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To the North Atlantic Landscape Conservation Cooperative

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Prioritization and Conservation Status of Rare Plants in the North Atlantic

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Abstract

The North Atlantic Region of the United States and Canada boasts diverse habitats, from coasts to mountains, that support endemic and rare plant species. However, recent conservation actions and prioritization efforts in this region have neglected to include plants. We conducted a broad-scale conservation assessment for vascular plants that occur in the North Atlantic Landscape Conservation Cooperative (NALCC). The primary outcome is a prioritized list of rare, highly threatened, declining, or sensitive plant species identified for conservation action. In close collaboration with Natural Heritage Botanists and other partners, we developed a list of vascular plant taxa of conservation concern for the region. We used the best available scientific data including Element Occurrences, published literature, and expert knowledge to develop a comprehensive list of over 3,135 vascular plant taxa for prioritization. This list of potential taxa was narrowed to approximately 1,200 taxa that were evaluated for their conservation priority in the North Atlantic region. For each taxon, we developed regional ranks (R-ranks), updated Global Ranks, documented threats and trends, and identified gaps in conservation knowledge. Of the evaluated taxa, 431 had R-ranks of R1 (Regionally Critically Imperiled), R2 (Regionally Imperiled), or R3 (Regionally Vulnerable). This group of 431 vascular plants were determined to be the highest conservation priorities for the NALCC.

**This report was revised December 2017 to clarify methodology for obtaining spatial data under the section "Generating a Comprehensive List of Rare Vascular Plants" under Objective One. Specifically, we removed wording that implied we did not use spatial data from Massachusetts when we did, in fact, incorporate Massachusetts' spatial data into this project.*

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Introduction

Maintaining a healthy diversity of native plants is of critical importance to our most pressing biodiversity conservation goals: the maintenance of biological diversity, climate change adaptation, food security, preservation of ecosystem function, invasive species control, habitat restoration, and carbon sequestration. Yet 30% of the native plant species in North America are currently threatened with extinction. This fraction is far larger than for vertebrate animals, which receive the bulk of attention and resources. Of the approximately 30% of plants threatened with extinction, only 11% receive protection under the Endangered Species Act (ESA) of 1973 (Negron-Ortiz 2014). While most species listed under the ESA are plants, less than 5% of all recovery funding is spent on plants (Negron-Ortiz 2014). Protection of plants at the state level also falls short of conservation needs, and is far less than the protection afforded to animals. This project focused on evaluating the conservation priorities of vascular plants in the North Atlantic to better protect this underrepresented element of biodiversity in federal, state, and provincial conservation plans.

The region encompassing the North Atlantic region includes some of the most diverse habitats and unique plant populations in North America. This project included an analysis of rare vascular plants throughout the entire North Atlantic region including four Canadian Provinces (New Brunswick, Nova Scotia, Quebec, and Prince Edward Island), 12 U.S. states (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and Virginia), and the District of Columbia (Fig. 1). Our goal was to build on the collective data, knowledge, expertise, and methodology of the Natural Heritage Network to develop Regional Conservation Ranks (R-ranks) and to complement and inform Global conservation status ranks (GRanks). Throughout this project three objectives were central to our work:

1. Assess regional responsibility of rare vascular plant species in the North Atlantic Region
2. Assess regional and global conservation status of rare vascular plants in the North Atlantic
3. Develop methodology for the regional prioritization of rare plants

Conducting an analysis of rare plants for this region was important for several reasons. First, existing conservation status data reflect assessments at the Global, National, and Subnational (state or provincial) spatial scales. While these data are useful for assessing conservation status at a regional scale, they are not sufficient. Second, some existing conservation status assessments are incomplete or not current. Anecdotally, we know that inventory and monitoring of rare plants in the region has decreased in some areas, yet we have not adequately documented gaps in knowledge. Many of NatureServe's Global, National, and Subnational conservation status assessments had not been updated to reflect recent changes in taxonomy, threats, and trends of rare North Atlantic plants. Third, the project allowed us to include Canadian conservation status and legal protection into this regional prioritization effort. Overall, this project enabled review of inventories across the region and brought together botanists from each subnation to determine how current threat and trend information in their own jurisdictions impacted the conservation status for the region.

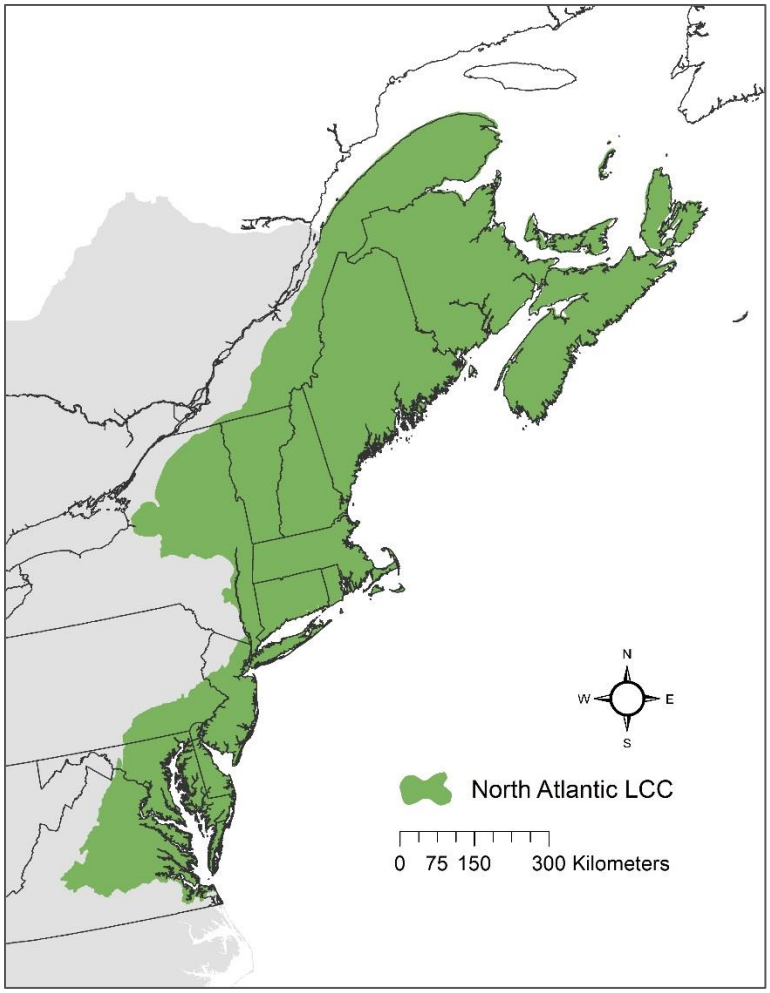

Figure 1. Map showing the boundaries of the North Atlantic Landscape Conservative Cooperative.

Methods

We created a methodology for regional rare plant prioritization based on NatureServe's Ranking Methodology that incorporates data on distribution, abundance, threats, and trends for each taxon. These data informed the Regional and Global Conservation Status Assessments. We also researched climate change literature relevant to plant species in the North Atlantic. Our methodology is described below, organized by the three project objectives.

Objective 1: Assess regional responsibility of rare vascular plant species in the North Atlantic LCC Region

Generating a Comprehensive List of Rare Vascular Plants

The first step in assessing the regional responsibility of vascular plants in the North Atlantic was to generate a comprehensive list of rare vascular plants for the region. To accomplish this, we incorporated data from several different sources including tabular and spatial data.

The tabular data included any taxon occurring in one of the NALCC subnations (states, provinces, and the District of Columbia) that met one or more of the following criteria:

- Global conservation rounded status rank of G1 (critically imperiled), G2 (imperiled), or G3 (vulnerable)
- Subnational conservation rounded status rank of S1 (critically imperiled) or S2 (imperiled)
- Legal protection at the international level (CITES)
- Legal protection and the national level (U.S. Endangered Species Act and Canada's Species At Risk Act)
- Legal protection at the state level (from the USDA PLANTS database)
- Species of Greatest Conservation Need in State Wildlife Action Plans
- Divisions 1 and 2 of Flora Conservanda.

The spatial data focused on gathering Element Occurrences (EOs) for any taxon ranked G1, G2, S1, or S2 with at least one occurrence in the North Atlantic region. We obtained current EO data for each Natural Heritage program which, in most cases, required executing subcontracts to many individual programs for data and administrative support. In ArcMap 10.5, we identified EOs for taxa that were within NALCC ecoregional boundary. Some states are entirely within the NALCC boundary, so all taxa ranked G1, G2, S1, or S2 in these states (excluding SNA, SX, SH, or SU species; see Table 1) were automatically included in the occurrence export. In some cases, we manually selected certain records to add to the dataset. For example, some coastal EOs along the Atlantic seaboard represent populations within the NALCC boundaries but did not intersect with the spatial NALCC boundary due to mapping or resolution discrepancies. We then intersected the compiled EO data with the spatial boundary of the North Atlantic, which allowed us to flag individual EOs as occurring within the NALCC boundary. The universe of taxa considered for regional ranks was created from the export of occurrences.

The resulting list totaled over 3,135 taxa. Because the tabular data was generated based on subnational boundaries and not NALCC boundaries, the list included taxa that occur in NALCC subnations but not within the NALCC boundary. We excluded taxa based on the following criteria:

- Ranked S4 or S5 in one or more subnation that is completely within the boundaries of the NALCC.
- Not having an element occurrence within the NALCC boundary despite being in one or more NALCC state, determined by reviewing results of the spatial intersection of EOs and the NALCC boundary, expert input, or review of floristic literature.

We shared the refined list of approximately 1,200 taxa with Natural Heritage botanists who reviewed each taxon for its potential as a conservation priority for the NALCC. We retained or excluded taxa based on the recommendations of Natural Heritage botanists. We manually reviewed the taxa with conflicting information or no clear majority. Some of these taxa were flagged for discussion at the virtual ranking sessions.

Determining Regional Responsibility

We originally proposed to conduct a spatial analysis to determine which rare plants are the primary responsibility of the NALCC, following the methodology used by White et al. (2014). This analysis determines the proportion of the species range that occurs within the region of interest. After reviewing the comprehensive list, we determined that over half of the taxa were globally secure or apparently

secure (G4 or G5) yet included on the list based on Sranks of 1 or 2. The original thinking in the proposal was that a regional responsibility analysis would help determine which of these relatively common species were priorities for conservation in the North Atlantic. However, we were not able to conduct the analysis as proposed because most G3, G4, or G5 species do not have complete EO data. Complete or nearly complete EO data are necessary to calculate the percentage of the range found within the NALCC boundaries compared to that of the total range. Since most Natural Heritage programs only maintain EOs for rare taxa, we do not have complete EO information for the more common taxa.

While the G1 and G2 taxa did have complete EO information, we did not conduct the regional responsibility analysis because it would not have affected the conservation priority of these taxa for the NALCC. Upon group discussion with heritage botanists, we concluded that even if a G1 or G2 taxon occurred primarily outside of the North Atlantic, it would still be considered a high priority for conservation within the North Atlantic because of its high risk of imperilment. Natural Heritage botanists decided to base their prioritization of taxa on factors independent of the overall percentage of a species range within the North Atlantic. For example, populations within the North Atlantic representing the northern edge of range, southern edge of range, or disjunct populations were determined to be biologically important for conservation even though the spatial footprint of those populations within the North Atlantic may be relatively small.

As a proxy to a quantitative measurement of regional responsibility, we determined the North Atlantic's relative responsibility for a taxon by combining Regional and Global Ranks, e.g., G1R1, G5R2 (Appendices 1, 2, and 3). Combined ranks with the same level of imperilment at both the global and regional scale (e.g., G2R2) may indicate that a significant part of a taxon's range, AOO, or number of EOs are in the North Atlantic. However, combined ranks with the same level of imperilment globally and regionally do not indicate if a taxon's range is entirely within the North Atlantic since the ranks are based on several factors in addition to range extent.

Objective 2: Assess the regional and global conservation statuses of rare vascular plant species in the North Atlantic LCC Region

Developing Regional Ranks

We used NatureServe's Rank Calculator with regionally scaled data to assign preliminary Regional Ranks (R-ranks). The Rank Calculator is a vetted, freely available tool that can be used any at any geographic scale. Ranks are determined using three factors: Rarity, Threats, and Trends (Faber-Langendoen et al. 2012 and Master et al. 2012). The factors are used to determine conservation status assessments, or Ranks, typically at the Global, National, and Subnational (state or provincial) level.

The Rarity factor generally uses the calculated Extent of Occurrence (EOO, also Range Extent) and Area of Occupancy (AOO) for each taxon. The EOO and AOO are critical factors in determining rarity because they are geospatial proxies for abundance and distribution. At a global scale, the EOO represents a taxon's rangewide distribution. The AOO is the area a taxon occupies on the ground and is measured in 2 x 2 km grid cells. In this case, we calculated the EOO and AOO within the boundary of the NALCC using EO data from Natural Heritage programs and following the protocol of the IUCN (2012) and NatureServe (Master et al. 2012). For taxa lacking EOs, we were unable to calculate the EOO and AOO and relied on expert opinion to determine rarity.

NatureServe, Natural Heritage, and Regional botanists assessed the threats and trends of each taxon in

their subnation and in the North Atlantic region. We used the existing NatureServe methodology for rating trends and threats, with slight modifications to scale to the geographic region of the North Atlantic and to simplify the contribution of the expert botanists due to the large number of taxa reviewed. In contrast to the odonate study that used a quantitative measure of change in abundance over time to calculate trends, we used qualitative trend and threat data provided by expert botanists for each species following the Rank Calculator methodology. This is because quantitative trend and threat data are rarely available for vascular plants.

Incorporating threats and trends into the rank is important for prioritizing species in need of protection. Taxa with increasing threats and declining population trends will be ranked at a higher risk of imperilment compared with a taxon that is not as threatened. For taxa considered a potential conservation priority, each botanist indicated the threat and trend level for the taxon in their subnation. NatureServe botanists reviewed the subnational threat and trend data to assign regional threat and trend levels. We used the Rank Calculator methodology, with simplified choices for threat and trend level to facilitate assigning threats and trends to all taxa. Although we did not have enough information to assign the scope, severity, and timing of each threat to each taxon, we did consider the following:

- Global threat and trend data were heavily weighted, particularly if a taxon's range fell entirely within NALCC boundaries.
- Subnational threat and trend data were more heavily weighted for those subnations with the largest percent of the taxon's range or populations within the North Atlantic. For example, if most of a taxon's populations occurred in one state, the threat level for that state carried more weight than for other states.
- The status and rank of EOs provided additional information for assigning trends. For example, taxa with more historical and extirpated EOs now than in the past would have a declining trend.
- For taxa with EOs occurring inside and outside the NALCC boundary, threats documented in individual EOs helped determine the threat level within the North Atlantic region.

The regional and global conservation status ranks for prioritized species were reviewed in collaboration with Natural Heritage Botanists and other experts in three virtual ranking sessions. Botanists also provided written information with additional threat, trend, and occurrence data, which contributed to refining the ranks. We manually reviewed and assigned an R-Rank using the Rank Calculator or based on expert opinion to determine whether each taxon was a regional priority (R1-R3). Taxa with a regional rank of R4 or R5 were determined not to be a priority for conservation in the North Atlantic (Table 1).

Assessing Climate Change Vulnerability

We researched climate change literature relevant to plants in the North Atlantic. We focused on studies that assessed the vulnerability of species using NatureServe's Climate Change Vulnerability Index (CCVI) in the North Atlantic region. Taxa included in these CCVI studies were matched to the list of approximately 1,200 taxa evaluated for conservation priority in the NALCC. The CCVI is designed to complement NatureServe Ranks rather than be incorporated into them. As such, we report on the CCVI results separately from the regional ranks.

Table 1: NatureServe Conservation Status Assessment Ranks and Variant Ranks

Global (G) Rank	Regional (R) Rank	Definition
GX	RX	Presumed Extinct — Species not located despite intensive searches and virtually no likelihood of rediscovery.
GH	RH	Possibly Extinct — Known from only historical occurrences but still some hope of rediscovery.
G1	R1	Critically Imperiled—At very high risk of extinction due to extreme rarity, very steep declines, or other factors.
G2	R2	Imperiled—At high risk of extinction or elimination due to very restricted range, very few populations, steep declines, or other factors.
G3	R3	Vulnerable—At moderate risk of extinction or elimination due to a restricted range, relatively few populations, recent and widespread declines, or other factors.
G4	R4	Apparently Secure—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5	R5	Secure—Common; widespread and abundant.
Variant G Ranks	**Variant R Ranks**	**Definition**
G#G#	R#R#	Range Rank — A numeric range rank (e.g., G2G3, R1R3) used to indicate uncertainty about the exact status of a taxon.
GU	RU	Unrankable — Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
GNR	RNR	Unranked – rank not yet assessed.
GNA	none	Not Applicable — A conservation status rank is not applicable because the species is not a suitable target for conservation activities.

Objective 3: Develop methodology for regional prioritization of rare plants

We developed methods for prioritizing rare plants from a regional perspective while considering threats and conservation efforts particularly important for plants. To begin developing the methodology, we organized and led a panel discussion session at NatureServe's Biodiversity Without Boundaries conference in April 2016 called "Protocol for Assessing the Regional Conservation Status of Species". The session highlighted aspects of the proposed methodology for this project followed by a discussion to gain feedback on the approach. The session was well attended with a very active discussion. The speakers and topics in the session included:

- Anne Frances, NatureServe, Introduction and purpose
- George Gann, The Institute For Regional Conservation, The importance of a regional perspective
- Wes Knapp, Maryland Natural Heritage Program, How to prioritize S1s and S2s in a regional context
- Gerry Moore, USDA PLANTS, Challenges designating legal protection for plants at the state level
- Matt Schlesinger and Erin White, New York Natural Heritage Program, Protocol for developing regional ranks for odonates in the Northeast

Although we originally proposed additional spatial analysis to further prioritize rare plants for the region, we were unable to do so because we did not have complete EO data for all taxa. The two spatial analyses, determining the proportion of a taxon's range in protected areas cross-walking rare species to specific habitats, would be beneficial to complete for the prioritized list of R1-R3 taxa from this study.

Our methodology, summarized above, was partially based on other regional prioritization projects (White et al. 2014, Brumback and Gerke 2013), yet relied more heavily on data and expertise from NatureServe and the Natural Heritage Network. Working with existing data was essential to the completion of the project because of the large number of taxa needing to be prioritized and ranked. In contrast to the odonate study, most rare vascular plant taxa in the North Atlantic had already been ranked at the subnational and global data. Updating the existing information with current EOs and expertise while scaling it to the North Atlantic region was the most efficient approach to prioritize rare taxa within the LCC.

Results and Discussion

Regional Ranks

Of the approximately 1,200 potential taxa of conservation concern in the North Atlantic, we determined 431 to be the highest priority for conservation in the North Atlantic region (Fig. 2, Appendix 1). A spreadsheet of all 1,200 species assessed is available by request. The highest priority taxa include those endemic to specific habitats such as alpine, maritime, and pine barrens as well as taxa endemic to certain areas like the St. Lawrence and Gaspe Peninsula. High priority taxa also include more wide ranging taxa that occur at the northern or southern extent of their range within the North Atlantic. The high priority taxa included those with regional ranks of R1 (128), R2 (163), and R3 (66, Fig. 1). The R1-R3 taxa include 15 that are federally listed or candidate under the U.S. Endangered Species Act, 24 taxa listed under Canada's Species At Risk Act, 16 likely endemic to a single subnation, and 18 likely endemic to the North Atlantic.

We identified 20 taxa that are likely historical (RH) and one taxon that is extirpated (RX) within the North Atlantic (Fig. 1, Appendix 2). To determine this status, we reviewed dates and element occurrence ranks for available EOs that were inside the boundary of the North Atlantic. Taxa ranked RH should be considered conservation priorities since they are extremely rare and may be rediscovered with targeted inventory.

Due to gaps in current knowledge, 63 taxa were unrankable (RU, Fig. 1, Appendix 3). The rank of RU was assigned to taxa that may be conservation priorities in the North Atlantic but were lacking sufficient information to assign a numbered rank. Multiple factors contributed to taxa ranked RU including: uncertain geographic distribution, unknown abundance in certain subnations, questionable taxonomy, and discrepancies on the taxon's nativity throughout the North Atlantic. While these data gaps can be resolved with additional work, the extent of the work involved was beyond the scope of this project. Resolving these unrankable taxa is important, both to ensure they are conserved when needed and to avoid investing resources on those that are not true priorities.

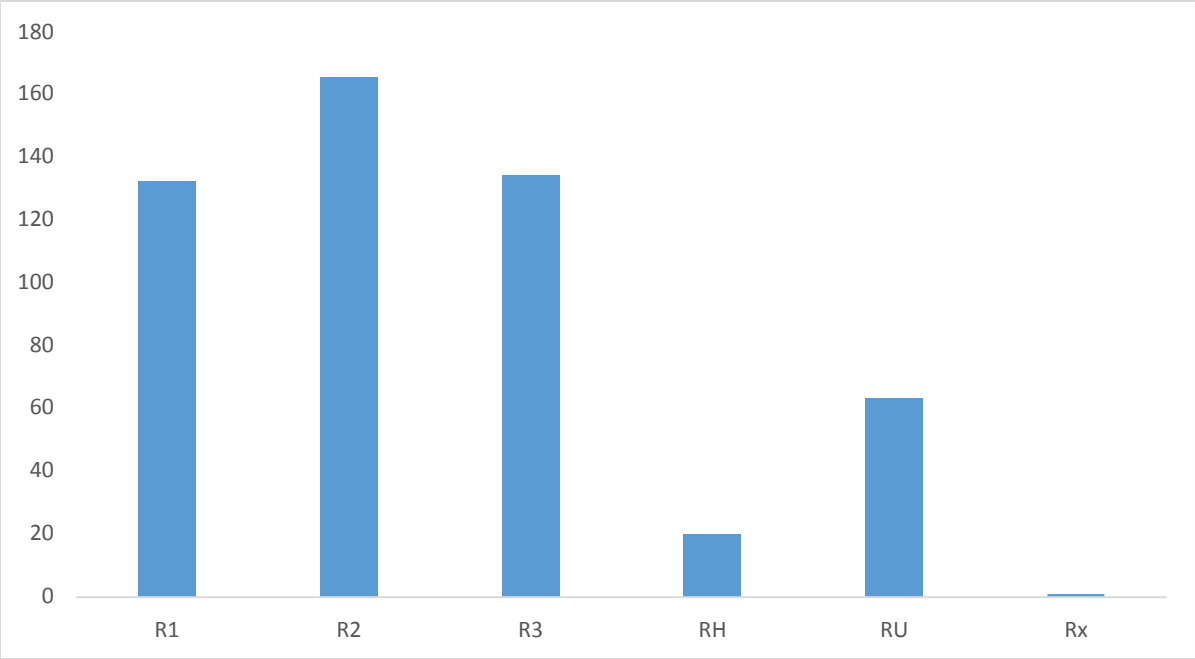

Figure 2. Number of vascular plant taxa in the North Atlantic by their assigned R-rank. Taxa ranked are R1-R3 ranks are considered high conservation priority for the North Atlantic region.

Taxa with questionable or unresolved taxonomy present significant challenges to assigning a rank. These taxa could be considered rare or threatened by one taxonomic perspective, or common and secure by another taxonomic perspective. For example, *Mimulus ringens* var. *colpophilus* is found only in Merrymeeting Bay in the Kennebec River Estuary, Maine, and in estuaries of the St. Lawrence River system, Quebec, Canada. Twelve current EOs are known from Maine; the number of EOs in Quebec is unknown. The taxon is ranked G5T2Q, indicating that the species *Mimulus ringens* is G5 (secure) and the variety *colpophilus* is T2 (imperiled). The Q on the rank supports the long-recognized question of whether this variety, described by Fernald, represents phenotypic variation of the species or a genetically distinct taxon. While there is some evidence in Stone and Brummond (2006) indicating var. *colpophilus* is genetically different and deserves recognition, not all agree. The Natural Heritage Botanists from Maine and Quebec concur that additional studies are needed to better understand and support the variation of *Mimulus ringen*s.
Many taxa were not assigned a regional rank. These largely represent taxa that are not conservation priorities in the North Atlantic. They include taxa that were not ranked at the subnational level for most the North Atlantic, in most cases indicating that they are relatively common. Although Natural Heritage and NatureServe botanists reviewed these taxa, they were not selected as high priority for conservation in the North Atlantic. While the list in Appendix 1 should be considered robust, a level of uncertainty or margin of error exists given the complexities of evaluating common taxa with only small parts of their ranges in the LCC. These more complex situations were discussed at virtual ranking sessions; however, it is still possible that taxa were accidentally excluded.

Interpreting regional conservation status ranks along with global and subnational ranks provides greater context the status of a taxon in general and can indicate a greater need for the NALCC to conserve a taxon (Appendix 1). Of the taxa reviewed, 119 had global and regional ranks at the same level of conservation concern, e.g. G1R1, G2R2, G3R3. This congruence is in large part due to the overlap in the taxon's global and regional distribution. When this rank pattern is detected in Appendix 1, the NALCC

should consider these taxa as their primary responsibility. Some of the taxa reviewed are clear conservation priorities for the region, like the US ESA Federally listed *Isotria medeoloides* (G2). It is a broadly distributed rare species, but the northern half of its range overlaps significantly with the North Atlantic LCC; it was ranked R2. Given its US federal status and high level of imperilment, this species is already a conservation priority for the states in the LCC.

Differences in the GRank and R-Rank can help detect taxa that may be more imperiled in the North Atlantic than rangewide. For example, *Lilium pyrophilum* is ranked G2R1, indicating the taxon is globally imperiled yet critically imperiled in the North Atlantic with only one EO in the region. Another example is *Eriocaulon decangulare* with a rank of G5R2. While broadly distributed across the southeastern US, it is highly threatened at the northern edge of its range in the North Atlantic. Unlike *Isotria medeoloides, Eriocaulon decangulare* has no US federal status and is not legally protected in any US state, though it is considered Threatened in Maryland. It is not included as a Species of Greatest Conservation Need in any State Wildlife Action Plans. This species exemplifies those typically overlooked in regional conservation prioritizing because of the G5 rank. This project highlighted these types of more elusive taxa in need of conservation attention and additional research in the North Atlantic. These cases can be identified in Appendix 1 by searching for taxa ranked G4 or G5 combined with regional ranks of R1 or R2. While differences in in ranks at different scales can indicate true differences in imperilment, it is important to note that differences between R-ranks and SRanks are also attributed to certain states (Pennsylvania, New York, Maryland, Virginia) occurring only partially with the NALCC boundary.

Climate Change

Of the many studies assessing species' vulnerability to climate change using the Climate Change Vulnerability Index (CCVI, Young et al. 2014), only two included vascular plant taxa within the North Atlantic (Morton and Speedy 2012, Sneddon and Hammerson 2014). There were 39 species assessed in these two studies that were also on the reviewed list of North Atlantic plant species (Table 2). The first study (Morton and Speedy 2012) evaluated the vulnerability of at-risk species to climate change in Pennsylvania.

Although the results of this study provide valuable information on the potential of certain taxa to be vulnerable to climate change in the North Atlantic, it should be noted that the portion of Pennsylvania that occurs within the NALCC boundary is relatively small compared to the entire region. Of the ten taxa assessed as vulnerable to climate change in Pennsylvania, four are already are high conservation priority in the North Atlantic. The six taxa assessed as vulnerable to climate change in Pennsylvania but are not high conservation priority likely require additional research and monitoring to track changes in status.

The second study (Sneddon and Hammerson 2014) applied the CCVI to 60 plants and animals within the North Atlantic that represented a) Federal Trust species of high responsibility by the NALCC, b) foundation species for habitats currently being assessed for climate change vulnerability by the Manomet Center for Conservation Sciences, and c) Species of Greatest Conservation Need (SGCN) as identified by the Regional Conservation Needs program. Of the 20 plants assessed in this study, 18 were selected as foundation species and 2 were of high regional concern. Climate change vulnerability was assessed for three different subregions within the North Atlantic (Maritime Canada and North Appalachians, North Atlantic Coast, and Mid Atlantic Coast, Table 2) providing vulnerability information on specific portions of a taxon's range. Of the 12 taxa assessed as vulnerable to climate change in part or throughout the North Atlantic, only 1 is already of high conservation priority in the North Atlantic. The remaining 11 taxa assessed as vulnerable to climate change in in the North Atlantic are commonly occurring tree and wetland species.

Table 2. Climate Change Vulnerability Index (CCVI) Results of Two Studies within the NALCC region
CCVI scores are: EV = Extremely Vulnerable; HV = Highly Vulnerable, MV = Moderately Vulnerable; PS =Presumed Stable; IL = Increase Likely. *Species not occurring in a subregion are indicated by "— ".

Species	CCVI Pennsylvania	CCVI Maritime Canada & North Appalachians	CCVI North Atlantic Coast	CCVI Mid Atlantic Coast*	Vulnerable in part or all of NALCC	Conservation priority in NALCC (R1-R3)
Abies balsamea	n/a	MV	HV	—	yes	no
Acer saccharinum	n/a	PS	PS	—	no	no
Acer saccharum	n/a	IL	PS	PS	no	no
Boechera patens	PS	n/a	n/a	n/a	unknown	no
Bouteloua curtipendula	PS	n/a	n/a	n/a	unknown	yes
Carex haydenii	MV	n/a	n/a	n/a	yes	no
Carex tetanica	MV	n/a	n/a	n/a	yes	no
Chamaecyparis thyoides	n/a	PS	PS	MV	yes	no
Chamaedaphne calyculata	n/a	PS	MV	MV	yes	no
Cuscuta cephalanthi	MV	n/a	n/a	n/a	yes	yes
Dicentra eximia	MV	n/a	n/a	n/a	yes	no
Filipendula rubra	HV	n/a	n/a	n/a	yes	no
Isotria medeoloides	n/a	PS	PS	PS	no	yes
Melica nitens	PS	n/a	n/a	n/a	unknown	yes
Nyssa sylvatica	n/a	PS	PS	PS	no	no
Paronychia fastigiata var. nuttallii	PS	n/a	n/a	n/a	unknown	yes
Pedicularis lanceolata	MV	n/a	n/a	n/a	yes	yes
Picea mariana	n/a	MV	HV	—	yes	no
Picea rubens	n/a	MV	HV	—	yes	no
Pinus rigida	n/a	PS	PS	PS	no	no
Pinus strobus	n/a	PS	PS	MV	yes	no
Platanthera blephariglottis	EV	n/a	n/a	n/a	yes	no
Platanthera ciliaris	PS	n/a	n/a	n/a	unknown	yes
Platanthera peramoena	MV	n/a	n/a	n/a	yes	yes
Pontederia cordata	n/a	PS	PS	MV	yes	no
Prunus alleghaniensis	PS	n/a	n/a	n/a	unknown	no
Pycnanthemum torrei	PS	n/a	n/a	n/a	unknown	yes
Quercus alba	n/a	PS	PS	PS	no	no
Ruellia strepens	MV	n/a	n/a	n/a	yes	yes
Sarracenia purpurea	n/a	MV	MV	MV	yes	no
Scirpus ancistrochaetus	n/a	PS	PS	MV	yes	yes
Scirpus cyperinus	n/a	PS	PS	PS	no	no
Solidago roanensis	PS	n/a	n/a	n/a	unknown	no
Spartina alterniflora	n/a	MV	MV	MV	yes	no
Thalictrum coriaceum	PS	n/a	n/a	n/a	unknown	no
Thuja occidentalis	n/a	MV	MV	HV	yes	no
Tipularia discolor	HV	n/a	n/a	n/a	yes	no
Tsuga canadensis	n/a	PS	MV	MV	yes	no
Vallisneria americana	n/a	PS	PS	PS	no	no

Conclusions

The list of vascular plants considered high priority for conservation in the North Atlantic provides a new resource for regionally focused conservation efforts and fills a knowledge gap for the region. The rapid prioritization of thousands of species at a regional scale required modifying existing methods and developing new methods. Rather than creating a new tool to assign Regional Ranks, we used a modified version of NatureServe's Rank Calculator. To acquire regional threat and trend information for so many taxa in a short timeframe, Natural Heritage botanists from each state and province in the LCC provided customized information for the region. Additionally, NatureServe, Natural Heritage, and regional botanists met and discussed taxa during three virtual ranking sessions where regional ranks were refined. Expert knowledge and ranking sessions were invaluable for gathering threat and trend data that are often anecdotal and difficult to quantify. The Global ranks of key species were also reviewed and refined at the virtual ranking sessions.

Developing the prioritized list of rare plants revealed knowledge gaps in several areas. It is essential to devote resources to filling those gaps so that regional ranks can be assigned to all priority taxa in the region. Uncertain geographic distribution, unknown abundance in certain subnations, questionable taxonomy, and discrepancies on the taxon's nativity throughout the North Atlantic all contributed to taxa assigned a rank of RU (unrankable). Although studies indicate that certain habitats within the North Atlantic are vulnerable to climate change, we are lacking climate change vulnerability assessments for plants in the North Atlantic. This is likely due in part to plants not being considered as Species of Greatest Conservation Need in most State Wildlife Action Plans. Regardless, completing climate change vulnerability assessments for plants in the North Atlantic is the first step toward developing climate management plans.

The outcome from both the individual subnational reviews and the group review during the virtual ranking sessions was a prioritized list of North Atlantic rare plant species and regional conservation status assessments. As conservation status changes over time and with new knowledge, we encourage further discussion by members of the NALCC with Natural Heritage botanists, the New England Wildflower Society, and other regional botanists to modify the list as needed. These activities will greatly further the conservation of vascular plants in this region.

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Appendix 1

Vascular plant taxa determined to be the highest conservation priority for the North Atlantic LCC with Regional, Global, and combined Global-Regional ranks. Highest conservation priority taxa are those with Regional Ranks of R1, R2, or R3. Rank definitions are found in Table 1 or at explorer.natureserve.org. Taxa with * are likely endemic to the North Atlantic.

Taxon	Rounded Global Rank	Regional Rank	Combined Global & Regional Rank
Adiantum aleuticum	G5	R3	G5R3
Adiantum viridimontanum	G3	R3	G3R3
Aeschynomene virginica	G2	R1	G2R1
*Agalinis acuta**	G1	R1	G1R1
Agalinis auriculata	G3	R1	G3R1
*Agalinis neoscotica**	G3	R3	G3R3
Agalinis skinneriana	G3	R1	G3R1
Aletris aurea	G5	R1	G5R1
Alnus maritima	G3	R3	G3R3
Amaranthus pumilus	G2	R2	G2R2
Amelanchier fernaldii	G3	R3	G3R3
Amelanchier nantucketensis	G3	R3	G3R3
Amerorchis rotundifolia	G5	R3	G5R3
Amianthium muscitoxicum	G4	R3	G4R3
Ammophila champlainensis	G2	R1	G2R1
Anemone multifida	G5	R2	G5R2
Arabis hirsuta var. adpressipilis	T4	R1	T4R1
Arabis missouriensis	G5	R3	G5R3
Arabis patens	G3	R2	G3R2
Arabis shortii	G5	R2	G5R2
Arctostaphylos alpine	G5	R1	G5R1
Aristida lanosa	G5	R3	G5R3
Aristida purpurascens var. virgata	T4	R3	T4R3
Armoracia lacustris	G4	R2	G4R2
Arnica acaulis	G4	R1	G4R1
Arnica frigida ssp. griscomii	T1	R1	T1R1
Arnica lonchophylla	G5	R3	G5R3
Arnoglossum muehlenbergii	G4	R3	G4R3
Artemisia campestris ssp. canadensis	TNR	R2	TNRR2
Asclepias lanceolata	G5	R2	G5R2
Asclepias rubra	G4	R2	G4R2
Asplenium bradleyi	G4	R2	G4R2
*Astragalus robbinsii var. jesupii**	T1	R1	T1R1
Astragalus robbinsii var. minor	T5	R2	T5R2

Taxon	Rounded Global Rank	Regional Rank	Combined Global & Regional Rank
Bacopa innominate	G4	R2	G4R2
Baptisia albescens	G4	R1	G4R1
Barbarea orthoceras	G5	R1	G5R1
Betula glandulosa	G5	R2	G5R2
Betula minor	G4	R3	G4R3
Bidens bidentoides	G3	R3	G3R3
Bidens eatonii	G3	R3	G3R3
Bidens heterodoxa	G2	R2	G2R2
Bidens hyperborea var. hyperborea	T3	R3	T3R3
Blysmus rufus	G5	R3	G5R3
Boechera grahamii	G5	R3	G5R3
Boechera quebecensis	G1	R1	G1R1
Boltonia asteroides var. asteroides	TNR	R1	TNRR1
Boltonia asteroides var. glastifolia	TNR	R2	TNRR2
Botrychium ascendens	G3	R1	G3R1
Botrychium campestre	G3	R1	G3R1
Botrychium lineare	G2	R1	G2R1
Botrychium michiganense	G3	R1	G3R1
Botrychium minganense	G4	R2	G4R2
Botrychium pallidum	G3	R1	G3R1
Botrychium rugulosum	G3	R2	G3R2
Botrychium spathulatum	G3	R1	G3R1
Bouteloua curtipendula	G5	R3	G5R3
Braya humilis	G5	R2	G5R2
Bromus nottowayanus	G4	R2	G4R2
Buchnera americana	G5	R2	G5R2
Callitriche hermaphroditica	G5	R3	G5R3
Calypso bulbosa	G5	R3	G5R3
Calypso bulbosa var. americana	T5	R2	T5R2
Canadanthus modestus	G5	R2	G5R2
Cardamine bellidifolia var. bellidifolia	T5	R2	T5R2
Cardamine dentata	G5	R1	G5R1
Cardamine longyi	G3	R3	G3R3
Cardamine rotundifolia	G4	R1	G4R1
Carex atherodes	G5	R2	G5R2
Carex bicknellii	G5	R2	G5R2
Carex capillaris ssp. fuscidula	TNR	R1	TNRR1
Carex capitata ssp. arctogena	T4	R1	T4R1
Carex careyana	G4	R1	G4R1
Carex decomposita	G3	R2	G3R2

Taxon	Rounded Global Rank	Regional Rank	Combined Global & Regional Rank
Carex formosa	G4	R3	G4R3
Carex garberi	G5	R3	G5R3
Carex gynocrates	G5	R3	G5R3
Carex livida	G5	R2	G5R2
Carex meadii	G4	R2	G4R2
*Carex oronensis**	G3	R3	G3R3
Carex polymorpha	G3	R2	G3R2
Carex richardsonii	G5	R2	G5R2
Carex schweinitzii	G3	R3	G3R3
Carex sterilis	G4	R3	G4R3
Carex tetanica var. canbyi	T1	R1	T1R1
Carex vacillans	GNR	R3	GNRR3
Carex viridula ssp. brachyrrhyncha	TNR	R2	TNRR2
Carex viridula var. elatior	TNR	R2	TNRR2
Carex viridula var. saxilittoralis	T1	R1	T1R1
*Carex waponahkikensis**	G2	R2	G2R2
Castilleja coccinea	G5	R3	G5R3
Ceanothus herbaceus	G5	R1	G5R1
Cerastium arvense var. velutinum	T4	R2	T4R2
Cerastium arvense var. villosum	T1	R1	T1R1
Chamaesyce bombensis	G4	R3	G4R3
Chelone cuthbertii	G3	R2	G3R2
Chelone obliqua	G4	R2	G4R2
Chenopodium foggii	G2	R2	G2R2
Cirsium muticum var. monticolum	T2	R2	T2R2
Cirsium virginianum	G3	R1	G3R1
Cladium mariscus ssp. jamaicense	T5	R1	T5R1
Cleistes divaricata	G4	R1	G4R1
Coelorachis rugosa	G5	R3	G5R3
Coleataenia rigidula ssp. rigidula	TNR	R2	TNRR2
Corallorhiza striata var. striata	T5	R2	T5R2
Corallorhiza striata var. vreelandii	T4	R1	T4R1
Corallorhiza wisteriana	G5	R2	G5R2
Coreopsis rosea	G3	R2	G3R2
Corydalis aurea	G5	R3	G5R3
Crassula aquatica	G5	R3	G5R3
*Crataegus bicknellii**	G1	R1	G1R1
Crataegus coccinioides	G4	R2	G4R2
Crataegus oakesiana	GNR	R2	GNRR2
Cuscuta cephalanthi	G5	R2	G5R2

Taxon	Rounded Global Rank	Regional Rank	Combined Global & Regional Rank
Cynoglossum virginianum var. boreale	T4	R2	T4R2
Cyperus houghtonii	G4	R2	G4R2
Cyperus plukenetii	G5	R1	G5R1
Cyperus refractus	G5	R3	G5R3
Cyperus schweinitzii	G5	R2	G5R2
Cypripedium arietinum	G3	R2	G3R2
Cypripedium kentuckiense	G3	R1	G3R1
Cystopteris laurentiana	G3	R2	G3R2
Cystopteris tennesseensis	G5	R2	G5R2
Desmodium ochroleucum	G2	R1	G2R1
Desmodium strictum	G4	R2	G4R2
Desmodium tenuifolium	G4	R1	G4R1
Diapensia lapponica	G4	R2	G4R2
Dichanthelium annulum	GNR	R2	GNRR2
Dichanthelium caerulescens	G2	R1	G2R1
Dichanthelium consanguineum	G5	R2	G5R2
Dichanthelium hirstii	G1	R1	G1R1
Draba arabisans	G4	R3	G4R3
Draba cana	G5	R3	G5R3
Draba pycnosperma	G1	R1	G1R1
Draba reptans	G5	R3	G5R3
Drosera anglica	G5	R1	G5R1
Drosera capillaris	G5	R3	G5R3
Drosera linearis	G4	R2	G4R2
Echinacea laevigata	G2	R2	G2R2
Eleocharis compressa	G4	R3	G4R3
Eleocharis diandra	G2	R2	G2R2
Eleocharis equisetoides	G4	R3	G4R3
Eleocharis melanocarpa	G4	R3	G4R3
Eleocharis nitida	G4	R3	G4R3
Eleocharis obtusa var. peasei	TNR	R2	TNRR2
Eleocharis vivipara	G5	R1	G5R1
Elymus macgregorii	GNR	R3	GNRR3
Empetrum eamesii ssp. atropurpureum	T5	R3	T5R3
Epilobium anagallidifolium	G5	R3	G5R3
Erigeron compositus	G5	R3	G5R3
Erigeron philadelphicus var. provancheri	T3	R3	T3R3
Erigeron vernus	G5	R2	G5R2
Eriocaulon decangulare	G5	R2	G5R2
Eriocaulon parkeri	G3	R3	G3R3

Taxon	Rounded Global Rank	Regional Rank	Combined Global & Regional Rank
Eryngium yuccifolium var. yuccifolium	T5	R2	T5R2
Eupatorium anomalum	G2	R1	G2R1
Eupatorium godfreyanum	G4	R3	G4R3
Eupatorium incarnatum	G5	R2	G5R2
*Eupatorium leucolepis var. novae-angliae**	T1	R1	T1R1
Eupatorium resinosum	G3	R2	G3R2
Eupatorium sessilifolium var. vaseyi	T4	R1	T4R1
Euphorbia purpurea	G3	R1	G3R1
Euphrasia oakesii	G4	R2	G4R2
Euphrasia williamsii	TNR	R1	TNRR1
Festuca paradoxa	G5	R2	G5R2
Festuca prolifera	GU	R3	RUR3
Festuca saximontana var. saximontana	T5	R3	T5R3
Fimbristylis annua	G5	R2	G5R2
Fimbristylis perpusilla	G2	R1	G2R1
Fimbristylis puberula var. puberula	T5	R2	T5R2
Galium brevipes	G4	R1	G4R1
Galium hispidulum	G5	R2	G5R2
Gaylussacia brachycera	G3	R2	G3R2
Gentiana autumnalis	G3	R2	G3R2
Gentiana villosa	G4	R3	G4R3
Geum peckii	G2	R2	G2R2
Goodyera oblongifolia	G5	R3	G5R3
Gratiola brevifolia	G4	R1	G4R1
Gratiola ramosa	G4	R1	G4R1
Gratiola viscidula	G4	R2	G4R2
Gymnocarpium jessoense ssp. parvulum	T4	R1	T4R1
Gymnopogon brevifolius	G5	R3	G5R3
Hackelia deflexa var. americana	T5	R2	T5R2
Harrimanella hypnoides	G5	R3	G5R3
Helenium brevifolium	G4	R2	G4R2
Helianthemum dumosum	G3	R3	G3R3
Helianthus occidentalis ssp. occidentalis	T5	R1	T5R1
Helonias bullata	G3	R2	G3R2
Heteranthera multiflora	G4	R2	G4R2
Hieracium robinsonii	G3	R3	G3R3
*Hieracium scabrum var. leucocaule**	T1	R1	T1R1
Hierochloe alpina (Anthoxanthum monticola subsp. monticola)	G5	R2	G5R2
Hottonia inflata	G4	R3	G4R3

Taxon	Rounded Global Rank	Regional Rank	Combined Global & Regional Rank
Huperzia selago	G5	R3	G5R3
Huperzia selago var. selago	T5	R3	T5R3
Hydrastis canadensis	G3	R2	G3R2
Hydrocotyle bonariensis	G5	R1	G5R1
Hypericum adpressum	G3	R2	G3R2
Hypericum setosum	G4	R2	G4R2
Ilex coriacea	G5	R1	G5R1
Isoetes acadiensis	G3	R3	G3R3
Isoetes hyemalis	G2	R1	G2R1
Isoetes melanopoda	G5	R1	G5R1
Isoetes piedmontana	G4	R1	G4R1
Isoetes prototypus	G2	R2	G2R2
Isoetes valida	G4	R2	G4R2
Isoetes virginica	G1	R1	G1R1
*Isoetes viridimontana**	G1	R1	G1R1
Isotria medeoloides	G2	R2	G2R2
Iva imbricata	G5	R3	G5R3
Juncus brachycarpus	G4	R2	G4R2
Juncus caesariensis	G2	R2	G2R2
Juncus elliottii	G4	R1	G4R1
Juncus longii	G3	R3	G3R3
Juncus megacephalus	G4	R3	G4R3
Juncus stygius ssp. americanus	T5	R3	T5R3
Juncus subtilis	G4	R2	G4R2
Juncus trifidus	G5	R3	G5R3
Juncus vaseyi	G5	R2	G5R2
Lactuca graminifolia var. graminifolia	T4	R1	T4R1
Lechea maritima var. subcylindrica	T2	R2	T2R2
Leersia hexandra	G5	R1	G5R1
Leucophysalis grandiflora	G4	R1	G4R1
*Liatris scariosa var. novae-angliae**	T3	R3	T3R3
Lilium pyrophilum	G2	R1	G2R1
Linum intercursum	G4	R3	G4R3
Linum sulcatum	G5	R2	G5R2
Lipocarpha maculata	G5	R1	G5R1
Lipocarpha micrantha	G5	R3	G5R3
Listera auriculata	G3	R2	G3R2
Listera australis	G4	R3	G4R3
Litsea aestivalis	G3	R1	G3R1
Lobelia boykinii	G2	R1	G2R1

Taxon	Rounded Global Rank	Regional Rank	Combined Global & Regional Rank
Lobelia elongata	G4	R2	G4R2
Loiseleuria procumbens	G5	R3	G5R3
Lomatogonium rotatum	G5	R2	G5R2
Ludwigia brevipes	G2	R2	G2R2
Ludwigia hirtella	G5	R2	G5R2
Ludwigia pilosa	G5	R1	G5R1
Ludwigia ravenii	G1	R1	G1R1
Luzula confusa	G5	R1	G5R1
Luzula spicata	G5	R3	G5R3
Lycopodium sitchense	G5	R3	G5R3
Lygodium palmatum	G4	R3	G4R3
Malaxis bayardii	G1	R1	G1R1
Malaxis brachypoda	G4	R3	G4R3
Matelea obliqua	G4	R2	G4R2
Melica nitens	G5	R1	G5R1
Micranthes gaspensis	G2	R2	G2R2
Mimosa quadrivalvis var. angustata	T5	R2	T5R2
Mimulus ringens var. colpophilus	T2	R2	T2R2
Minuartia marcescens	G2	R2	G2R2
Minuartia rubella	G5	R3	G5R3
Mitreola petiolata	G5	R1	G5R1
Monotropsis odorata	G3	R1	G3R1
Montia fontana ssp. fontana	T5	R2	T5R2
Muhlenbergia torreyana	G3	R2	G3R2
Najas guadalupensis ssp. muenscheri	T1	R1	T1R1
Narthecium americanum	G2	R2	G2R2
Nuphar lutea ssp. sagittifolia	T2	R2	T2R2
Nymphaea leibergii	G5	R3	G5R3
Nymphoides aquatica	G5	R2	G5R2
Oligoneuron rigidum	G5	R2	G5R2
Oligoneuron rigidum var. glabratum	T4	R1	T4R1
Omalotheca supina	G5	R1	G5R1
Onosmodium virginianum	G4	R2	G4R2
Ophioglossum pusillum	G5	R3	G5R3
Osmanthus americanus	G5	R2	G5R2
Osmorhiza depauperata	G5	R3	G5R3
Oxypolis canbyi	G2	R1	G2R1
Oxyria digyna	G5	R2	G5R2
Oxytropis campestris	G5	R2	G5R2
Oxytropis campestris var. johannensis	T4	R2	T4R2

Taxon	Rounded Global Rank	Regional Rank	Combined Global & Regional Rank
Oxytropis deflexa var. foliolosa	T5	R1	T5R1
Panax quinquefolius	G3	R2	G3R2
Panicum hemitomon	G5	R3	G5R3
Paronychia fastigiata var. nuttallii	T4	R3	T4R3
Paronychia virginica var. virginica	T1	R1	T1R1
Paspalum dissectum	G4	R3	G4R3
*Pedicularis furbishiae**	G1	R1	G1R1
Pedicularis lanceolata	G5	R3	G5R3
Phlox pilosa	G5	R2	G5R2
Phragmites australis ssp. americanus	T5	R3	T5R3
Phyllodoce caerulea	G5	R3	G5R3
Piptatherum canadense	G4	R3	G4R3
Pityopsis falcata	G3	R3	G3R3
Platanthera ciliaris	G5	R2	G5R2
Platanthera flava var. flava	T4	R3	T4R3
Platanthera leucophaea	G2	R1	G2R1
Platanthera orbiculata var. macrophylla	T4	R3	T4R3
Platanthera peramoena	G5	R1	G5R1
Poa laxa ssp. fernaldiana	T3	R2	T3R2
Poa paludigena	G3	R2	G3R2
Poa saltuensis ssp. languida	T3	R3	T3R3
Polemonium vanbruntiae	G3	R3	G3R3
Polygonum glaucum	G3	R3	G3R3
Polygonum raii	G4	R2	G4R2
Polystichum scopulinum	G4	R1	G4R1
Potamogeton hillii	G3	R3	G3R3
Potamogeton ogdenii	G1	R1	G1R1
*Potamogeton pusillus ssp. gemmiparus**	T3	R3	T3R3
Potamogeton strictifolius	G5	R2	G5R2
Potamogeton vaseyi	G4	R3	G4R3
*Potentilla robbinsiana**	G1	R1	G1R1
Prenanthes autumnalis	G4	R3	G4R3
*Prenanthes boottii**	G2	R2	G2R2
Primula mistassinica	G5	R3	G5R3
Pterospora andromedea	G5	R1	G5R1
Ptilimnium nodosum	G2	R1	G2R1
Puccinellia ambigua	G3	R1	G3R1
Puccinellia laurentiana	G3	R2	G3R2
Pycnanthemum clinopodioides	G1	R1	G1R1
Pycnanthemum torrei	G2	R2	G2R2

Taxon	Rounded Global Rank	Regional Rank	Combined Global & Regional Rank
Quercus hemisphaerica	G5	R1	G5R1
Quercus incana	G5	R2	G5R2
Ranunculus allenii	G3	R2	G3R2
Ranunculus ambigens	G4	R3	G4R3
Ranunculus hederaceus	G5	R1	G5R1
Ranunculus lapponicus	G5	R2	G5R2
Rhexia aristosa	G3	R2	G3R2
Rhododendron lapponicum	G5	R2	G5R2
Rhynchospora capillacea	G4	R2	G4R2
Rhynchospora cephalantha var. attenuata	T3	R1	T3R1
Rhynchospora debilis	G4	R1	G4R1
Rhynchospora fascicularis	G5	R1	G5R1
Rhynchospora filifolia	G5	R1	G5R1
Rhynchospora harperi	G4	R1	G4R1
Rhynchospora inundata	G4	R3	G4R3
*Rhynchospora knieskernii**	G2	R2	G2R2
Rhynchospora nitens	G4	R2	G4R2
Rhynchospora oligantha	G4	R2	G4R2
Rhynchospora rariflora	G5	R2	G5R2
Rhynchospora scirpoides	G4	R3	G4R3
Rorippa sessiliflora	G5	R2	G5R2
*Rubus novocaesarius**	G1	R1	G1R1
Rudbeckia fulgida var. fulgida	T4	R3	T4R3
Ruellia strepens	G4	R3	G4R3
Rumex pallidus	G4	R3	G4R3
Rumex persicarioides	G3	R3	G3R3
Sabatia campanulata	G5	R3	G5R3
Sabatia dodecandra var. dodecandra	T4	R2	T4R2
*Sabatia kennedyana**	G3	R3	G3R3
Saccharum coarctatum	G5	R2	G5R2
Sagittaria subulata	G4	R3	G4R3
Sagittaria teres	G3	R3	G3R3
Salix arctophila	G5	R1	G5R1
Salix chlorolepis	G1	R1	G1R1
Salix herbacea	G5	R2	G5R2
Salix planifolia ssp. planifolia	G5	R2	G5R2
Salix uva-ursi	G5	R3	G5R3
Sarracenia flava	G5	R1	G5R1
Saxifraga aizoides	G5	R3	G5R3
Saxifraga cernua	G5	R1	G5R1

Taxon	Rounded Global Rank	Regional Rank	Combined Global & Regional Rank
Saxifraga foliolosa	G4	R1	G4R1
Saxifraga oppositifolia	G5	R2	G5R2
Saxifraga paniculata ssp. neogaea	T5	R2	T5R2
Saxifraga rivularis	G5	R1	G5R1
Schoenoplectus etuberculatus	G3	R1	G3R1
Schoenoplectus heterochaetus	G5	R2	G5R2
Schoenoplectus novae-angliae	G5	R3	G5R3
Schoenoplectus torreyi	G5	R3	G5R3
Schwalbea americana	G2	R2	G2R2
Scirpus ancistrochaetus	G3	R2	G3R2
Scirpus longii	G3	R3	G3R3
Scleria nitida	GNR	R1	GNRR1
Scleria verticillata	G5	R2	G5R2
Sclerolepis uniflora	G4	R3	G4R3
Scutellaria parvula var. missouriensis	T4	R3	T4R3
Selaginella eclipes	G4	R2	G4R2
Sida hermaphrodita	G3	R2	G3R2
Sideroxylon lycioides	G5	R1	G5R1
Solidago cutleri	G4	R2	G4R2
Solidago gracillima	G4	R1	G4R1
Solidago multiradiata	G5	R3	G5R3
Solidago rupestris	G4	R1	G4R1
Solidago simplex var. chlorolepis	T2	R2	T2R2
Solidago simplex var. racemosa	T3	R3	T3R3
Solidago tarda	G4	R3	G4R3
Solidago tortifolia	G4	R1	G4R1
Spermacoce glabra	G4	R1	G4R1
Spiraea septentrionalis	G2	R2	G2R2
*Spiranthes casei var. novaescotiae**	T2	R2	T2R2
Sporobolus heterolepis	G5	R3	G5R3
Stachys eplingii	G5	R2	G5R2
Stachys matthewsii	G1	R1	G1R1
Steinchisma hians	G5	R1	G5R1
Stellaria crassifolia	G5	R2	G5R2
Stellaria crassifolia var. crassifolia	T5	R2	T5R2
Stewartia ovata	G4	R2	G4R2
Stipulicida setacea var. setacea	T4	R1	T4R1
Stuckenia filiformis	G5	R3	G5R3
Stylisma pickeringii var. pickeringii	T3	R1	T3R1
Suaeda rolandii	G1	R1	G1R1

Taxon	Rounded Global Rank	Regional Rank	Combined Global & Regional Rank
Symphyotrichum anticostense	G3	R3	G3R3
Symphyotrichum concolor var. concolor	T5	R1	T5R1
Symphyotrichum depauperatum	G2	R2	G2R2
Symphyotrichum elliotii	G4	R1	G4R1
Symphyotrichum laurentianum	G2	R2	G2R2
Symphyotrichum subulatum var. 2	T2	R2	T2R2
Talinum teretifolium	G4	R3	G4R3
Tanacetum bipinnatum ssp. huronense	T4	R3	T4R3
Taraxacum latilobum	G2	R2	G2R2
Tephrosia spicata	G4	R2	G4R2
Tetragonotheca helianthoides	G5	R1	G5R1
Thalictrum venulosum	G5	R3	G5R3
Tillandsia usneoides	G5	R2	G5R2
Triadenum tubulosum	G4	R2	G4R2
Triantha racemosa	G5	R1	G5R1
Tridens flavus var. chapmanii	T3	R1	T3R1
Triglochin striata	G5	R1	G5R1
Trillium flexipes	G5	R1	G5R1
Trillium pusillum	G3	R3	G3R3
Trillium pusillum var. virginianum	T2	R2	T2R2
Triphora trianthophora var. trianthophora	T3	R3	T3R3
Trollius laxus ssp. laxus	T3	R2	T3R2
Utricularia olivacea	G4	R1	G4R1
Vaccinium boreale	G4	R3	G4R3
Valeriana pauciflora	G4	R2	G4R2
Verbena scabra	G5	R1	G5R1
Veronica catenata	G5	R1	G5R1
Vitis rupestris	G3	R1	G3R1
Vittaria appalachiana	G4	R1	G4R1
Woodsia alpina	G4	R3	G4R3
Woodsia glabella	G5	R3	G5R3
Woodsia oregana ssp. cathcartiana	T5	R1	T5R1
Xyris fimbriata	G5	R2	G5R2
Xyris platylepis	G5	R1	G5R1
Zigadenus elegans	G5	R3	G5R3
Zigadenus elegans ssp. glaucus	T4	R2	T4R2
Zigadenus leimanthoides	G4	R1	G4R1
Zizania aquatica var. brevis	T3	R3	T3R3

Appendix 2

Vascular plant taxa determined to be high conservation priority but regionally ranked as historical (H) or extirpated (X) for the North Atlantic LCC. Regional, Global, and combined Global-Regional ranks are included. Rank definitions are found in Table 1 or at explorer.natureserve.org.

Taxon	Rounded Global Rank	Regional Rank	Combined Global & Regional Rank
Astragalus distortus	G5	RH	G5RH
Botrychium mormo	G3	RH	G3RH
Carphephorus bellidifolius	G4	RH	G4RH
Carphephorus tomentosus	G4	RH	G4RH
Cirsium carolinianum	G5	RH	G5RH
Coreopsis linifolia	G4	RH	G4RH
Crataegus schizophylla	G1	RH	G1RH
Cypripedium candidum	G4	RH	G4RH
Didiplis diandra	G5	RH	G5RH
Eleocharis brittonii	G4	RH	G4RH
Listera borealis	G4	RH	G4RH
Lithospermum caroliniense	G4	RH	G4RH
Lysimachia quadriflora	G5	RX	G5RX
Matelea decipiens	G5	RH	G5RH
Rhexia petiolata	G5	RH	G5RH
Scleria ciliata var. ciliata	TNR	RH	TNRRH
Spiranthes magnicamporum	G3	RH	G3RH
Thalictrum macrostylum	G3	RH	G3RH
Xyris difformis var. curtissii	T5	RH	T5RH
Zigadenus glaberrimus	G5	RH	G5RH
Zornia bracteata	G5	RH	G5RH

Appendix 3

Vascular plant taxa likely to be high conservation priority but currently unrankable (U) for the North Atlantic LCC. Regional, Global, and combined Global-Regional ranks are included. Rank definitions are found in Table 1 or at explorer.natureserve.org.

Taxon	Rounded Global Rank	Regional Rank	Combined Global & Regional Rank
Amelanchier sanguinea var. gaspensis	T4	RU	T4RU
Anagallis minima	G5	RU	G5RU
Asclepias longifolia	G4	RU	G4RU
Betula pumila var. renifolia	T4	RU	T4RU
Botrychium oneidense	G4	RU	G4RU
Botrychium simplex var. simplex	T3	RU	T3RU
Botrychium simplex var. tenebrosum	T4	RU	T4RU
Cardamine pratensis var. palustris	T5	RU	G5RU
Carex lupuliformis	G4	RU	G4RU
Carex rostrata	G5	RU	G5RU
Cirsium altissimum	G5	RU	G5RU
Corallorhiza maculata var. occidentalis	T4	RU	T4RU
Crataegus biltmoreana	G5	RU	G5RU
Crataegus irrasa var. blanchardii	TNR	RU	TNRRU
Crataegus jesupii	G4	RU	G4RU
Crataegus jonesiae	G4	RU	G4RU
Crataegus macracantha	G5	RU	G5RU
Crataegus pennsylvanica	G3	RU	G3RU
Crataegus populnea	G5	RU	G5RU
Crataegus suborbiculata	G3	RU	G3RU
Ctenium aromaticum	G5	RU	G5RU
Digitaria serotina	G5	RU	G5RU
Draba glabella	G5	RU	G5RU
Drosera rotundifolia var. comosa	TNR	RU	TNRRU
Echinodorus tenellus	G5	RU	G5RU
Elatine americana	G4	RU	G4RU
Eleocharis aestuum	G3	RU	G3RU
Elymus glabriflorus var. australis	TNR	RU	GNRRU
Elymus glabriflorus var. glabriflorus	TNR	RU	GNRRU
Festuca brachyphylla (F. brachyphylla ssp. brachyphylla)	G5	RU	G5RU
Hieracium kalmii var. fasciculatum	T4	RU	T4RU
Hieracium kalmii var. kalmii	T5	RU	T5RU
Isoetes appalachiana	G4	RU	G4RU
Juglans cinerea	G4	RU	G4RU

Taxon	Rounded Global Rank	Regional Rank	Combined Global & Regional Rank
Lachnocaulon anceps	G5	RU	G5RU
Ludwigia polycarpa	G4	RU	G4RU
Malus angustifolia var. puberula	T3	RU	T3RU
Mimulus moschatus	G5	RU	G5RU
Osmunda cinnamomea var. glandulosa	TNR	RU	TNRRU
Phlox pilosa ssp. pilosa	T5	RU	T5RU
Platanthera integra	G3	RU	G3RU
Poa pratensis ssp. agassizensis	TNR	RU	TNRRU
Poa pratensis ssp. alpigena	T5	RU	T5RU
Pseudognaphalium helleri	G4	RU	G4RU
Ranunculus laxicaulis	G5	RU	G5RU
Rhinanthus minor ssp. groenlandicus	T5	RU	T5RU
Rubus hypolasius	G1	RU	G1RU
Rubus originalis	G3	RU	G3RU
Rumex aquaticus var. fenestratus	T5	RU	T5RU
Scutellaria parvula	G4	RU	G4RU
Scutellaria saxatilis	G3	RU	G3RU
Silene nivea	G4	RU	G4RU
Solidago simplex	G5	RU	G5RU
Solidago simplex var. randii	T4	RU	T4RU
Stachys tenuifolia (exlcluding var. hispida)	GNR	RU	GNRRU
Symphyotrichum novi-belgii var. crenifolium	TNR	RU	TNRRU
Trichostema setaceum	G5	RU	G5RU
Valerianella chenopodiifolia	G4	RU	G4RU
Veronica wormskjoldii	G5	RU	G5RU
Vicia americana ssp. americana	T5	RU	T5RU
Viola brittoniana var. pectinata	T3	RU	T3RU
Wisteria frutescens	G5	RU	G5RU
Zigadenus densus	G5	RU	G5RU