

Native Plant

FALL/WINTER 2015

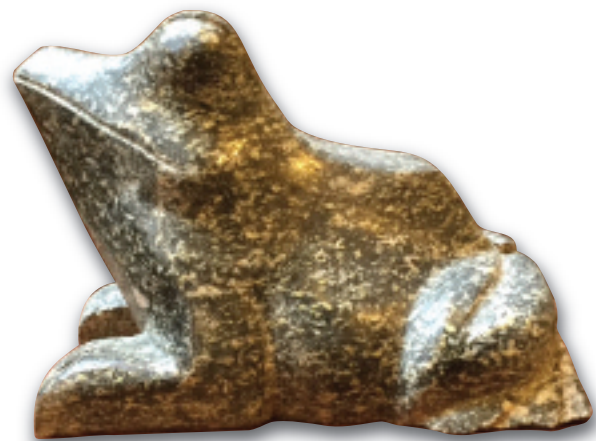
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Native Plant News

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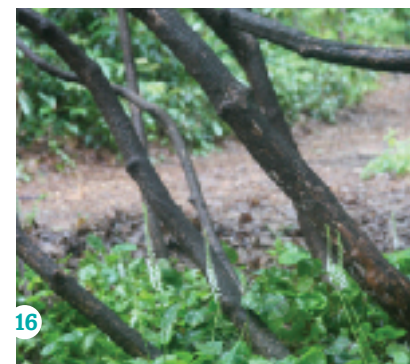
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From the Executive Director



“TILL AND KEEP” THE GARDEN OF THE WORLD

As Thanksgiving nears, we should count our conservation blessings. The headline news came this summer in the form of a papal encyclical on the environment, in which Pope Francis urges both personal and political action to save a planet that “groans in travail” and exhibits “symptoms of sickness...in the soil, in the water, in the air and in all forms of life.” In a heartfelt plea to “hear the cry” of the earth, he reminds us that stewardship is both a moral issue and one of self-preservation, and we must therefore develop in our policies and practices an “integral ecology” that resets “the relationship existing between nature and the society that lives in it.”

One could argue that President Obama's national pollinator strategy, unveiled in May, is a big step forward, as it creates a multifaceted, cross-agency approach to restoring landscapes and improving habitat for pollinators. Central to the long-term success of the program is the “National Seed Strategy for Rehabilitation and Restoration,” published in August, which aims to build a national network of native seed collectors, seed storage facilities, and nurseries to supply local native plants for projects responding to “large-scale disturbances and other stressors that threaten important plant communities and the ecosystem services they provide on Federal, state, local, and private land.” The Society is one of a dozen organizations named as key non-federal partners in implementing the national plan. The next step, of course, is funding the initiative.

The Plant Conservation Alliance, which developed the seed strategy and of which the Society is a member, has proposed legislation to move the vision of landscape-scale restoration to reality. In the coming months, we will join our colleagues in asking Congress to pass “The Botanical Sciences and Native Plant Research, Restoration and Promotion Act,” which aims to establish the necessary pipeline of trained botanists “who know how to put the right seed in the right place at the right time” as well as the regulations and budget authorization to enable federal agencies to conduct research on, develop, and use native plant material in key projects.

These are all “wins” for plant conservation in 2015, for which we give thanks.

Sincerely,

Debbi Edelstein

Contents

- 2 **BREAKING NEWS**
Small foundation makes big move to save imperiled plants
- 3-5 **IN BRIEF**
From symposium insights to the summit of Cadillac Mountain, growing beetles, and highlights from the field
- 6-17 **FEATURES**
 - 6 *What Is “Managed Relocation”?*
By Jesse Bellemare, *Smith College*
 - 14 *Reviving the Curtis Woodland Garden*
By Mark Richardson, *Director of Horticulture*
- 18-28 **ANNUAL REPORT 2014**
Celebrating your support, financial report, and recent events
- BACK COVER **BOTRYCHIUM SPATHULATUM**



On the cover: A proposal to move the endangered conifer *Florida torreya* (*Torreya taxifolia*) outside its small native range in the Florida panhandle has sparked a decade-long scientific debate about “managed relocation” or “assisted migration.” (Photo by ©Julie Tew)



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SMALL FOUNDATION MAKES BIG MOVE TO SAVE IMPERILED PLANTS



Potentilla robbinsiana



Astragalus robbinsii var. jesupii



Agalinis acuta

In an extraordinary move, the Hope Goddard Iselin Foundation of Rhode Island has pledged nearly its entire annual grant funding over the next five years to New England Wild Flower Society for its initiative to collect and permanently store the seeds of imperiled plants.

The foundation made its \$500,000 commitment to challenge other foundations and individuals to invest in this critically important conservation effort. With a total of \$5 million, the Society aims to bank seeds of all of New England's globally and regionally rare plants by 2020, which is the target date established by the worldwide Convention on Biological Diversity in its Global Strategy for Plant Conservation [see box]. With threats to our native plants accelerating, and a changing climate creating even more stress on imperiled species, we need to dramatically increase the pace of seed collection.

Today, 17 percent of New England's native plant species are on the brink of being lost—and another 5 percent have already disappeared from the region. Seed banking is one key strategy for conserving at-risk plant species. The Society aims to collect and preserve seeds of the 387 globally and regionally rare species in New England, 10 of which occur nowhere else in the world. The goal includes securing seeds from at least 2,000 of the 3,300 populations of these rare plants, which will preserve the range of genetic diversity and each species' ability to adapt to changing conditions. The project entails obtaining landowner permission and federal and state permits;

collecting, cataloguing, and processing the seed; storing the seeds in perpetuity; and testing the seed for viability at regular intervals.

Why Saving Plants Matters

Native plants are the foundation of ecosystems and provide the basic functions and structure on which all life—and the food chain that leads to our own dinner tables—depends. The loss of a single plant species can disrupt an intricate web supporting myriad plants and animals. In New England, rare plant species have lost, on average, 67 percent of their known range and face a combination of 5 threats, from invasive species to habitat conversion to climate change. While the ultimate goal is to conserve plants in functioning ecosystems, seed banking is a critical form of insurance, as it preserves the genetic material for possible restoration or reintroduction of lost species.

For example, using material from our seed bank, the Society propagated the endangered Robbins' cinquefoil (*Potentilla robbinsiana*) to augment existing populations within the historic range on Mt. Washington in New Hampshire. As a result, the species met federal recovery objectives and became the first—and still the only—plant removed from the Endangered Species List. The Society has also developed germination protocols for and tested restoration methods to augment populations of the endangered Jesup's milk vetch (*Astragalus robbinsii* var. *jesupii*), which is found in only three places in the world, all on a 16-mile stretch of the Connecticut River. In addition, the Society was able to use banked seed to successfully create new and large populations of the endangered Sandplain gerardia (*Agalinis acuta*) in Massachusetts. This species' range had been limited to several cemeteries in the Commonwealth, an irony that was not lost on the conservation community. 🌱

To help us meet the challenge, please contact the Philanthropy Department at development@newenglandwild.org, call 508-877-7630 x 3802, or go to the campaign page at www.newenglandwild.org/support/seedark.

Global Strategy for Plant Conservation 2011-20

All the nations of the world, with the exception of the United States and the Vatican, are partners in the Convention on Biological Diversity, which since 2002 has included the Global Strategy for Plant Conservation. The GSPC "seeks to halt the continuing loss of plant diversity" and has a clear purpose:

"Our vision is of a positive, sustainable future where human activities support the diversity of plant life (including the endurance of plant genetic diversity, survival of plant species and communities and their associated habitats and ecological associations), and where in turn the diversity of plants support

and improve our livelihoods and well-being." The GSPC has sixteen primary targets and focuses on countrywide plans for achieving them. In New England, the Society initiated programs long ago that presaged the targets, and we're proud to have accomplished some of the key goals on a regional level in

recent years, such as the launch of Go Botany; publication of the "State of the Plants" report and the 2012 *Flora Conservanda*, which is the updated status report on all rare plants; and ongoing partnerships and education programs focused on plant conservation.

Insights from the "Climate Change and the Future of Plant Life" Symposium

On March 26, 150 people from throughout New England as well as from Delaware, New York, and Pennsylvania gathered in Cambridge, MA, to hear five noted botanists and ecologists discuss how plants might respond to the predicted changes in temperature, precipitation, and sea-level rise from a warming climate. Speakers examined the state of New England's plants; the historical patterns and current evidence of climate-induced adaptation, migration, and loss; and strategies for conserving and managing plant species and natural communities in the face of multiple threats and climate change.



Umbrella magnolia (*M. tripetala*)

Here are some key insights:

- » Humans and most other animals are almost entirely dependent on plants, directly or indirectly, through a highly complex system of interactions. The loss of a single plant species can affect the fates of many other species in ways that are difficult to predict.
- » Botanists are documenting evidence of climate change on the ground: in New England, alpine species have moved upslope, bloom time for some species is much earlier, and a few southern species—like umbrella magnolia (*M. tripetala*), which has existed in New England gardens since the 1800s—have recently naturalized in the wild in multiple locations, suggesting climate conditions are now suitable for self-sustaining populations.
- » Many botanists and ecologists make the case for no major interventions; rather, we should let systems respond and recover on their own.
- » Deciding what to do is a social issue, with ethical and legal dimensions; deciding how to do it is a scientific issue.
- » There is no technological or economic reason why any plant species should become extinct. We have the ability to protect and manage plant habitats and to bank seeds for future research or reintroduction. But we need the will to do so.
- » You can take action to protect New England's native plants in your daily life, in your community, and at the state and national level; see our "State of the Plants" report at www.newenglandwild.org/stateofplants.
- » Plant-based solutions are required to address all of the major environmental challenges: food security, water scarcity, energy, human health, biodiversity conservation, and climate change. Much of the plant diversity for food, including underused species and wild relatives of crops, still needs to be protected or secured.
- » Since the last glaciation, some plant species have moved a long way and others have stayed put. Factors affecting a species' distribution and risk of extinction under a new climate regime include the range of conditions it can tolerate, its inherent ability to adapt to changing conditions, natural and manmade barriers to its dispersal, and loss of habitat.
- » To protect biological diversity and avert extinctions, we must use the full set of conservation tools: bank seeds; restore degraded sites and specific plant populations and communities; and protect land, by setting priorities using factors like size, connectivity, and diversity of landforms and microclimates.
- » Today, only 69 percent of New England's plants are native to the region; of those, 22 percent are rare, endangered, or historic (not seen in the region for more than 20 years). Worldwide, 20 percent of plant species are currently threatened with extinction. Scientists believe 15-37 percent of all species on the planet are on a path to extinction by 2050.
- » More controversial are emerging management strategies: managed stasis, which is protecting species by modifying biotic or abiotic conditions (like planting trees to cool a stream); managed relocation or migration, which is moving plant species outside their current or historic range; and managed evolution, which is modifying the genetic properties of plant populations by introducing genes from another population growing in different conditions.
- » Our behavior—development, introducing pests, salvage logging—has had and may continue to have more effect on nature and plant communities than impending climate change. We need to reverse or mitigate the multiple manmade threats and stresses to increase the ability of plants and communities to adapt and survive.

The symposium presentations are available on YouTube! www.youtube.com/user/newenglandwild

Restoring Cadillac Mountain in Maine's Acadia National Park

This summer, we begin a three-year project for the National Park Service (NPS) to help in the development and implementation of a long-term management plan for the summit of Cadillac Mountain in Maine's Acadia National Park. The NPS notes that with 80 years of high visitation, including extensive off-trail exploration by visitors, "the summit area has sustained substantial loss of soil and vegetation" and "several rare plants that inhabit the mountaintop may be threatened."

Our work has two parts: inventory and restoration. Given that there is not currently adequate baseline data about the plants on the summit, we will survey both the rare and common vascular plants to establish the ecological community framework for future restoration.

In the second phase, we will collect seed, propagate plants, and experiment with techniques for restoring plants and creating functioning, resilient communities. The project is funded by the National Park Service and Friends of Acadia. 🌱



Top: Small area adjacent to parking lot on Cadillac Mountain after planting in 2006. Bottom: Same area in 2015. As evidence of the plant community's fragile nature, little to no natural revegetation has occurred despite the installation of an enclosure.

Photo courtesy of National Park Service

Amanda Weise © New England Wild Flower Society



Dr. Paul Smith Awarded Founders' Medal

At a gala dinner in Cambridge on March 26, the Society presented its inaugural Founders' Medal to Dr. Paul Smith for his exceptional achievements as Head of the Millennium Seed Bank (MSB) and Seed Conservation Department, Royal Botanic Gardens, Kew. The evening was co-sponsored by the British Consulate-General Boston.

Dr. Smith, now the Secretary General of Botanic Gardens Conservation International, was the head of the MSB from 2005 to 2014. The MSB aims to conserve seed from all plant species as insurance against the risk of extinction in their native habitats and for research, forest and habitat restoration, food security, and sustainable livelihoods. Under Dr. Smith's leadership, the MSB conserved seeds from more than 25,000 plant species, achieved the first milestone of securing seed from 10 percent of the world's plants, and was on track to bank seeds of 25 percent of the world's flora by 2020. During his tenure, the MSB expanded the partnership network to 170 institutions in 80 countries; trained 2,000 seed biologists around the world; and established important initiatives to adapt agriculture to climate change and to increase the capacity of local communities, primarily in Africa, to conserve their natural resources and to store, propagate, and sustainably grow plant species to meet human needs. 🌱

Pictured above: Debbi Edelstein, the Society's Executive Director; Jacqueline Greenlaw, Vice Consul, British Consulate-General Boston; and Paul Smith (Photo by TMP Images)

Growing Beetles to Manage Purple Loosestrife

For a second year, the Society raised insects for a Mass Audubon project to manage invasive purple loosestrife (*Lythrum salicaria*) in the Sudbury River watershed. Last year, we successfully raised approximately 50,000 *Galerucella* beetles, which are a USDA-approved biological control for purple loosestrife that, according to well-documented studies, does not have unwanted ecological side effects. This season, our target was 150,000 beetles.

Raising the beetles is fairly straightforward and, ironically, involves growing its only food and habitat source, purple loosestrife—which we had to collect, with

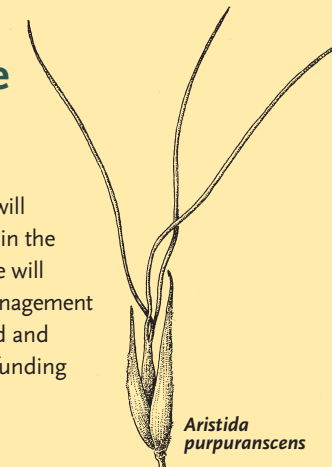
permission, from the wild. Members of the Horticulture staff grew this year's crop in controlled conditions at Garden in the Woods. Since purple loosestrife is a wetland species, the plants grew in pots placed in flooded stock beds. In late May, beetles from the New Jersey Department of Agriculture's insect-rearing laboratory were released onto the plants, which were then enclosed in nylon mesh bags to keep the beetles from escaping. Each of the 150 plants received 10 beetles, which bred and produced roughly 1,000 offspring during the early summer months. The beetles were released into the wild in late summer. Our work is funded by Mass Audubon through a resource damages settlement against Nyanza chemical company for mercury and other toxic pollution in the Sudbury River between 1917 and 1978. 🌱



Staff and interns wrap purple loosestrife in netting to ensure the beetles stay on the plants and breed

Monitoring Rare Plants in the Westfield River Watershed

A \$15,000 grant from the Beveridge Family Foundation will enable the Society to monitor 60 rare plant populations in the Westfield River watershed of western Massachusetts. We will collect seed from ten of the populations and undertake management for three of the surveyed populations. The Westfield Wild and Scenic Committee contributed an additional \$8,000 of funding to support our ongoing efforts. 🌱



Aristida purpurascens

HIGHLIGHTS FROM THE 2014 FIELD SEASON

Staff, interns, New England Plant Conservation Program members, and our Plant Conservation Volunteers spent 3,000 hours in 2014 performing conservation actions throughout the region. Below are highlights from three states.

- An inventory of 200 acres of conservation land surrounding the headwaters of a brook in Hillsborough County, NH, identified 330 species from 79 families, including 10 species previously undocumented in the county and 5 unconfirmed species believed to be rare in the state. The town will use the data to protect important plant resources.
- Staff and PCVs made another important discovery in NH. While walking along a logging road, former PCV Coordinator John Burns noticed an unusual Indian cucumber. When the group found seed pods, he was able to identify it as a small-whorled pogonia (*Isotria medeoloides*), a federally listed endangered orchid species. The group documented a previously unknown population of 11 plants.
- A rare plant survey in pitch pine-scrub oak habitat in Charlestown, RI, for the US Fish and Wildlife Service documented two rare species. A follow-up survey and report to be completed in 2015 will guide the management of this fire-dependent community.
- In MA, we are in the fifth year of managing invasive plants threatening the largest population in New England of the rare coast violet (*Viola brittoniana*). What once was two acres of six-foot-tall glossy buckthorn (*Frangula alnus*) is now a more open area of mostly native plants, with 2,000 violets. Our strategies have moved from applying herbicide to woody plant stems, to grappling with the wave of glossy buckthorn seedlings that sprouted due to the increased light, to removing mature trees around the periphery, which are now the main source of buckthorn seed.

WORK IN PROGRESS

- Developing an invasive species management and native species restoration plan for the waterfront area on a college campus
- Updating a town's "Best Management Practices" guide for wetland mitigation and for creating better functioning manmade wetlands
- Creating a restoration plan for a wet meadow owned by a land trust
- Relocating and augmenting a population of winged monkey-flower (*Mimulus alatus*) along a river
- For the fifth year, working to control the non-native, invasive broad-leaved pepperweed (*Lepidium latifolium*), which is threatening coastal marshes in the Northeast and is the target of federal and state early detection initiatives 🌱

What is “Managed Relocation” and Will It Have a Place in our Conservation Toolbox?

Jesse Bellemare, Assistant Professor, Department of Biological Sciences, Smith College, Northampton, MA

Along with habitat destruction and invasive species, rapid climate change is predicted to be one of the top threats to biodiversity in this century.

Indeed, some studies have estimated that from many hundreds of thousands to more than a million species might be at risk of extinction due to climate change. In these studies, one crucial factor linked to extinction risk has been dispersal ability. This is because species that are slow to disperse will likely see suitable climatic conditions shift poleward faster than the species can migrate to keep up with their required

habitat. Regions that support species survival today will likely experience new climatic conditions in the future that

might become unsuitable for continued survival and reproduction. This will result in population declines or the outright loss of some species from their current native ranges. If these species are incapable of dispersing and establishing new populations in new areas, they are predicted to slip toward extinction. Although there is some possibility that species might be able to stay in place and adapt to new climate conditions, it appears that the response of most species to past episodes of major climate change, such as during the Ice Ages, has been migration to follow their favored climatic niche. Further, the high rate of modern climate change is likely to outstrip the speed at which most plants, particularly slow-growing perennials, could conceivably evolve to tolerate new conditions. As such, dispersal and geographic range shifts to new areas will likely be a crucial step for enabling at-risk plant species to survive a warming climate.

Given the pivotal role of species' dispersal ability in avoiding climate-triggered extinctions, some ecologists and conservation biologists have proposed that humans might directly intervene to “assist” poorly

Photo: *Diphylleia cymosa* (umbrella-leaf), Dan Jaffe ©2015 New England Wild Flower Society

dispersing species in tracking their required habitats as they shift poleward in coming decades. In other words, if the decisive factor for avoiding the extinction of climate-threatened species will be their ability to disperse to new areas of suitable habitat as climate changes, might there be some role for conservationists in facilitating this crucial step?

This new conservation strategy has variously been called “assisted migration,” “assisted colonization,” or “managed relocation.” Most strikingly, and controversially, this approach would involve moving climate-threatened species beyond their native ranges into regions where they have not occurred historically, but where they are predicted to survive in the

This approach would involve moving climate-threatened species beyond their native ranges into regions where they have not occurred historically, but where they are predicted to survive in the future.



future. Not surprisingly, this new strategy of “managed relocation,” although still largely theoretical, has run headlong into several decades of conservation focus on the threats of exotic species and biological invasions! Critics of managed relocation have cited several significant concerns, including the risk that some relocated species might become invasive where they are introduced. Others have argued that this conservation approach might undermine important efforts to fight climate change and protect rare species in their native habitats. Even so, as the rate and magnitude of climate change becomes clearer, it appears that an increasing number of biologists, conservationists, and land managers are taking the possibility of managed relocation seriously and beginning to consider how this new strategy might fit into the conservation toolkit of the 21st century, alongside more traditional approaches such as habitat preservation, passive dispersal corridors, and *ex situ* conservation in botanical gardens or seed banks.

PLANTS AND THE MANAGED RELOCATION DEBATE

Plant species have played a central role in both triggering and illustrating the debate surrounding managed relocation. Indeed, much of the current discussion was sparked by a 2004 article in *Wild Earth* in which Connie Barlow and Paul Martin proposed “assisted migration” to establish new populations of the endangered conifer Florida torreya (*Torreya taxifolia*, figure 1) outside its small native range in the Florida panhandle. These researchers noted that torreya was in severe decline in its few remaining populations in the wild due to attack by a new pathogen, possibly combined with climate change and other environmental stresses. However, the Florida torreya survives, and even thrives, when planted in areas to the north of its native range at cooler, higher-elevation sites in the southern Appalachian Mountains.

The radical proposal to establish naturalized populations of torreya in these areas outside its native range

Figure 1. The endangered conifer Florida torreya (*Torreya taxifolia*) in seed at the Biltmore Estate Gardens in Asheville, North Carolina, more than 500 kilometers north of the species’ native range on the Florida Panhandle. Florida torreya appears to perform quite well in the cooler climate of the Southern Appalachian Mountains. In contrast, surviving trees in the native range in Florida are no longer reproducing, likely due to disease and other environmental stresses. (Photo courtesy of Connie Barlow and TorreyaGuardians.org)

was inspired in part by my Smith College colleague Rob Nicholson, who wrote in a 1990 *Natural History* magazine piece on the decline of torreya that an artificial refugium might be established in the southern Appalachians to ensure the continued survival and evolution of the species in the wild. The fossil record has produced evidence of torreya in North Carolina in earlier geologic periods, showing that its natural range has indeed extended elsewhere in the past. Given the negative trends in the present-day wild populations of Florida torreya, it is possible that naturalized plantings outside the native range and in botanic garden collections might be the only place where the species survives in the future. Barlow and Martin argued that ensuring the species survival in the wild, even if beyond its historical range boundaries, should be a top priority. However, alongside this provocative piece, conservation biologist and long-time torreya researcher Mark Schwartz responded with an article contending that “conservationists should not move *Torreya taxifolia*,” citing invasion risks and the need to invest in conserving species within their current native ranges. Even now, 10 years later, the contours of the scientific and ethical debate sketched out by these well-intentioned authors continues.

WHAT PLANT SPECIES MIGHT BE CANDIDATES FOR MANAGED RELOCATION?

Florida torreya is typical of the plant species that are often cited as likely candidates for managed relocation. Small-ranged or “endemic” species, like torreya, are thought to be at greatest immediate risk from climate change, for two reasons: their small geographic ranges suggest that they might have limited dispersal ability – in that they have not spread widely in the past – and climate conditions could change rapidly across the whole of their small native ranges, exposing them to entirely new conditions in a short period of time. In contrast, species with larger geographic ranges have, to some extent, already demonstrated substantial dispersal ability by expanding over a large area in the past. More importantly, it is likely that some portions of their ranges will remain climatically-suitable into the future, even if other portions are compromised. For example, while the southern margins of a widespread plant species’ range might decline in the eastern U.S., it is likely that more northern areas would remain suitable for many decades or centuries to come. This type of retreat-without-migration scenario would not be an option for a small-ranged endemic species restricted to just a few counties in its native distribution.

Our Take on Managed Relocation

The Society’s regional collaboration, the New England Plant Conservation Program (NEPCoP), discussed managed relocation at a recent Regional Advisory Council meeting. Jesse Bellemare of Smith College gave an overview of the issues and presented some of his research on transplanting species beyond their historic ranges. John O’Leary of MA Division of Fisheries and Wildlife discussed the adaptive capacity of organisms and suggested that plants and animals may adapt in unknown ways at their current locations rather than shifting their ranges as predicted by various climate models.

The topic of managed relocation is controversial, but members of the Council agreed that the organizations and agencies represented in NEPCoP need to develop guidelines for New England. The Council is hoping to avoid ad hoc translocations of rare species in our region and made the following decisions:

- Managed relocation is a tool that should be considered part of overall strategies to conserve plants in the region, and its use should be guided by the best science available.
- New England endemic (or near-endemic) taxa in habitats that are considered vulnerable to climate change should be researched as potential targets for managed relocation. These are:
 - Astragalus robbinsii* var. *jesupii* (NH, VT)
 - Carex oronensis* (ME)
 - Carex waponahkikensis* (C. scoparia var. tessellata) (ME)
 - Crataegus bicknellii* (MA)
 - Crataegus schizophylla* (MA)
 - Eleocharis diandra* (MA, NH, NY, VT, ONT Canada)
 - Eupatorium novae-angliae* (MA, RI)
 - Geum peckii* (NH, NB Canada)
 - Nabalus boottii* (ME, NH, NY)
 - Pedicularis furbishiae* (ME, NB Canada)
 - Potamogeton gemmiparus* (CT, MA, ME, NH, RI)
 - Potamogeton ogdenii* (MA, NY, ONT Canada)
 - Potentialla robbinsiana* (NH)
- Botanists may propose managed relocation of rare species from areas south of New England into our region. We need guidelines before receiving these transplants and need to investigate any such plans for relocation. 🌱

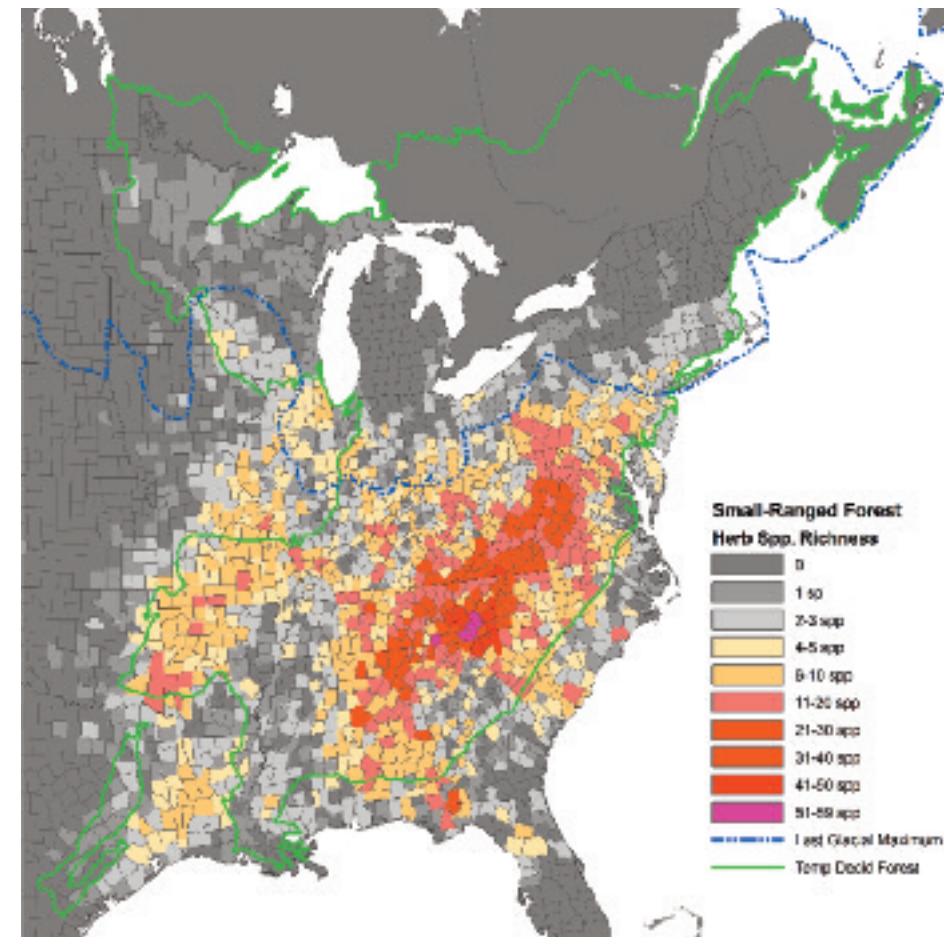


Figure 2. The richness of small-ranged endemic forest herbs by county in the eastern United States, with the outline of the temperate deciduous forest biome highlighted in green. This biogeographic analysis shows that the diversity of small-ranged forest herbs is highly concentrated in the southeastern U.S., while very few small-ranged species have distributions extending into the upper Midwest or Northeast. In particular, a substantial drop-off in diversity was detected near the last glacial maximum (blue dotted line), the southern boundary of the peak ice sheets of the last ice age about 18,000 years ago. The persistence of this diversity pattern over thousands of years suggests that these small-ranged plant species have limited dispersal ability and were strongly affected by past climate change, characteristics that might place them at high risk with modern climate change. (Based on an analysis presented in a contributed chapter by Jesse Bellemare and David Moeller in the book *The Herbaceous Layer in Forests of Eastern North America*, 2nd edition, Oxford University Press, 2014.)

In my lab at Smith College, we have been investigating the distribution of small-ranged plant species native to the eastern deciduous forests to gain insight into where at-risk species might be concentrated. Consistent with the prediction that small-ranged species might also be dispersal-limited species, we've found that almost all endemic forest plant species are concentrated in the Southeast U.S., with a pronounced drop-off in diversity near the southernmost boundary of the last continental ice sheet about 18,000 years ago (figure 2). Surprisingly, many of these southern endemic species are grown in horticulture far to the north of their native ranges in botanical gardens like Smith College, Garden in the Woods, and the Arnold Arboretum (figures 3A, 3B). This suggests that climatically-suitable habitat might already exist to the north of these species' small native ranges in the Southeast. Overall, these patterns suggest that some plant species have exhibited little potential for northward migration, even given thousands of years since the last ice age. Unfortunately, while these small-ranged species would probably be well-positioned in the Southeast to survive the climatic *cooling* of another ice age, the current trend toward rapid climatic *warming* seems to place many on the wrong side of climate history. It is among this set of species that climate change might pose an immediate threat and where unconventional conservation approaches, like managed relocation, might be necessary to avoid extinctions.

WHAT IS THE INVASION RISK FROM MANAGED RELOCATION?

The top concern for most biologists and land managers is the possibility that some species moved to new regions via managed relocation might be *too successful* in their new homes – that they might become the next wave of problematic invasives. Despite years of research on exotic species management and invasion biology, it is still challenging to predict invasion potential in plants, so the possibility of invasiveness among translocated species is hard to rule out, even with screening efforts. Citing the precautionary principle, this has led some biologists to argue against taking any management actions that could inadvertently trigger harmful biological invasions.

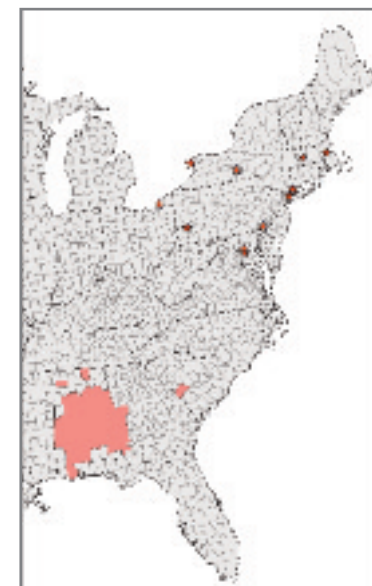
However, ecological data are emerging to suggest that the types of *within*-continent movements proposed for managed relocation efforts might not be as risky as they would first appear. In particular, most problematic invasive plants have been introduced from other continents; only a small proportion of plant species consid-

ered exotic invasives somewhere in the continental U.S. are native to other parts of the U.S. A fascinating 2012 study by Dan Simberloff and colleagues documenting this phenomenon was titled “the natives are restless, but not often and mostly when disturbed,” referring to the observation that the few cases where native plants have been considered problematic usually occur in places where human disturbances have already altered natural ecosystems, such as through fire suppression or overgrazing. Overall, they found that exotic species from other continents were about 40 times more likely to be considered invasive compared to U.S. native species introduced elsewhere in the country. This finding suggests that invasion risk from native species is probably modest and, relative to the permanent loss of species due to extinction, might be an acceptable risk to consider.

The reasons that native plant species are less prone to invasive behavior are not fully known; however, several interesting hypotheses have been proposed. First, plant species living within a broad geographic area or biome, such as the eastern deciduous forests, likely have a shared ecological and evolutionary history spanning millions of years, even if they do not occur together across the entire region today. This suggests some level of co-evolution within ecological communities that might constrain many native species from becoming too successful or invasive. Similarly, within a broad geographic region, the natural enemies that have co-evolved with native plant species (insects, pathogens, etc.) might regulate population growth. In contrast, plant species introduced from other continents often leave behind their natural enemies and can exhibit more rampant population growth. Second, within a broad geographic region, it is likely that most species prone to rapid spread and population growth have already done so – thousands of years ago. These ancient “invaders” are the common, widespread plant species that we see all around us today in the post-glacial forests of the Northeast. Indeed, the post-glacial period might even be viewed as a “trial run” on species’ potentials for invasiveness, and it appears that many of the small-ranged endemic species concentrated in the Southeast are among those least likely to spread rapidly.

WHAT ABOUT EX SITU CONSERVATION IN SEED BANKS AND BOTANICAL GARDENS?

Given persistent concerns about the potential for invasiveness with managed relocation, why should we risk releasing non-native plant species into the wild?



Figures 3A-3B. Bottlebrush buckeye (*Aesculus parviflora*) is a striking example of a forest plant endemic to the southeastern U.S., but grown widely in horticulture outside its native range, including areas far to the north. This map indicates the native range of bottlebrush buckeye centered in Alabama and nearby states (pink), as well as botanical gardens where the species is grown outside its range (red stars), including the Smith College Botanic Garden and Arnold Arboretum. Research in my lab at Smith College in 2012-13 found that bottlebrush buckeye produced viable seeds at both locations in Massachusetts, despite very different climatic conditions than seen within the species’ native range in the south. (Photo courtesy of J. Bellemare. Native range drawn from the Biota of North America Program’s North American Plant Atlas (www.bonap.org); horticultural sites from BG-BASE (www.bg-base.com).)

It might seem that preservation of genetic material in seed banks and as representative individuals in botanical gardens would be much safer. However, one of the key goals of managed relocation would be to maintain species as wild, ecologically and evolutionarily dynamic entities—in other words, enabling these threatened species to adapt and evolve in a new region, maintain ecological interactions with other wild species, and maybe even buy some additional time to adapt to changing climate. Proponents of managed relocation argue that it is not sufficient to simply preserve threatened species as static entities “on ice” in a seed bank, or as small sets of individuals under artificial conditions in a garden setting. Although these *ex situ* options

The broad climatic, geologic, and vegetational similarities between portions of the Southeast and Northeast suggests that northward managed relocation efforts might be practicable for many at-risk species. And, given that most of the present-day flora in the formerly glaciated Northeast migrated into the region from the south, these regions already share a common biological and biogeographic history, potentially lessening threats of unexpected and negative ecological interactions.

certainly play a critical role in many plant conservation efforts, they cannot substitute for wild, self-sustaining populations, particularly when the timescales involved with modern climate change extend over many centuries and it might never be possible to reintroduce threatened species to their former native ranges due to permanently altered climate.

**MANAGED RELOCATION:
THE VIEW FROM NEW ENGLAND**

It is likely that the first experience New England botanists and plant enthusiasts will have with managed relocation efforts will come in the form of “climate refugees” from the south. Because of New England’s severe and recent glacial history, the region

is home to relatively few small-ranged endemic species, although some alpine and coastal habitats deserve mention. As such, most candidates for conservation intervention will likely come from elsewhere – primarily from the botanical hotspots in the Southeast. The broad climatic, geologic, and vegetational similarities between portions of the Southeast and Northeast suggests that northward managed relocation efforts might be practicable for many at-risk species. And, given that most of the present-day flora in the formerly glaciated Northeast migrated into the region from the south, these regions already share a common biological and biogeographic history, potentially lessening threats of unexpected and negative ecological interactions.

Importantly, there is a great need for additional study and cautious experimentation *before* any actual managed relocation efforts are undertaken. Although climate models and biogeographic data suggest this approach might be a crucial conservation tool in the future, few would argue these efforts should be launched now, particularly in the absence of clear evidence that candidate species are declining in the wild in their current ranges due to climate change. In collaboration with my colleague David Moeller at the University of Minnesota, my lab has been experimentally growing the southeastern endemic umbrella-leaf (*Diphylleia cymosa*; figure 4) at a series of study sites within and beyond its native range, from North Carolina to Massachusetts, in order to gauge the species’ performance under new conditions outside the Southeast and to observe whether it exhibits any trends toward invasive behavior beyond its range. This study has been running for several years and promises to provide fascinating insights into what conservation options might be available for umbrella-leaf and similar endemics in the future, should they decline in their native ranges.

Beyond the efforts of individual researchers, organizations like New England Wild Flower Society, botanical gardens, arboreta, and academic institutions are ideally positioned to take a leading role in efforts to refine our understanding of the risks and opportunities of managed relocation. For example, information from decades of native plant horticulture at sites like Garden in the Woods might be leveraged to better understand threatened plant species’ actual climatic tolerances, beyond what would be inferred from their small native ranges. Is it generally the case, for instance, that many small-ranged endemics from the

Southeast can already tolerate environmental conditions in the Northeast? The many southeastern endemics growing successfully at Garden in the Woods and other botanic gardens in the north suggest this might be the case. However, it is also the case that some endemic plants that might be at risk from climate change are not present in the horticultural trade or botanical gardens due to their lower desirability in gardens, or because they have only recently been discovered and described by botanists. Little is known about these species’ tolerances and ecological tendencies, and an important effort might be to bring representatives of these species into semi-natural garden settings where they could be observed in more detail.

In addition to observations drawn from native plant horticulture, organizations like New England Wild Flower Society and other research and academic institutions might play a key role in coordinating with citizen scientists to install well-documented and well-controlled experimental plots in which the success and ecological behavior of managed relocation candidate species could be gauged in natural plant communities in the Northeast. This type of effort could greatly augment what is possible for individual researchers to accomplish due to time, travel, and funding constraints. In parallel with such efforts, enhancing connections with botanical organizations in the Southeast would also be critical, in order to begin monitoring wild populations of species predicted to be at risk and to make comparisons with experimental plantings outside native ranges. In the Northeast, these investigations would ask whether candidate species are even capable of surviving in the full ecological context of native plant communities outside their native ranges, or, conversely, might they be too successful and displace native species? These types of empirical observations from the field will be crucial for evaluating the potential and risks of managed relocation as a new element in our conservation toolkit for the 21st century.

Clearly the many issues surrounding managed relocation also extend beyond the objective purview of science and into the more subjective realms of conservation ethics and philosophy. Nevertheless, this is a conversation that is certainly needed given the pressing reality of climate change, and organizations like New England Wild Flower Society are well poised to contribute significantly to that debate as it relates to the conservation of plant diversity. ☺



Figure 4. Umbrella-leaf (*Diphylleia cymosa*) is a large perennial herbaceous plant endemic to high-elevation forests in the southern Appalachian Mountains of western North Carolina. Since 2008, this species has been the focus of a large-scale field experiment coordinated by my lab at Smith College and our colleague David Moeller at the University of Minnesota. The research is testing how well umbrella-leaf performs when grown in natural forest plant communities beyond its native range in the Mid-Atlantic and Northeast. Can it grow to maturity from seed outside its range? Does it show signs of being too successful? To date, we’ve found that umbrella-leaf grows well beyond its native range and has even flowered and produced seed at some sites; however, its slow growth to maturity and low seed production suggest it would be unlikely to become invasive. At the end of the data collection for the project, the experimental plants will be removed from all sites outside the native range. (Photo courtesy of J. Bellemare)

Reviving the Curtis Woodland Garden

Mark Richardson, Director of Horticulture

Fifty years ago, New England Wild Flower Society received a tremendous gift from a renowned local plantsman.

On his 82nd birthday in May 1965, Will Curtis entrusted us with Garden in the Woods, his crowning achievement as a landscape architect and a place that has inspired generations of native plant enthusiasts to build “big beautiful wildflower gardens” of their own. As we celebrate Curtis’s generosity, we look forward to the next fifty years and have embarked on a project to renew the sense of wonder and the beauty he created.

The first step was the creation of an inspiring master plan for the Garden, which we completed with Andropogon Associates in 2013 and which provides a compelling long-term vision for this marvelous site. Last year, with funding from the Hope Goddard Iselin Foundation, the Society began envisioning a new planting plan for the “first garden,” called the Curtis Woodland Garden. For design expertise, we partnered with landscape architect W. Gary Smith, who has spent his career working almost exclusively with public gardens. Gary’s previous projects include several notable native plant gardens, such as Peirce’s Woods at Longwood Gardens in Delaware, and a master plan for the Southern Highlands Reserve in North Carolina. The “Hidden Valley” sculpture from his *Art Goes Wild* installation in 2007 still graces the slopes of Garden in the Woods. His artistic vision, enthusiasm for the Society’s mission, and decades of experience designing with native plants made him the perfect fit for a reexamination of a beloved garden.

This revival provides an interesting counterpoint to the ecological focus of the master plan, which calls for

the creation of displays of New England native plant communities that reflect and enhance the character, landforms, and range of environmental conditions across the Garden’s 44-acres. The plan carved out an exception for the Curtis Woodland Garden, which will pay homage to the founder’s passion for collecting, propagating, and comparing plants from different regions and to his affinity for plants from the Piedmont area, which stretches in a band from New Jersey to Alabama. As the historic core, this garden will continue to showcase plants from a broad geographic range, while recommitting to the original design intent of emphasizing the beautiful topography. Beauty is the driving force behind the revised planting plan as well; however, true to the Society’s ideals, beauty has a conscience. The Society’s mission challenges us to envision a garden that can satisfy both our aesthetic and our ecological values.

We first thought about the landscape as canvas and therefore selected plants that complement each other and paint a mosaic of colors across the seasons. We also carefully chose species that are well adapted to the conditions of the site, rather than taking the typical approach of modifying the site to suit the plants we want to feature. Finally, we paid careful attention to sourcing new plants from nurseries that share our commitment to growing genetically diverse plants. Most of the herbaceous layer is being grown by Nasami Farm; many of the trees and shrubs are coming from nurseries that grow plants of known ecotype. We limited the use of cultivars and clonal plants (those grown from cuttings, for example, rather than from seed) as much as possible, and we are implementing the project in phases over three years to give Nasami Farm ample time to grow approximately 42,000 plants that meet these objectives.



Landscape architect W. Gary Smith's early drawing for the revival of the Curtis Woodland Garden, emphasizing the shape of the land

Left: Beetleweed (*Galax urceolata*) under Rhododendron
Photo by Dan Jaffe © New England Wild Flower Society

CHALLENGES PRESENT OPPORTUNITIES

The Curtis Woodland Garden had some inherent challenges. First, the eastern hemlocks (*Tsuga canadensis*) on the slopes and along the fence line were not providing adequate screening from the main roadway and were also in decline due in part to the invasive pest



Top: Horticulture crew planting a sugar maple (*Acer saccharum*)
Bottom: Mark Richardson, Lauren Weeks, and Anna Fialkoff planting a fringe tree (*Chionanthus virginicus*) along the path

woolly adelgid, which defoliates and ultimately kills the trees. Second, the hemlocks and some other trees were at just the right height to block early spring light from reaching the center of the garden, making it difficult to grow several species that once thrived here and contributing to the loss of the glorious spring bloom remembered by long-time visitors. Finally, the mature garden did not take full advantage of the site's unique natural features, like its bowl shape and the arching canopy trees. Each of these challenges presented an opportunity to improve the display and infuse the garden with a sense of drama.

We decided early in the process that to address the screening and light-quality issues, the eastern hemlocks would need to be replaced along the fence line with a high shrub layer of broadleaved evergreens. We removed approximately one hundred trees on the eastern slope, which instantly brought in more sunlight, revealed the cathedral-like space framed by steep-sided slopes and a high canopy, and tripled the area available for planting. By transplanting large specimens of great rhododendron (*Rhododendron maximum*), highland dog-laurel (*Leucothoe fontanesiana*), and the occasional American holly (*Ilex opaca*) from the center of this garden and from elsewhere on the property to the buffer zone, we will be able to achieve good screening without blocking spring sunlight and will gain a nice backdrop for the showier areas down the slope. The new plan calls for limiting the height of plants in the central corridor so that the full impact of the landform here can be admired.

PAINTING THE WOODLAND FLOOR

In a native plant woodland garden in the Northeast, the showiest season is spring. To play to the strengths of the native woodland palette, therefore, the majority of the species added to the garden will enhance the display during its peak in May. Plants like American bugbane (*Actaea podocarpa*) will extend the flowering season into late summer/early fall, while the shrub layer, composed of smooth azalea (*R. arborescens*), flame azalea (*R. calendulaceum*), and plumleaf azalea (*R. prunifolium*), will provide structure and a long season of flowering time.

This spring we planted large patches of pink creeping phlox (*Phlox stolonifera*) and yellow trillium (*Trillium luteum*) to greet visitors as they walk past the Curtis Cottage through a new informal allée of American hornbeam (*Carpinus caroliniana*). A carpet of foamflower (*Tiarella cordifolia* var. *cordifolia*) and phlox (*Phlox stolonifera* and *P. divaricata*)—a signature Curtis combination that disappeared from the garden over the years—planted on the slopes and core of the garden will envelop visitors with color and fragrance. The massive sweeps both amplify the topography and help to highlight the garden's many unique specimen plants.

In the moister soils adjacent to the Lily Pond, the garden will feature a combination of clammy azalea, (*R. viscosum*), with its strongly fragrant blossoms, and pink-shell azalea (*R. vaseyi*), which displays its showy flowers in mid-summer. Sweetbay magnolia (*Magnolia virginiana*) will flank a new seating area underplanted with beetleweed (*Galax urceolata*), a Will Curtis favorite.

Much of the charm of the Curtis Woodland Garden exists in the fine details and diverse specimens, like sharp-lobed hepatica (*Anemone acutiloba*), southern red trillium (*Trillium sulcatum*), and yellow lady's-slipper (*Cypripedium parviflorum*). Tightly clustered in the central part of the garden, these individual specimens can be hard to see. The plan calls for many of them to be artfully arranged and showcased along the existing stone staircase, new stone steps on a path on the eastern slope, and around a stone patio to be created at the base of the steps leading into the garden. Framed by low walls, the patio will serve as both a gathering space for groups and a place to sit among a sea of white trillium (*Trillium grandiflorum*). The trillium patch will also have a smattering of double-flowered and pink forms, and will be paired with long beech fern (*Phegopteris connectilis*). As the trilliums die back each season in late spring, the ferns will emerge to take their place in the composition through summer and fall.

NEW PERSPECTIVES

Already underway are subtle changes to circulation that will enable visitors to experience the garden from wonderful vantage points. Additional seating areas will encourage people to linger and enjoy the splendor of the seasons. The improvements also offer those who love the garden a new perspective on the "living picture" Curtis painted and revival of the magic so many have enjoyed here. 🌿



Dan Jaffe © New England Wild Flower Society 1

Among the highlighted species planted throughout the Curtis Woodland Garden: 1. flame azalea (*R. calendulaceum*), 2. A carpet of foamflower (*Tiarella cordifolia* var. *cordifolia*) and phlox (*Phlox divaricata*), a signature Will Curtis combination, 3. plumleaf azalea (*R. prunifolium*), 4. pink creeping phlox (*Phlox stolonifera*), and 5. long beech fern (*Phegopteris connectilis*)



Lisa Mattei © New England Wild Flower Society 2



Dan Jaffe © New England Wild Flower Society 3



Dan Jaffe © New England Wild Flower Society 4



Cheryl Lowe © New England Wild Flower Society 5



“THERE LIVES THE DEAREST FRESHNESS...”

The line that always comes to me when I roam my gardens is from my favorite poet, Gerard Manley Hopkins: “There lives the dearest freshness deep down things.” Hopkins was a 19th-century Jesuit who saw God in nature. In “Binsey Poplars,” Hopkins mourned the loss of a beloved grove of trees: “Oh if we but knew what we do when we delve or hew / Hack and rack the growing green!” Nature is, he said, “so tender” and “her being so slender,” that “even where we mean to mend her we end her... Aftercomers cannot guess the beauty been.” Hard to say whether it was Hopkins or a childhood spent largely outdoors that influenced my conservation ethic more. But I went to law school at 37 specifically (and only) to try to do good things for the Earth. So the New England Wild Flower Society is a perfect fit.

When asked to be on the Board of Trustees, after a career in environmental law, activism, and management, I readily accepted. Intense exposure to the Society’s world-beating conservation program has sharpened my understanding of the role of native plants in healthy ecosystems. We gardeners can help by planting native plants and teaching our children their importance. I wish I had known,

decades earlier, when I was planting monoclonal nursery specimens, that I could have done so much more for the environment, for pollinators and wildlife, by using locally grown native plants. My gardens grow differently now.

Our obligation, as Earth’s stewards, to conserve biodiversity drives my passion for New England Wild Flower Society. Native plant conservation is a critical response to climate change. We can help retain landscape resiliency and prevent species decline and even extinction only by preserving biologically diverse ecosystems, which begin with plants.

As an insurance policy, the Society is helping to lead a global seed-banking project, through our citizen-science-model-for-the-world. This “Seed Ark” effort may turn out to be our most important response to climate change, enabling our successor-stewards to figure out how best to deploy precious germplasm for the health of the planet when we are long gone. Anyone who has seen showy lady’s-slippers (*Cypripedium reginae*) in Vermont or Robbins’ cinquefoil (*Potentilla robbinsiana*) on the top of Mount Washington knows why we need to succeed. I hope our children’s children – our aftercomers – won’t have to “guess the beauty been.”

TMP Images



DEIRDRE MENOYO is a member of the Society’s Conservation Circle and Chair of the Board of Trustees

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In 1900 our founders had a compelling vision—to build an organization dedicated to protecting the region’s native flora. Their efforts foreshadowed our work today in conservation, horticulture, and education in all six New England states. As you read about our many accomplishments, please take a moment to be proud of your own support for this renowned organization. Friends like you are at the heart of all our successes, and we are delighted to celebrate and publicly thank all of you!

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OLD FRIENDSHIPS & NEW ENDEAVORS LUNCHEON

On April 10, we hosted our annual luncheon for a lively mix of longtime friends, recent interns, and certificate program graduates. The guests enjoyed the conversation and a talk by Director of Horticulture Mark Richardson on our nationally certified trillium collection. Among the guests were (top to bottom) Honorary Trustee Dana Jost and Betty Jost, who are Life Members; Roberta "Bobbie" Hodson, a graduate of the certificate program; and Honorary Trustee Thelma Hewitt and Jack Hewitt, who are Life Members and members of the Conservation Circle.



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 Louise Westcott
 Weston Garden Club
 Cheryl K. Wilfong
 Robin E. Wilkerson and Steve Atlas
 Patricia Plum Wylde
 Margaret F. and T.C. Price Zimmerman

TRILLIUM SOCIETY

The following generous friends have included the Society in their estate plans, to help ensure our future ability to conserve native plants and their habitats.

Elizabeth L. Aghajanian
 Annemarie Altman and David Cook
 Joyce H. and Raymond A. Bisson
 Lalor and Patricia N. Burdick
 Frances H. Clark and Bernard J. McHugh
 Paul Cook+
 Stuart L. Cummings
 Ruah Donnelly and Steven E. Dinkelaker
 Peter V. Doyle and Ellen Clancy
 Christopher R. and Carole M. Ely
 Nancy Goodman and Mike Kotarba
 George C. and Diantha C. Harrington
 Patti Laier
 Ann R. Lemmon
 Deirdre Menoyo
 Carole M. Merrifield
 Carolyn M. and Robert T. Osteen
 Jessie B. and Jon Panek
 Geri and Douglas D. Payne
 Karen D. and Matthew V. Pierce
 Barbara F. and Frederick M. Pryor
 Beverly H. Ryburn
 Dori Smith
 Anita E. Springer and James P. Lerner
 Natalie Starr
 Jackie and Thomas E. Stone
 Mary Ann Streeter
 Leslie Turek
 Cheryl K. Wilfong
 Elizabeth H. Wright
 Patty Wylde

FREE FUN FRIDAY



For the fifth year, Garden in the Woods participated in Free Fun Friday, a program of the Highland Street Foundation that encourages cultural institutions to open their doors without charge on one Friday in the summer to make the arts accessible to all residents of Massachusetts. The foundation provides grant support to offset the costs of the additional staffing needed for the large influx of visitors—at the Garden, typically around 1,500 people.

INAUGURAL FOUNDERS' MEDAL DINNER

Enjoying the Founders' Medal dinner on March 26 are (top) John and Judie Post, Sandra Moose, and Pam and Griff Resor; (middle) Bob and Carolyn Osteen; (bottom) Jessie and Jon Panek, Wickie Rowland, and Jane Packard.



TRIBUTES

In 2014 we received honoraria or memorial donations in tribute to the following friends, colleagues, mentors, and loved ones.

In Honor Of

Peter V. Doyle
Marjorie D. Greville
Jane C. Hollowell
Linda Kirschner
Bessie Manz
Doris Pratt
Michael Robinson
Bonnie Rosenthal
Gray and Paul Wexelblat

In Memory Of

Bob August
Anthony T. Cope
Robin Furumoto
Roberta Garvin
John R. Held
Linda Kirschner
Patricia A. (Dawson) Midura
Frank Miles
Stephen Mitchell
Ginny Neville
Abdaris Pabon
Nan St. Goar
Gerard B. Townsend

MATCHING GIFT COMPANIES

We extend special thanks to the following businesses for their generous support in 2014.

Citizens Charitable Foundation
Coca-Cola Foundation
Delaware Life
FM Global Foundation

GE Foundation
Goldman, Sachs & Co. Matching Gift Program
Mass Mutual
National Grid
Pfizer Foundation Matching Gift Program
Unum Provident Corporation

GIFTS IN-KIND

We are grateful to the following individuals, organizations, and companies for their generous donation of in-kind goods and services in 2014.

Appalachian Mountain Club
Boston Red Sox
Linda C. Bowman
Camp Birch Hill
Elite Island Resorts
Adam Ganson
Julia Homer
Kripalu Center
J. P. Mauney
Gregor I. McGregor
Karen Melo
Natick Senior Center
Page Waterman Gallery, Inc.
Douglas Pitman
Christine K. Quinby
REI - Framingham Store
Rose Island Lighthouse
Shaw's Market
Dori Smith
Southwest Airlines
George Swift
Trader Joe's
Whole Foods

2014 Partners and Clients CONSERVATION SERVICES

In 2014, the following organizations contracted for our services and utilized our expertise in rare plant surveys, seed collection, invasive species management, botanical inventories, and restoration.

National Park Service

Appalachian National Scenic Trail (CT, MA)
Acadia National Park (ME)

U.S. Army Corps of Engineers

U.S. Fish and Wildlife Service

Ninigret National Wildlife Refuge (RI)
North Attleboro National Fish Hatchery (MA)
Parker River National Wildlife Refuge (MA)
Petit Manan National Wildlife Refuge (ME)
Rhode Island NWR Complex (RI)
Silvio O. Conte National Wildlife Refuge (MA)
U.S. Fish and Wildlife Service (Northeast Region)

U.S. Forest Service

White Mountain National Forest (NH)
Green Mountain National Forest (VT)

State Natural Heritage Programs

CT Recreation and Natural Heritage Trust Program
MA Natural Heritage and Endangered Species Program
ME Natural Areas Program
NH Natural Heritage Bureau
RI Natural History Survey
VT Natural Heritage Inventory

State Offices

Baxter State Park (ME)
CT Department of Environmental Protection - Hurd State Park
CT Department of Environmental Protection - Kettletown State Park

CT Department of Environmental Protection - Chatfield Hollow State Park

CT Department of Environmental Protection - West Rock Ridge State Park

CT Department of Environmental Protection - Wildlife Division

CT Department of Transportation - Division of Property Management

MA Department of Conservation & Recreation - Savoy Mountain SF & Deer Hill State Reservation

MA Department of Conservation & Recreation - Mt. Greylock State Reservation

MA Department of Conservation & Recreation - Neponset River Reservation

MA Department of Conservation & Recreation - Maudslay State Park

MA Department of Conservation & Recreation - Manuel F. Correllus State Forest

MA Department of Conservation & Recreation - Skinner / Holyoke Range State Park

MA Department of Conservation & Recreation - Myles Standish State Forest

MA Division of Fisheries & Wildlife
ME Forest Service

NH Division of Forests & Lands - Mt. Cardigan State Forest

NH Division of Parks & Recreation - Franconia Notch State Park

NH Division of Parks & Recreation - Pawtuckaway State Park

NH Division of Parks & Recreation - Weeks State Park

RI Department of Environmental Management - Division of Fish & Wildlife

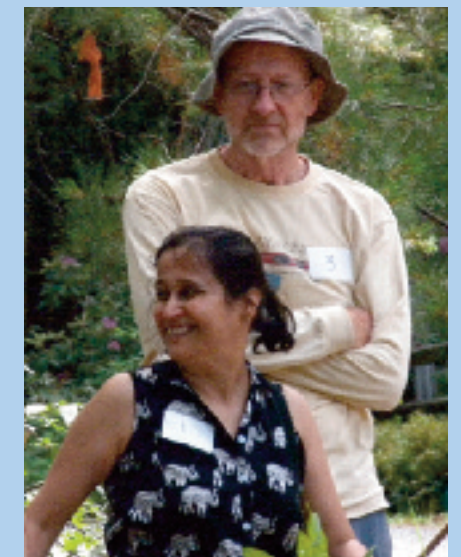
RI Department of Environmental Management - Water Resources Board

VT Department of Fish & Wildlife

VT Department of Forest, Parks & Recreation - Kingsland Bay State Park

MEMBERS' PLANT EXCHANGE

Members gathered at Garden in the Woods on June 14 for the annual Plant Exchange.



VT Department of Forest, Parks & Recreation - Mt. Mansfield State Forest

VT Department of Forest, Parks & Recreation - Tinmouth Channel Wildlife Management Area

Invasive Species Cooperative Partnerships

Connecticut River Watershed Cooperative Invasive Species Management Area (CT, MA, NH, VT)

Sudbury-Assabet-Concord River Watershed Cooperative Invasive Species Management Area (MA)

Westfield River Invasive Species Partnership (MA)

OTHER PARTNERS

Includes towns, land trusts, utility companies, and other private and public landowners who allowed staff and volunteers access to their properties for conservation of our native flora

A & J Construction (MA)

A.D. Makepeace (MA)

American Forest Management (ME)

Amherst Country Club (NH)

Aquarion Water Company (CT)

BioDrawversity (MA)

Black Bear Hydro (ME)

Branford Land Trust (CT)

Camp Sloane (CT)

Carlisle Conservation Foundation (MA)

Chicago Botanic Garden (IL)

City of Cambridge (MA)

City of Groton (MA)

City of Holyoke (MA)

City of New Haven (CT)

City of Pawtucket (RI)

Dartmouth College Woodlands (NH)

Dartmouth College-Real Estate Office (NH)

Dragon Cement (ME)

Elephant's Trunk Flea Market (CT)

Groton Utilities (CT)

Homestead Farms (NH)

Irving Woodlands LLC (ME)

Lakes Region Conservation Trust (NH)

Loon Echo Land Trust (ME)

Manchester-Essex Conservation Trust (MA)

Mashantucket Pequot Indian Tribal Nation (CT)

Massachusetts Audubon Society (MA)

Nantucket Conservation Foundation (MA)

Nantucket Land Bank (MA)

National Audubon Society

Northeast Utilities (CT)

O and G industries (CT)

Ocean Edge Golf Course (MA)

Old Quarry Association (CT)

Opacum Land Trust (MA)

Oxbow Associates (MA)

Porter's Point School (VT)

Salem Land Trust (CT)

Schumacher Companies, Inc. (MA)

South Central CT Regional Water Authority (CT)

South Windsor Land Conservation Trust (CT)

Southbury Land Trust (CT)

Sudbury Historical Society (MA)

Sudbury Valley Trustees (MA)

Sudbury Weed Education and Eradication Team (MA)

The Nature Conservancy (CT, ME, NH, RI, VT)

The Trustees of Reservations (MA)

Town of Avon (CT)

Town of Barnstable (MA)

Town of Bethel (CT)

Town of Carlisle (MA)

Town of Concord (MA)

Town of Conway (MA)

Town of Cumberland (RI)

Town of East Granby (CT)

Town of East Haven (CT)

Town of East Longmeadow

Town of Framingham (MA)

Town of Franklin (MA)

Town of Guilford (CT)

Town of Hyannis (MA)

Town of Madison (CT)

Town of Mason (NH)

Town of New Milford (CT)

Town of Newburyport (MA)

Town of Salem (NH)

Town of Seabrook (NH)

Town of Stratford (CT)

Town of Suffield (CT)

Town of Thomaston (ME)

Town of Vernon (VT)

Town of Westford (MA)

Town of Westwood (MA)

Town of Windham (NH)

Town of Yarmouth (MA)

TransCanada (VT)

University of Maine 4-H Camp

University of Rhode Island

Walden Woods Project (MA)

Yale University

CUSTOM HORTICULTURE SERVICES

At our Nasami Farm Native Plant Nursery, we are constantly expanding the list of native species available for landscaping and restoration projects, as well as for individual retail sales through our Garden Shops. The following organizations either contracted with us for custom grows in 2014 or purchased quantities of plugs for their projects (* indicates a partner nursery).

Amherst Nurseries (MA)*

Audubon Greenwich (CT)

Bryan Sweeney (MA)

Cape Cod Museum of Natural History (MA)

City of Cambridge Water Dept. (MA)

Division of Fisheries & Wildlife, Natural Heritage & Endangered Species Program (MA)

Eric Bloomquist (MA)

Garden Dance Landscape Design (MA)

Green Thumb for Hire (MA)

Hillside Nursery (MA)*

Manitoga, Inc. (NY)

Michael D. Bliss (MA)

NatureWorks Landscape Services Inc. (MA)

RI Natural History Survey (RI)

RI Wild Plant Society (RI)

Speaking of Landscapes, LLC (CT)

Sterling Services Inc. for Hills at Mainstone Condominium Association (MA)

The Arnold Arboretum of Harvard University (MA)

The Nature Conservancy, Massachusetts Island Office (MA)

The Trustees of Reservations, Boston

Natural Areas Network (MA)

Tom Wirth Associates, Inc. (MA)

Town of Braintree, Planning and Community Development Dept./Dept. of Public Works (MA)

Town of Smithfield Conservation Commission (RI)

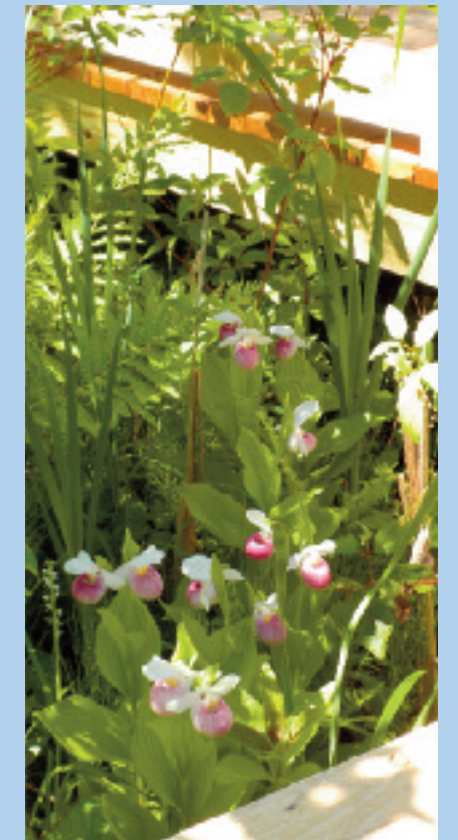
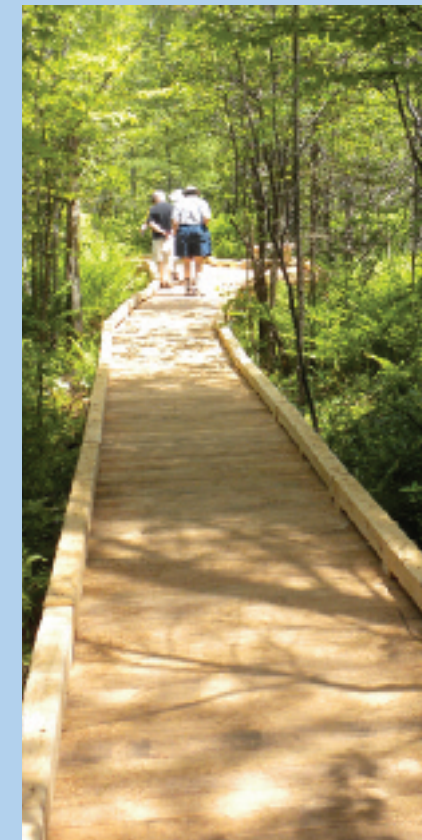
U.S. Fish and Wildlife Service, Monomoy National Wildlife Refuge (MA)

Van Berkum Nursery (NH)*

RIBBON CUTTING FOR ESHQUA BOG BOARDWALK

Friends and supporters of the Society and the Vermont Chapter of The Nature Conservancy gathered to celebrate the opening of the new, fully accessible boardwalk and parking lot at Eshqua Bog in Hartland, VT, which the two organizations co-own. The boardwalk was designed and installed by Josh Ryan and his team at Timber & Stone, LLC of Montpelier.

Cutting the garland are (left to right) Debbi Edelstein, the Society's Executive Director; Heather Furman, Executive Director of TNC in Vermont; Richard Heilemann, chair of the board of TNC VT; sanctuary stewards Susan and Dean Greenberg; and Bill Chorske, whose late wife Gail was a leader in the effort to protect the bog from development.



MESSAGE FROM THE TREASURER

In 2014 the Society moved several key initiatives forward and ended the year well-positioned for continued outstanding programmatic success. New funded programs that will come to fruition in 2015 include a suite of pilot online education programs, research and publication of the first comprehensive "State of the Plants" report, and expansion of seed banking of both rare and common species.

In addition to operating activities, the Society secured funding for two important capital projects, thanks to the generosity of individuals, the Hope Goddard Iselin Foundation, Amelia Peabody Charitable Fund, and Massachusetts Cultural Facilities Fund. Their support makes possible an exciting revival of the Woodland Garden and a new deer exclusion fence around the nearly two-mile perimeter of Garden in the Woods.

The fiscal year ended with a modest operating deficit, in part due to the delayed start of two large-scale projects that support conservation staff. Those projects began instead in 2015. In addition, the staff secured a five-year commitment to the initiative to collect and bank the seeds of rare and endangered plants, for which funding begins in 2016.

Thanks to the hard work of our Board, dedicated staff, committed volunteers, and the generous gifts of our many members and supporters, the Society had a successful year in 2014.

Sincerely,



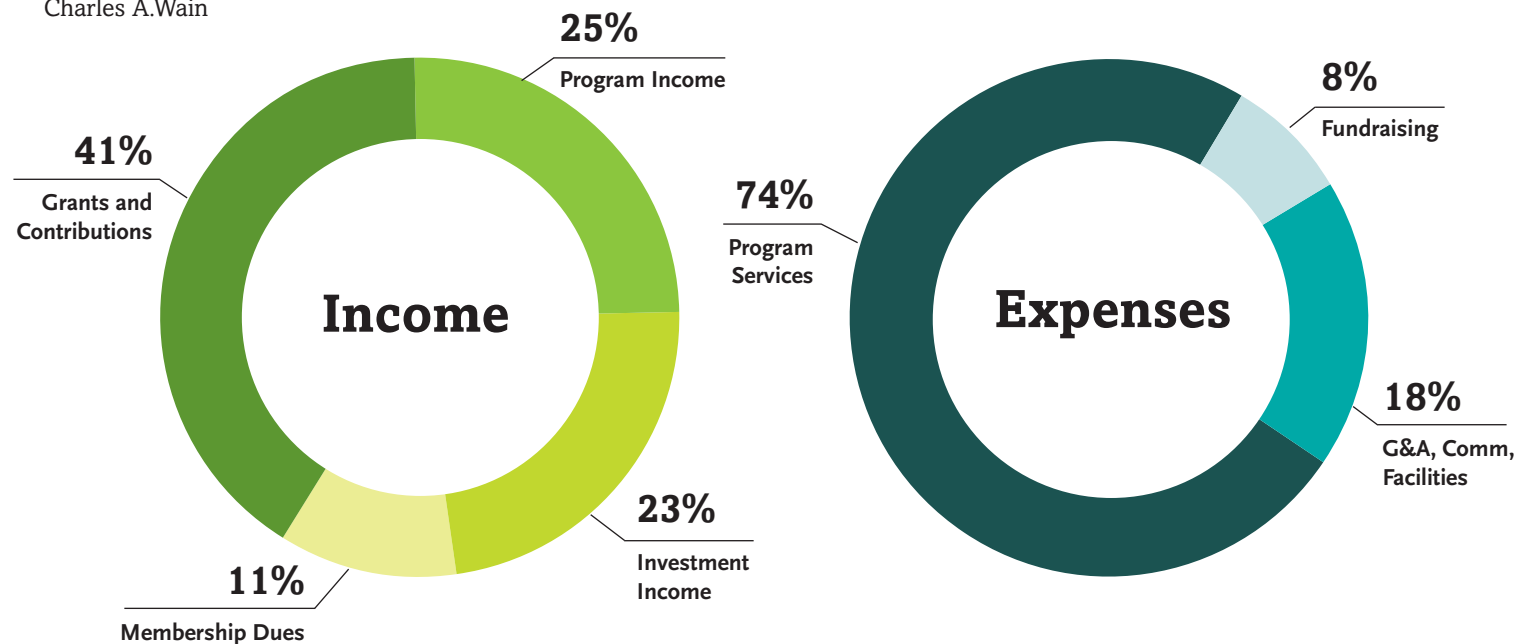
Charles A. Wain

Fiscal Year 2014 Operating Results

Income	
Grants and Contributions	\$ 887,813
Program Income	\$ 541,677
Investment Income	\$ 502,085
Membership Dues	\$ 235,735
Total Income	\$ 2,167,310
Expenses	
Program Services	
Conservation & Sanctuaries	\$ 716,390
Education	\$ 233,878
Horticulture	\$ 613,188
Member Services	\$ 146,576
Retail Shops	\$ 216,146
Total Program Services	\$ 1,926,178
Support Services	
G&A, Comm, Facilities	\$ 471,085
Fundraising	\$ 211,534
Total Support Services	\$ 682,619
Total Expenses	\$ 2,608,797
Operating Surplus (Deficit), incl. depreciation	\$ (441,487)

Notes

- Operating Surplus (Deficit) includes \$294,041 of noncash depreciation of fixed assets and the amortization of the development of the Go Botany website.
- The Society's net asset value is \$10,742,961 as of December 31, 2014.
- A complete copy of the audited financial statements is available upon request by emailing twillmott@newenglandwild.org.



DON'T HIBERNATE

This winter, exercise your legs and your brain! Join us for a great selection of new programs. For more information and to register, go to www.newenglandwild.org/learn/our-programs.



Snowshoe Tours at Garden in the Woods

The Winter Garden, JANUARY 9

Winter Warm Up, JANUARY 23

Winter World Explorations, FEBRUARY 7

Frozen Flora, FEBRUARY 27

Horticulture & Gardening

Water Conservation in the Garden, JANUARY 10

Residential Landscape Design, FEBRUARY 9

Gardening for Pollinators, FEBRUARY 20

Understanding and Managing Soils, FEBRUARY 10

Botany & Conservation

Bare Trees and Naked Shrubs, DECEMBER 5

The World of Plant Genetics, BEGINS JANUARY 6

Killer Plants, JANUARY 16

Conservation Biology, BEGINS JANUARY 17

Bare Trees and Naked Shrubs, JANUARY 23

Winter Botany, JANUARY 30

Maple Sugaring, JANUARY 30

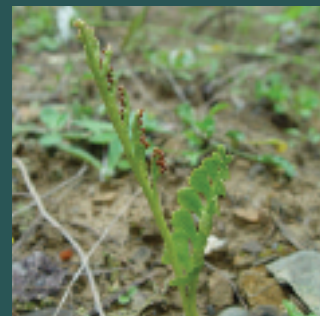
Wetland Shrubs in Winter, FEBRUARY 3

Fire on the Landscape, FEBRUARY 26



Botrychium spathulatum
© Tab Tannery

RARE
NATIVE PLANT
SPOTLIGHT



Botrychium lunaria
© Arthur Haines

Botrychium spathulatum (spatulate moonwort)

Prior to the 1980s, the moonworts (genus *Botrychium* in the strict sense) had only a handful of named taxa in North America that were recognized by botanists, who believed the complexity of forms observed in the field could be explained through tremendous plasticity in the shapes of their leaves (specifically, the vegetative portion of the leaves, called the trophophore). Since 1981, taxonomists have slowly pieced together a complex puzzle revealing the presence of many previously unnamed species. The naming of more than 20 species of moonworts is supported by several lines of evidence, including morphology, chromosome numbers, molecular phylogeny, and geographic distribution. The result of considerable careful work is a daunting taxonomy with subtly distinguished species complicated by sun, shade, and depauperate forms within the same species.

Within this complex of species closely related to the common moonwort (*Botrychium lunaria*), only two were thought to occur in New England. However, five additional species are now documented here—and all seven are regionally rare. The latest

discovery is the spatulate moonwort (*Botrychium spathulatum*). While previously known from New Brunswick only a couple of miles from the Canadian border with Maine, this moonwort was recently discovered at a single site in Vermont. It prefers relatively open sites that occur on high pH bedrock and/or till, including roadsides, quarries, clearings, and fields. It is likely this species also occurs in northeastern Maine.

The spatulate moonwort is an allopolyploid species. This means that it has more than two sets of chromosomes, and those chromosomes were contributed by two (or more) different species. In other words, it is a hybrid-derived species. It is found scattered over much of northern North America, though it is considered rare in most states and provinces in which it occurs. Go Botany (gobotany.newenglandwild.org) will ultimately have images, a description, and different avenues people can use to identify this moonwort from closely related species. Stay tuned for that update! 🍷

—Arthur Haines, *Research Botanist*