

A photograph of a dirt path winding through a dense forest of evergreen trees. The path leads towards a valley with rolling hills and mountains in the distance under a blue sky with some clouds. The trees are lush green, and the overall scene is bright and natural.

NATIVE PLANT NEWS

PAGE 06

Saving the Right Places as the Climate Changes



Winter 2022 contents

p. 04

02

In Brief

Saving Plants on Rivers and Mountains, Fire and Germinating, and more

04

Saving Plants as the Climate Changes

A Strategy for Land Conservation
— Michael Piantedosi

08

What is a Climate-resilient Landscape

— Jane Roy Brown

10

IPAs by the Numbers

— Jane Roy Brown

12

Conservation Goals by State

— Michael Piantedosi

16

Rare Plant Spotlight

Northern Blazing Star
— Arthur Haines

25

Happenings

Director Series: Plants and Their Stories



p. 03

NATIVE PLANT NEWS

DESIGN

Moth Design
Rachel Wolff Lander

EDITORIAL

Jane Roy Brown;
jrbrown@NativePlantTrust.org

COVER

Mt. Mansfield State Forest,
Cambridge, VT © Clay Kaufmann

BOARD OF TRUSTEES

Chair
Ralph G. Brown

Vice Chair
Ruah Donnelly

Treasurer
Tony Wain

Clerk
Ruth Shelley

Executive Director
Debbi Edelstein

TRUSTEES

- Abby Coffin
- William (Buzz) Constable
- Arabella Dane
- Charles Fayerweather
- Suzanne Groet
- Kendy Hess
- William Huyett
- Lita Nelsen
- Elizabeth (Zibby) Pyle
- Susan Schadler
- Alan Smith
- Thomas Stone

Native Plant News is published by Native Plant Trust, an independent, nonprofit, member-supported organization. Subscriptions are included in membership dues. For information, contact: membership@NativePlantTrust.org.

© 2021 Native Plant Trust. All rights reserved.



Facing Existential Crises

World leaders recently wrapped up the latest summit on climate change. Having failed to meet the targets they set in Paris in 2015 for reducing emissions, they are promising to meet ambitious goals for decarbonization by 2030—while admitting that it’s probably too late to limit global temperature rise to 1.5°C. That would require cutting worldwide emissions in half in just nine years. For perspective, it took the pandemic's shutdown to cut carbon dioxide emissions by 7 percent, while other greenhouse gases continued to rise.

Debbi Edelstein



DEBBI EDELSTEIN
Executive Director

The summit charged countries with strengthening their climate plans, which currently put us on track for a 2.5°C rise by the year 2100. That’s double what we’ve already experienced. While we the people may have little influence on the plans our governments write, we can advocate for legislation that codifies promises ranging from phasing out coal to halting deforestation.

We can also hold more flexible actors accountable. More than 2,000 companies have pledged to reduce their emissions, and 400 financial firms promised to make their investment portfolios net-zero by 2030. Countries, cities, and major automakers agreed to accelerate the production and purchase of zero-emission vehicles. Learn their names, and let them—and your own municipality and local businesses—know that you want them to do better.

The next worldwide summit, the UN Biodiversity Conference, in April 2022, will convene leaders of nearly 200 nations to plan how to halt catastrophic biodiversity loss. With more than one million species facing extinction, it is urgent that we press our government to adopt the global biodiversity framework.

IN BRIEF

Saving Plants on Rivers and Mountains

—Michael Piantedosi, Director of Conservation

We're reaching a turning point in our understanding of the globally rare Jesup's milk-vetch (*Astragalus robbinsii* var. *jesupii*), as we await results of a genetic analysis being conducted at Brown University. The findings will help us determine how best to use seed sources at new introduction sites in our longstanding experiments with augmenting existing populations on the northern Connecticut River. In May we sowed seed from Native Plant Trust's seed bank directly into the ground and later directly from the mature fruits on site. In both cases we expect the seed to germinate next spring. Should direct-sowing prove successful, it would be more efficient than our current practice, which is to grow plug-size plants of Jesup's milk-vetch in our greenhouses and plant them on the site. (Plugs are seedlings grown in five-inch-deep cells for robust root development.) Also, we are developing a matrix to guide when to manage invasive species on Jesup's milk-vetch sites. This new tool will be complete at around the same time as the genetic analysis.

We completed our fifth and final year of working with the National Park Service to restore native plant communities on the summit of Cadillac Mountain at Acadia National Park in Maine. We have learned a great deal about the hardships that face even thriving plant communities on exposed, subalpine summits. These challenging natural conditions, coupled with inadvertent trampling by thousands of visitors to Cadillac Mountain each year, make it difficult for plant populations to recover from damage. This year we applied mulch to help prevent frost from ejecting the plugs we have planted. Water collects in flat spaces on the mountain, and plugs planted in or near these get heaved out of the soil when the water freezes and expands, often killing the ejected plants. Mulching will add weight and increase the surface distribution of water, which could decrease the mortality from frost heaves. We also are assessing the vegetation and geology of neighboring summits (Penobscot and Sargent mountains) to build our knowledge of mountaintop revegetation.



01

Where There's Smoke, (Maybe) There's Germination

—Jane Roy Brown, Writer-Editor

In the Northeast, fire plays a significant role in maintaining several local coastal and inland ecosystems, including the globally rare pitch pine–scrub oak barrens. These habitats support rare and endangered plants, and they face threats including encroachment by invasive species, especially Japanese barberry (*Berberis thunbergii*), burning bush (*Euonymus alatus*), and glossy false buckthorn (*Frangula alnus*).

Although research shows that invasive plants can impact and respond to fire and smoke differently than native species, these impacts rarely have been studied in the Northeast. This past summer, Native Plant Trust staff and colleagues conducted experiments to see if native plant seeds that are stimulated by smoke germinate at a higher rate when the smoke comes from native plant fuels.



02

response to native species smoke.” She adds that the team plans to continue its research at Framingham State and has shared the test medium with a colleague at Smith College Botanic Garden who is working on a related experiment.

The team consisted of Research Botanist Jessamine Finch, Director of Conservation Michael Piantedosi, Nursery Manager Alexis Doshas, and their colleagues George LoCasio and Molly Krofssik, of Framingham State University, and Emily Fusco, of University of Massachusetts Amherst. They produced smoke-infused water from two non-native and one native plant species. They then applied it to seeds from nine species (including one non-native) and in three different dilutions.

Finch reports that germination varied significantly across all combinations of these factors. Seventy-one percent of species across all smoke-fuel combinations germinated best at the lowest (1 percent) smoke dilution. Eighty-six percent of species germinated best on the 1 percent smoke water dilution of the native and Japanese barberry fuels.

“Preliminary results do not suggest an overall trend of increased germination in response to smoke derived from burning native plant species,” Finch says. “However, we did see maximum germination for big bluestem grass (*Andropogon gerardii*) and northern blazing star (*Liatris novae-angliae*) in

03



Rose of Plymouth Blooms

—Uli Lorimer, Director of Horticulture

This season provided many successes, along with challenges that included copious amounts of rainfall, the fungal diseases that often accompany damp conditions, and plants germinating from seed in unplanned places. We continued to incorporate rare and unusual plants into our habitat displays at Garden in the Woods. In one notable example, the expert propagators at Nasami Farm coaxed the federally listed rose of Plymouth (*Sabatia kennedyana*) into bloom, and the blooms were spectacular. In total, we added 218 plant accessions representing 84 species, 26 of which are new to our collections—part of our effort to make the Garden as species-diverse and ecologically sound as possible. Tracking this diversity has entailed verifying nearly 3,500 plants at the Garden as part of our ongoing inventory.



04

Join the Race to Bank the Seeds of New England's Rare Plants

A fifth of the region's native plants face dire threats. The race to save them is on. Endowing New England's seed bank is our winning strategy.

A generous donor is leading the way by pledging to match your contribution, dollar for dollar, for gifts up to \$100,000.

Storing genetic material in the form of seeds is how New England can prepare for—and recover from—catastrophic climate change and other threats.

Native Plant Trust is already banking the seeds of New England's 389 most at-risk rare plants. Your gift to the Seed Ark Endowment Fund helps to protect those plants forever, and with them, the web of life they support.

Right now you can double your impact. Use the donation envelope in this magazine, or email gifts@NativePlantTrust.org to receive stock transfer information or a link to the Seed Ark Endowment Fund's online giving page. Or call the Philanthropy Department at 508-877-7630 x3802. Thank you.

Together, we can win this race.





Saving Plants as the Climate Changes

A Strategy for Land Conservation

—Michael Piantedosi, Director of Conservation

Conserving Plant Diversity in New England is a groundbreaking new report resulting from a two-year collaboration between Native Plant Trust and The Nature Conservancy. The report provides a scientific framework and detailed roadmap for conservation action and land protection at the species, habitat, and parcel scales that will effectively save plant diversity—and thus overall biodiversity—in New England as the climate changes.

Released in July 2021, the report and the accompanying mapping tool give policy makers, federal and state agencies, and land trusts in each state the detailed information needed to most effectively spend conservation dollars. The full report, including state-specific summaries, resides at www.NativePlantTrust.org.

In this special issue of *Native Plant News*, we look at key aspects of the report and the priorities for land conservation in all the New England states.

Background

The report seeks to answer the question: Has more than a century of land conservation in New England protected enough land in the right places to save the region's plant diversity? We used as benchmarks two internationally recognized standards:

- targets in the Global Strategy for Plant Conservation (GSPC), which is part of the United Nations' Convention on Biological Diversity;
- the "Global Deal for Nature" (Dinerstein et al. 2019), which aims to conserve 30% of the world's ecosystems by 2030.

The latter is the basis for the "30 by 30" goal in the Biden administration's "Conserving and Restoring America the Beautiful" initiative. In our report, we adapted the "Global Deal for Nature" for conditions in New England, added climate resilience (see p. 10) as a criterion, and called it the NE target (NET).

For the analysis, the team:

- examined the current protection status of every parcel within the 43 dominant habitats across New England, estimated the likely losses to development by 2050, and evaluated the parcels’ inherent resilience to a changing climate;
- identified 234 climate-resilient areas that contain an abundance of rare and endangered plant species. These Important Plant Areas (IPAs) cover 2.6 million acres, contain multiple occurrences of 212 of our rarest species, and represent 92% of the habitats. Protecting IPAs is a priority goal in the GSPC. (See p. 14.)

With that data, the team determined how much of each resilient habitat or IPA needs protection to meet the two benchmarks.

Results

The report distinguishes between land that is *secured* against development and land that is *protected* for nature and natural processes. To achieve the target of securing 30% of habitats against conversion to development will require conservation of 2.3 million acres of climate-resilient land in specific habitats. To achieve the target of protecting 15% of the region’s habitats for nature will require selective targeted conservation of 3.5 million acres.

- Forests cover 86% of the natural landscape, but only two of New England’s ten dominant forest types meet the NET of 30% secured and 5% protected, and only one meets the GSPC goal of 15% protected.
- Wetlands cover 12% of the region and are critical to sustaining almost half our plants, birds, and other wildlife. Of the eighteen types of bogs, swamps, floodplains, and marshes, only three meet the NET of 30% secured and 10% protected on resilient sites and six meet the GSPC target. These are mostly small, unique bogs and peatlands. None of our five most common wetland types meet either target, although at least 20% of each habitat is secured against conversion.
- Patch-forming habitats, like summits, cliffs, barrens, and dunes, cover only 2% of the landscape, but have rare plant densities ten times higher than wetlands and forty times higher than upland forests. Of these unusual habitat types, seven of the fourteen meet the GSPC target. However, only habitats occur on flat and fragmented land that is vulnerable to climate change.



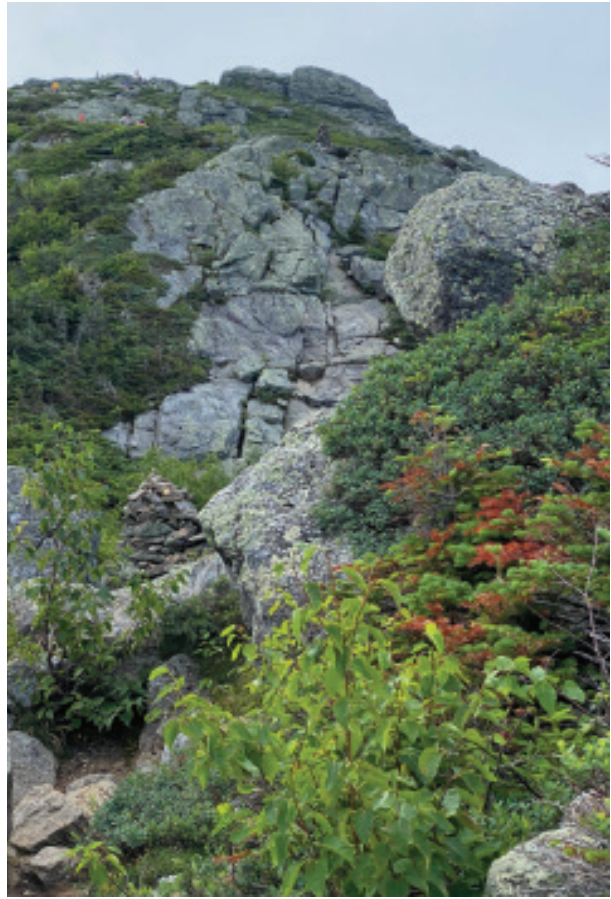
ACRES NEEDED TO REACH TARGETS

	GSPC	NET
Forests	3 million	2 million
Wetlands	405,083	253,902
Patch-forming Habitats	8,408	88,620*

**Meeting NET 30% requires 17,726 acres, but it will take 88,620 acres to bring the silt- and sand-based systems to the standard for climate resilience.*



03



Recommendations

We recommend focusing on more proportional representation of the region’s habitats across their ranges, rather than on securing more acres of habitat types that are abundantly conserved already. Specifically, we recommend:

- that each state aim for 15% of each habitat protected (conserved for nature and natural processes), with a minimum of 5% for dominant forest types;
- prioritizing IPAs to ensure that habitat protection also captures rare plant species;
- focusing on habitats that are rare in New England, on relatively large areas of common habitats that lack conservation protection, and on habitats facing significant losses to development by 2050.

Finally, sustaining plant diversity is more than just land conservation. We need a multi-layered approach that includes enhanced protection and more effective management of the 5.3 million acres of forest already secured from conversion, but open to logging and mineral extraction. These forests are central to wildlife habitat and carbon storage. In addition, strategies such as seed banking, reintroduction, and assisted migration will become more important as species try to adapt to changing conditions. With this report, our goal is to ensure that New England’s native plants—the green foundation for functioning ecosystems—are at the forefront of conservation policy and action as climate plans develop.

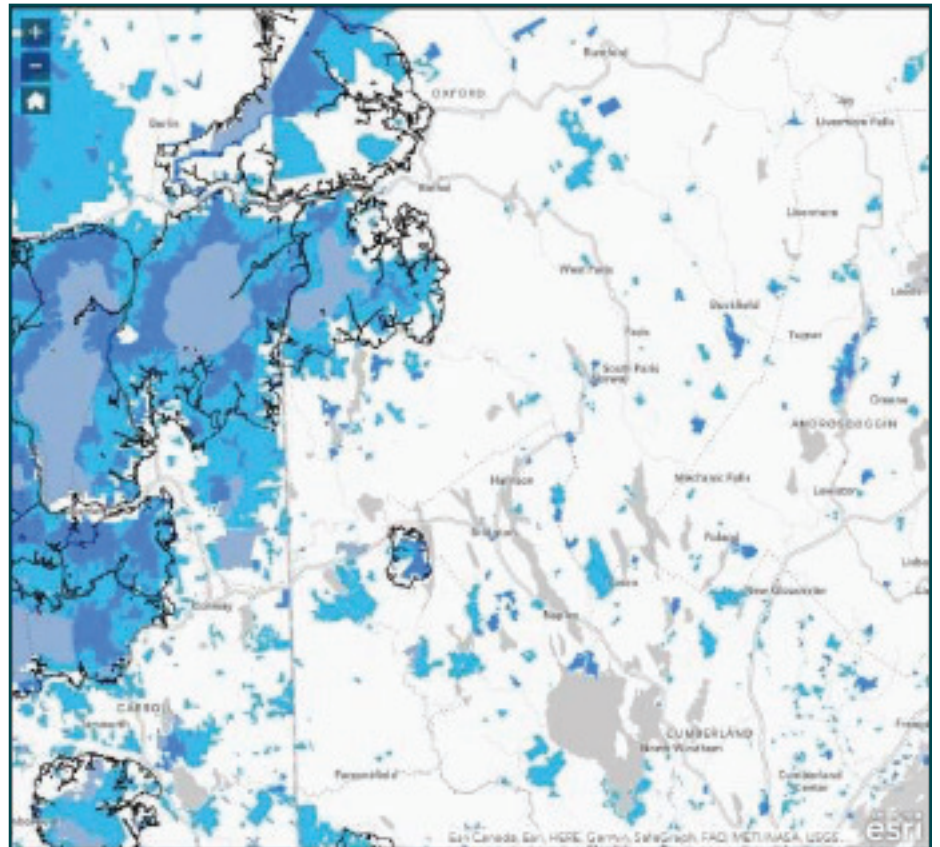
We wish to extend our gratitude to the individuals who made this report possible. While honoring their desire to remain anonymous, we publicly celebrate what they helped to achieve. Many of the innovations in this report were realized only thanks to their generous support.

What is a Climate-resilient Landscape?

In *Conserving Plant Diversity in New England*, we examine the landscape from the plants' perspective. Plants form distinct communities and habitats based on geology, elevation, hydrology, and climate. From the forest floor, the field edge, or the tidal shore, we have a close perspective on distinct species and plant communities, but we cannot see how the parcels of land in a particular habitat relate to each other or the pattern of habitats on the landscape. Our report and its mapping tool provide the ability to zoom out and see how the degree of connectivity or fragmentation at the habitat scale affects climate resilience. In other words, we can see how contiguous areas of intact conservation land contrast with those that include roughly the same number of acres but are highly fragmented.

For example, the two maps below show an area of exceptional botanical richness on the borders of New Hampshire and Maine, with the White Mountain National Forest appearing left-of-center. Using our mapping tool, we can see in Map 1 Important Plant Areas (IPAs) containing exceptionally high rare plant diversity, outlined in black, and conserved lands,

which vary in shades of blue depending on their level of conservation protection. (Our classification of conservation lands follows the U.S. Fish and Wildlife Service GAP program terminology, which ranks the level of protection 1–3, from most to least restricted.) In Map 2, we see these same two layers (IPA, conservation status), but also the spectrum of climate



Map 1: NH/ME, White Mountain National Forest with GAP and IPA layers

resilience, with parcels shading from climate resilient (dark green) to climate vulnerable (dark brown).

We can see a valuable trend playing out in a single geographic area by contrasting its map layers in our tool. Clusters of secured conservation lands increase climate resilience at nearby parcels that are unsecured, simply because of landscape connectivity. The opposite occurs near major highways and surrounding developed areas, such as in the eastern portion of these maps.

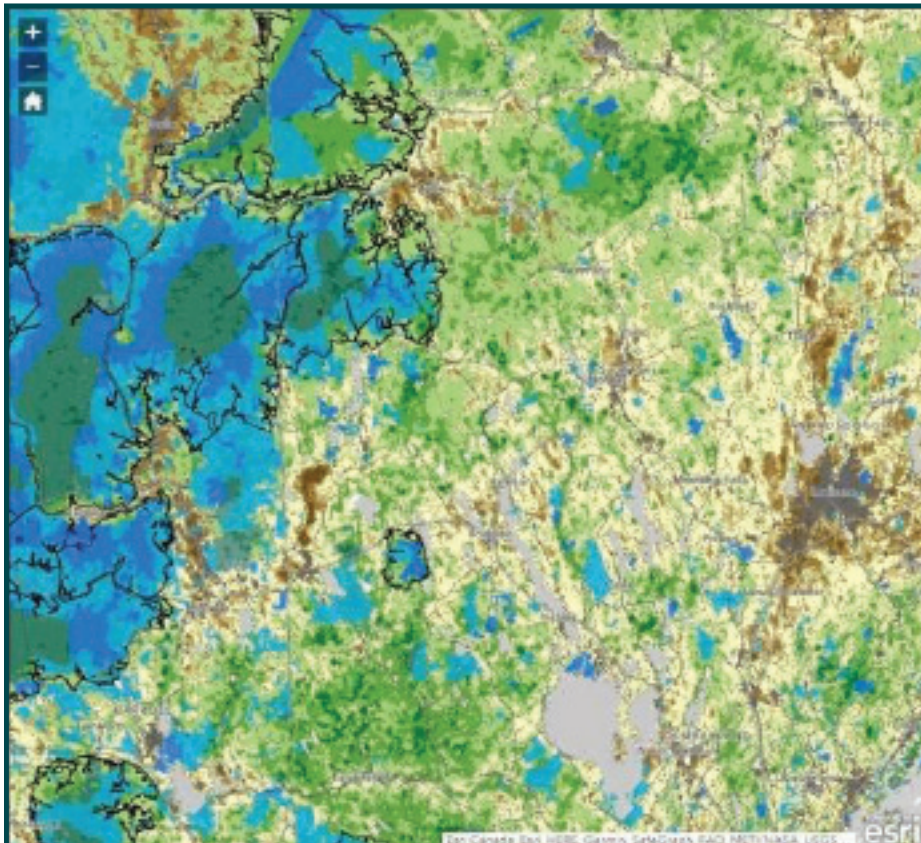
Here and elsewhere, many landscapes that stand out as climate vulnerable are those on which development has separated one conserved parcel from another. Such fragmentation disrupts seed dispersal and migration routes. It also leads to an increase in

edge effects—more light, higher temperatures, and other factors—especially when land use on abutting properties differs dramatically. Because certain species will not thrive on the edges of habitat, fragmentation often diminishes overall biodiversity.

Plants experience climate at the micro scale (inches to yards), and thus sites that include variations in topography and hydrology create a mix of microclimates that have the potential to buffer the impact of climate change. Plants can move to more favorable microclimates within these climate-resilient sites. If these sites are also connected to each other, they can facilitate longer-distance range shifts.

Ultimately, there will be some habitat types that are more vulnerable to rapid climate change than others—particularly low-lying coastal habitats with sandy substrates, which could be eroded in storms, and remnant habitats isolated by surrounding development, which have a lot of edges and no buffer.

But an important take-away from our analysis is that resilience exists across a spectrum, and habitats can be made more resilient. As a starting point, focusing on increasing the connectivity among fragmented conservation parcels (particularly those adjacent to Important Plant Areas) is a simple way to gradually increase overall climate resilience in our region.



Map 2: NH/ME, White Mountain National Forest with GAP, IPA, and climate-resilience layers

IPAs by the Numbers

Important Plant Areas are climate-resilient sites containing between 2 and 26 rare taxa depending upon the size of the site. We assessed progress toward goals in the Global Strategy for Plant Conservation (GSPC) and the New England targets (NET) in two ways: (1) the number of IPAs protected, meaning having 75% or more of their area conserved for nature and natural processes; and (2) the percentage of acres secured (30% goal) and protected (75% goal).*

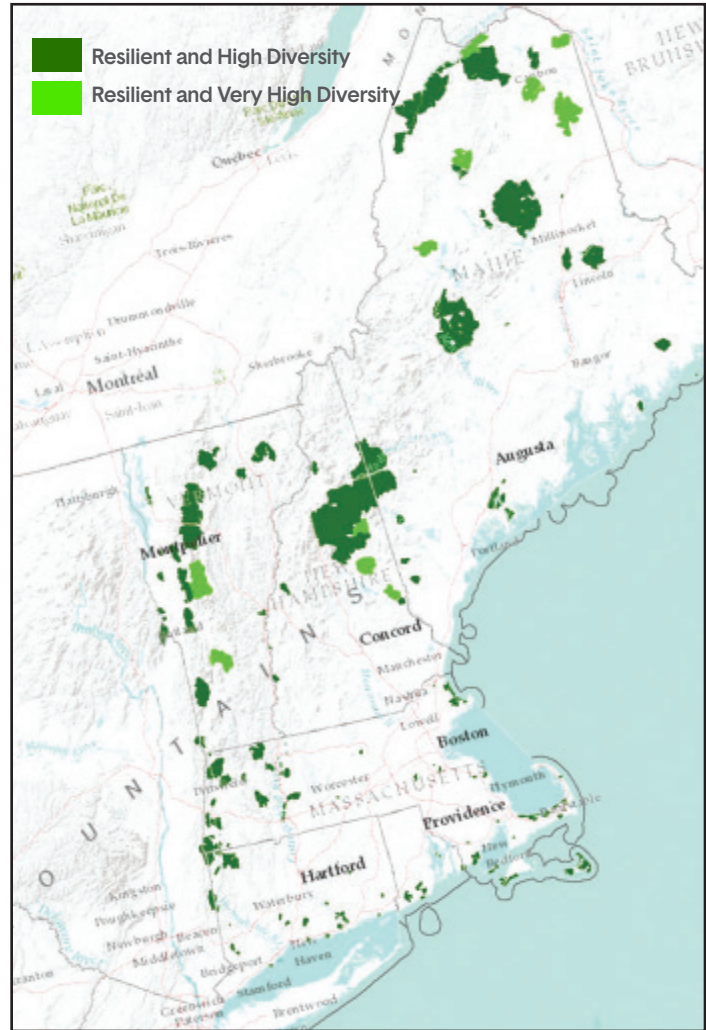
By site:

- Of the **234 IPAs**, **only 10 meet the GSPC goal of 75% protected**, and they are distributed evenly across forest, wetland, and patch habitats.
- 32 IPAs that are mostly forest meet the NET of 75% of their area secured in a combination of protected and multiple-use land. Of these, 19 also meet the 30% protection goal in the NET.
- Of the remaining 192 IPAs, 155 have some level of securement, including 122 with some protection for nature. None of these reach the 75% secured threshold.

By area:

Of the **2.6 million acres** within the IPAs:

- 29% are protected for nature and natural processes
- 23% are on multiple-use land
- thus 52% of the IPA area is in some level of securement
- but that leaves 1.3 million acres unprotected.



These 234 IPA sites are climate-resilient areas with multiple populations of globally and regionally rare species.

Since IPAs encompass 92% of the habitat types in New England, giving them priority would be an effective way to meet the two sets of conservation targets for the region. There are several strategies for safeguarding IPAs:

- Prioritize IPAs whose dominant habitat is generally not well conserved.
- Focus on the 27 sites with the highest diversity value; presently, only one is more than 75% protected (GSPC target); 9 are more than 30% protected (NET), and 9 are less than 5% protected.
- Reduce the acres in IPAs open for multiple uses, thus raising the protection level.

Detailed information about all the region's IPAs appears in an appendix in the report.

WHAT YOU CAN DO TO CONSERVE PLANT DIVERSITY

Our report focuses on land conservation as a primary strategy for saving plant diversity as the climate changes. The key is not just conserving more land, but strategically conserving a proportional amount of every habitat type in New England and prioritizing Important Plant Areas. There are several ways you can help achieve these goals.

1. Get involved with your local land trust.

- New England has more than 250 land trusts, and it's likely that one of them is active in your town or county.
- Tell them about our plant diversity report and mapping tool, and encourage them to consider biological value when acquiring or putting easements on properties. That will help them spend limited conservation dollars on properties that will do the most to save plant and thus overall biodiversity.
- Encourage them to focus on Important Plant Areas and habitats urgently needing conservation in your state. You can find information about the latter in the executive summary and the state fact sheets in the report.

2. Be an advocate at the local, regional, and state levels of government.

- Get involved in your town's, city's, or county's planning process, to advocate for ecologically sensitive development and for preserving land with ecological, rather than recreational, value.

- Advocate for funding for land protection, management, and restoration at local and state levels.
- Support strengthening laws that protect wetlands and other sensitive habitats from unwise development or use.
- Advocate for laws that protect endangered species and eliminate loopholes.
- Support legislation to reduce greenhouse gas and pollutant emissions, and to reduce the use of pesticides.

3. Champion native plants.

- In your volunteer positions and at home, plant or advocate for species native to the New England ecoregions to assist insects, birds, mammals, and all other wildlife to survive and thrive.
- Urge your local garden centers to sell New England native plants grown from seed.
- Encourage your schools, environmental centers, and scout troops to teach botany and ecology.

4. Put conservation principles to work at home.

- Enjoy the great outdoors, and keep learning about the plants you see.
- Reduce or replace your non-native lawn.
- Minimize fertilizers and pesticides, which pollute water and kill pollinators.
- Identify and control non-native invasive plants on your property.



Conservation Goals by State

Land conservation will be most effective when we focus on resilient sites where plants are likely to be most successful due to the properties of the land. IPAs make a perfect starting point for conserving resilient sites that contain rare species and represent a range of habitats.

CONNECTICUT

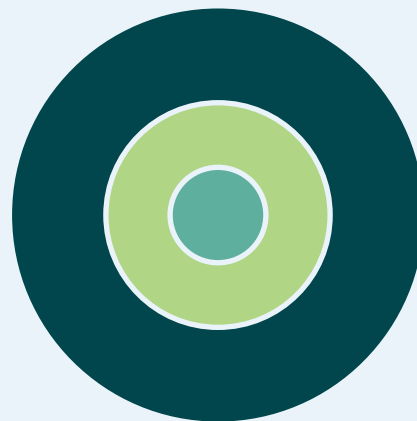
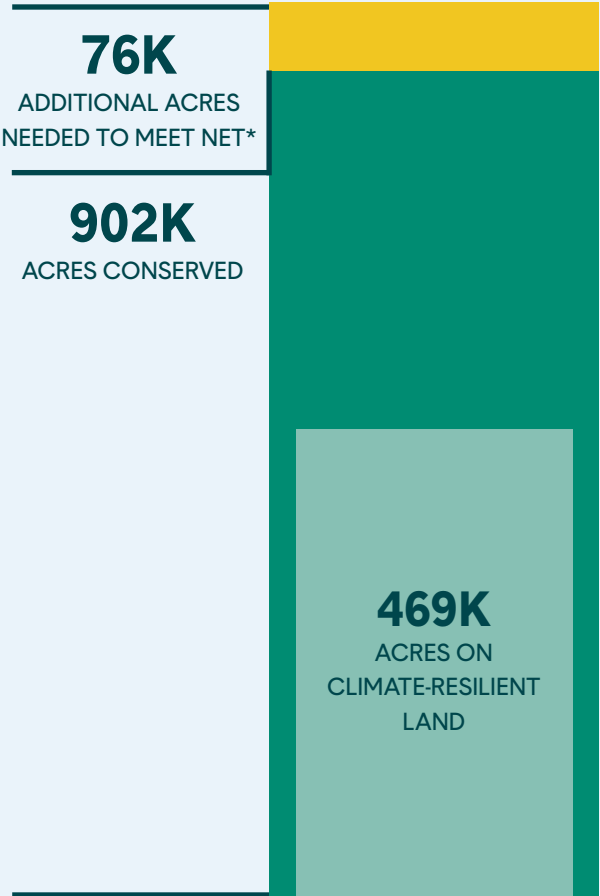
2M TOTAL ACRES



- 56K IPA Acres in State
- 22K IPA Acres Secured
- 3K IPA Acres Protected

MASSACHUSETTS

3.7M TOTAL ACRES

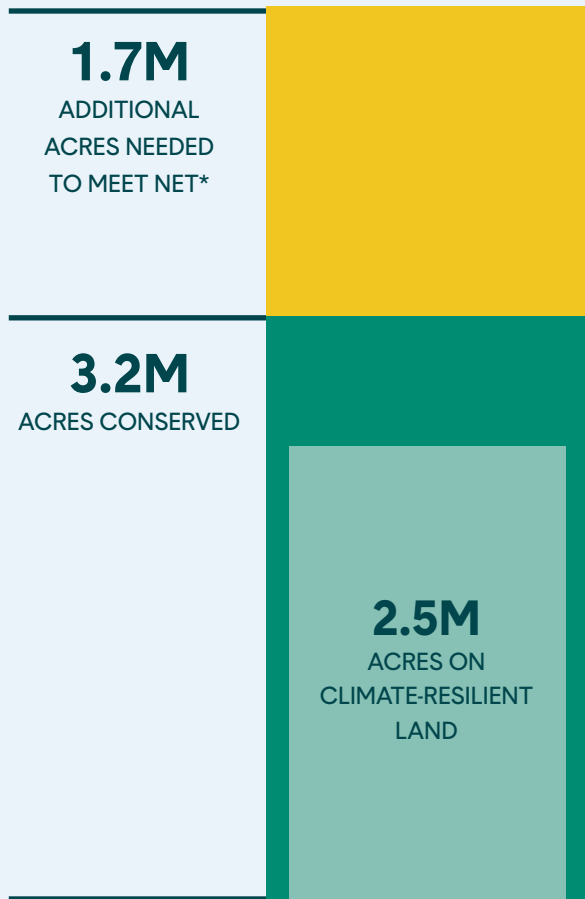


- 149K IPA Acres in State
- 48K IPA Acres Secured
- 8.5K IPA Acres Protected

*NET = New England Target of 30% secured from development and 5-15% protected for nature

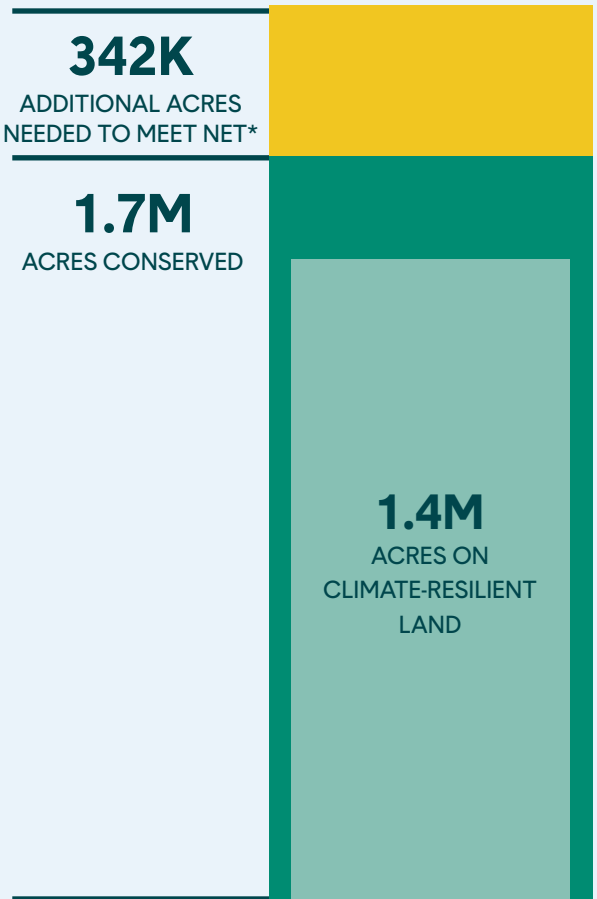
MAINE

18.8M TOTAL ACRES



NEW HAMPSHIRE

5.2M TOTAL ACRES



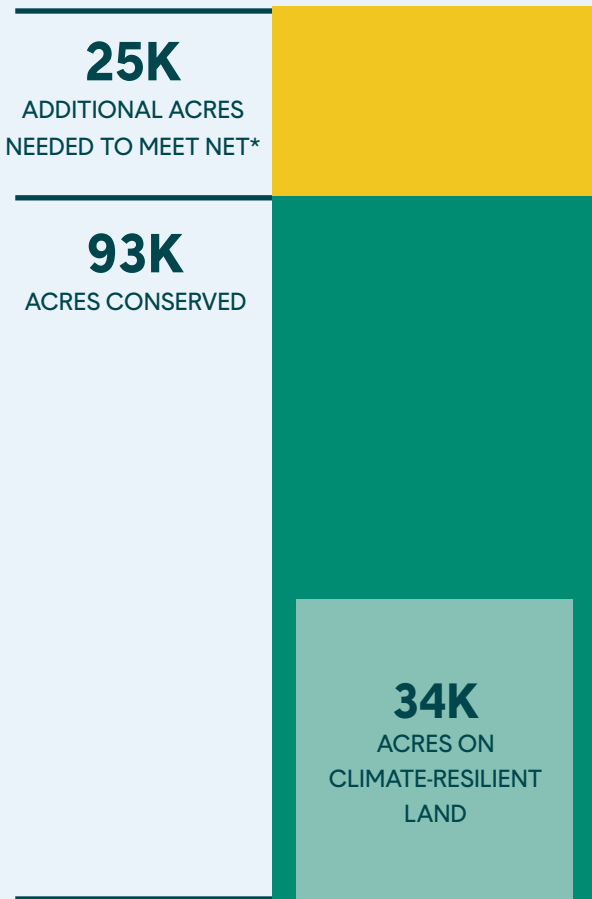
- 1.4M IPA Acres in State
- 505K IPA Acres Secured
- 191K IPA Acres Protected



- 449K IPA Acres in State
- 275K IPA Acres Secured
- 126K IPA Acres Protected

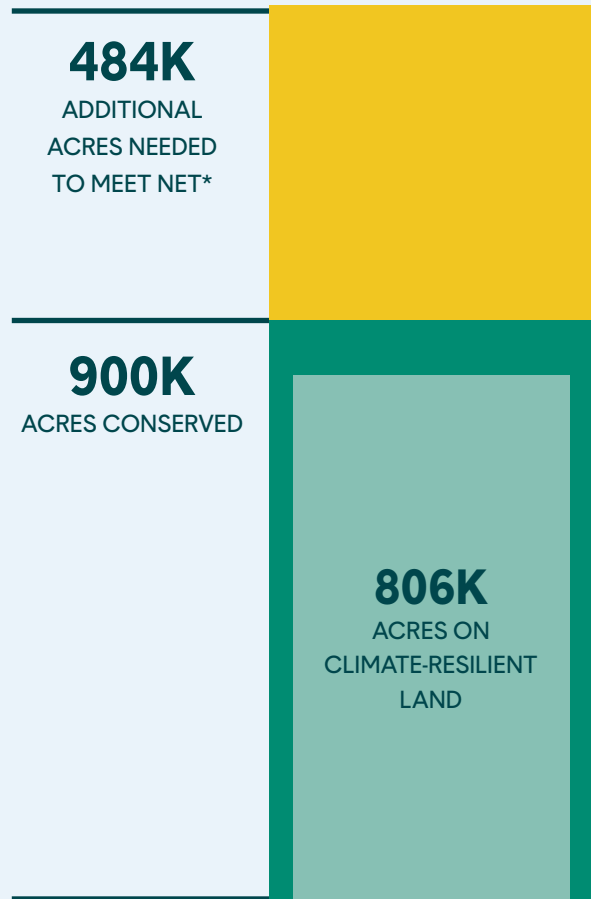
RHODE ISLAND

462K TOTAL ACRES



VERMONT

5.5M TOTAL ACRES



- 8K IPA Acres in State
- 2K IPA Acres Secured
- 1.8K IPA Acres Protected



- 471K IPA Acres in State
- 169K IPA Acres Secured
- 41K IPA Acres Protected

Rare Plant Spotlight



Northern Blazing-star

(*Liatris novae-angliae*)

—Arthur Haines, Senior Research Botanist

Many New England plants were once present in several locations throughout the region—widespread enough so that botanists of 75 years ago might have scoffed at the idea that those plants would become rare. Those species include northern blazing-star (*Liatris novae-angliae*), which once inhabited many open, sandy sites in southern and eastern New England, such as dry fields, sandplains, and open banks, where sand was deposited during the melting of the last ice sheet, creating well-drained soils.

Pollinated by bees, butterflies, moths, and flies, northern blazing-star is an attractive perennial that produces congested flower heads of small, tubular, blue to red-blue flowers that collectively resemble a single flower. The flower heads are arranged in beautiful spires along the axis of the plant. In some places in New England, they still occur in large numbers, creating stunning landscapes. Yet such large populations are much fewer and farther apart than they were in the early 1900s.

While northern blazing-star can take advantage of human disturbance, it is native to what are now critically imperiled habitats that originally required fire to maintain populations—fires that were caused by non-human phenomena or set by indigenous people. Today, intentional burning and machine clearing are sometimes used to maintain these plant communities.

These open, often tree-free habitats are vulnerable to development and climate change. Because their relatively flat terrain lacks topographical variation, the plants cannot take advantage of a diversity of microclimates that would enable them to migrate as weather patterns change. Although many of our botanist predecessors of the early 20th century foresaw the threat of widespread development, few had grasped the possibility of a warming planet.

Please support the work of our conservation botanists with a donation to Native Plant Trust. www.NativePlantTrust.org/support. Thank you.

HAPPENINGS



DIRECTOR SERIES: PLANTS AND THEIR STORIES

These special events offered by Native Plant Trust directors will take you into spring. Reserve your place and get details at www.NativePlantTrust.org.

Tales from the Field: Botany Story Slam

Saturday, February 26, 2022, 6-8 p.m.

Join Director of Conservation Michael Piantedosi and special guest for an evening of plant-adventure storytelling. Prominent botanists and horticulturists will share their most riveting and hilarious tales from the field. You too can participate in person, at Garden in the Woods, online.

Author Talk: *The Northeast Native Plant Primer:*

235 Plants for an Earth-Friendly Garden

Friday, June 10, 2022, 12:30-2:00 p.m. Join Uli Lorimer, Director of Horticulture, for the debut of his new book, which highlights our region's spectacular plant diversity and varied habitats. Lorimer's book serves as a gardener's guide and informs readers how native plants heal our landscapes, welcome wildlife into our gardens, and inspire us. This illustrated book will prove useful to gardeners at all levels of experience. At Garden in the Woods.

NATIVE PLANT TRUST THE GARDEN SHOP

*Thank you for making 2021
a great planting season!*

Winter snows bring spring flowers.
The 2022 native plants list will be posted
in mid-January. Plan your preorder!

Find it at:

www.nativeplanttrust.org/for-your-garden/buy-native-plants/

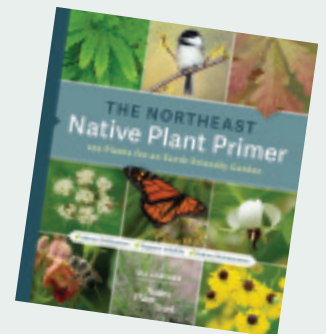
Gift cards available

EVERY PURCHASE SUPPORTS OUR MISSION

Start off your gardening
season with a copy of
Uli Lorimer's *The Northeast
Native Plant Primer*

Available in May, at a
member price of \$22.00
(\$24.44 for nonmembers).

Pre-order your copies online at
[http://www.nativeplanttrust.org/
for-your-garden/books/](http://www.nativeplanttrust.org/for-your-garden/books/) or call
508-877-7630 x3601.



SIGN-UP

Sign up for our free eNews to
get updates about our public
programs, events, and other
activities.

Visit www.NativePlantTrust.org
and click on eNews in the footer
on any page.

HEADQUARTERS & GARDEN IN THE WOODS

180 Hemenway Road
Framingham, Massachusetts 01701-2699

CLIMATE CHANGE CAN-DO:

Make the Switch

Substituting a handful of nuts, vegetables, fruits for half a portion of beef could buy you 48 extra minutes of healthy life and reduce that meal's carbon footprint by 33 percent. — Stylianou et al., *Nature Food* 2021

