lindauer, I. E. 1983. A comparison of the plant communities of the South Platte and Arkansas River drainages in eastern Colorado. Southwestern Naturalist 28:249-259.

Lindauer, I. E. and J. P. Fitzgerald. 1974. Ecological survey and analysis of terrestrial communities at the Weld County (Hardin) proposed reservoir site. Unpublished report to U.S. Bureau of Reclamation, Denver, CO, by University of Northern Colorado, Greeley. 45 pp.

Lindauer, I. E. and R. T. Ward. 1968. A survey of the woody phreatophytes in the lower Arkansas River Valley of Colorado Unpublished report to U.S. Bureau of Reclamation, Denver, CO, by the Department of Botany, Colorado State University, Fort Collins. 46 pp.

Lindauer, I. E. and S. J. Christy. 1972. An analysis of the woody vegetation on the South Platte River floodplain in northeastern Colorado. Unpublished report to the U.S. Bureau of Reclamation, Denver, CO, by the University of Northern Colorado, Biology Department, Greeley.

Lindauer, I. E., J. P. Fitzgerald and L. L. Lindauer. 1973. Ecological analyses of flood plain communities, Narrows Reservoir Site, Colorado. Unpublished report to U.S. Bureau of Reclamation, Denver, CO, by the University of Northern Colorado, Department of Biology, Greeley. 108 pp.

Lindsey, A. A., D. V. Schmelz, and S. A. Nichols. 1969. Natural areas in Indiana and their preservation. Indiana Natural Areas Survey. Purdue University, Lafayette, IN. 594 pp.

Lisenbee, A., F. Karner, E. Fashbaugh, D. Halvorson, F. O'Toole, S. White, M. Wilkinson, and J. Kirchener. 1981. Geology of the Tertiary intrusive province of the northern Black Hills, South Dakota and Wyoming. Pages 126-133 in: F. J. Rich, editor. Geology of the Black Hills, South Dakota and Wyoming. Geological Society of America Guidebook.

Livingston, R. B. 1947. An ecological study of the Black Forest region and adjacent plains. Unpublished dissertation. Duke University, Durham, NC. 134 pp.

Livingston, R. B. 1949. An ecological study of the Black Forest, Colorado. Ecological Monographs 19:123-144.

Livingston, R. B. 1952. Relict true prairie communities in central Colorado. Ecology 33:72-86.

Looman, J. 1980. The vegetation of the Canadian prairie provinces. II. The grasslands, Part 1. Phytocoenologia 8:153-190.

Looman, J. 1981a. The vegetation of the Canadian prairie provinces. III. Aquatic and semi-aquatic vegetation. Phytocoenologia 9:473-497.

Looman, J. 1982. The vegetation of the Canadian prairie provinces. III. Aquatic and semi-aquatic vegetation, Part 2. Freshwater marshes and bogs. Phytocoenologia 10:401-423.

Looman, J. 1986. The vegetation of the Canadian prairie provinces. III. Aquatic and semi-aquatic vegetation, Part 3. Aquatic plant communities. Phytocoenologia 14:19-54.

Love, J. D. and A. C. Christiansen. 1985. Geologic map of Wyoming. U.S. Geologic Survey. Prepared in cooperation with Geologic Survey of Wyoming.

Lucky McMine Application. No date. Nos. 356C and 356C-A2, on file at Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne.

Luti, R. 1953. Ecological features of the vegetation of a ridge in the montane forest of Boulder County, Colorado. Unpublished thesis. University of Colorado, Boulder. 100 pp.

Lynn, R., M. Larson, D. Hoeft, L. Todd, T. Raetz, L. Fager, and G. Barranco. No date. Black Hills National Forest ecological land units study. USDA Forest Service, Black Hills National Forest, SD.

MacCracken, J. G., D. W. Uresk, and R. M. Hansen. 1983. Plant community variability on a small area in southeastern Montana. Great Basin Naturalist 43:660-668.

MacCracken, J. G., L. E. Alexander, and D. W. Uresk. 1983a. An important lichen of southeastern Montana rangelands. Journal of Range Management 36:35-37.

Mack, S. E. 1981. Hardwood ravines and associated vegetation in west-central North Dakota. M.S. thesis. North Dakota State University, Fargo. 168 pp.

Mack-Olson, D. 1998. Felsenmeers: The species and ecology of the glacial relicts of Rusk and Barron counties, Wisconsin. Unpublished report to University of Wisconsin Department of Geology.

Madany, M. H. 1981. A floristic survey of savannas in Illinois. Pages 177-181 in: R. L. Stuckey and K. J. Reese, editors. The Prairie Peninsula: In the "shadow" of Transeau. Proceedings of the Sixth North American Prairie Conference. Ohio Biological Survey Biology Notes, No. 15, Columbus.

Maine Natural Heritage Program. 1991. Natural landscapes of Maine: A classification of ecosystems and natural communities. Unpublished document. Office of Comprehensive Planning, Maine Natural Heritage Program, Augusta. 77 pp.

Malter, J. L. 1977. The flora of Citico Creek Wilderness Study Area, Cherokee National Forest, Monroe County, Tennessee. M.S. thesis. University of Tennessee, Knoxville. 116 pp.

Manning, M. 1988. Ecology and rooting characteristics of four intermountain meadow community types. Unpublished thesis. University of Nevada, Reno.

Marr, J. W. and D. L. Buckner. 1974. Colorado to Wyoming pipeline corridor study. Unpublished report for Colony Development Operation, Atlantic Richfield Co., Denver by Thorne Ecological Institute, Boulder, CO. 79 pp.

Marriott, H. J. 1985. Flora of the northwestern Black Hills, Crook and Weston counties, Wyoming. Unpublished M.S. thesis. Department of Botany, University of Wyoming, Laramie.

Marriott, H. J. and D. Faber-Langendoen. 2000. The Black Hills community inventory. Volume 2: plant community descriptions. The Nature Conservancy, Midwestern Resource Office, Minneapolis, MN. 326 p.

Marriott, H. J., D. Faber-Langendoen, A. McAdams, D. Stutzman, and B. Burkhart. 1999. The Black Hills Community Inventory: Final report. The Nature Conservancy, Midwest Conservation Science Center, Minneapolis, MN.

Martin, N. D. 1959. An analysis of forest succession in Algonquin Park, Ontario. Ecological Monographs 29:187-218.

Masek, J. 1979. Vegetation community descriptions for the South Platte River in Colorado and Nebraska. Unpublished report prepared for the Water and Power Resources Service, Denver, CO. 23 pp.

Masters, R. E. and C. W. Wilson. 1994. Effects of midstory vegetation removal and fires on the breeding birds and plant community compositions in red-cockaded woodpecker clusters. Final Report to USDA Forest Service.

Matherne, A. M. 1994. Freshwater and saline floodplain wetlands of the North Platte River - sources and seasonal dynamics: Kiowa Wildlife Management Area, Morrill, NE. Report to the Nebraska Game and Parks Commission, Lincoln. 19 pp. plus appendices.

Mattson, D. J. 1984. Classification and environmental relationships of wetland vegetation in central Yellowstone National Park. Unpublished thesis. University of Idaho, Moscow. 409 pp.

Mattson, D. J. No date. Classification and environmental relationships of wetland vegetation in central Yellowstone National Park.

Maxwell, E. L. 1975. Multispectral analysis of rangeland conditions. Unpublished dissertation. Colorado State University, Fort Collins. 198 pp.

Maycock, P. F. 1961. The spruce-fir forest of the Keweenaw Peninsula, northern Michigan. Ecology 42:357-365.

Maycock, P. F. and J. T. Curtis. 1960. Ecological Monographs 30:1-35.

McAdams, A. G., D. A. Stutzman, and D. Faber-Langendoen. 1998. Black Hills Community Inventory, unpublished data. The Nature Conservancy, Midwest Regional Office, Minneapolis, MN.

McCarthy, T. G., R. W. Arnup, J. Nieppola, B. G. Merchant, K. C. Taylor, and W. J. Parton. 1994. Field guide to forest ecosystems of northeastern Ontario. NEST Field Guide FG-001, Ontario Ministry of Natural Resources, Northeast Science and Technology, Timmins, ON.

McClain et al. 1997. [Incomplete]

McClain, W. E. 1986. Illinois prairie: Past and future. A restoration guide. Illinois Department of Natural Heritage. 27 pp.

McClain, W. E. Personal communication. Ecologist, Illinois Department of Natural Heritage.

McClain, W. E., M. A. Jenkins, S. E. Jenkins, and J. E. Ebinger. 1993. Changes in the woody vegetation of a bur oak savanna remnant in central Illinois. Natural Areas Journal 13:108-114.

McClain, W. E., T. L. Esker, B. R. Edgin, and J. E. Ebinger. 1998?. Fire history of a post oak (*Quercus stellata* Wang.) woodland in Hamilton County, Illinois. [Citation missing]

McClain, W. E., V. LaGesse, R. Larimore, and J. Ebinger. 1998. Black soil prairie groves of the Headwaters region of east-central Illinois. Transactions of the Illinois Academy of Science 86:129-135.

McEachern, K. 1979. Population biology of *Populus sargentii* in northeastern Colorado. Unpublished thesis. University of Northern Colorado, Greeley. 41 pp.

McInteer, B. B. 1952. Original vegetation in the Bluegrass Region of Kentucky. Castanea 17:153-164.

McIntosh, A. C. 1930. Botanical features of the northern Black Hills. Black Hills Engineer 18:79-101.

McIntosh, R. 1950. Pine stands in southwestern Wisconsin. Wisconsin Academy of Arts and Letters 40:243-257.

McKnight, J. S., D. D. Hook, O. G. Langdon, and R. L. Johnson. 1981. Flood tolerance and related characteristics of trees of the bottomland forests of the southern U.S. Pages 29-69 in: J. R. Clark and J. Benforado, editors. Wetlands of bottomland hardwood forests. Elsevier Scientific Publishing Company, New York.

McLean, A. 1970. Plant communities of the Similkameen Valley, British Columbia, and their relationships to soils. Ecological Monographs 40:403-424.

McNab, W. H. and P. E. Avers, compilers. 1994. Ecological subregions of the United States: Section descriptions. USDA Forest Service. Administrative Publication WO-WSA-5. Washington, DC. 267 pp.

McWilliams, W. H. and J. F. Rosson, Jr. 1990. Composition and vulnerability of bottomland hardwood forests of the Coastal Plain province in the south central United States. Forest Ecology and Management 33/34:485-501.

Meanley, B. 1972. Swamps, river bottoms and canebrakes. Barre Publishing, Barre, MA. 142 pp.

Medicine Bow Mine Application. No date. Application No. 331-T1, on file at Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne.

Meijer, W., J. J. N. Campbell, H. Setser, and L. E. Meade. 1981. Swamp forests on high terrace deposits in the bluegrass and knobs regions of Kentucky. Castanea 46:122-135.

Merz, R. W. 1958. Silvicultural characteristics of American sycamore. Central States Forest Experiment Station. Mississippi. USDA Forest Service Release 26.

Meyer, M. I. 1985. Classification of native vegetation at the Woodworth Station, North Dakota. Prairie Naturalist 17:167-175.

Michigan Natural Features Inventory. 1999. Natural community abstract for wooded dune and swale complex. Lansing, MI. 6 pp. Compiled by D. A. Albert and P. J. Comer.

Miller, R. B. and L. R. Tehon. 1929. The native and naturalized trees of Illinois. Volume XVIII, Article I. State of Illinois Department of Registration and Education, Division of the Natural History Survey, Urbana. 339 pp.

Minc, L. D. 1996. Michigan's Great Lakes coastal wetlands: Definition, variability, and classification. A report in 2 parts submitted to Michigan Natural Features Inventory, Lansing, MI.

Minc, L. D. and D. A. Albert. 1998. Great Lakes coastal wetlands: Abiotic and floristic characterization. Great Lakes Wetlands 9:1-15.

Minckler, L. S. 1957. Silvical characteristics of pin oak. Central States Forest Experiment Station, USDA Forest Service Misc. Release 20.

Mine Reclamation Consultants. 1977. Buckskin Mine Application No. 500-T2, on file at Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne.

Minney, D. 2000. Edge of Appalachia Preserve: Plant community descriptions. Preliminary draft. An unpublished report for the Ohio Chapter of The Nature Conservancy.

Mitchell, G. C. 1971. Spatial distribution and successional state of grassland vegetation related to grazing intensity treatments. U.S. International Biological Program Grassland Biome Technical Report 101. 70 pp.

Mitsch, W. J. and J. G. Gosselink. 1993. Wetlands. Second edition. Van Nostrand Reinhold Company, New York. 722 pp.

MNNHP [Minnesota Natural Heritage Program]. 1993. Minnesota's native vegetation: A key to natural communities. Version 1.5. Minnesota Department of Natural Resources, Natural Heritage Program, St. Paul, MN. 110 pp.

Mohlenbrock, R. H. 1959. A floristic study of a southern Illinois swampy area. Ohio Journal of Science 59:89-100.

Mohlenbrock, R. H. 1986. Guide to the vascular flora of Illinois. Southern Illinois University Press, Carbondale. 507 pp.

Mohlenbrock, R. H. and D. M. Ladd. 1978. Distribution of Illinois vascular plants. Southern Illinois University Press, Carbondale. 282 pp.

Mohlenbrock, R. H. and J. Schwegman. 1969. New and unusual grass and sedge records for Illinois. Transactions of the Illinois State Academy of Science 62:100-101.

Mohlenbrock, R. H. and J. W. Voigt. 1959. A flora of southern Illinois. Southern Illinois University Press, Carbondale. 390 pp.

Mohr, C. T. 1901. Plant life of Alabama. Contrib. U.S. National Herbarium No. 6. Washington, DC. 921 pp.

Moir, W. H. 1969. Steppe communities in the foothills of the Colorado Front Range and their relative productivities. The American Midland Naturalist 81:331-340.

Moir, W. H. 1972. Tall grass prairie in Colorado and its aesthetic value. Pages 40-46 in: J. H. Zimmerman, editor. The Second Midwest Prairie Conference, 1970, University of Wisconsin Arboretum, Madison.

Moir, W. H. and M. J. Trlica. 1976. Plant communities and vegetation pattern as affected by various treatments in shortgrass prairies of northeastern Colorado. Southwestern Naturalist 21:359-371.

Montana Natural Heritage Program. 1988. Draft guide to the natural vegetation of Montana. Montana Natural Heritage Program, Helena. 389 pp.

Montana Natural Heritage Program. No date. Unpublished data on file. Helena, MT.

Moore, B. and N. Taylor. 1927. An ecological study of the vegetation of Mount Desert Island, Maine. Brooklyn Botanical Garden Memoirs 3:1-151.

Moretti, M. C. 1979. Vegetation and soil factors in relation to slope position: A study of plant communities on foothill knolls in the Uintah Basin of Utah. Unpublished thesis. Brigham Young University, Provo. 31 pp.

Moretti, M. C. and J. D. Brotherson. 1982. Vegetation and soil factors in relation to slope position of foothill knolls in the Uinta Basin of Utah. Great Basin Naturalist 42:81-90.

Morgan, M. D. 1969. Ecology of aspen in Gunnison County, Colorado. The American Midland Naturalist 82:204-228.

Moseley, R. K., M. Manusco, and J. Hiltly. 1992. Rare plant and riparian vegetation inventory of the Boise foothills, Ada County, Idaho. Unpublished report on file IdCDC Department of Fish & Game, Boise, ID. 20 pp.

Moulton, M. P., J. R. Choate, S. J. Bissell, and R. A. Nicholson. 1981. Associations of small mammals on the central high plains of eastern Colorado. Southwestern Naturalist 26:53-57.

Moulton, M. P., P. J. Moulton, and J. Sundine. 1980. Site guide to Bonny Reservoir. Colorado Field Ornithologists Journal 14:53-55.

Mueggler, W. F. 1988. Aspen community types of the Intermountain Region. USDA Forest Service General Technical Report INT-250. Intermountain Research Station, Ogden, UT. 135 pp.

Mueggler, W. F. and R. B. Campbell, Jr. 1982. Aspen community types on the Caribou and Targhee national forests in southeastern Idaho. USDA Forest Service, Intermountain Forest and Range Experiment Station. Research Paper INT-294. Ogden, UT. 32 pp.

Mueggler, W. F. and R. B. Campbell, Jr. 1986. Aspen community types of Utah. USDA Forest Service Research Paper INT-362, Intermountain Forest and Range Experiment Station, Ogden, UT.

Mueggler, W. F. and W. L. Stewart. 1978. Grassland and shrubland habitat types of western Montana. USDA Forest Service. General Technical Report INT-66. Ogden, UT. 154 pp.

Mueggler, W. F. and W. L. Stewart. 1980. Grassland and shrubland habitat types of western Montana. USDA Forest Service, General Technical Report INT-66. Intermountain Forest and Range Experiment Station. Ogden, UT. 154 pp.

Mueller-Dombois, D. 1964. The forest habitat types in southeastern Manitoba and their application to forest management. Canadian Journal of Botany 42:1417-1444.

Muenscher, W. C. 1927. *Spartina patens* and other saline plants in the Genesee Valley of western New York. Rhodora 29:138-139.

Muldavin, E. and P. Mehlhop. 1992. A preliminary classification and test vegetation map for White Sands Missile Range and San Andreas National Wildlife Refuge, New Mexico. University of New Mexico, New Mexico Natural Heritage Program.

Muldavin, E., B. Sims, and L. Johnson. 1993. Pecos wild and scenic river in stream flow report. Final Report prepared for the USDA National Forest Service, Santa Fe National Forest, Santa Fe, NM.

Mutel, C. F. 1973. An ecological study of the plant communities of certain montane meadows in the Front Range of Colorado. Unpublished thesis. University of Colorado, Boulder. 77 pp.

Mutel, C. F. 1976. From grassland to glacier: An ecology of Boulder County, Colorado. Johnson Publishing Company, Boulder. 169 pp.

Mutel, C. and J. W. Marr. 1973. A vegetative study of three montane herbaceous basins. Journal of the Colorado-Wyoming Academy of Science 7:28. (Abstract)

Mutz, K. M. and J. Queiroz. 1983. Riparian community classification for the Centennial Mountains and South Fork Salmon River, Idaho. Unpublished report prepared for USDA Forest Service Intermountain Region under contract 53-84M8-2-0048 by Meiiji Resource Consultants, Layton, UT. 168 pp.

Mutz, K. M. and R. Graham. 1982. Riparian community type classification-Big Piney Range District, Wyoming. Unpublished report prepared for USDA Forest Service, Intermountain Region under contract 53-84M8-1-974, by Meiiji Resource Consultants, Layton, UT. 88 pp.

Nelson, J. B. 1986. The natural communities of South Carolina: Initial classification and description. South Carolina Wildlife and Marine Resources Department, Division of Wildlife and Freshwater Fisheries, Columbia, SC. 55 pp.

Nelson, J. R. 1961. Woody plant communities in the badlands of western North Dakota. Proceedings of the North Dakota Academy of Science 15:42-44.

Nelson, P. W. 1985. The terrestrial natural communities of Missouri. Missouri Natural Areas Committee, Jefferson City. (Reprinted in 1987.) 197 pp.

Nelson, P. and D. Ladd. 1983. Preliminary report on the identification, distribution and classification of Missouri glades. Pages 59-76 in: C. L. Kucera, editor. Proceedings of the Seventh North American Prairie Conference. Southwest Missouri State University, Springfield.

Nelson, W. T., W. T. Barker, and H. Goetz. 1981. Habitat type classification of grasslands of Sheyenne National Grassland of southeastern North Dakota. Completion Report for Cooperative Agreement No. RM-80-139-CA. Unpublished report. 138 pp.

Nichols, J. T. 1964. Effect of protection from grazing on two vegetative types in the Big Horn Basin of Wyoming. Wyoming Range Management 192:60-69.

Nichols, J. T. 1964a. Soil-vegetation relationships of the 15-mile drainage, Washakie County, Wyoming. Unpublished dissertation. University of Wyoming, Laramie.

Niering, N. A. 1985. Wetlands. The Audubon Society Nature Guides. Chanticleer Press, Inc. 638 pp.

Nigh, Tim A. Personal communication. Ecologist, Missouri Conservation Commission, Jefferson City.

Nixon, F. S. 1967. A vegetational study of the Pine Ridge of northwestern Nebraska. Southwestern Naturalist 12:134-145.

North Dakota Natural Heritage Program. 1982. Unpublished data from field survey. North Dakota Parks and Recreation Department, Bismarck, ND.

North Dakota Natural Heritage Program. 1997. Unpublished data and field forms. North Dakota Parks and Recreation Department, Bismarck, ND.

Northern Appalachian Ecology Working Group. 2000. Northern Appalachian / Boreal Ecoregion community classification (Review Draft). The Nature Conservancy, Eastern Conservation Science Center, Boston, MA. 117 pp. plus appendices.

Northwest Resources Co. 1981. Grass Creek Mine Application No. 211-T1, on file at Wyoming Department of environmental Quality, Land Quality Division, Cheyenne.

Nowacki, G. J., M. D. Abrams, and C. G. Lorimer. 1990. Composition, structure, and historical development of northern red oak stands along an edaphic gradient in north-central Wisconsin. Forest Science 36:276-292.

Nuzzo, V. A. 1985. Extent and status of Midwest oak savanna: Presettlement and 1985. Natural Areas Journal 6:6-36.

NVS Corporation. No date. Amax Eagle Butte Mine Application No. 428-T1, on file at Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne.

Oberholster, C. 1993. Preliminary list of natural communities of Alabama. Unpublished document. Alabama Department Conservation and Natural Resources, Natural Heritage Section, Montgomery, AL. 6 pp.

Ode, Dave. Personal communication. South Dakota Natural Heritage Program, Pierre, SD.

Ohmann, L. F. and P. R. Ream. 1971. Wilderness ecology: Virgin plant communities of the Boundary Waters Canoe Area. USDA Forest Service, North Central Forest Experiment Station. Research Paper NC-63. St. Paul, MN. 35 pp.

Olson, J. S. 1958. Rates of succession and soil changes on southern Lake Michigan sand dunes. Botanical Gazette 119:125-170.

Olson, R. A. and W. A. Gerhart. 1982. A physical and biological characterization of riparian habitat and its importance to wildlife in Wyoming. Unpublished report prepared for Wyoming Fish and Game Department, Cheyenne, WY. 188 pp.

Orzell, S. L. 1983. Natural area inventory and floristic analysis of fens in selected southeastern Missouri counties. M.S. thesis. Southern Illinois University, Carbondale. 203 pp.

Orzell, S. L. 1984. Natural area inventory and floristic analysis of fens in selected southeastern Missouri counties: Part II. Missouriensis 5:109-117.

Orzell, S. L. and D. R. Kurz. 1984. Floristic analysis of prairie fens in the southeastern Missouri Ozarks. Pages 50-58 in: G. K. Clamby and R. H. Premble, editors. Proceedings of the Ninth North American Prairie Conference, Moorhead, MN.

Orzell, S. and B. Pell. 1985. Notes on three palustrine natural community types in the Arkansas Ozarks. Proceedings of the Arkansas Academy of Science 39:141-143.

Orzell, S., B. Pell, and G. Tucker. 1985. Notes on three palustrine natural community types in the Arkansas Ozarks. Arkansas Academy of Science Proceedings 39:141-143.

Ownbey, G. B. and T. Morley. 1991. Vascular plants of Minnesota: A checklist and atlas. University of Minnesota Press, Minneapolis.

Packard, S. 1988. Rediscovering the tallgrass savanna of Illinois. In: A. Davis and G. Stanford, editors. The Prairie: Roots of our culture, foundation of our economy. Proceedings of the 10th North American Prairie Conference. Native Prairie Association of Texas, Dallas.

Packard, S. 1993. Restoring oak ecosystems. Restoration and Management Notes 11:5-16.

Padgett, W. G. 1982. Ecology of riparian plant communities in southern Malheur National Forest. Unpublished thesis. Oregon State University, Corvallis. 143 pp.

Padgett, W. G., A. P. Youngblood, and A. H. Winward. 1988b. Riparian community type classification of Utah. USDA Forest Service, Intermountain Region Publication R4-ECOL-88-01. Ogden, UT.

Padgett, W. G., A. P. Youngblood, and A. H. Winward. 1989. Riparian community type classification of Utah and southeastern Idaho. USDA Forest Service, Intermountain Region. Report R4-ECOL-89-01. Ogden, UT. 191 pp.

Palmer-Ball, B., Jr., J. J. N. Campbell, M. E. Medley, D. T. Towles, J. R. MacGregor, and R. R. Cicerello. 1988. Cooperative inventory of endangered, threatened, sensitive and rare species, Daniel Boone National Forest, Somerset Ranger District. USDA Forest Service, Daniel Boone National Forest, Berea, KY. 244 pp.

Paris, O. and M. J. W. Paris, editors. 1974. Initial composite report on the environmental impact assessment of the proposed Black Thunder Mine. Volume 1. Unpublished report submitted to the Wyoming Environmental Institute by the University of Wyoming Black Thunder Project Research Team.

Patterson, K. D., C. J. Ulrey, and J. Drake. 1999. Vegetation classification of Great Smoky Mountains National Park: Cades Cove and Mount Le Conte quadrangles. Unpublished report submitted to BRD-NPS Vegetation Mapping Program. The Nature Conservancy, Chapel Hill, NC.

Patterson, W. B. and H. R. DeSelm. 1989. Classification of forest vegetation of the bottomlands of west Tennessee. University of Tennessee, Department of Biological Sciences, Knoxville, and Tennessee Department of Conservation, Ecological Services Division. Report for Contract No. 89-3347. Nashville. 151 pp.

Pearson, J. A. and M. J. Leoschke. 1992. Floristic composition and conservation status of fens in Iowa. Journal of the Iowa Academy of Science 99:41-52.

Pearson, J. A., D. J. Ode, G. M. Vandel, and K. W. C. Houtcooper. 1985. Classification, distribution, and literature sources for terrestrial and palustrine communities in South Dakota. Unpublished manuscript. South Dakota Department of Game, Fish, & Parks, Pierre, SD.

Peet, R. K. 1975. Forest vegetation of the east slope of the northern Colorado Front Range. Unpublished dissertation. Cornell University, Ithaca, NY.

Pell, W. F. and J. H. Rettig, compiler. 1983. Arkansas natural community abstracts. Arkansas Natural Heritage Commission, Little Rock. 37 pp.

Pell, W. F. and R. N. Mack. 1977. The *Fagus grandifolia* - *Acer saccharum* - *Podophyllum peltatum* association in northeastern Ohio. Botanical Gazette 138:64-70.

Penfound, W. T. 1952. Southern swamps and marshes. Botanical Review 7:413-446.

Pfannmuller, L. A. 1991. Significance of oaks and oak forest communities for nongame wildlife. Pages 56-64 in: S. B. Laursen and J. F. DeBoe, editors. Proceedings of The Oak Resource in the Upper Midwest Conference, St. Mary's College, Winona, MN. Publication No. NR-BU-5663-S, Minnesota Extension Service, University of Minnesota.

Pfister, R. D., B. L. Kovalchik, S. F. Arno, and R. C. Presby. 1977. Forest habitat types of Montana. USDA Forest Service. General Technical Report INT-34. Intermountain Forest and Range Experiment Station, Ogden, UT. 174 pp.

Phillips, C. M. 1977. Willow carrs of the upper Laramie River Valley, Colorado. Unpublished thesis. Colorado State University, Fort Collins. 71 pp.

Platt, S. G. and C. G. Brantley. 1992. The management and restoration of switchcane (Louisiana). Restoration Management Notes 10:84-85.

Platt, S. G. and C. G. Brantley. 1993. Switchcane: Propagation and establishment in the southeastern United States. Restoration and Management Notes 11:135-137.

Platt, S. G. and C. G. Brantley. 1997. Canebrakes: An ecological and historical perspective. Castanea 62:8-21.

Pool, R. J. 1914. A study of the vegetation of the sandhills of Nebraska. Minnesota Botanical Studies 4:189-312.

Potter, L. D. and D. R. Moir. 1961. Phytosociological study of burned and unburned deciduous woods, Turtle Mountains, North Dakota. Ecology 42:468-480.

Poulton, C. E. 1955. Ecology of the non-forested vegetation in Umatilla and Morrow counties, Oregon. Unpublished dissertation. State College of Washington, Pullman. 166 pp.

Powell, D. C. 1988a. Aspen community types of the Pike and San Isabel national forests in south-central Colorado. USDA Forest Service, Rocky Mountain Region, Report R2-ECOL-88-01. 254 pp.

Powell, J. W. 1985. Physiographic regions of the United States, National Geographic Society. Monograph 3. Pages 65-100.

Pregitzer, K. S. and B. V. Barnes. 1984. Classification and comparison of upland hardwood and conifer ecosystems of the Cyrus H. McCormick Experimental Forest, upper Michigan. Canadian Journal of Forest Research 14:362-375.

Pringle, J. S. 1982. The distribution of *Solidago ohioensis*. The Michigan Botanist 21:51-57.

Prodgers, R. 1978. Circle West vegetation baseline study: Final report. Circle West Technical Report No. 1. Energy Division, Montana Department of Natural Resources and Conservation, Helena. 115 pp.

Pruka, B. W. 1994. Distribution of understory plant species along light and soil depth gradients in an upland oak savanna remnant in southern Wisconsin. M. S. thesis. University of Wisconsin-Madison.

Putnam, J. A. 1951. Management of bottomland hardwoods. USDA Forest Service, Southern Forest Experiment Station. Occasional Paper No. 116. New Orleans, LA.

Putnam, J. A., G. M. Furnival, and J. S. McKnight. 1960. Management and inventory of southern hardwoods. USDA Forest Service. Handbook 181. Washington, DC. 102 pp.

Pyne, M. 1994. Tennessee natural communities. Unpublished document. Tennessee Department of Conservation, Ecology Service Division, Nashville. 7 pp.

Pyne, M. 1997. Biodiversity of Beaman Park Property, Davidson County, Tennessee. Unpublished report to Lose and Associates. 20 pp.

Pyne, Milo. Personal communication. Regional community ecologist. Association for Biodiversity Information/The Nature Conservancy. Southern Resource Office, Durham, NC.

Pyne, S. J. 1982. Fire in America: A cultural history of wildland and rural fire. Princeton University Press. Princeton, N. J.

Quarterman, E. and R. L. Powell. 1978. Potential ecological/geological landmarks of the interior low plateaus. Vanderbilt University, Nashville, TN. 739 pp.

Racine, C. H. 1966. Pine communities and their site characteristics in the Blue Ridge escarpment. Journal of the Elisha Mitchell Scientific Society 82:172-181.

Ramaley, F. 1914. The amount of bare ground in some mountain grasslands. Botanical Gazette 57:526-529.

Ramaley, F. 1916. Dry grassland of a high mountain park in northern Colorado. The Plant World 19:249-270.

Ramaley, F. 1919. Some mountain plant communities of sandy soil. The Plant World 22:313-329.

Ramaley, F. 1919a. The role of sedges in some Colorado plant communities. American Journal of Botany 6:120-130.

Ramaley, F. 1927. Colorado plant life. University of Colorado Semicentennial series 1877-1927. Volume II. 299 pp.

Ramaley, F. 1939. Sand-hill vegetation of northeastern Colorado. Ecological Monographs 9:1-51.

Ramaley, F. 1942. Vegetation of the San Luis Valley in southern Colorado. University of Colorado Studies, Series D, 1:231-277.

Rawinski, T. J. 1988. Ecology forum: Notes on riverside vegetation. The Nature Conservancy News 38:24-25.

Rawinski, T. J. 1992. A classification of Virginia's indigenous biotic communities: Vegetated terrestrial, palustrine, and estuarine community classes. Unpublished document. Virginia Department of Conservation and Recreation, Division of Natural Heritage. Natural Heritage Technical Report No. 92-21. Richmond, VA. 25 pp.

Rector, C. D. 1979. Lower Gunnison River Basin wetland inventory and evaluation. Unpublished thesis. University of Colorado, Boulder. 71 pp.

Redmann, R. E. 1972. Plant communities and soils of an eastern North Dakota prairie. Bulletin of the Torrey Botanical Club 99:65-76.

Redmann, R. E. 1975. Production ecology of grassland plant communities in western North Dakota. Ecological Monographs 45:83-106.

Reid, M. S., L. S. Engelking, and P. S. Bourgeron. 1994. Rare plants communities of the conterminous United States, Western Region. Pages 305-620 in: D. H. Grossman, K. L. Goodin, and C. L Reuss, editors. Rare plant communities of the conterminous United States, a initial survey. The Nature Conservancy, Arlington, VA.

Reid, W. H. 1974. Analysis of plant ecological systems through simulation of individual organisms. Unpublished dissertation. University of Colorado, Boulder. 265 pp.

Reschke, C. 1990. Ecological communities of New York State. New York Natural Heritage Program. New York State Department of Environmental Conservation. Latham, NY. 96 pp.

Reschke, C., R. Reid, J. Jones, T. Feeney, and H. Potter, on behalf of the Alvar Working Group. 1998. Conserving Great Lakes Alvars. Final Technical Report of the International Alvar Conservation Initiative. December 1998. The Nature Conservancy, Great Lakes Program, Chicago, IL. 119 pp. plus 4 appendices.

Reznicek, A. A. 1994. The disjunct Coastal Plain flora of the Great Lakes region. Biological Conservation 68:203-215.

Reznicek, A. A. and P. M. Catling. 1989. The flora of Long Point, Regional Municipality of Haldimand-Norfold, Ontario. The Michigan Botanist 28:99-175.

Ribbeck, K. Personal communication. Louisiana Department of Forestry.

Rice, E. L. and W. T. Penfound. 1959. The upland forests of Oklahoma. Ecology 40:593-608.

Richard, C., G. Kittel, and S. Kettler. 1996. A Classification of the Riparian Vegetation of the San Juan National Forest. Draft 1 report. Colorado Natural Heritage Program, Colorado State University, Fort Collins.

Richardson, J. L., T. J. Malterer, A. Gienke, J. L. Arndt, M. J. Rosek, and A. J. Duxbury. 1987. Classification problems associated with histic soils of calcareous fens. Soil Survey Horizons.

Risser, P. G. 1988. Diversity in and among grasslands. In: E. O. Wilson, editor. Biodiversity. National Academy Press. 520 pp.

RMS. 1998. Unpublished, untitled document containing Black Hills riparian vegetation classification, key and tables of canopy cover and constancy estimates. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Rapid City, SD.

Robbins, W. W. 1917. Native vegetation and climate of Colorado in their relation to agriculture. Colorado Agricultural Experiment Station. Bulletin 224. 56 pp.

Roberts, D. W. 1980. Forest habitat types of the Bear's Paw Mountains and Little Rocky Mountains, Montana. Unpublished thesis. Department of Forestry, University of Montana, Missoula. 116 pp.

Robertson, P. A. and A. L. Heikens. 1994. Fire frequency in oak-hickory forests of southern Illinois. Castanea 59:286-291.

Robertson, P. A., M. D. MacKenzie, and L. F. Elliott. 1984. Gradient analysis and classification of the woody vegetation for four sites in southern Illinois and adjacent Missouri. Vegetatio 58:87-104.

Rogers, C. M. 1950. The vegetation of the Mesa de Maya region of Colorado, New Mexico, and Oklahoma. Unpublished dissertation. University of Michigan, Ann Arbor. 125 pp.

Rogers, C. M. 1950a. The vegetation of the Mesa de Maya region of Colorado, New Mexico, and Oklahoma. Botany __:16-17.

Rogers, C. M. 1953. The vegetation of the Mesa de Maya region of Colorado, New Mexico, and Oklahoma. Lloydia 16:257-290.

Rogers, R. S. 1980. Hemlock stands from Wisconsin to Nova Scotia: Transitions in understory composition along a floristic gradient. Ecology 61:178-193.

Rolfsmeier, S. B. 1993. The saline wetland - meadow vegetation and flora of the North Platte River Valley in the Nebraska Panhandle. Transactions of the Nebraska Academy of Sciences 20:13-24.

Rolfsmeier, S. B. 1993b. Analyses of the natural vegetation at Kiowa Basin, Scotts Bluff County, Nebraska. Report to the Nebraska Game and Parks Commission, Lincoln. 12 pp. plus map.

Rosburg, T. R. and D. C. Glenn-Lewin. 1996. Species composition and environmental characteristics of grassland and ecotonal plant communities in the Loess Hills of western Iowa (USA). Natural Areas Journal 16:318-334.

Ross, R. L. and H. E. Hunter. 1976. Climax vegetation of Montana, based on soils and climate. USDA-SCS. Bozeman, Mont.

Russo, M. J. 1997. Arnold Engineering Development Center preliminary community classification. Appendix to draft report to The Nature Conservancy, Tennessee Field Office, Nashville. 23 pp.

Salas, D. E. and M. J. Pucherelli. 1998. USGS-NPS Vegetation Mapping, Devil's Tower National Monument, Wyoming. USDI Bureau of Reclamation, Technical Memorandum No. 8260-98-08, Denver, CO.

Savage, D. A. 1937. Drought survival of native grass species in the central and southern Great Plains, 1935. USDA Technical Bulletin 549.

Schafale, M. P. and A. S. Weakley. 1985. Classification of the natural communities of North Carolina: Second approximation. North Carolina Department of Environment, Health, and Natural Resources, Division of Parks and Recreation, Natural Heritage Program, Raleigh. 202 pp.

Schafale, M. P. and A. S. Weakley. 1990. Classification of the natural communities of North Carolina. Third approximation. North Carolina Department of Environment, Health, and Natural Resources, Division of Parks and Recreation, Natural Heritage Program, Raleigh. 325 pp.

Schneider, G. J. and K. E. Cochrane. 1997. Plant community survey of the Lake Erie drainage. A final report to The Nature Conservancy, Great Lakes Program (Chicago, IL) and The Ohio Chapter (Columbus, OH), and the U.S. Environmental Protection Agency - Great Lakes National Program Office (Chicago, IL). 158 pp.

Schroeder, R. E. 1977. Species composition changes on three range types under two grazing systems. Unpublished thesis. Colorado State University, Fort Collins. 65 pp.

Schroeder, W. A. 1982. Presettlement prairie of Missouri. Natural History Series No. 2, Missouri Department of Conservation. Second edition. 37 pp.

Schwegman, J. E. 1968. New plant records from southern Illinois. Transactions of the Illinois State Academy of Science 61:313-314.

Schwegman, J. E. 1968a. Notes on *Woodwardia areolata* and other rare Illinois ferns. American Fern Journal 58:89-90.

Schwegman, J. E. 1969. Vegetation of some seep springs in the Cretaceous Hills of southern Illinois. Master's thesis. Southern Illinois University, Carbondale.

Schwegman, J. E. 1973. Comprehensive plan for the Illinois nature preserve system. Part 2. The natural divisions of Illinois. Illinois Nature Preserve Commission, Rockford, IL.

Schwegman, J. E. and W. E. McClain. 1985. Vegetative effects and management implications of a fall prescribed burn on an Illinois hill prairie. Natural Areas Journal 5(3):4-8.

Schwintzer, C. R. 1981. Vegetation and nutrient status of northern Michigan bogs and conifer swamps with a comparison to fens. Canadian Journal of Botany 59:842-853.

Schwintzer, C. R. and T. J. Tomberlin. 1982. Chemical and physical characteristics of shallow ground waters in northern Michigan bogs, swamps, and fens. American Journal of Botany 69:1231-1239.

Seminoe I Mine Application. No date. Application No. 378-T1, on file at Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne, WY.

Senft, R. L., L. R. Rittenhouse, and R. G. Woodmansee. 1983. The use of regression models to predict spatial pattern of cattle behavior. Journal of Range Management 36:553-557.

Severson, K. E. and C. E. Boldt. 1977. Problems associated with management of native woody plants in the western Dakotas. Pages 51-57 in: K. L. Johnson, editor. Wyoming Shrublands, Proceedings of the Sixth Wyoming Shrub Ecology Workshop, Buffalo, WY.

Severson, K. E. and J. F. Thilenius. 1976. Classification of quaking aspen stands in the Black Hills and Bear Lodge Mountains. USDA Forest Service Research Paper RM-166. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 24 pp.

Shanks, D. L. 1977. Aerial photo densitometry for rangeland planning and evaluation. Unpublished thesis. Colorado State University, Fort Collins. 66 pp.

Shanks, R. E. 1966. An ecological survey of the vegetation of Monroe County, New York. Rochester Academy of Science Proceedings 11:108-252.

Shantz, H. L. 1906. A study of the vegetation of the mesa region east of Pike's Peak, the *Bouteloua* formation. II. Development of the formation. Botanical Gazette 42:179-207.

Shantz, H. L. 1911. Natural vegetation as an indicator of the capabilities of land for crop production in the Great Plains area. USDA Bureau of Plant Industry Bulletin 201. 100 pp.

Shantz, H. L. 1923. The natural vegetation of the Great Plains region. Annals of the Association of American Geographers 13:81-107.

Shay, J. M. and C. T. Shay. 1986. Prairie marshes in western Canada, with specific reference to the ecology of five emergent macrophytes. Canadian Journal of Botany 64:443-454.

Shupe, J. B., J. D. Brotherson, and S. R. Rushforth. 1986. Patterns of vegetation surrounding springs in Goshen Bay, Utah County, Utah, U.S.A. Hydrobiologia 139:97-107.

Sieg, C. H. 1991. Ecology of bur oak woodlands in the foothills of the Black Hills, South Dakota. Ph.D. dissertation. Department of Range and Wildlife Management, Texas Tech University.

Sims, P. L., B. E. Dahl, and A. H. Denham. 1976. Vegetation and livestock response at three grazing intensities on sandhill rangeland in eastern Colorado. Colorado Agricultural Experiment Station. Technical Bulletin 130. 48 pp.

Sims, R. A., W. D. Towill, K. A. Baldwin, and G. M. Wickware. 1989. Field guide to the forest ecosystem classification for northwestern Ontario. Ontario Ministry of Natural Resources.

Sims, R. A., W. D. Towill, K. A. Baldwin, P. Uhlig, and G. M. Wickware. 1997. Field guide to the forest ecosystem classification for northwestern Ontario. Ontario Ministry of Natural Resources, North West Science and Technology, Thunder Bay, ON. Field Guide FG-03. 176 pp.

Skull Point Mine Application. No date. Application No. 2335-T2, on file at Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne.

Skull Point Mine Permit Renewal. No date. On file at Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne.

Smeins, F. E. and D. E. Olsen. 1970. Species composition and production of a native northwestern Minnesota tall grass prairie. The American Midland Naturalist 84:398-410.

Smith, A. L. 1973. Life cycle of the marsh grass *Scolochloa festucacea*. Canadian Journal of Botany 51:1661-1668.

Smith, D. D. 1981. Iowa prairie--An endangered ecosystem. Proceedings of the Iowa Academy of Science 88:7-10.

Smith, J. No date. Comprehensive data base for surface mining in Wyoming. Unpublished data, Department of Environmental Quality, Land Quality Division, Cheyenne.

Smith, L. M. and N. J. Craig. 1990. The natural communities of Louisiana. Revised edition. Louisiana Department of Wildlife and Fisheries, Natural Heritage Program, Baton Rouge. 23 pp.

Smith, L. M., compiler. 1996. Natural plant communities in Louisiana currently recognized by the Louisiana Natural Heritage Program. Unpublished document. Louisiana Department of Wildlife and Fisheries, Natural Heritage Program, Baton Rouge. 2 pp.

Smith, Latimore M. Personal communication. Natural Heritage Program Ecologist. Louisiana Department of Wildlife and Fisheries, Natural Heritage Program, Baton Rouge.

Smith, S., D. Zollner, and S. Simon. 2000. Reassessment of Roaring Branch Research Natural Area. Unpublished technical report. The Nature Conservancy, Arkansas Field Office, Little Rock.

Snider, J. A. 1970. The genus *Sphagnum* in Illinois. Transactions of the Illinois State Academy of Science 63:329-338.

Society of American Foresters. 1967. Forest cover types of North America. Society of American Foresters, Washington, DC. 67 pp.

Soil Conservation Service. No date. Range site descriptions of vegetation in Colorado. Unpublished report series MLRA dating from 1975 to 1989. Soil Conservation Service, Colorado Field Office, Denver.

Soil Conservation Service. 1975. Range sites of North Dakota. USDA Soil Conservation Service, Bismarck, ND.

Soil Conservation Service. 1978. Range site descriptions for Colorado. Technical Guide, Section II-E. USDA Soil Conservation Service, Colorado State Office, Denver.

Soil Conservation Service. 1986. Technical guide to range sites, section II. Wyoming State Office, Casper, WY.

Soper and Given. 1981. [Incomplete]

South Dakota Geological Survey. No date. Major physiographic divisions of South Dakota. Educational Series, Map 4. Pierre, SD.

Sparks, J. C., R. E. Masters, D. M. Engle, M. W. Palmer, and G. A. Bukenhofer. 1998. Effects of late growing-season and late dormant-season prescribed fire on herbaceous vegetation in restored pine-grassland communities. Journal of Vegetation Science 9:133-142.

Sperduto, D. D. 1996. A Guide to the Natural Communities of New Hampshire. Review draft. New Hampshire Natural Heritage Program, Division of Forests and Lands, Department of Resources and Economic Development. Concord, NH. 75 pp.

Stearns-Roger, Inc. 1978. Rawhide Energy Project. Transmission system, ecological investigations. Volume II. Technical baseline report to Platte River Power Authority. 51 pp.

Steele, R., R. D. Pfister, R. A. Ryker, and J. A. Kittams. 1981. Forest habitat types of central Idaho. USDA Forest Service General Technical Report INT-114. Intermountain Forest and Range Experiment Station, Ogden, UT. 138 pp.

Steffen, J. and J. Anderson. 1997. Chicago Wilderness Community Classification System (draft). Chicago Wilderness Biodiversity Council, Chicago, IL.

Steinauer, G. 1989. Characterization of the natural communities of Nebraska. Appendix D, pages 103-114 in: M. Clausen, M. Fritz, and G. Steinauer. The Nebraska Natural Heritage Program, two year progress report. Unpublished document. Nebraska Game and Parks Commission, Natural Heritage Program, Lincoln, NE.

Steinauer, G. A. 1984. A classification of the *Cercocarpus montanus, Quercus macrocarpa, Populus tremuloides*, and *Picea glauca* habitat types of the Black Hills National Forest. Unpublished thesis. University of South Dakota, Brookings. 95 pp.

Steinauer, G. A., S. B. Rolfsmeier, and J. Phillips Hardy. 1996. Inventory and floristics of Sandhills fens in Cherry County, Nebraska. Transactions of the Nebraska Academy of Sciences 23:9-21.

Steinauer, G. and S. Rolfsmeier. 2000. Terrestrial Natural Communities of Nebraska. Nebraska Game and Parks Commission, Lincoln, NE. Unpublished report. 143 pp.

Steward, L. H. 1982. Desert grassland communities on Otero Mesa, Otero County, New Mexico. Unpublished thesis. New Mexico State University, Las Cruces.

Stewart, B. K. 1940. Plant ecology and paleoecology of the Creede Valley, Colorado. Unpublished dissertation. University of Colorado, Boulder. 154 pp.

Stewart, R. E. and H. A. Kantrud. 1971. Classification of natural ponds and lakes in the glaciated prairie region. USDI Bureau of Sport Fisheries and Wildlife Resources, Publication 92. Washington, DC. 77 pp.

Stewart, R. E. and H. A. Kantrud. 1972. Vegetation of prairie potholes, North Dakota, in relation to quality of water and other environmental factors. USDI Geologic Survey Professional Paper 585-d. 36 pp.

Steyermark, J. 1963. Flora of Missouri. University of Iowa Press, Ames.

Steyermark, J. A. 1958. An unusual botanical area in Missouri. Rhodora 60:205-208.

Stoecker-Keammerer Consultants. No date (a). Black Thunder Mine Application No. 233-T3, on file at Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne.

Stoecker-Keammerer Consultants. No date (b). Coal Creek Mine Application No. 483-T1, on file at Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne.

Stoecker-Keammerer Consultants. No date (c). North Rochelle Mine Application No. 550-T2, on file at Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne.

Stotler, R., and B. Crandall-Stotler. 1977. A checklist of liverworts and hornworts of North America. The Bryologist 80:405-428.

Strong, L. L. 1980. Estimating phytomass production of habitat types on sagebrush steppe. Unpublished thesis. Colorado State University, Fort Collins. 133 pp.

Strong, N. M., R. D. Comer, and D. G. Steward. 1978. An ordination and classification of the woody vegetation in Boulder County Colorado. Journal of the Colorado-Wyoming Academy of Science 10:35-36. (Abstract)

Swanson, G. A. and P. F. Springer. 1972. Widgeongrass balls on alkali lakes. Prairie Naturalist 4:52-54.

Sweetwater Uranium Project. 1978. Application No. 481, on file at Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne.

Swindale, D. N. and J. T. Curtis. 1957. Phytosociology of the larger submerged plants in Wisconsin lakes. Ecology 38:397-407.

Swinehart, A. L. and G. R. Parker. 2000. Paleoecology and development of peatlands in Indiana. The American Midland Naturalist 143:267-297.

Swink, F. and G. Wilhelm. 1994. Plants of the Chicago Region. Morton Arboretum. Lisle, Illinois.

Sytsma, K. J. and R. W. Pippen. 1981. The Hampton Creek wetland complex in southwestern Michigan I. History and physical features. The Michigan Botanist 20:137-142.

Sytsma, K. J. and R. W. Pippen. 1981a. The Hampton Creek wetland complex in southwestern Michigan II. Community classification. The Michigan Botanist 20:147-156.

Szaro, R. C. 1989. Riparian forest and scrubland community types of Arizona and New Mexico. Desert Plants Special Issue 9:70-139.

Taft, J. B., M. W. Schwartz, and L. R. Phillippe. 1995. Vegetation and physiographic ecology of flatwoods on the Illinoian tillplain. Unpublished paper. 53 pp.

Tatina, R. 1987. Gradient analysis and description of a transition zone prairie in eastern South Dakota. Proceedings of the South Dakota Academy of Science 66:51-64.

Terwilliger, C., Jr., K. Hess, and C. H. Wasser. 1979. The habitat types of Region II, USDA Forest Service: A preliminary list and description. Unpublished initial progress report for Habitat Type Classification, Region 2, USDA Forest Service.

Terwilliger, C., K. Hess, and C. Wasser. 1979a. Key to the preliminary habitat types of Region 2. Addendum to initial progress report for habitat type classification. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. Fort Collins, CO.

Texas Parks and Wildlife Department. 1990c. Department lands inventory: Colorado Bend State Park -- Summary of representative plant communities. June 1990. Texas Parks and Wildlife Department, Parks Division, Austin. 25 pp. including species checklist.

Thilenius, J. F. 1970. An isolated occurrence of limber pine (*Pinus flexilis* James) in the Black Hill of South Dakota. The American Midland Naturalist 84:411-417.

Thilenius, J. F. 1971. Vascular plants of the Black Hills of South Dakota and adjacent Wyoming. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. General Technical Report RM-71. Fort Collins, CO.

Thilenius, J. F. 1972. Classification of the deer habitat in the ponderosa pine forest of the Black Hills, South Dakota. USDA Forest Service Research Paper RM-91. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 28 pp.

Thilenius, J. F. and D. R. Smith. 1985. Vegetation and soils of an alpine range in the Absaroka Mountains, Wyoming. USDA Forest Service General Technical Report RM-121. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 18 pp.

Thilenius, J. F. and G. R. Brown. 1990. Vegetation on semi-arid rangelands, Cheyenne River Basin, Wyoming. Unpublished report prepared for USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Laramie, WY. 147 pp.

Thilenius, J. F., G. R. Brown, and A. L. Medina. 1995. Vegetation on semi-arid rangelands, Cheyenne River Basin, Wyoming. USDA Forest Service. General Technical Report RM-GTR-263. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 60 pp.

Thompson, C. A. 1990. Iowa's peatlands. Iowa Geology 15:18-21.

Thompson, E. 1996. Natural communities of Vermont uplands and wetland. Nongame and Natural Heritage Program, Department of Fish and Wildlife in cooperation with The Nature Conservancy, Vermont chapter. 34 pp.

Thompson, P. W. 1984. Vegetation and common plants of Sleeping Bear. Cranbrook Institute of Science Bulletin 52, 1967. Cranbrook Press, Bloomfield Hills, Michigan. 48 pp.

Thornbury, W. D. 1965. Regional geomorphology of the United States. John Wiley and Sons, Inc., New York. 609 pp.

Tiedemann, J. A., R. E. Francis, C. Terwilliger, Jr., and L. H. Carpenter. 1987. Shrub-steppe habitat types of Middle Park, Colorado. USDA Forest Service Research Paper RM-273. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 20 pp.

Tisdale, E. W. 1947. The grasslands of the southern interior of British Columbia. Ecology 28:346-382.

Tisdale, E. W. and A. McLean. 1957. The Douglas fir zone of southern British Columbia. Ecological Monographs 27:247-266.

TNC [The Nature Conservancy]. 1995a. A classification and description of plant communities in southern Illinois. Report by the Southern Illinois Field Office, Ullin, IL, and the Midwest Regional Office, Minneapolis, MN.

TNC [The Nature Conservancy]. 1998. An investigation and assessment of the vegetation of Arnold Air Force Base. Coffee and Franklin counties, Tennessee. The Nature Conservancy, Tennessee Field Office, Nashville. 37 pp. plus appendices.

Tolstead, W. L. 1941. Plant communities and secondary succession in south-central South Dakota. Ecology 22:322-328.

Tolstead, W. L. 1942. Vegetation of the northern part of Cherry County, Nebraska. Ecological Monographs 12:257-292.

Tolstead, W. L. 1947. Woodlands in northwestern Nebraska. Ecology 28:180-188.

Tomanek, G. W. and F. W. Albertson. 1957. Variations in cover, composition, production, and roots of vegetation in two prairies in western Kansas. Ecological Monographs 27:267-281.

Tucker, G. E. 1989. A survey of the botanical features of Magazine Mountain on the slopes and plateau surface. Unpublished document. USDA Forest Service, Ozark National Forest, Russellville, AR. 53 pp.

Tuhy, J. S. and S. Jensen. 1982. Riparian classification for the Upper Salmon and Middle Fork Salmon River drainages, Idaho. Unpublished report prepared for the USDA Forest Service, Intermountain Region by White Horse Associates, Smithfield, UT. 183 pp.

Turner, R. L. Personal communication. The Nature Conservancy, Nacogdoches, TX.

Turner, R. L., J. E. Van Kley, and L. M. Smith. 1997. Field guide: Ecological classification system for the national forests and surrounding areas of the western Gulf Coastal Plain. Final draft report. The Nature Conservancy, Nacogdoches, TX. 95 pp.

Turner, R. L., J. E. Van Kley, L. S. Smith, and R. E. Evans. 1999. Ecological classification system for the national forests and adjacent areas of the West Gulf Coastal Plain. The Nature Conservancy, Nacogdoches, TX. 95 pp. plus appendices.

Tweit, S. and K. Houston. 1980. Grassland and shrubland habitat types of the Shoshone National Forest. USDA Forest Service, Rocky Mountain Region, Shoshone National Forest.

Tyrrell, L. E. 1987. A floristic survey of buttonbrush swamps in Gahanna Woods State Nature Preserve, Franklin County, Ohio. The Michigan Botanist 26:29-36.

Tyrrell, L. E. and T. R. Crow. 1994. Structural characteristics of old-growth hemlock-hardwood forests in relation to age. Ecology 75:370-386.

U.S. Army Corps of Engineers. 1979. A cultural resources reconnaissance of the federal lands on the east bank of Lake Francis Case, South Dakota. U.S. Army Engineer District, Corps of Engineers, Omaha, NE.

U.S. Fish & Wildlife Service. 1998. *Sedum integrifolium ssp. leedyi* (Leedy's roseroot) recovery plan. Fort Snelling, MN. vi plus 31 pp.

U.S. Forest Service. 1990. Establishment record for Dismal Hollow Research Natural Area within Ozark National Forest, Newton County, Arkansas. Unpublished document. USDA Forest Service, Ozark National Forest, Russellville, AR. 20 pp. plus map.

U.S. Forest Service. 1992. Draft habitat types of the Little Missouri National Grasslands. Medora and McKenzie ranger districts, Custer National Forest. Dickinson, ND.

Umbanhowar, C. E., Jr. 1992. Reanalysis of the Wisconsin prairie continuum. The American Midland Naturalist 127:268-275.

Ungar, I. A. 1967. Vegetation-soil relationships on saline soils in northern Kansas. The American Midland Naturalist 78:98-121.

Ungar, I. A. 1970. Species-soil relationships on sulfate dominated soils of South Dakota. The American Midland Naturalist 83:343-357.

Ungar, I. A. 1972. The vegetation of inland saline marshes of North America, north of Mexico. Pages 397-411.

Ungar, I. A. 1974. Halophyte communities of Park County, Colorado. Bulletin of the Torrey Botanical Club 101:145-152.

Ungar, I. A., W. Hogan, and M. McClennand. 1969. Plant communities of saline soils at Lincoln, Nebraska. The American Midland Naturalist 82:564-577.

Van Deelen, T. R. 1999. Deer-cedar interactions during a period of mild winters: Implications for conservation of conifer swamp deeryards in the Great Lakes region. Natural Areas Journal 19:263-274.

Van der Valk, A. G. 1975. Floristic composition and structure of fen communities in northwest Iowa. Proceedings of the Iowa Academy of Science 82:113-118.

Van Kley, J. E. and D. N. Hine. 1998. The wetland vegetation of Caddo Lake. Texas Journal of Science 50:267-290.

Van Kley, J. E., G. R. Parker, D. P. Franzmeier, and J. C. Randolph. 1995. Field Guide - Ecological classification of the Hoosier National Forest and surrounding areas of Indiana. USDA Forest Service, Hoosier National Forest.

Van Pelt, N. S. 1978. Woodland parks in southeastern Utah. Unpublished thesis. University of Utah, Salt Lake City.

Van Wie, E. and M. Damm. 1997. Colorado state community abstract - *Populus deltoides ssp. monilifera / Panicum virgatum* community. Colorado Natural Heritage Program, Fort Collins.

Vestal, A. G. 1913. Plains vegetation adjoining the mountains: The region about Boulder in Colorado. Unpublished thesis. University of Colorado, Boulder. 40 pp.

Vestal, A. G. 1914. Prairie vegetation of a mountain-front area in Colorado. Botanical Gazette 58:377-400.

Vestal, A. G. 1919. Phytogeography of the eastern mountain front in Colorado. I. Physical geography and distribution of vegetation. Botanical Gazette 68:153-193.

Vogl, R. J. 1961. The effects of fire on some upland vegetation types. Ph.D. dissertation. University of Wisconsin. 103 pp.

Vogl, R. J. 1964. Vegetational history of Crex Meadows, a prairie savanna in northwestern Wisconsin. The American Midland Naturalist 72:157-175

Vogl, R. J. 1970. Fire and the northern Wisconsin pine barrens. Proceedings of the Tall Timbers Fire Ecology Conference 10:175-209.

Voigt, J. W. and R. H. Mohlenbrock. 1964. Plant communities of southern Illinois. Southern Illinois University Press, Carbondale. 202 pp.

Von Loh, J., D. Cogan, D. Faber-Langendoen, D. Crawford, and M. Pucherelli. 1999. USGS-NPS Vegetation Mapping Program, Badlands National Park, South Dakota. USDI Bureau of Reclamation, Technical Memorandum No. 8260-99-02, Denver, CO.

Vora, R. S. 1993. Moquah barrens: Pine barrens restoration experiment initiated in Chequamegon National Forest. Restoration & Management Notes 11:39-44.

Voss, E. G. 1972. Michigan flora: A guide to the identification and occurrence of the native and naturalized seed-plants of the state. Part I. Gymnosperms and Monocots. Cranbrook Institute of Science. 488 pp.

Walford, G. M. 1996. Statewide classification of riparian and wetland dominance types and plant communities - Bighorn Basin segment. Report submitted to the Wyoming Department of Environmental Quality, Land Quality Division by the Wyoming Natural Diversity Database. 185 pp.

Wali, M. K., K. T. Killingbeck, R. H. Bares, and L. E. Shubert. 1980. Vegetation-environment relationships of woodland and shrub communities, and soil algae in western North Dakota. Report of a project of the North Dakota Regional Environmental Assessment Program. ND REAP Project No. 7-01-1. Department of Biology, University of North Dakota, Grand Forks, ND.

Walker, B. H. and R. T. Coupland. 1970. Herbaceous wetland vegetation in the aspen grove and grassland region of Saskatchewan. Canadian Journal of Botany 48:1861-1878.

Walker, G. L. 1987. Ecology and population biology of *Thuja occidentalis* L. in its southern disjunct range. Ph.D. dissertation. University of Tennessee, Knoxville. 160 pp.

Wanek, W. J. and R. E. Newman. [1976]. The structure, composition, and community dynamics of an orchid bog in the Chippewa National Forest. Center for Environmental Studies, Bemidji State University, Bemidji, MN. 69 pp.

Wasser, C. H. and K. Hess. 1982. The habitat types of Region II. USDA Forest Service: A synthesis. Final report prepared for USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 140 pp.

Watson, J. R. 1912. Plant geography of north central New Mexico: Contributions from the Hull Botanical Laboratory. Botanical Gazette 54:194-217.

Weakley, A. S., K. D. Patterson, S. Landaal, M. Pyne, and others, compilers. 1998. International classification of ecological communities: Terrestrial vegetation of the Southeastern United States. Working draft of March 1998. The Nature Conservancy, Southeast Regional Office, Southern Conservation Science Department, Community Ecology Group. Chapel Hill, NC. 689 pp.

Weaver, J. E. 1958. Native grassland of southwestern Iowa. Ecology 39:733-750.

Weaver, J. E. 1960. Flood plain vegetation of the central Missouri Valley and contacts of woodland with prairie. Ecological Monographs 30:37-64.

Weaver, J. E. 1965. Native vegetation of Nebraska. University of Nebraska Press, Lincoln. 185 pp.

Weaver, J. E. and F. W. Albertson. 1956. Grasslands of the Great Plains: Their nature and use. Johnsen Publishing Co., Lincoln, NE. 395 pp.

Weaver, J. E. and W. E. Bruner. 1948. Prairies and pastures of the dissected loess plains of central Nebraska. Ecological Monographs 18:507-549.

West, N. E., F. D. Provenza, P. S. Johnson, and M. K. Owens. 1984. Vegetation change after 13 years of livestock grazing exclusion on sagebrush semidesert in west central Utah. Journal of Range Management 37:262-264.

West, P. and J. Welsh. 1998. Characterization of unglaciated quartzite bedrock glades in the Baraboo Hills of Wisconsin. Interim Report on RJ/KOSE 1997 Grant. Wisconsin Field Office, Madison, WI. 19 pp.

Western Resources Development Corporation. No date. Caballo Mine Application No. 433-T2. On file at Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne.

Western Resources Development Corporation. No date (a). North Antelope Mine Application No. 532-T2. On file at Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne.

Western Resources Development Corporation. No date (b). Rawhide Mine Application No. 240-T1. On file at Wyoming Department of Environmental Quality, Land Quality Division, Cheyenne.

Wharton, C. H. 1978. The natural environments of Georgia. Georgia Department of Natural Resources, Atlanta. 227 pp.

Wharton, C. H. 1989. The natural environments of Georgia. Georgia Dep. of Natural Resources. Bulletin 114:75-80.

Wharton, C. H., W. M. Kitchens, E. C. Pendleton, and T. W. Sipe. 1982. The ecology of bottomland hardwood swamps of the Southeast: A community profile. USDI Fish & Wildlife Service, Office of Biological Services. FWS/OBS-81/37. Washington, DC.

Wharton, M. E. 1945. Floristics and vegetation of the Devonian-Mississippian Black-Shale Region of Kentucky. Ph.D. dissertation. University of Michigan, Ann Arbor. 45 pp.

Whicker, A. D. and J. K. Detling. 1988. Ecological consequences of prairie dog disturbances. BioScience 38:778-784.

White, A. S. 1986. Prescribed burning for oak savanna restoration in central Minnesota. Research Paper NC-266, Forest Service, North Central Forest Experiment Station, St. Paul, MN. 12 pp.

White, J. 1981. A survey of Illinois prairies. In: R. L. Stuckey and K. J. Reese, editors. Proceedings of the Fifth North American Prairie Conference. Ohio Biological Survey Notes No. 15.

White, J. 1994. How the terms *savanna, barrens*, and *oak openings* were used in early Illinois. Pages 25-63 in: J. S. Fralish, R. C. Anderson, J. E. Ebinger and R. Szafoni, editors. Illinois State University. Proceedings of the North American Conference on Savannas and Barrens.

White, J. A. and D. C. Glenn-Lewin. 1984. Regional and local variation in tallgrass prairie remnants of Iowa and eastern Nebraska. Vegetatio 57:65-78.

White, J. and M. Madany. 1978. Classification of natural communities in Illinois. Pages 311-405 in: Natural Areas Inventory technical report. Volume I. Survey methods and results. Illinois Natural Areas Inventory, Urbana, IL.

White, J. and R. C. Anderson. 1970. A cypress swamp outlier in southern Illinois. Illinois State Academy of Science 63:6-13.

White, M. A. and K. A. Chapman. 1989. Vegetation analysis of the Toledo Metroparks oak openings for community characterization and monitoring. Unpublished report. The Nature Conservancy, Midwest Regional Office.

Whitley, J. R., B. Bassett, J. G. Dillard, and R. A. Haefner. 1990. Water plants for Missouri ponds. Missouri Department of Conservation. 151 pp.

Whitney, G. G. 1986. Relation of Michigan's presettlement pine forests to substrate and disturbance history. Ecology 67:1548-1559.

Whitney, G. G. 1987. An ecological history of the Great Lakes forest of Michigan. Journal of Ecology 75:667-684.

Whittaker, R. H. 1956. Vegetation of the Great Smoky Mountains. Ecological Monographs 26:1-80.

Wieland, R. G. 1994. Mississippi Natural Heritage Program: Ecological communities. Unpublished document. Mississippi Department of Wildlife, Fisheries, and Parks, Museum of Natural Science, Natural Heritage Program, Jackson, MS. 7 pp.

Wilcox, D. A., R. J. Shedlock, and W. J. Hendrickson. 1986. Hydrology, water chemistry and ecological relations in the raised mound of cowles bog. Journal of Ecology 74:1103-1117.

Wilhelm, G. S. 1991. Implications of changes in floristic composition of the Morton Arboretum's East Woods. Proceedings of the Oak Woods Management Workshop: 31-54. Eastern Illinois University, Charleston, IL.

Williams, C. K. and T. R. Lillybridge. 1983. Forested plant associations of the Okanogan National Forest. USDA Forest Service, Pacific Northwest Region. R6-Ecol-132b-1983. 140 pp.

Williams, C. K. and T. R. Lillybridge. 1985. Forested plant associations of the Colville National Forest. Draft. Unpublished field guide prepared for USDA Forest Service.

Williams, R. P. 1979a. Vascular flora of south central North Dakota. Ph.D. thesis. North Dakota State University, Fargo.

Wilson, H. C. 1969. Ecology and successional patterns of wet meadows, Rocky Mountain National Park, Colorado. Unpublished dissertation. University of Utah, Salt Lake City. 99 pp.

Wilson, R. E. 1970. Succession in stands of *Populus deltoides* along the Missouri River in southeastern South Dakota. The American Midland Naturalist 83:330-342.

Wing, L. W. 1937. Evidences of ancient oak openings in southern Michigan. Ecology 18:170-171.

Winter, T. C. 1989. Hydrologic studies of wetlands in the northern prairie. Pages 16-55 in: A. Van der Valk, editor. Northern prairie wetlands. Iowa State University Press, Ames.

Winterringer, G. S. and A. G. Vestal. 1956. Rock-ledge vegetation in southern Illinois. Ecological Monographs 26:105-130.

Wistendahl, W. A. 1980. River birch - sycamore. Pages 47 in: F. H. Eyre, editor. Forest cover types of the United States and Canada. Society of American Foresters, Washington, DC. 148 pp.

Wooten, S. A. 1980. Vegetation recovery following disturbance on the Central Plains Experimental Range. Unpublished thesis. Colorado State University, Fort Collins.

Wovcha, D. S., B. C. Delaney, and G. Nordquist. 1995. Minnesota's St. Croix Valley and Anoka sandplain: A guide to native habitats. University of Minnesota Press, Minneapolis. 234 pp.

Wright, H. A. and A. W. Bailey. 1982. Pinyon-juniper. Pages 195-208 in: Fire ecology: United States and southern Canada. Wiley-Interscience Publication, John Wiley and Sons, New York. 501 pp.

Wyoming Natural Diversity Database. 1990. Unpublished data on file. Laramie, WY.

Yeager, J. E. 1949. Effect of permanent flooding in a river-bottom timber area. Bulletin of the Illinois Natural History Survey 25:33-65.

Young, J. A., R. A. Evans, B. A. Roundy, and J. A. Brown. 1986. Dynamic landforms and plant communities in a pluvial lake basin. Great Basin Naturalist 46:1-21.

Youngblood, A. P. and W. F. Mueggler. 1981. Aspen community types on the Bridger-Teton National Forest in western Wyoming. USDA Forest Service. Research Paper INT-272. Intermountain Forest and Range Experiment Station, Ogden, UT. 34 pp.

Youngblood, A. P., W. G. Padgett, and A. H. Winward. 1985. Riparian community type classification of eastern Idaho-western Wyoming. USDA Forest Service, Intermountain Region. R4-Ecol-85-01. Ogden, UT. 78 pp.

Youngblood, A. P., W. G. Padgett, and A. H. Winward. 1985b. Riparian community type classification of northern Utah and adjacent Idaho. Unpublished report prepared for USDA Forest Service, Intermountain Region, Ogden, UT. 104 pp.

Zamora, B. A. 1983. Forest habitat types of the Spokane Indian Reservation. Agricultural Research Center, Washington State University Research Bulletin XB-0936-1983.

Zimmerman, D. A. 1956. The jack pine association in the lower peninsula of Michigan: Its structure and composition. Ph.D. dissertation. University of Michigan.

Zoladeski, C. A., G. M. Wickware, R. J. Delorme, R. A. Sims, and I. G. W. Corns. 1995. Forest ecosystem classification for Manitoba: Field guide. Natural Resources Canada, Canadian Forest Service, Northwest Region, Northern Forestry Center, Edmonton, Alberta. Special Report 2.

Zollner, Douglas. Personal communication. Ecologist, The Nature Conservancy, Arkansas Field Office, Little Rock.