

2020
NEW JERSEY
NATURAL LANDS TRUST
ANNUAL REPORT



Preserving New Jersey's Natural Diversity

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STATEMENT OF PURPOSE

The New Jersey Natural Lands Trust was created in 1968 by legislation which became effective on January 23, 1969, making 2019 the 50th Anniversary of the Trust. The intent of this legislation was to create an independent agency with the mission to preserve land in its natural state for enjoyment by the public and to protect natural diversity through the acquisition of open space. The Trust preserves land primarily by donations of open space through acquisition of title in fee simple or of conservation easements, and manages its properties to conserve endangered species habitat, rare natural features, and significant ecosystems. The Trust invites passive use by the public for recreational or educational purposes wherever such use will not adversely affect ecological communities and biological diversity.

The Trust also recognizes that ownership and management alone are not enough to achieve its mission. Public education is an integral function of protecting natural diversity. The Trust distributes information designed to convey a conservation ethic for the protection of open space and its natural values.



New Jersey Natural Lands Trust

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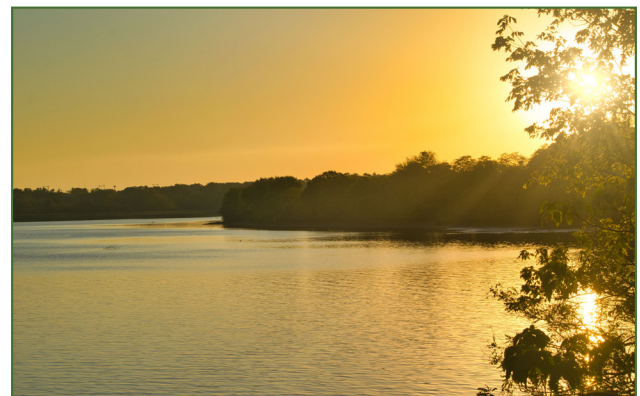
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A beautiful sunrise over the Delaware River Back Channel.

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In 2020...

The New Jersey Natural Lands Trust brought approximately 600 new acres under Trust stewardship adding to its system of more than 120 preserves throughout the state.

The acquisitions in 2020 built upon the **Bearshead, Bear Swamp at Red Lion, Beech Ridge, First Time Fen, Hamilton, Sooy Place, and Walkkill** preserves.



Mr. Mark Moore Simons with Trust Preserve Manager Martin Rapp and Kathi Croes discussing the addition of his beautiful property to the Bear Swamp at Red Lion Preserve. The Simons and the Moores were long-time residents of Burlington County, with the Moores having settled in what is now Moorestown in 1682. For years, the Moores operated Moore's Cranberries in the area of Hampton Gate near Moore's Meadow Road in Tabernacle.

The Trust – A Unique Conservation Organization

By Michael Catania, Trust Chair

In 1968, at the dawn of the environmental movement, the New Jersey Legislature created a unique agency “in but not of” the Department of Environmental Protection and gave it a very special mission: the preservation of land in its natural state...and to protect elements of natural diversity. This special mission was prescient, as efforts to preserve our fast-disappearing biodiversity would not become common until more than a decade later. In the more than 52 years since that law took effect in January of 1969, the Trust has stayed true to both this special mission and to its status as a unique agency.



Trust Staff with Chairman Catania:
Martin Rapp, Michael Catania, Cari Wild,
Bob Cartica, and Darin Oliver.



The Trust has provided red knot research funding since the 1980s.

The Trust is unique in many ways in addition to its mission. First, the Trust comprises an exemplary public/private partnership, in that it is governed by a board of 11 members, six of whom are private citizens nominated by the environmental community and appointed directly by the Governor. The remaining five members include three representatives of DEP designated by the Commissioner, a representative of the Treasurer, and a representative of the State House Commission. This membership allows the Trust to tap into expertise in land acquisition from the executive branch, as well as multiple non-profit conservation organizations, so that the Trust is often able to coordinate with many of the major players in the area of land preservation to acquire or restore habitat that is critical for threatened or endangered species. An excellent example of this coordinating role is the shorebird program, which has been funded, in part, by a fund managed by the Trust. In the aftermath of Superstorm Sandy, when many of the handful of beaches heavily used by shorebirds in their spring migration to arctic nesting grounds were all but destroyed, the Trust was able to coordinate restoration efforts with public and private partners just in time to save the spring migration. And the research conducted by the Endangered and Nongame Species Program and the Conserve Wildlife Foundation, which was funded in large part by the Trust, was essential in establishing the scientific basis for the U.S. Fish and Wildlife Service’s listing of the red knot as a federally threatened species.



Chair Michael Catania congratulating the Trust on its 50th Anniversary from the location of the future Petty's Island Visitors Center.



Former Trust Secretary-Treasurer Dave Moore describing his inspiration for the Trust.

Similarly, the Trust has been able to play a leadership role in the preservation of Petty's Island, some 500 acres in the Delaware River just offshore of Camden and Pennsauken. The island provides critical habitat for migrating songbirds and waterfowl in the Atlantic Flyway, as well as the bald eagle and American kestrel. As the island is being cleaned up by its owner, CITGO Petroleum Corporation (CITGO), the Trust is working with CITGO and the DEP Site Remediation Program to transform the island, which will be owned by the Trust once the cleanup has been completed, into an urban wildlife sanctuary.

What has always been amazing to me is that the Trust is able to play this role with very little in the way of resources. Although at one time there were three full-time Trust staff funded by DEP, the Trust's Volunteer Coordinator position was eliminated in 2005, leaving just two full-time staff for the Trust. In addition, the Trust has not received a penny in general state funds for more than a decade, and relies on donations, grants, and the active involvement of its Trustees. Hopefully, as the State's fiscal position gradually improves, the Trust will once again be fully staffed and funded in the annual state budget.

Today, some 52 years from its creation, the Trust now owns or manages more than 30,000 acres as a system with more than 120 nature preserves statewide. This system of nature preserves protects some of most critical elements of biodiversity here in the Garden State and is a testament to the Legislature's foresight more than half a century ago.

On a personal and professional basis, I have had the privilege of being associated with the Trust for many years, having served as an *ex officio* representative of DEP during my time as Director of Regulatory Services and as Deputy Commissioner, and then again as a private citizen appointed by five different Governors. And I can honestly say that there is very little in a long conservation career that makes me prouder than my service on the unique conservation agency known as the New Jersey Natural Lands Trust.

For information on the New Jersey Natural Lands Trust, please visit [our website](#).

Petty's Island Update:

Surrounded by 2020's River of the Year

2020: A year to remember or a year to forget? While many of the plans we had for Petty's Island in 2020 were dashed by COVID-19, many notable and amazing things still happened.

In 2020, American Rivers, a national river conservation organization, named the Delaware River as the [River of the Year for 2020!](#) American Rivers honored the Delaware “to recognize its momentous progress for water quality, river restoration and community revitalization.” In doing so, they noted that the Delaware provides clean drinking water for 15 million people. When you consider how polluted the Delaware was just decades ago, this is remarkable. As the Delaware River Basin Commission noted, “The [Delaware’s] water was so foul that it would turn the paint of ships brown as they traveled through or were docked for any period of time. People were sickened simply by the smell of the river.” Now, the Delaware is so clean it is a key drinking water source, and animal species such as American shad and rare mussels are returning to the river.



Petty's Island surrounded by the Delaware River, River of the Year 2020!

American Rivers also noted that the Delaware contributes more than \$22 billion to the economy every year from water supply, recreation, tourism, and other benefits. The work that the Trust is doing in partnership with the NJ Department of Environmental Protection, the Alliance for Watershed Education (AWE), and Discover the Delaware increases and enhances these benefits for local communities within Camden and Philadelphia. Discover the Delaware is a partnership of nine organizations with a vision to promote education on and access to the Delaware River, including NJ Natural Lands Trust, Camden County, UrbanPromise, Center for Aquatic Sciences at Adventure Aquarium, New Jersey Conservation Foundation, Independence Seaport Museum, Cooper's Ferry Partnership, Camden County Utilities Authority, and Upstream Alliance. Part of AWE's vision is to create an eight-mile greenway along the Delaware and Cooper Rivers and a 13-mile water trail. The greenway will provide communities with climate resiliency, serving as a buffer against flooding, along with greater water access. These efforts will enhance the quality of life for the local communities. And as places to fish, birdwatch, kayak, bike, and hike, these communities will become recreational destinations, bringing economic opportunities to the local communities as visitors spend time eating and shopping in the area.

The Trust, working with New Jersey Audubon Society and others, has provided a decade of environmental education programming at Petty's Island. While this year's programming opportunities were reduced because of COVID-19, they still occurred in person and virtually. Spring programming was postponed, but by mid-July in-person programming had resumed. This included teacher workshops, bird hikes, history hikes, and a bat hike. The bat hike is a relatively new program which showcases Petty's Island after dark. With the oil tanks and Crowley Marine truck traffic gone, visitors were able to walk the road and explore the field habitats of Petty's Island looking for bats. Almost immediately upon the start of the hike, bat echolocation calls were detected. It was amazing to hear the bats and to enjoy an evening nature walk at Petty's with the Philadelphia skyline all lit up and fireworks over the Camden skyline off in the distance.

“...when people have meaningful experiences outdoors their quality of life, health and social well-being improve, and in turn their communities become stronger and more sustainable...”

This year the Trust was again fortunate to have the support of an AWE fellow. The William Penn Foundation sponsored each of the AWE centers to host a summer fellow. The Trust's fellow, Priscilla “Cilla” Rios, collaborated with fellows Ivana “Eve” Quinones and Adriana “Adri” Amador Chacon, with the Center for Aquatic Sciences and New Jersey Conservation Foundation, respectively, on a project called “[Virtually Camden](#)” where they created a series of educational videos, informational graphics, and social media posts showcasing Camden's rivers, trails, parks, and preserved natural areas. There was a great article about them in [Philly Voice](#) in which Adri explained how important these programs are to cultivate awareness and appreciation for the natural areas within Camden communities. As she so eloquently expressed, “Unfortunately for most residents, we've been disconnected from natural spaces for a multitude of reasons, and if we do have access, there tends to be a disregard and lack of respect for nature, as there is a lot of litter in these beautiful places. We hope to expose more families to activities in our natural surroundings that many don't normally get to see or enjoy and show them ways they can help preserve these areas by making small eco-friendly changes.”



The Philly skyline during the Petty's bat hike.



William Penn Fellows Adri, Cilla, and Eve producing a “Virtually Camden” program for Petty's Island.

The “Virtually Camden” programs were featured as part of the fourth annual Delaware River Festival, formerly called River Days, which featured a series of events sponsored by AWE centers throughout September. Funded by the William Penn Foundation, there are 23 AWE centers, including Petty's Island, located along the major Circuit Trails, or connecting trails throughout the Delaware River watershed, which share a mission to collectively increase and enhance constituent appreciation and stewardship of the Delaware River watershed. Through the Delaware River Festival, AWE aims to raise awareness about the Delaware River and its watershed. This year, the mostly virtual Festival's theme was “Healthy River. Healthy Life.” The Delaware River Festival offered 45 different virtual events (live and pre-recorded) with 16,895 viewers and 13 in-person events with 455 attendees. As part of the Festival, an in-person youth bird hike was offered at Petty's Island. For the in-person events, 68.7 percent of festival attendees were from Camden County.

The 2020 Philadelphia Environmental Film Festival, which included the Trust's documentary film *Petty's Island: A Journey Back to Nature*, was postponed from the spring to a virtual event held in the fall. Our 22-minute documentary film has been well received and can now be viewed [online](#). We hope that you will enjoy this historical look at over four centuries of events literally and figuratively shaping life on Petty's Island. The story is told from the perspective of the island as witness to events which took it from its natural state to various states of development over the centuries and now back to a natural state.



Juvenile bald eagle
Photo: William Culp

As an example of the island's journey back to nature, it is exciting to watch as the former 50-acre Crowley Marine parking lot is restored to grassland habitat for numerous bird and wildlife species. At least 12 American kestrels have been observed foraging in the new meadow. Since some of them are juveniles, it is assumed that they are nesting nearby. Juvenile bald eagles have been regularly observed in the tree line surrounding the new meadow habitat. Hopefully, these sightings are signaling the return of nesting eagles to the island someday soon.

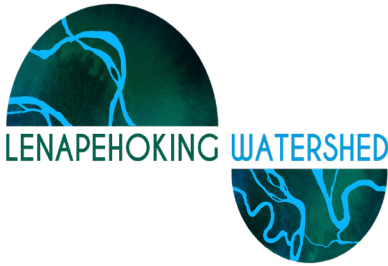
During 2021, despite continuing COVID-19 challenges, we will be able to offer new and interesting programming at Petty's. For information about upcoming programs, please check the [Audubon program page](#). The Trust continues to look for ways to expand public access and opportunities because, as is so well said by the [Blue Sky Funders Forum](#), "when people have meaningful experiences outdoors their quality of life, health and social wellbeing improve, and in turn, their communities become stronger and more sustainable." The Trust, with its partners, will keep working to engage the local community and provide them with meaningful nature-based experiences either remotely or in-person at Petty's Island.



Former Crowley parking lot, now a meadow of warm season grasses, where American kestrel (photo: William Culp) and bald eagle enjoy hunting.

PhragFest: Art Comes to the Delaware River Watershed

PhragFest 2020 was the official kickoff for a Delaware River Watershed-wide ecological art project sponsored by the Alliance for Watershed Education (AWE). The purpose of PhragFest was to harvest invasive Phragmites (Phrag for short) reeds for its use in creating site-specific ecological art installations using natural materials at AWE centers across the Delaware River Watershed. At more than a half dozen events held last winter, the public was invited to “join us in the reeds” and help with the harvest. The call went out over social media that if you wanted “to get more exercise, spend time in nature, volunteer, embrace the winter weather, help the community and the environment, try new things, be more creative, or be a better person ... well then ... PhragFest is for you!” The response was overwhelmingly positive and more than enough Phrag was collected to start building, but then ... yep, COVID-19 hit. But the collected Phrag is still good, and the art project is still a go! So, more about the art project.



The name of the AWE art project is “Lenapehoking~Watershed.” Lenapehoking is a place name that means “the land of the Lenape people” and which roughly corresponds to the Delaware River Watershed. This name was chosen after a six-month consultation process between AWE, its Art Project and Diversity, Equity, Inclusion, and Justice (DEIJ) work groups, and representatives from the Nanticoke-Lenni-Lenape Tribe. The consultation process focused on the implications of using an indigenous Lenape place name in a respectful way.

The artist behind Lenapehoking~Watershed is Sarah Kavage, a Seattle-based artist and urban planner whose artwork incorporates social engagement in addition to urban planning, research, and community organizing methods. Her work is process-based and focuses on relationship building through communal design and building. Kavage also served as an artistic director on Duwamish Revealed, a project of the Environmental Coalition of South Seattle which consisted of a series of outdoor art installations, performances, and community activities along the entire length of the Duwamish River. Featuring over 40 artists, the project used temporary public art and cultural events to activate the river corridor and highlight the communities, history, industry, and ecology of the Duwamish, Seattle’s only river.



Artist Sarah Kavage on Petty’s Phrag bench.

A critical goal of the AWE art project is that the art be created and interpreted through a community engagement process that will result in meaningful relationships between centers and their communities. Through the process of creating the installations with community members as volunteers, assistants, and/or collaborators, there is the potential for an exchange of knowledge between the artists, the centers, and the community that creates a sense of place and ownership, leading to deepened relationships. It is hoped that the art will be an expression of that shared creative endeavor, and the new relationships that have developed through the project will create a firm foundation for the centers and their communities to build upon in the future.

Once completed, these art installations are designed to be inhabited by the public as spaces for gathering, teaching, or performance, both formal and informal. Centers could use these installations as outdoor classrooms, for special events, or could invite outside community groups to activate the installations in their own unique way. The hope is that, however used, the art installation will give people a sense of belonging at the site, as well as a sense of belonging within their community.

Like Duwamish Revealed, a culminating event in the form of a festival to celebrate our natural environment within the Delaware River Watershed, as well as the diversity of cultures and communities that depend upon and value our watershed, is envisioned. The intention of the festival is not to create a repeating event but to bring communities and the centers together through this shared art experience as a catalyst to spark new relationships and new partnerships that will extend well into the future. We hope to see you in the reeds!



*Because the Trust's mission is to preserve land in its natural state and protect New Jersey's natural diversity, our annual report profiles a selected rare plant each year. This year we profile **Isotria medeoloides**,*

Small Whorled Pogonia

This year we profile a beautiful, delicate globally rare orchid. It is listed by the U.S. Fish and Wildlife Service as federally threatened and as endangered in New Jersey. Until last year, all known populations of small whorled pogonia in New Jersey occurred only on two Trust preserves. Excitingly, over the past year, this plant was also found by an interested citizen in Stokes State Forest and on a Trust preserve by the Trust's Preserve Manager Martin Rapp. Great news, although many people spent many hours, even days, looking for it.

It is a perennial that appears in the spring if it appears at all (more about that later). The stems are usually single, but occasionally in groups of two or three. Leaves and stems are green with the stems being greenish white and fleshy, not stringy. The stems can be from one inch to more than a foot tall.

The plant gets its name from a whorl of five to six leaves that occur near the top of the stem. From the whorl of leaves, one or more flowers rises. Flowers are yellowish green with a greenish white lip. Each flower has three sepals of equal length that spread outward. The flowers are scentless, lack nectar, and are primarily self-pollinating.

Discovery of this plant can be tricky and frustrating. It has at least two look-alikes that bloom at the same time and grow alongside it. While searching for this orchid, you can glance down and think "Eureka," there it is, only to realize you are looking at Indian cucumber-root, or the large whorled pogonia, which is larger than the small whorled, hence the name, and has a stringy purplish brown stem and purple, instead of green, sepals.



Block print of small whorled pogonia by Terry Lee Schmidt.



Small whorled pogonia seed pod.

Small whorled pogonias that seemed healthy and flowering one year can be gone the next... and the next... and the next. This unpredictable dormancy makes monitoring the plant challenging. It also makes it very difficult to know if the plant is in peril and whether habitat manipulation or restoration is working or will work. It seems that the best explanation for dormancy may be related to fungi, specifically mycorrhizal fungi.

An article, [*In Defense of Plants*](#), summarizes the fungal relationship well:

“Orchids are the poster children for mycorrhizal symbioses. Every aspect of an orchid’s life is dependent on these fungal interactions. Despite our knowledge of the importance of mycorrhizal presence in orchid biology, no one had looked at how the abundance of mycorrhizal fungi influenced the life history of these charismatic plants until now.

By observing the presence and abundance of a family of orchid associated fungi known as Russulaceae, researchers found that the abundance of mycorrhizal fungi in the environment is directly related to whether or not an orchid will emerge. The team focused on a species of orchid known commonly as the small whorled pogonia (*Isotria medeoloides*). Populations of this federally threatened orchid are quite variable and assessing their numbers is difficult.

The team found that the abundance of mycorrhizal fungi is not only related to prior emergence of these plants but could also be used as a predictor of future emergence. This has major implications for orchid conservation overall. It’s not enough to simply protect orchids, we must also protect the fungal communities they associate with.

Research like this highlights the need for a holistic habitat approach to conservation issues. So many species are partners in symbiotic relationships and we simply can’t value one partner over the other. If conditions change to the point that they no longer favor the mycorrhizal partner, it stands to reason that it would only be a matter of years before the orchids disappeared for good.”

The Trust has been monitoring the small whorled pogonia populations on its preserves for years. Luckily, although the plants have disappeared from some spots, Trust staff has discovered them in others. They have always at least “shown up” on the preserves each year. Staff has observed that the small whorled pogonia appears to thrive in areas of decaying wood such as tree stumps and to associate with certain

trees and plants such as the American beech and rattlesnake plantain.

Recognizing the rarity of the plant, and our responsibility for its care in New Jersey, the Trust has tried to be proactive with habitat management. It has been suggested that this plant requires small light gaps, or canopy breaks, and generally grows in areas with sparse to moderate ground cover. This need for sunlight may account for the plant occurring adjacent to streams, ravines, stone walls, and other such landscape features. Based on this, the Trust has taken steps to girdle trees to create breaks in the canopy, and to remove vegetation encroaching onto the orchid’s habitat. However, because of the delicate fungal balance that must be maintained, the Trust has refrained from doing more. Deer browse also poses a threat. It is disturbing to see an otherwise healthy plant with its whorl of leaves and flowers chewed off.

To protect the health and composition of the soil for the small whorled pogonia, the Trust has tried to preserve lands adjacent to the preserves where the plant occurs to establish the greatest possible buffer against storm water runoff and other environmental threats that could alter soil composition.



Small whorled pogonia watercolor, by Beverly Simone, featured in *Losing Paradise? Endangered Plants Here and Around the World*.

As the Trust has reported in past annual reports, in 2009, the American Society of Botanical Artists sponsored a project entitled, *Losing Paradise? Endangered Plants Here and Around the World*, which profiled 24 plants from the United States and 20 plants worldwide threatened with extinction. The small whorled pogonia was amongst those profiled. While the exhibition focused on our love of plants and appreciation of their beauty through artwork, it was also intended to educate and remind us of our total dependence on plants and the complex consequences of our actions which limit their abundance, diversity, and their very existence. In his introduction to the exhibition, Peter H. Raven speaks to our complex relationship with plants:

“ We are completely dependent on plants, directly or indirectly, for our food; most people in the world depend on them for their medicine; and they collectively protect our soils, regulate the natural flow of water, and provide the pollinators that make a high proportion of our crops productive. By capturing a small measure of the energy from the sun that bombards the earth continuously in enormous amounts and transforming it through the process of photosynthesis into chemical bonds that store energy, they, along with algae and a few kinds of bacteria, provide the basis of life on earth. Particularly at a time when we are still building our knowledge of molecular biology rapidly, we look forward to many unknown but important further uses of plants and their products in the future.

...

In order to achieve success in plant conservation, it will be necessary to address the general environmental conditions that are threatening the survival of organisms throughout the world. In the largest sense, the factors responsible for the pressure on populations of organisms are the size of the human population, our levels of consumption, and the kinds of technologies that we have selected for use. These in turn lead to habitat destruction, the spread of alien invasive

species (including diseases), and the widespread use of harmful technologies. Now it is evident that global climate change is also a major factor contributing to biological extinction, one that must be addressed for success in preserving species overall.

...

Education is fundamental to success in saving our plants and the planet. We must make the wonder and the importance of plant diversity accessible and understandable to the public, whose values and actions will ultimately decide our success or failure. ”

More than a decade after the exhibition, with plants under ever-increasing threats from climate change, Mr. Raven's words have greater urgency and significance.

Although the Trust cannot share locational information due to the plant's rarity, we invite you to look at these pictures and gain information about the plant so that when you are enjoying a walk in the woods you might be on the lookout for this beautiful, delicate orchid. And, if you find one, please let us know by submitting a [Natural Heritage Rare Plant Species Reporting Form](#).



Small whorled pogonia

SOURCES

American Society of Botanical Artists. 2009. *Losing Paradise? Endangered Plants Here and Around the World*. Introduction by Peter H. Raven. <https://www.indefenseofplants.com/blog/2017/1/30/orchid-dormancy-mediated-by-fungi>
<https://www.fws.gov/southeast/wildlife/plants/small-whorled-pogonia/>

White-tailed Deer: Densities and Why It Matters

By Dr. Jay F. Kelly

Overabundant populations of white-tailed deer (*Odocoileus virginianus*) are causing multiple problems for forests and other habitats in New Jersey. With the extermination of their natural predators, warming winters, and increased food resources provided in the suburban and agricultural lands that have fragmented forests throughout the Northeast, deer populations have increased far beyond the ability of local ecosystems to support them, or to sustain a great many other species in their midst.

When white-tailed deer increase above densities of about 10 deer per square mile, a variety of problems tend to occur, including declines in the abundance of species like hemlock, trillium, and certain lily and orchid species that deer prefer to browse. Densities of tree seedlings begin to decline, and with them some of the more vulnerable wildlife species. When populations rise above 20 per square mile, forest regeneration begins to shut down entirely and “cascade effects” can be observed throughout the forest food web, including declines in tree diversity, insect abundance, nesting bird populations, amphibians, and all but the most unpalatable of plant species which, consequently and tragically, include many exotic, invasive plant species. It can even result in changes to the physical landscape, impacting soil structure, nutrient cycling, microclimate conditions, and water quality.

In New Jersey, statewide minimum deer densities were estimated to be at the sustainable level of 10 per square mile in the early 1970’s but had risen to three times that amount by the late 1990’s, according to the NJ Department of Environmental Protection, with densities as high as 70 per square mile in parts of central NJ. Since that time, populations in excess of 100 per square mile have regularly been observed in preserves and communities throughout central and northern NJ.

Despite the severity and extent of these problems, numerous successful case studies exist of effective deer management, both through long-term exclosures maintained by organizations such as the Great Swamp Watershed Association, Duke Farms, and Greenbrook Sanctuary, as well as intensive hunting programs implemented in preserves and communities such as Duke Farms, Friends of Hopewell Valley Open Space, Princeton Township, and Union and Morris county parks.



Deer browsing at mid-day unfazed by human presence.

To begin to assess the significance of these problems on NJ Natural Lands Trust Preserves, the Trust partnered with Raritan Valley Community College (RVCC), Center for Environmental Studies to conduct infrared drone surveys of deer on 10 Trust preserves in 2020-2021. When used by professional biologists, these thermal sensors provide the most accurate measurements of deer populations available and are much more affordable when mounted on drones than on manned aircraft. These surveys are typically conducted on winter nights, taking advantage of both the differences in temperature between the bodies of the deer and their surroundings, as well as the lack of leaves in the tree canopies, which would otherwise obscure their view.



The preliminary results from surveys conducted in 2020 found deer populations on Trust preserves in northern NJ to be 63 per square mile on average – more than six times levels that are optimal for supporting forest biodiversity, structure, and function. These results also found marked differences in deer densities by hunting regime: the two preserves with no hunting had deer populations of 84/mi², compared to 72/mi² with bow hunting only, and 43/mi² with full hunting seasons.

These results are being combined with a much larger data set being developed by RVCC, which should total over 100,000 acres in 2021. With this data, RVCC hopes to better understand the response of deer populations to landscape factors such as forest cover and fragmentation along urban-suburban-rural gradients, the effectiveness of different types of hunting programs, as well as the relationships to forest understory conditions, deer-vehicle collisions, Lyme's disease prevalence, and other factors.

In the meantime, the Trust is considering how to take advantage of these important findings to increase the effectiveness of deer management taking place in its preserves to ensure that they continue to support the unique species and biological communities that they were acquired to protect.



Biodiversity Inventory Updates: Few Rare Species Despite Extra Fieldwork



Photos

Top: Nighttime moth survey.

Middle: Moth block print by Terry Lee Schmidt.

Bottom: American Chesnut.

Species inventories and monitoring has been something the Trust has pursued for years to understand population numbers and trends for plants and animals on its preserves. Casting a wide net has been the Trust's approach to gathering new and updated information about locations and species numbers. With so many preserves spread across the entire state, the Trust plans and conducts its surveys to represent each part of the state. Such surveys might be done in the Pine Barrens, a North Jersey forest or a coastal marsh. Little by little we are learning new biodiversity details about each of our preserves.

This year's major biodiversity inventory project studied the rugged, forested Reinhardt Preserve in Sussex County. The Reinhardt Preserve is named for the late Goyn Reinhardt, who donated the initial core area of the preserve. This is one of the Trust's earliest preserves and has long been a highlight of the Trust's preserve portfolio. With over 100 acres recently added to the preserve, it was time to focus more survey attention here. Reinhardt Preserve is next to High Point State Park and other conservation lands, bringing a wider connected landscape of hardwood forests, beaver marsh, and clean flowing streams into study plans.

The Trust hired Biostar Associates, Inc. to conduct the groundwork needed to identify and record the plants, reptiles, amphibians, and insects at Reinhardt. The consultant team hiked up mountains, kayaked down streams, and worked both day and night shifts to get the most results. In their travels they documented 357 vascular plant species. Of note was a rare mature fruiting American chestnut. This species was nearly extirpated by chestnut blight, surviving from sending up persistent stump sprouts. Several plant species recorded are rare. Logs and stones were turned to uncover salamanders or snakes hidden underneath. Biostar Associates did two nighttime moth surveys. Bright lights beamed onto white sheets at night were a beacon, attracting moths from a considerable distance from forest, swamp, and field habitats. Each moth was photographed to help verify proper identification. Mostly unnoticed, often with somewhat bland but complex coloration, moths comprise an important element of natural diversity. In all, 247 moth species were recorded at Reinhardt from just one spring and one fall night survey.

The wide-net approach for biological surveys also led to many single species surveys, too. An additional moth study was conducted at the Mackenzie's Bog Preserve, this time by Blaine Rothauer of GZA Consultants. Blaine compared the 169 moth species he attracted in his one-night summer survey with his own statewide database of other locations he has surveyed. Using his own unique comparison data, Blaine was able to correlate the moth species list he assembled for Mackenzie's Bog with the unique ecological habitat qualities at the preserve. Blaine incorporates his detailed understanding of the life histories of each moth species discovered with that moth's own unique or specialized micro-ecological requirements. His report is an assessment of local moth habitat and provides an overall rank score for the site and how it compares to other sites he has surveyed statewide. His method uses the moths as a barometer of ecological integrity.

Also at Mackenzie's Bog, after a two-day summer search we compiled and updated a species list of butterflies. This butterfly survey will be supplemented with more search days in 2021, plus we will add dragonflies to the search.

Some of the most interesting finds on Trust preserves this year came not from planned or Trust-directed surveys but from individual naturalists. Hobbyists and professionals, on their own, seek out plants, animals, or other elements of our natural world of interest to them. Botanists scour the woods and swamps to discover new plant populations or species lost to time. Bob Moyer, who works part time for the NJDEP, Office of Natural Lands Management, is one such person who found a plant called smooth orache (*Atriplex glabriuscula*). This is the first and only documented location for this plant in New Jersey. He discovered it growing in the coastal brackish marsh at the Trust's Sands Point Harbor Preserve near Waretown, Ocean County. Another special find was an interesting gilled mushroom (*Calliderma indigofera*), which has a very distinctive and unique blue hue, discovered growing in an Atlantic white cedar swamp at the Crossley Preserve. Not seen growing in New Jersey for over a century, it went unnoticed and unappreciated until it was rediscovered in 2013 by the New Jersey Mycological Association. Subsequent surveys by Jason Hafstad, a botanist with the NJDEP, have yielded numerous new populations scattered across southern New Jersey, including the one at Crossley.

What have you found? Users of the phone app iNaturalist.com have provided some incredible and useful information on species in Trust preserves. Specialists in dragonflies and birds have uploaded important records of species to the phone app, sharing photographs for all to view. Trust Preserve Manager Martin Rapp has added well over 700 species records from Trust preserves. To see what he's found on your favorite preserve, follow him yourself at [iNaturalist.org](https://www.inaturalist.org/users/njnltrapp). His handle is NJNLTRAPP.



Smooth orache
Photo: Glen Mittelhauser



Calliderma indigofera

Photo: Jason Hafstad

Ceremonial Stone Landscapes: An Indigenous Inscription on Preserves

New Jersey offers a variety of dramatic landscapes, many of which are found on Trust preserves. Mountain views, city skylines, and ocean beaches can inspire and provoke wonder. Yet, there is a subtle landscape form found across the state, often right under our feet, of which most of us are barely aware. It is such a seamless part of the landscape that it draws little attention. Known as Ceremonial Stone Landscapes, these are the placed, positioned stones, arranged by Native American ancestors hundreds or thousands of years ago, which tell a story. A story that Native Americans are hearing anew and listening to closely.



Large boulder perched to overlook valley in Sussex County.

Take a walk on one of the many Trust preserves in the northern counties of New Jersey and you will note any number of uniquely shaped boulders, rock piles, and stone walls which draw you to explore. Sometimes the boulders are oddly balanced, the rock piles resemble animal shapes, and the stone walls seem to zig-zag with symmetry and regularity but have no practical agricultural application. Their locations are often so rugged that Yankee practically can't justify their construction. These could all be examples of Ceremonial Stone Landscapes, placed and arranged by our Native American ancestors.

To Native Americans, the patterns of these stones may bring honor and recognition to forefathers--a form of prayer. Prominent boulders arranged high on a bedrock ledge are known styles of sacred stone placements. Some of these arrangements have been found to align with celestial events or groundwater flow. Stones appearing to be scattered may actually depict an animal effigy, perhaps a turtle or a snake.

Most often, the stories these stones were intended to tell or symbolize have been lost. After Native American displacement, death and near demise, the passing of the stone stories through generations became unlinked. The keepers of those stories, who heard from their elders who learned from their ancestors before them, have died and their knowledge and stories now go lost and unshared. There is not a written resource like "Ancestry.com" to help unearth the stories of the stones.

Perhaps with renewed interest and sharing across cultures we can decipher the lingering messages. Martin Rapp, Trust Preserve Manager, is learning to recognize these Ceremonial Stone Landscapes as he traverses Trust preserves. "I have been wandering the woods my whole career, practically my whole life, and never thought that these stones I was seeing might have such meaning and purpose for Native Americans," said Rapp. "Like many of us, I've found all types of stone walls interesting and artistic. Many indeed are typical colonial farm walls that formed field and property boundaries. Since learning to identify Native American stonework I walk through the woods much more aware, peering at groupings of stones which have gone unnoticed, perhaps for centuries."



A stone wall "serpent" moving downhill.

Locations of sites Rapp has discovered are shared with local tribes and the NJDEP, State Historic Preservation Office. These Ceremonial Stone Landscapes deserve the respect afforded to any sacred site; that is simply to be left as placed, so the creator's prayers may continue, uninterrupted. By protecting nature's landscapes, the Trust is also protecting these ancient and sacred Ceremonial Stone Landscapes, giving us and others opportunity to listen for their stories.

Fire: A Native American Practice We Continue

It should come as no surprise that fire is, in fact, an element of nature. It has coexisted with and influenced our natural environment, like it or not. We should learn how to best use fire on our natural landscapes as an ecological tool. In New Jersey, our beloved Pine Barrens is a prime example of how important a balanced fire patchwork is to achieving an ecological balance. The pine forests of southern New Jersey have naturally developed over millennia to adapt to and evolve with fire.

Even in our hardwood forests in north Jersey, fire plays a natural role, although somewhat more subdued. Throughout time, these fires have occurred because of such things as lightning strikes; but also, as a spiritual, traditional, and practical tool of our Native American predecessors. As once practiced by Native Americans across New Jersey, a purposefully lit fire, set upon small sections of the forest, were known to maintain proper growing conditions for selected edible and medicinal plants, enhance habitat for wildlife while improving hunting success, and stave off uncontrolled wildfire from entering their village grounds. We in New Jersey are continuing to use prescribed fire in a safe and controlled manner to accomplish many of the goals of these early keepers of the land.

The New Jersey Forest Fire Service (NJFFS) is a national leader in fire management and has protected property and saved lives from destructive wildfire for better than a century. A key method the NJFFS has used to prevent forest fires mimics what Native Americans had been doing: prescribed or controlled burns. These planned, purposeful, and well managed fires have proved that periodically burning away accumulated duff and debris reduces excess fuels and limits chances of unchecked, destructive wildfires.



Planning a prescribed burn.



The Trust has utilized the expertise and services of the NJFFS in applying prescribed burns on its preserves. This year the Trust partnered with Dr. Jay F. Kelly of Raritan Valley Community College to research the practical values of applying prescribed burning to suppress non-native and invasive plant species. Several plots were selected for burning within selected Trust preserves in North Jersey. Dr. Kelly established vegetation study plots within and outside of the proposed burn areas. These plots were studied before and after burning and the differences compared. Although more years of data are needed, it looks hopeful that prescribed fire might be a necessary element of a healthy forest ecosystem; a tradition Native Americans have known since the start.

In 2020, prescribed burns were conducted at the Sweet Hollow Preserve, Thomas F. Breden Preserve at Milford Bluffs, and Abraitys Pine Stand Preserve, all within Hunterdon County. Several planned burns were postponed due to COVID-19, but the Trust hopes to implement them in 2021.



Bald Cypress in New Jersey: Native or Not?

By David Snyder, Botanist, NJ Natural Heritage Program

That plants have a specific natural geographical range in which they are native is not news, but periodic reminders that this is so is worth repeating. It also bears repeating that the natural geographical range of plants are not static and are in constant flux. Although it may not be obvious to us, plant species are always on the move. Seeds and propagules are constantly being spread near and far by wind, water, animals, and other natural events. Since the close of the last Ice Age 11,700 years ago, plants adapted to warmer climates that had been pushed southwards by the advancing glaciers began moving northwards as the glaciers melted. Similarly, cold-adapted species also moved northwards seeking the cooler latitudes vacated by the glaciers. These advances and retreats continue today—their pace likely quickened by global warming. Humans, however, have disrupted the orderly natural migration of plants in a more obvious and significant way—by planting them wherever they choose to.



Bald cypress aflame in autumnal color.

Some native species are widespread and occupy broad ranges. Red maple (*Acer rubrum*), for example, is a tree common throughout the eastern half of North America. The small whorled pogonia orchid (*Isotria medeoloides*) is an example of a species with a broad geographical range (nearly as broad as red maple) but is scattered and very rare throughout most of it. Other species have restricted and very narrow ranges: Knieskern's beaked rush (*Rhynchospora knieskernii*), once known from Delaware and New Jersey, is now restricted to five counties in the New Jersey Pine Barrens, and the Venus' flytrap (*Dionaea muscipula*) is native only to a fairly small area of the Coastal Plain in North and South Carolina.

But unlike Knieskern's beaked rush, an obscure and rather boring-looking sedge with no popular appeal (at least to nonsedge lovers), Venus' flytrap is an exciting and bizarre-looking carnivorous plant that is world famous for eating bugs and snapping shut on fingers. People's fascination with the Venus' flytrap, coupled with the relative ease of its cultivation, has, unfortunately, led to commercial exploitation of this rare and vulnerable species. Some flytrap lovers have planted it in wild habitats far outside of its natural geographical range, especially Florida, Delaware and New Jersey. When folks stumbled onto colonies of flytrap in New Jersey at Oceanville Bog, Webbs Mill, or Elizabeth White's bog garden at Whitesbog, it was pretty obvious that they were planted occurrences. (All these plantings are documented in the literature as introductions.) But for some New Jersey plant species it's not quite that easy to tell for certain whether the population is native or not. The bald cypress (*Taxodium distichum*) is a classic example of this uncertain status.

Bald cypress is among a number of native plant species that have broad natural geographical ranges that are near or adjacent to New Jersey. The tree is also widely planted in New Jersey and it sometimes escapes from cultivation and establishes populations in natural habitats. The same is true for redbud (*Cercis canadensis* var. *canadensis*). This showy flowering tree is wildly popular and is commonly planted in New Jersey and, for some curious and as yet uncertain reason, it has over the last several decades freely escaped cultivation and has established naturalized populations along roadsides and in woodlands throughout New Jersey—something it had not been documented as readily doing in prior decades. It has now reached the point that it is no longer possible to tell whether newly discovered populations are native or not. Bald cypress is in a similar situation, but unlike redbud which has well documented natural occurrences based on herbarium



Tell-tale bald cypress knees.

specimens and literature references dating back more than 150 years, bald cypress has had only one somewhat recent occurrence that was, at least for several decades, considered native by the botanists of the day.

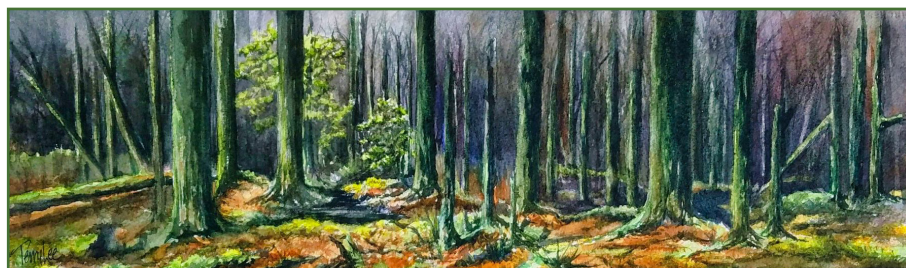
The earliest report for bald cypress occurring as a native species in New Jersey is by Lewis Beck in his 1833 *Flora of the Northern and Middle States*. According to Beck the species occurred from “N.J. to Flor[ida]” but he provided no details and there are no extant specimens that vouch for his statement. In 1848 the first edition of Asa Gray’s *Manual of the Botany of the Northern United States* gives the range as “S. New Jersey? [sic] and Delaware, common southward.” In later editions of Gray’s Manual (e.g., fifth and sixth editions), Gray and subsequent authors deleted New Jersey from the range of bald cypress.

In the late 1890s a few bald cypress were discovered growing co-mingled with trees of Atlantic white cedar (*Chamaecyparis thyoides*) along the edge of a salt marsh in the Meadowlands by Arthur Hollick of the New York Botanical Garden. Hollick estimated the age of the bald cypress to be about 20 to 30 years but was “unable to determine if they were native there or had been introduced.” Hollick goes on to say that “several reports have been made of old cypress stumps having been found in swamps in other parts of the State, but in no instance have I been able to verify them.” What might have been Hollick’s site was rediscovered in the 1930s by Warren Eaton who discovered a large stump along Frank’s Creek near Newark. The botanist/birder James Edwards learned of the site and around 1948 showed the location to ecologist Calvin Heusser who reported a “large stump and knees of bald cypress” growing “on the border of a dump.” Whether this occurrence was native or not remains an unsolvable mystery.

The only record for bald cypress seemingly growing as a wild species were two trees discovered in 1908 by H. Walker Hand in a wooded wetland at the edge of a salt marsh along Sluice Creek near South Dennis, Cape May County. This occurrence was accepted by Witmer Stone in his 1912 South Jersey flora as native but he did add that there were stories that the trees “were brought from farther south and planted there.” In 1965 John Bernard published an article confirming that the stories Stone had heard about its planting were true. Bernard was able to track the origin of the story, learn the name of the person who planted it, and spoke to descendants who confirmed the story’s veracity. Richard Anderson told Bernard that his grandfather, Captain Thompson van Guilder, brought several bald cypress trees from Darien, Georgia, via schooner to Cape May. According to Bernard’s research Stone’s tree was planted on the shore of Sluice Creek about 1880 by Anderson’s uncle, James van Guilder. Hearing this, Bernard concluded, “there is no evidence at present time that the bald cypress is a part of the native New Jersey flora.”

In 1980, while writing the book on New Jersey’s rare and endangered plants for the US Fish & Wildlife Service, I visited Stone’s tree with Gene Vivian and Ted Gordon. I wanted to evaluate the location and habitat firsthand. Ted told me that Lou Hand (a South Jersey botanical expert) and other contemporary botanists had agreed that it was planted. A few years ago I revisited this tree, and although it is humungous, it is on death’s doorstep because the salt marsh has expanded significantly (perhaps as a result of sea level rise related to climate change) and is flooding its habitat. (Ca. 1965 Bernard recorded the tree’s height at 88 feet, counted 92 growth rings, observed numerous knees, placed its distance from the salt marsh at 36 feet, and noted that despite two years of searching no seedlings were found.)

Cypress bog watercolor



By Terry Lee Schmidt

During my research for the book I learned of several other South Jersey sightings of bald cypress. Vincent Abraitys, a collaborator on the book, told me of several locations that he had seen. He of course had visited Stone's tree in 1961. In the same year he discovered two trees along a road at Batsto. He also found trees growing on lawns along the Garden State Parkway and at Lakehurst as well as isolated trees in Salem and Cumberland counties. Did he think they were native? "Probably not," was his answer. Frank Hirst and Gilbert Cavileer (also collaborators) told me similar stories and neither were convinced that the tree was native to New Jersey. However, Gil told me about some trees that an "older friend" of his (Gil was 69 at the time he told me this story) had located along the Mullica River in Atlantic County that were accessible only by boat. Despite numerous attempts by Gil, he never did relocate the trees—all he found at the site were Atlantic white cedars. In any case, all my collaborators were in agreement that bald cypress should be excluded as a New Jersey native rare plant—at least for the time being.

Since 1980 I have been shown or discovered several New Jersey locations of bald cypress, mostly in South Jersey. Excluding street plantings (e.g., Trenton) or obvious escapes from plantings (along the Stony Brook in Princeton) the majority of these trees have been isolated, fairly large single trees, suggesting plantings. None of the sites had young trees or seedlings. One exception was a swamp in northern Monmouth County where I stumbled onto a dozen or so trees that were 10-15 feet tall but oddly all growing in a perfectly straight line. Further exploration showed this line of trees to be an extension of an old fence line of the adjoining property. Some of the trees that I have seen in natural habitats in Salem and Cumberland counties were reportedly the result of plantings made by a South Jersey resident who had been planting trees at scattered sites for years. I called him "Johnny Bald Cypress Seed." Occasionally I have found puzzling trees that have defied easy explanation, like a tree at Atsion and a 12-foot tree growing along the edge of a slightly brackish marsh on the northern tip of Sandy Hook. Isolated trees also have been found here and there in Cape May County by Keith Seager and Clay and Pat Sutton. Although clearly not planted I have chalked off all these trees as spontaneous escapes from cultivation.



Delicate branches of bald cypress.

Delaware has similar problems in determining native versus nonnative populations of bald cypress. In recent decades isolated trees have been turning up—either as spontaneous escapes or possible plantings. Delaware, however, is the documented northeastern native limit of bald cypress' range and it has well documented native stands that date back a century or two. A decade or so ago when I was revisiting (once again) the issue of bald cypress' nativity in New Jersey, I had a discussion with Delaware's state botanist Bill McAvoy. He was seeing the same thing—new trees being reported or spontaneously popping up in new areas of the state. Since the nativity of the species in Delaware is soundly settled, and the species is listed as rare in the state, this creates a similarly difficult situation for Bill to deal with—determining what populations are likely native so that planted or escaped occurrences are not regulated and land owners are not unfairly burdened by compliance with state laws designed to protect populations of rare native plant species. Based on his knowledge of large, unquestionably native populations, Bill came to the conclusion that isolated trees well distanced from confirmed native occurrences should be carefully evaluated before accepting as native. Just because a species is native to a state doesn't mean that every occurrence is native. It was Bill's experience that trees that formed large, native occurrences produced characteristic cypress knees, while single isolated trees typically did not.¹ That became Bill's first step when evaluating whether new occurrences were likely native—multiple old trees that regularly produce knees and grow in the appropriate natural wetland communities are much more likely to be a native population. It's a good starting point and I adopted it for New Jersey.

¹Despite 200 years of observation and research, botanists have yet to come up with a satisfactory explanation as to why bald cypress trees produce knees or what their biological function might be. Botanist Christopher Briand in his 2000 paper discusses and rejects numerous hypotheses put forward by researchers over many decades including aeration, methane emission (so-called swamp gas), vegetative reproduction, mechanical support, nutrient acquisition, and carbohydrate storage. Although the mystery of their existence persists, Briand acknowledged there was general agreement on the conditions under which they were produced. "Knees are most often found on the roots of trees growing in wet soil and in relatively shallow water; they are generally absent from trees growing in deeper water and only occasionally on trees growing on land that is dry yearround."

On 14 November 2018, while taking a short cut through Wharton State Forest, I whizzed through an Atlantic white cedar swamp and caught a flash of what struck me as the autumn orange-yellow color of bald cypress foliage. I had driven past this stretch of cedar swamp countless times before but never in this late season. Bald cypress? Probably not. I've run through similar scenarios many times before—you think you've found something good but upon inspection you find out that you were mistaken. Nonetheless, I turned around and headed back to where I saw the flash of color, parked the car, and entered the swamp. I was amazed by what I found. Everywhere I searched there were bald cypress trees. In places they were co-dominant with the cedars. In a quick and far from thorough search, I counted 70 trees along a distance of 0.15 miles. Although some were young trees, about 10-15 feet tall, most stretched skyward for 50 feet or so. A few were pushing 80 feet. Most were in peak autumnal color and blazed in orangey-yellow hues, but a few of the smaller trees were still green. Some trees were copper-brown in color and in the process of dropping their needles. (Bald cypress, like the larch (*Larix laricina*), is a deciduous conifer.) Beneath the trees, among the deep peaty sphagnum hummocks and iron-stained pools of water, rose numerous knobby knees that sprang from the roots of the cypress. Some of the knees were nearly knee-high. The swamp appeared largely undisturbed and was filled with many characteristic native cedar swamp species—including some uncommon and rare species. A review of aerial photos indicates the forested swamp has been around since at least the 1930s.

Weighing the evidence, it seems to me that the scale tips more in favor of this being a native population. I suppose it could have been planted by the Civilian Conservation Corps back in the 1930s (they did a lot of tree planting in South Jersey) but that seems a stretch. The trees are growing in a relatively remote area, with no houses in the immediate vicinity and well outside the native range of Johnny Bald Cypress Seed and is inaccessible by schooner. Absolutely

native? I can't say for certain—you rarely can in these situations. But based on available information, a reasonable argument supporting a native status for bald cypress at this site can be made. That's my tentative conclusion. More comprehensive field surveys are planned as well as taking core samples from a few of the largest trees. I also plan to carefully reexamine the possible nativity of some of New Jersey's other bald cypress occurrences—ones that I and others have previously dismissed as introductions. Ironically, it looks as though Witmer Stone may have been correct in his assessment of the nativity of bald cypress in New Jersey—he just had the wrong population.

To me, one of the most disconcerting consequences resulting from planting native rare plant species in natural habitats is the blurring of the natural geographical ranges of our native plants. This is especially true for species that easily escape from cultivation and are successful in establishing populations in natural plant communities. It is all the more alarming when the plantings are done in absolute secrecy and without the landowner's knowledge or permission. When it is no longer possible to determine with a reasonable degree of certainty whether or not a plant species is native to any given area, not only does it cause chaos for plant geographers and rare plant researchers, but most importantly it undermines our ability to protect populations of truly rare species. If a tipping point is reached and plants that once were extremely rare in New Jersey—such as redbud—become common place as a result of escapes from cultivation or deliberate plantings, should they then be delisted as state endangered? When someone in the public asks me why New Jersey still lists redbud as state endangered, I tell them that there are only three populations in New Jersey that have been determined to be native populations, one of which hasn't been seen in over a hundred years and a second one has been partially destroyed by a new housing development. To this they frequently reply, "But it can't be rare I see it everywhere."

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The Effects of Climate Change on New Jersey's Plants

By Natale (Lee) Minicuci

How will climate change affect the wild plants of New Jersey? Well, it is complicated. New Jersey is incredibly diverse for its size and position. We lie on the cusp between the mid-Atlantic and the Northeast regions, smack dab in the middle of what is known as the Northeast megalopolis. And yet, our plant diversity rivals much larger states such as New York and Pennsylvania. With over 2,000 native plant species, four of which are found nowhere else in the world, it is difficult to generalize the overall effects that climate change will have on our wild plants.

Perhaps it is best to start on the most noticeable change: phenology. Phenology is the study of cyclic events in the life stages of plants and animals and how seasonality and habitat can affect these events. Events like germination, flowering, and autumn leaf color are all phenological changes that are in some way dependent on seasonality. Plants, in general, respond disproportionately to changes in average temperature and are indispensable for monitoring the effects of climate change. What happens when winters become short and mild? When spring arrives sooner, and summer lasts longer? Spring flowering species are, on average, blooming three weeks earlier than they were in 1920. Highbush blueberry, an iconic New Jersey species, is blooming a full six weeks earlier. Some, responding to a lack of prolonged cold winter temperatures, are delaying their time of first flowering. Evidence has shown that these changes are only accelerating in response to more drastic warming in the last few decades.



Seabeach amaranth



Highbush blueberry, an iconic New Jersey species.

There are a whole host of issues involved with wild plants blooming far earlier or later than they otherwise would. While many of these species have yet to reach any sort of breaking point, the issues lie in environmental and ecological interactions. Blooming far earlier subjects these plants to wide temperature swings characteristic of seasonal transitions. Hard frosts can top-kill plants with newly developed flowers, inhibiting fruit and seed production later in the season. Just as important is the issue of plant-pollinator mismatch. If the timeline for spring plant blooming is dramatically altered, it is likely that many pollinator species could experience a decrease in food availability. This also means that plant species reliant on pollinators could experience a dramatic decline in reproductive success.

Summer conditions are changing as well. The growing season is becoming warmer and longer, lengthening by roughly 13 days since the middle of the 20th century. Warmer average temperatures will increase evaporation rates, drying soil and favoring drought tolerant species. Heavy, but less frequent summer rain causes periods of low stream flow to arrive earlier and last longer. July 2020 was the hottest month on record for New Jersey. For 25 out of the 31 days in the month, temperatures exceeded 90 degrees. These prolonged periods of hot weather can reduce or

eliminate flowering in some species, while reducing overall flower size in others. Furthermore, plants that can flower exhibit lower pollen production and viability. Even the compounds related to nectar and floral scent suffer a decrease in production during periods of prolonged heat.

Carbon dioxide concentrations can be a boon to certain plant species, but that is not always a good thing. Poison ivy, for example, has responded to an increase in CO₂ concentrations by not only growing more vigorously, but by producing even greater amounts of urushiol, the compound responsible for the dermatitis the plant causes. CO₂ is an important nutrient for all plants, being vital for photosynthesis, but a general increase is not always healthy for plant growth. Enhanced rates of photosynthesis are very much dependent on water and limited nutrients such as nitrogen. Additionally, nutrients in the soil can be sapped by a rapid increase in the rate of microbial decomposition. Many invasive species, such as multiflora rose and Japanese barberry, stand to benefit from both an increase in average temperatures and CO₂ concentrations.

Alongside increases in average temperature and CO₂ concentrations, sea levels are steadily rising on New Jersey's coasts. Plant species that occupy the beaches, maritime forests, and coastal wetlands are at risk of inundation, saltwater intrusion, and habitat destruction. Two globally rare species, seabeach amaranth and seabeach knotweed, occupy beach habitat directly threatened by rising sea levels. Coastal freshwater wetlands are experiencing saltwater flooding far more frequently than in the past. Most wetlands can tolerate brief periods of higher salinity, but prolonged events can cause vegetative dead zones that take many years to recover.

New Jersey's rare plants, in general, face significant threats from climate change. Nearly 40 percent of New Jersey's 2,000-plus native plant species are rare or endangered. For many of these species, rarity is a natural part of their existence, as the very specific habitats they live in tend to be rare as well. Unfortunately, these specific habitat requirements mean that many rare plants species exist in scattered and precarious populations, already at risk from threats like habitat destruction and invasive species. The biggest threat climate change poses to many of these rare species are conditions that could lead to the loss of habitat they depend on. More common plant species can depend on dispersal and migration to adapt to a rapidly changing climate, but rare plants don't always have this luxury. Due to the relatively low number of populations and specific habitat requirements, rare plants are severely limited in their ability to disperse or migrate in the face of climate change. It is likely that many of the vulnerable plant species in New Jersey will no longer be present or be severely reduced by the effects of climate change.

For a much more in-depth look at the effects of global warming on plants, as well as animals and many other factors in New Jersey, readers are directed to the New Jersey Department of Environmental Protection's [2020 New Jersey Scientific Report on Climate Change](#).



Hunting News

During the 2020-2021 hunting season, 4,814 hunters registered at Trust preserves through its website: www.njnlt.org. The Trust allows deer hunting only at many of its preserves to maintain biodiversity. The deer population in New Jersey is far greater than the ecosystem can sustain. Over-browsing by deer depletes native vegetation resulting in impacts to animal and plant habitat, such as decreased food sources and increased invasive plants.

To hunt deer at selected Trust preserves, hunters access the Trust's website, electronically submit information to the Trust, and print their own hunter registration letter with the required accompanying preserve map. The Trust can use this information to sort hunter registrations by preserve. Trust staff may reach out to hunters registered at a specific preserve to determine their interest in volunteering for clean-ups and maintenance projects.

It is important to note that the Trust does not allow hunting for waterfowl, small game, turkey, or bear, as it maintains that only over-browsing by deer poses a threat to biodiversity. In addition, Sunday bow hunting is not authorized on Trust preserves as it is on state wildlife management areas and private property during deer season.

While hunting on Trust preserves, all rules and regulations in the New Jersey Division of Fish and Wildlife game code must be followed. Hunting deer by bow and arrow, shotgun or muzzleloader are acceptable, depending on the preserve. No target shooting or discharge of weapons other than for deer hunting purposes is permitted. Permanent deer stands are not allowed, and portable deer stands, while permitted, must be removed after the hunting season is completed or are subject to confiscation by the Trust.

Impacts of deer abundance are not limited to plant species, but cascade throughout the food web.*



Deer hunting with bow is permitted at the Mackenzie's Bog Preserve.

*Kelly, JF. 2018. Results of white-tailed deer (*Odocoileus virginiana*) surveys in Watchung Borough in April 2018. Raritan Valley Community College.



Thanks to Our Volunteers

The Trust would like to acknowledge and thank its many volunteers for their invaluable contributions to the maintenance of Trust preserves.



PhragFest volunteers at Petty's Island.

Contribute to the Delaware Bay Shorebird Fund

Each spring in Delaware Bay, from about the first week in May to the second week in June, the largest concentration of horseshoe crabs in the world comes onshore to spawn. At the same time, tens of thousands of shorebirds arrive at the Bay en route from southern wintering grounds to Arctic breeding territory, and Delaware Bay is their most critical stopover. The shorebirds need to quickly double their weight to complete their migration north and breed successfully. To refuel at such capacities and in only a 10-day window, high-energy horseshoe crab eggs provide essential nourishment. But since the early 1990s, there have been major declines in both the number of adult horseshoe crabs and their eggs. With the decline of their critical food source, shorebird numbers also plummeted. For the past 35 years, the Trust has funded scientific research and conservation efforts through the Delaware Bay Shorebird Fund with the goal that someday Delaware Bay's skies will be once again filled with shorebirds.

The Delaware Bay Shorebird Fund was initially created in 1985 through an agreement between the Department of Environmental Protection and Public Service Electric and Gas Company (PSEG). The agreement provided that \$600,000 would be transferred to the Trust, as a fiduciary, to invest and administer solely for protection and management of shorebird habitat. After funding critical shorebird research for the past 35 years, the Delaware Bay Shorebird Fund is now nearing depletion. With contributions, the Delaware Bay Shorebird Fund could continue critical long-term shorebird and horseshoe crab research.

In order to protect these shorebirds, please consider making a donation to the Trust's Delaware Bay Shorebird Fund. Donations can be made online through PayPal:

Donate with PayPal button:



Please indicate that the donation is being made to the Delaware Bay Shorebird Fund.



Delaware Bay Shorebirds
Photos: William Culp

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NJDEP Endangered and Nongame Species Program
Dr. Jay F. Kelly/Raritan Valley Community College
Friends of Taylor Wildlife Preserve
Pinelands Preservation Alliance
Bruce Bieber
Keith Seager
John King
National Fish & Wildlife Federation
Barnegat Bay Sportsmen's Club
Upstream Alliance
Wayne Township
Wildlife Preserves, Inc.

For more information about how you can donate to further the Trust's mission to acquire, preserve and manage natural lands for the protection of natural diversity, please visit the [Trust's website](#).



Board of Trustees

The Trust is governed by an eleven-member Board of Trustees. The Board is comprised of six representatives from the private sector and five representatives from State government. The State government members include the Commissioner of DEP and two DEP staff members designated by the Commissioner; the State Treasurer; and a member of the State House Commission. Employees of the Office of Natural Lands Management, Division of Parks & Forestry, serve as staff to the Trust and implement the policy set by the Board.

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In the spirit of healing, the New Jersey Natural Lands Trust acknowledges and honors the Lenni-Lenape, Munsee Lenape, and Nanticoke Tribes, the original people of the lands that we manage as Trust preserves.



View of Philadelphia at sunset from the Delaware River Back Channel and Petty's Island, former hunting, gathering, and fishing grounds of the Lenni-Lenape.

Photo: Don Baugh, Upstream Alliance.



New Jersey
NATURAL LANDS TRUST