Pennsylvania Natural Heritage Program

information for the conservation of biodiversity

WILD HERITAGE NEWS

Spring 2025

Inside This Issue

Photo Banner
Calcareous woodland habitat with shooting star (*Primula media*) and a diverse assemblage of other calciphile species

Claire Ciafré

Bringing a Habitat Focus to Plant Conservation

by
Jessica McPherson, Senior Botanist

For several years, PNHP has been writing recovery plans for our globally endangered plant species. These plans address the status of a species remaining populations, threats and conservation needs, and data gaps that are impeding progress. These detailed assessments have facilitated focused, science-informed conservation work for these species coordinated by DCNR's Pennsylvania Plant Conservation Alliance. Over the last two years we expanded this approach in a new direction: a habitat recovery plan.

The Calcareous Barrens Habitat Recovery Plan catalogues sites across the state that host this unique ecosystem, describes regional subtypes, identifies reference sites, and provides conservation recommendations focused on habitat characteristics and indicator species.

Why use habitat as a focus for conservation? Plant diversity is closely dependent on environmental characteristics such as light availability, soil pH, wetland hydrology, slope, and aspect. Different habitats have suites of specialist plant species associated with them. For example, bogs host species adapted to low nutrients, extremely low pH, and wet conditions; these include cranberries, sundews, pitcher plants, and sphagnum mosses. Shale barrens host species adapted to extremely dry, open conditions and rocky substrate, such as prickly pear and Kate's mountain clover. If we focus conservation efforts on plant habitats, we protect the entire set of species that depend on the habitat.

At DCNR's request, our first habitat recovery plan focused on calcareous barrens. We were prepared for the "calcareous" part after our previous work,

The steep, dry slopes of shale barrens host many habitat specialist plants.

Conservation Assessment of Calcareous Ecosystems in Pennsylvania. Calcareous geology is one of four primary drivers of biodiversity identified in the Nature Conservancy's "Conserving the Stage" approach to protecting diversity even as our climate changes. If the primary physical habitat conditions of various ecosystems are preserved, species will theoretically be able to find new homes even if they are forced to migrate. In Pennsylvania, most calcareous geology is limestone geology; we use the term calcareous to also include lime-rich shales, sandstones, and other rocks that have abundant amounts of calcium.

In our previous study we assessed the pH preferences of our entire vascular plant flora, and found that one third of Pennsylvania's extant vascular flora utilizes calcareous habitat, and 10% (197 taxa) are calcareous habitat specialists that depend mainly or exclusively on high-pH habitat. Furthermore, the majority of these calcareous habitat specialists (57%) are rare in the state. Although they are only 10% of the flora as a whole, calcareous taxa make up 23% of the rare vascular plant taxa in the state. Calcareous sites not only host many specialist rare plant species, but they host a large diversity of species compared to other kinds of ecosystems. In contrast, bogs have many specialist plants, but they tend to be very low in overall diversity.

Eastern columbine (*Aquilegia canadensis*), a species that requires calcareous rock habitats.

While our previous work detailed the strong association of plant diversity with calcareous geology, it also found that these ecosystems are under serious threat. Calcareous geology is relatively uncommon in Pennsylvania (usually at lower elevations e.g., valleys), and it has been developed and altered at a much higher rate than lands on non-calcareous geology (higher elevations), so there are relatively few high quality

This limestone grassland in Centre County has been invaded by non-native shrubs, and lost much of the diverse herbaceous layer so unique to the community.

natural areas remaining. They face many threats; calcareous landscapes are more likely to be developed, fragmented, and invaded by non-native species than non-calcareous landscapes.

There is a range of habitat types that occur on calcareous geology in Pennsylvania, from calcareous fens (groundwater-fed wetlands), rocky outcrops, forests, floodplains, woodlands on steep, dry slopes, and grasslands that were once kept open by human activity. When DCNR challenged us to study calcareous barrens we had to look at them through a new lens. "Barrens" is a colloquial term that refers to sites that have less dense and less tall vegetation than is typical for the region, usually because of some combination of drought, rocky substrate, exposure, substrate toxicity, or disturbance regime. While we could have focused exclusively on a well-defined habitat like limestone grasslands or dry rock outcrops, we decided to use a broad definition that includes numerous natural community types. Specialist taxa often span across multiple subtypes of geology, environmental setting, region, or plant community. On the conservation stage, these sites are similar enough to be considered the same kind of potential habitat.

The first step in a recovery plan is to inventory how much remains of the species or ecosystem under study. For calcareous barrens, we approached this task by using PNHP's rare plant data across the state. We chose about twenty rare plant species that we believed were usually found on calcareous barrens, and reviewed each known location to see if it met our criteria for calcareous barrens. It had to have calcareous substrate in the plant

rooting zone; and it had to have vegetation less dense and less tall than typical undisturbed forest cover.

Seneca snakeroot (*Polygala senega*), a habitat specialist of calcareous woodlands.

A few species were model indicator taxa. Seneca snakeroot (*Polygala senega*) almost always occurred in calcareous woodlands, usually of the red oak - mixed hardwood community type. Hoary puccoon (*Lithospermum canescens*) was a very reliable indicator of calcareous woodlands and grasslands. Sideoats grama grass (*Bouteloua curtipendula*) was a very reliable indicator of calcareous grasslands and occasionally woodlands.

Considered together, however, our "indicators" showed an impressive level of idiosyncrasy in the habitats they managed to survive in, tied to each species' individual characteristics. Fragrant sumac (*Rhus aromatica*) is a good barrens indicator but isn't confined to calcareous geology. Flat-topped goldenrod (*Solidago rigida*) is usually a great indicator of limestone grasslands, but also occasionally shows up in disturbed habitats of less distinction, probably because goldenrods generally tend to be good dispersers and hardy, disturbance-tolerant plants.

Flat-topped goldenrod (*Solidago rigida*) a heliophyte species in flower on a calcareous limestone grassland

Snowberry (*Symphoricarpos albus*) is a good indicator of calcareous woodlands and outcrops, and because it is near the edge of its range in Pennsylvania, it is associated with northern-affiliated habitats; it was one of the indicators of the Pine Creek Gorge calcareous barrens type.

Common snowberry (*Symphoricarpos albus*), an indicator species of calcareous woodlands and outcrops, associated with northern-affiliated habitats.

Northern bedstraw (*Galium boreale*) occurs in limestone woodlands but also in seepage-fed calcareous outcrops above the Delaware River, challenging us to determine whether those met the criteria for barrens even though they weren't dry. (We decided they did, since the steep slope and rocky substrate definitely created lower and sparser vegetation than forest conditions).

Many species occupied more than one subtype of habitat, such as grasslands and woodlands, woodlands and outcrops, or outcrops and floodplains.

The set of sites we identified across the state ultimately included a broader geographic range and a broader set of environmental conditions than we initially anticipated. While most sites occur within the Ridge and Valley province, where most of Pennsylvania's calcareous geology is more abundant, they also ranged from the afore-mentioned Delaware River outcrops, to cliffs

Dry calcareous slopes in Pine Creek Gorge, Tioga County.

in Pennsylvania's Grand Canyon where a particular calcareous geological layer is exposed, steep bluffs in the glaciated northwest that cut through calcareous glacial till, forested outcrops in the Allegheny Mountains of Mauch Chunk calcareous sandstone, and steeply sloped woodlands in the southwest on Monongahela formation. One overarching feature is that many sites were on cliffs cut by waterways, which exposed calcareous rocks or glacial sediments. Once we found that the habitat in focus consisted of many regional subtypes, we created sections of the plan to address each of these individually. One of the major questions in conservation of barrens ecosystems is whether they require disturbance to persist. By looking at regional subtypes, we were able to consider patterns in topography, land use history, and pre-European settlement fire history for each group to provide tailored conservation recommendations.

A community ecology plot in a small patch of xeric limestone prairie; woody succession threatens this habitat.

One subtype in critical need of conservation is the Xeric Limestone Prairie of the Ridge and Valley. Daniel Laughlin extensively studied these systems and determined that they were likely almost all historically maintained by human disturbances, beginning with Native American fire management practices. With over a century of fire suppression and the gradual reduction of grazed lands, these unique ecosystems are steadily reverting to shrublands and young forest, and losing their distinctive "prairie" species such as sideoats grama grass and flat-top goldenrod. We recommend that fire is experimentally introduced to these systems.

The Pennsylvania Grand Canyon may have had a low frequency of fire in pre-European settlement times, but its recent history over the last two centuries includes extensive disturbance, with clearcutting and fire across the landscape. This area needs further study to determine if woodlands and cliff openings are closing in, and may need active management to conserve sun-loving calcium specialist plant species.

The flowers of tall larkspur (*Delphinium exaltatum*), a globally rare species of calcareous woodlands

In the southwestern part of the state, calcareous woodlands are found on steep but not vertical slopes. Fire could have been important in maintaining a more open canopy for these sites; the pre-European settlement fire frequency is highest in this region of the state. Limestone barrens systems of most areas across the southeastern United States have been linked to fire, and good management techniques have been developed for many of them. However, the history of our systems has received relatively little study, and fire management has never been tried. Tall larkspur (*Delphinium exaltatum*), a globally rare species that was once found in many calcareous woodlands in southeastern Pennsylvania but has declined, has been shown to have a dramatic positive response to fire in Missouri populations.

Prescribed burning of a dolomite glade in Missouri.

The steep bluffs in the glaciated northwestern part of the state are an example of an environment that maintains its own disturbance naturally, through frequent erosion of the friable glacial sediments. The most important conservation need in these habitats is invasive species control. Calcareous habitats are particularly susceptible to invasive species, and this is a serious conservation problem across all habitat subtypes.

Hoary puccoon (*Lithospermum canescens*), a heliophyte and an indicator species of calcareous woodlands and grasslands.

Evaluating success in conservation of a habitat is more complex than for a species, where population monitoring can be used to monitor trends. To create benchmarks for success in habitat conservation, we identified "reference" sites for each subregion. We also identified plant taxa particularly tied to some aspect of the environment. These taxa can be monitored to determine if management is maintaining appropriate conditions. These included heliophytes (sun loving taxa), which can show whether woody species management is creating appropriate light levels; highly conservative species, which are likely to be early indicators of ecological decline from edge effects or invasive species; and calcareous habitat specialists, which can't migrate to nearby areas as more generalist species might be able to do.

Big Hollow xeric limestone prairie, a calcareous grassland.

The Calcareous Barrens Habitat Conservation Plan identifies 90 sites across the state where these unique ecosystems are found. It identifies10 regional subtypes, describing their typical topographic and geological settings, ecosystem conditions, and management needs. It also highlights data gaps. It includes a site assessment template designed to evaluate ecological history, current community condition, and identify indicator species. With these pieces in place, the plan lays the foundation for habitat-specific conservation planning and action at these sites.

About the Author

Jessica McPherson has worked with PNHP for over 20 years as an ecologist and botanist. She currently works on strategic planning for botany, emphasizing site-based planning, habitat-focused plant conservation, building data-driven management through partnerships, and efficient data capture. She has a particular interest in understanding how plants' life history and ecology impact their distribution, rarity, and adaptability to change, and in the ecological influence of soil pH and geology.

Saving the Places We Care About Takes More Effort Than Inventory and Monitoring: Sometimes You Have to Roll Up Your Sleeves.

by
Ephraim Zimmerman, Senior Director of Conservation Science

Recently, PNHP has begun to conduct more deliberate ecological stewardship actions, in partnership with state agencies, academics, and conservation groups, and funded by state, federal, and private funding sources. These small, but successful, efforts suggest that a greater focus on stewardship can be effective in increasing the viability of our occurrences of rare plants and wildlife.

Plant Conservation Alliance and High Conservation Value Areas

The Heritage Program is working with the DCNR Bureau of Forestry's Pennsylvania Plant Conservation Alliance (PPCA) to protect the rarest plants in Pennsylvania. Together with other experts and practitioners we are conducting assessment and monitoring, range-wide studies of conservation genetics, off-site conservation collections at regional seed banks and botanic gardens, and stewardship for sites where the rare plants occur.

PNHP Botanist Rachel Goad cuts invasive plants away from rare plants at Conococheague Bluffs.

One example of a dedicated effort that has resulted in a noticeable positive ecological change is the Conococheague Bluffs Natural Heritage Area in Franklin County. PNHP Ecologist Claire Ciafré and Botanists John Kunsman and Rachel Goad have been working with a group of dedicated volunteers, including former PNHP Ecologist Rocky Gleason, to remove

Shooting star (*Primula meadia*)

winter creeper (*Euonymus fortunei*), which has proliferated in the understory of the calcareous woodland, negatively impacting a number of rare species like smooth rockcress (*Arabis patens*), green-and-gold (*Chrysogonum virginianum*), and eastern shooting star (*Primula meadia*).

A similar site along Licking Creek, where limestone bluffs support a number of rare species like black stemmed spleenwort (*Asplenium resiliens*) and species of early spring flora, is engulfed by non-native plants that have swallowed the cliffs. There PNHP botanists are slowly working to pull back the invasive plants, freeing the walls for the rare fern.

Canby's mountain lover (*Paxistima canbyi*), a globally imperiled shrub, grows on the rich limestone outcrops at WPC's Lutzville Cliffs Natural Area in Bedford County. Its stewardship needs include not only invasive plant removal but also the treatment of a non-native insect, euonymus scale (*Unaspis euonymi*), which feeds on and damages the plants. We have been

Canby's mountain lover

treating the plants for scale and removing Asian bittersweet (*Celastrus orbiculatus*), an invasive plant that outcompetes Canby's mountain lover and acts as an alternate host for the euonymus scale. We are hopeful that long-term monitoring and treatment as needed will have good prospects for success.

A team of botanists after a day of removing large quantities of Asian bittersweet from a Canby's mountain lover site.

Stewardship doesn't always mean controlling invasive species. At Ricketts Glen State Park, Ecologist Claire Ciafré helped PPCA Coordinator Cheyenne Moore and park staff install a cage around the rare bog Jacob's ladder (*Polemonium vanbruntiae*) to protect plants within the population from deer herbivory.

Cheyenne Moore and Claire Ciafré carrying a cage to protect bog Jacob's ladder (shown on right) from deer browse.

The state-endangered beautiful Barbara's buttons (*Marshallia pulchra*) is found in patches of Appalachian River Scour community on the rocky shores of the Youghiogheny River in Fayette County, Pennsylvania. *Marshallia* has been a focus of PNHP since the early 1980s and in recent years we have increased the intensity of our monitoring efforts. *Marshallia* has declined over the years due in part to habitat alterations and invasive species competition. Through the PPCA and close work with Ohiopyle State Park, PNHP monitoring data will be used to develop a recovery strategy that will focus on removal and control of Asian bittersweet and other invasive plants while monitoring the population responses of *Marshallia* and other rare plants to the management activities.

Beautiful Barbara's buttons

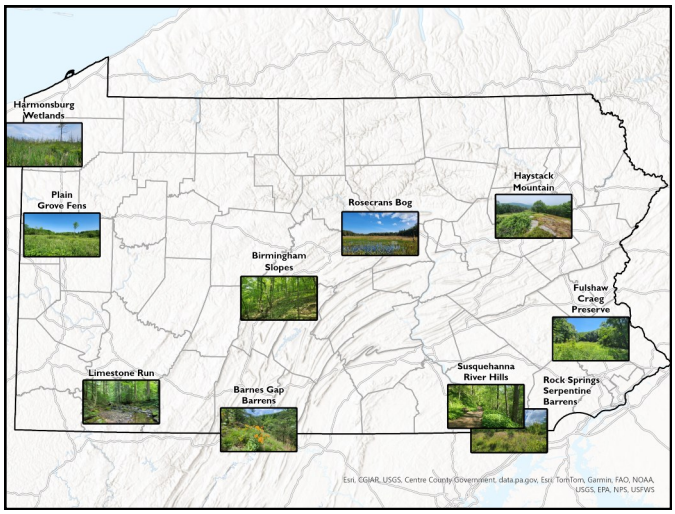
As part of DCNR's Forest Stewardship Council (SFC) certification, areas are designated as High Conservation Value Forests (HCVFs) where management activities are implemented to maintain or enhance an area's conservation value, such as stewardship of rare species. One such site is Scotch Pine Hollow in Tioga State Forest, a forest tract containing a Cottongrass Poor Fen community with a large population of few-seeded sedge (*Carex oligosperma*). This population is thought to have declined as white pine (*Pinus strobus*) has increased within the wetland, increasing shade, and possibly changing the site's hydrology. PNHP ecologists and Bureau of Forestry staff have established long term vegetation monitoring sites and water monitoring wells to asses changes in vegetation and hydrology, and in 2024, district foresters removed much of the white pine cover from the wetland. A combination of baseline assessment and continuous monitoring of the sedge and environmental variables will tell us if this stewardship activity is effective.

Aerial photo, captured by a drone, of PNHP ecologists surveying the permanent transects at the Scotch Pine Hollow restoration site.

Invasive Plant Tracking, Assessment, and Control

Much of our stewardship action is occurring at sites where invasive plants are the most visible threat to rare plants. But we're also tracking the spread of invasive species overall. We began tracking invasive species through the iMapInvasives program in 2013. In all, this program has recorded 83,010 records of invasive species in Pennsylvania! The database includes over 3,228 contributors, including staff in state and federal agencies, PNHP staff, and community scientist volunteers.

In 2023, WPC received a grant from the Richard King Mellon Foundation to work with various partners around the state to assess and monitor invasive plants at ten significant ecosystems, including rare habitats and populations of rare plant species where invasive plants were thought to be abundant. As an outcome of this effort, Invasive Species Ecologist Brian Daggs developed detailed site assessment reports, including proposing recommendations for controlling the invasive species found at these sites.



Map of the ten sites assessed by PNHP staff for invasive plant populations.

PNHP staff are now beginning to implement actions to manage these ecologically-sensitive sites. Funding, provided to WPC by a generous donor, has enabled our staff to implement control recommendations at four of the ten assessment sites included in the RKM project.

Through this project, we've seen the benefit of having trained PNHP staff work alongside our plant control practitioners. For example, at Presque Isle State Park, while treating the invasive common reed (*Phragmites australis*) within the Gull Point Natural Area, we found a small population of the native common reed (*Phragmites australis* subsp. *americanus*) among the more common invasive – which many contractors would have overlooked.

Brian Daggs with native *Phragmites* at the Gull Point Natural Area during vegetation management activities.

To further support efforts where a knowledgeable expert is needed to both appropriately apply the chemicals and insure that it does not destroy rare native plants, our staff have obtained the appropriate training and applicators licenses. This will greatly expand our capacity to conduct stewardship projects in highly sensitive areas and avoid unintentional harm to rare species when treating invasive vegetation.

From Monitoring to Stewardship for the Eastern Massasauga Rattlesnake

Our stewardship work to improve the condition of critical habitats for rare wildlife species continues to be a focus area for PNHP, state land management agencies, and private conservation organizations like WPC and our long-term projects have been paving the way for a greater focus on application of stewardship activities.

One of our longest running monitoring projects is our work with the eastern massasauga rattlesnake (*Sistrurus catenatus*). The snake was likely never common in

Eastern massasauga rattlesnake

Pennsylvania, as we are situated on the very edge of its range which includes the midwestern wet prairie regions of the Ohio River Basin and Great Lakes states. Development and agricultural conversion in northwestern Pennsylvania further reduced the available habitat and in the absence of periodic fires, which prevented succession to shrubland and forest, substantially reduced the amount of functional habitat in the region, leaving only three known sites.

Before (top) and after (bottom) a habitat restoration cut that removed shade bearing vegetation from the open meadows that the massasauga prefers.

From work that began nearly 25 years ago with inventory and habitat studies in the early 2000s, PNHP activities have evolved to include applied habitat management with our partners at all three properties that support the small rattlesnake and a number of other properties that may support the species if properly restored.

Management staff from WPC, PGC, and State Parks have utilized herbicide, mechanical mowing and cutting, and prescribed fire to restore these habitats. PNHP staff have been working with stewardship staff at WPC along with PFBC to make sure that the site restoration activities are implemented sensitively, so that the snakes are not destroyed.

Vernal Pools Conservation, Outreach, and Stewardship

Pennsylvania is thought to have once supported over a million acres of wetlands. However, in the years since European colonization, over half of those wetlands have been lost to development or drained and converted to agriculture or other land uses. Small wetlands such as vernal pools have likely experienced an even higher rate of loss since they are often overlooked, are dry for portions of the year, and are easy to drain and fill.

Because of their high biodiversity conservation value, PNHP has worked with partners to advance vernal pool inventory, long-term conservation, and stewardship to prevent further losses. Our work has addressed ongoing and emerging research, management, and outreach needs for vernal pools. Specifically, our vernal pool stewardship activities have included a number of demonstration projects where we have trained people in the steps of vernal pool identification, design, and restoration.

In recent years this has included trail maintenance projects to reduce erosion and manage run-off, creation/restoration of vernal pool wetlands and wet meadows, control of invasive plants, native plantings to restore areas where soils were disturbed or where invasive plants were removed, and installation of fencing that protects sensitive native plants.

Friends of Pinchot State Park volunteers make a ‘gravel mattress’ to stabilize an eroding trail adjacent to a vernal pool. The gravel mattress allows water to slowly pass through to the adjacent wetland.

Monitoring phenology of vernal pool plants and amphibians with the Penn State Master Watershed Stewards and Friends of Pinchot State Park.

Outreach and education has been an important component of our work in these charismatic ecosystems. Our outreach efforts have included developing community science monitoring stations to track year-round changes in hydrology and habitat, volunteer trainings that foster engagement through an 'Adopt-a-Pool' program, development of vernal pool educational materials, and participating in public outreach events like vernal pool walks. Landowners have also been encouraged to work with local conservancies and land trusts to enact protection strategies such as conservation easements.

Northeastern bulrush

Vernal pools are ecosystems that support rare plant species too! The northeastern bulrush (*Scirpus ancistrochaetus*) is a rare plant that is found, almost exclusively in ephemeral wetland habitats. Invasive non-native and aggressive native species like cattail (*Typha* spp.) can take over vernal pools, especially when runoff from nearby development introduces additional nitrogen and other nutrients into the ecosystem. At one site, Canada Run, PNHP Ecological Assessment Manager Mary Ann Furedi and DCNR Botanist Chris Firestone have pivoted from assessment and monitoring to direct stewardship as they work to manage some of the competing vegetation to benefit the rare bulrush.

More than Just Inventory

While losses of critical habitat sometimes feel insurmountable, our recent attention to stewardship action has shown promise in conserving these important ecological areas. While our mission is to "gather and provide information on the location and status of important plants, animals, natural communities and geologic features to inform environmental and conservation decisions," we know that without action to maintain critical habitat, we will lose these areas to the threats posed by development and invasive species.

About the Author

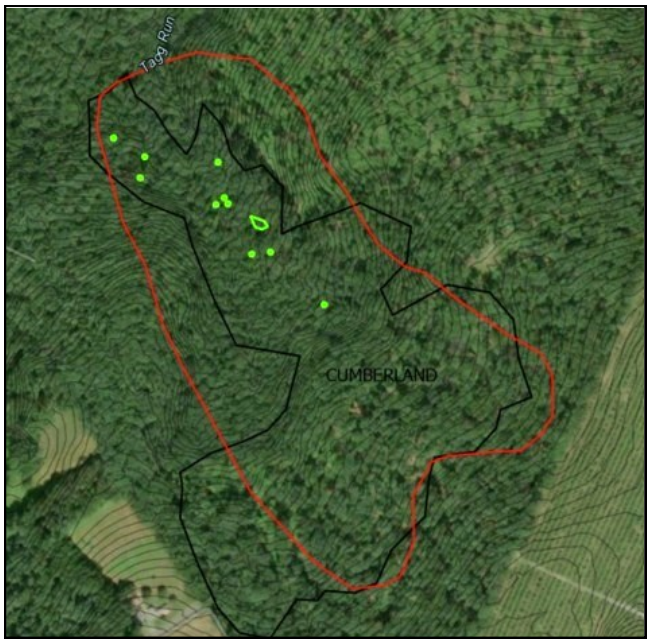
Ephraim Zimmerman is the Senior Director of Conservation Science for the Pennsylvania Natural Heritage Program, where he has worked for 21 years. He received his B.S. degree in Wildlife Biology from Colorado State and an M.S. in Forest Ecology from the University of Michigan. With PNHP, his primary focus has been on plant community inventory, mapping, and classification.

Notes from the Field

Not All Surveys are Field Surveys – Desktop Review in the Winter

Scott Schuette, Botany Manager

Pennsylvania Natural Heritage Program (PNHP) data remains the most taxonomically inclusive and vetted source of biodiversity information in our region. Our task is not only to report on rare elements of biodiversity, but to interpret their ecological and conservation significance as it relates to a holistic conservation approach. This has become particularly critical as our data set now includes over 30,000 records, and a majority of these element occurrence records (EOs) are for rare plants. PNHP botanists at the Western Pennsylvania Conservancy developed a statewide botany inventory plan that identified sites where plant EOs were found and grouped them into four different prioritization tiers. The bulk of these sites are considered lower priority and rarely qualify for on-the-ground surveys due to a variety of factors including number of EOs present, their conservation ranks, and time since last observation. These sites add to the administrative burden for DCNR environmental review staff and need to be updated with current information about presence or absence of the plant and condition of the site with regard to habitat suitability for the species.



Aerial image of site with predicted location of EO (Red polygon), survey area (black polygon), and updated EO location(s) (green polygons).

To chip away at this large amount of old rare species data, PNHP botanists created a desktop review tool that can be used in the office and ultimately aid in deciding whether the EOs at these lower priority sites are likely to persist. The tool examines data quality, factors impacting the EO, and summary outcome that determines probability of persistence and whether the EO needs a field survey. A WRCP-funded project to implement the desktop review tool was completed in December 2024. The project focused on reviewing 110 EOs with a state conservation rank of S1 (critically imperiled) and had a last observed date of greater than 25 years. The occurrences represented 73 plant species that are currently considered endangered in Pennsylvania. The initial data quality review identified 10 EOs that lacked enough information for the tool to be useful in determining persistence at those sites, but a majority of the EO data was usable in the tool.

Low rough aster (*Eurybia radula*) in flower and current habitat condition at a site used as a ground-truth survey to test the effectiveness of the desktop review tool.

Two important aspects of this tool are to identify EOs that are no longer present due to significant land use changes and to select EOs for ground-truthing the effectiveness of the desktop review process. Through careful review of aerial imagery over time, sites are determined to possess or lack suitable conditions for persistence of the EO. In doing this review, there were seven sites that had significant land use changes that likely extirpated the EO from those sites, plus an additional 23 sites deemed unlikely to support the EOs found at them. Twenty-seven sites were considered good and likely able to sustain the EOs present.

However, fifty-five of the sites reviewed were identified for ground-truth surveys due to uncertainty of the land use change impacts and the species' ability to adapt to those changes. This review process helped refine the number of EOs requiring field surveys and identified EOs that can be extended in the environmental review database as well as those that can be removed due to site changes leading to extirpation. The end result being a cleaner, up-to-date source of rare species and habitat information needed by DCNR for environmental review and management.

Camera Trapping Efforts Bolster Data Entry of Rare Mammals into Biotics Database

Emily Szoszorek, Senior Conservation Information Assistant
Ryan Miller, Senior Zoologist

Camera traps with wildlife cameras for research are not an entirely new concept. A small hidden camera with a sensor is attached to a tree or hidden in brush. When the sensor detects movement, the camera is triggered to take a picture. These cameras have been used to survey wildlife since the early 1900s. However, with the invention of the digital camera and compact computer interfaces, wildlife camera use really took off around 2005. Today, they are an invaluable tool in our arsenal for surveying rare animals. The Pennsylvania Game Commission and PNHP have utilized cameras to survey for Allegheny woodrat, least weasel, least shrew, and spotted skunk. Having cameras deployed in the wild over long periods of time provides a large number of images and a large amount of data with limited manpower. For example, during the recently completed least weasel survey, our cameras collected 740,029 photos that had to be analyzed.

Digital trail cameras are compact, easy to use tools that can be attached to trees or hidden in habitat to survey for rare species.

One of these large datasets was recently shared with PNHP Information Management for processing. Last summer, Pennsylvania Game Commission zoologists provided a collection of statewide camera trap records for Allegheny woodrat that were deployed from 2017 to 2023. This information was reviewed by PNHP Information Management then prepared as a bulk data load to be entered into our Biotics database. From this camera trap data, a total of 254 newly mapped features were drawn – a percentage increase of 30% for this species – and 109 previously mapped features were updated for Allegheny woodrat. In addition to the mapped features, a total 374 site visits, some of which were repeated visits to the same site, were also loaded into Biotics. Not only do these site visits include new observations, they also include unsuccessful surveys to previously established sites. This helps us track which sites are being used or are no longer occupied by the rare animals that we study. These simple to use tools can be easily deployed, gather large amounts of data, and help update our knowledge of our rare species in Pennsylvania.

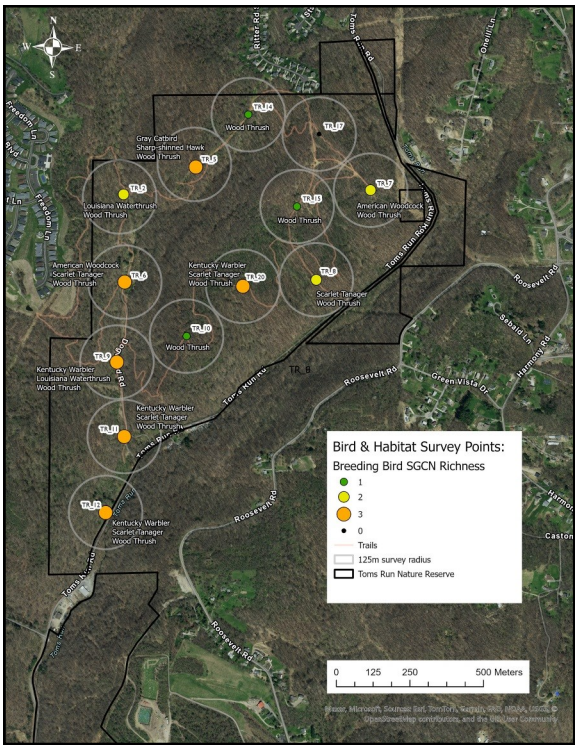
A least weasel image collected in a camera "trap" baited with scent lure. The trap was apparently in the weasel's hunting territory as it was repeatedly documented in the trap over several months.

Voucher photograph of an Allegheny woodrat from a trail camera survey.

The Pittsburgh Penguins aren't the Only Birds in the "Burgh

Ephraim Zimmerman, Senior Director Conservation Science
David Yeany, Avian Ecologist

Patches of forest, woodland, and wetlands are found scattered around our major urban centers. These open spaces are important for both resident and migratory birds, that often have limited habitat area in the urban/suburban matrix. In 2015, Pittsburgh-based conservation groups facilitated the City's signing of the Urban Bird Treaty, a program organized by the U.S. Fish and Wildlife Service supporting city partners in conserving birds and their habitats and providing opportunities for community engagement. A year later, the same group of scientists and stewardship professionals from several leading Pittsburgh area conservation organizations formed the Allegheny Bird Conservation Alliance (ABCA) to work together on conservation projects that benefit birds in the Western Pennsylvania region. A decade later, the Western Pennsylvania Conservancy (WPC), Carnegie Museum of Natural History (CMNH), Audubon Society of Western Pennsylvania (ASWP), Allegheny Land Trust (ALT), The National Aviary, BirdLab, Pittsburgh Parks Conservancy (PPC), and Erie Bird Observatory (EBO) are still working on high priority bird conservation efforts. Some of this work includes habitat quality evaluations of urban green-spaces, long-term bird banding stations to contribute to an understanding of migratory bird movement and landscape use, and continuing work with the city, local businesses, and residents to reduce bird-window collisions.



An example map showing SGCN found and SGCN diversity (0-3 species) at each survey point across Toms Run Nature Reserve. These maps were provided to ABCA partner organizations for use in finer scale habitat conservation at the survey areas.

Volunteers plant native trees and shrubs at Toms Run Nature Reserve as part of a WPC-led ABCA habitat restoration event.

Last year, a group of ABCA member organizations, led by PNHP staff from WPC, completed a four-year project funded by the DCNR Community Conservation Partnership Program (C2P2). The project included bird inventories during both breeding and spring migration of 2022 and habitat assessments within five protected natural areas in Allegheny County. Final bird and habitat management recommendations were developed, and ABCA partners implemented volunteer restoration activities to benefit bird Species of Greatest Conservation Need (SGCN) from the Pennsylvania State Wildlife Action Plan.

At ALT's Churchill Valley Greenway, the findings were included in the restoration plan for a small stream running through the site. This site is undergoing a transformation from an abandoned golf course to a floodplain wetland that will help manage stormwater runoff from the surrounding neighborhoods and also enhance floodplain shrub habitat for breeding SGCN with declining populations, like the willow flycatcher, documented by PNHP zoologists along the waterway. Hydrological restoration will increase the amount of habitat for this species and other wetland species, which have limited habitat in the suburban matrix.

At Frick Park (PPC), Dead Man's Hollow Conservation Area (ALT), and Beechwood Farms Nature Reserve (ASWP), we documented several species of forest interior nesting birds – including scarlet tanager and

black throated green warbler – species often associated with interior forest conditions. However, forest habitat at these sites was degraded by high percent cover of invasive plants and severe overbrowsing of native species by white-tail deer. These threats, which are common in urban parks and green spaces are two of the greatest threats to bird populations in the region. PNHP staff made recommendations on specific actions to control invasive plants at specific locations within each site where bird SGCN were found and to reduce the impact of deer, including fencing and deer population control.

Scarlet tanager (male shown here) is both a Species of Greatest Conservation Need (SGCN) and a forest interior species found breeding across several of the ABCA sites, making it a target for habitat conservation efforts.

At Tom's Run Nature Reserve (WPC), PNHP zoologists documented the highest number of bird SGCN. The seven species, which included Kentucky warbler, scarlet tanager, Louisiana waterthrush, and wood thrush, require forest interior conditions with a dense forest understory. The second-growth forests of Tom's Run could use an improvement in the quality of this structure. So, over the past year, PNHP zoologists and ecologists worked with WPC's Land Stewardship and Community Forestry staff to plant understory trees and shrubs in the riparian forests to improve the critical understory structure.

The organizations that make up the ABCA are restoring habitat conditions for the region's bird communities through a combination of outreach, conservation science, and land stewardship. Future projects will continue these successful efforts and will guide the activities of land managers, land trusts, and homeowners in successful implementation of conservation activities that benefit migratory and breeding birds in Allegheny County and Western Pennsylvania.

A "Meeting of the Pines" - Updating Shortleaf Pine Occurrences in the South Mountain Area

Noah Yawn, Ecologist

Shortleaf pine (*Pinus echinata*) is a large, attractive conifer species that historically occupied fire-adapted ecosystems throughout its southeastern U.S. range but has since experienced range-wide decline. Pennsylvania's known and recorded populations of naturally-occurring shortleaf pine represent the near-northernmost extent for the species. As part of the four-county Natural Heritage Inventory update project (Franklin, Cumberland, Adams, and York counties), we planned to update the populations in the South Mountain physiographic section, which are some of the largest in the state. We reviewed existing Element Occurrence (EO) data collected by staff over the past 20 years to best determine how to go about re-surveying and updating them. Shortleaf pine, similar to other PNHP-tracked tree species, presents certain challenges for field surveys, namely due to their distribution across a large geographic area within a given EO. To make things even trickier, Pennsylvania's shortleaf pine co-occurs with four other pine species and can hybridize with at least two!

An overall view of a shortleaf pine from the forest floor. Note its horizontal branches, clustered crown, and absence of low limbs.

Scott Schuette and a young shortleaf pine seedling. Recruitment of this species is rare in Pennsylvania.

In March, PNHP and BOF staff and volunteers spearheaded this effort by visiting 83 one hectare plots and recording individual tree condition and character data on 88 trees total, 42 of which were determined to be "excellent" shortleaf pine individuals.

Rachel Goad and Meredith Seltzer examining a tree for shortleaf pine characters.

So, if it can occur with four other pines, what makes a shortleaf pine? Within the South Mountain region, shortleaf pine (*P. echinata*), Virginia pine (*P. virginiana*), white pine (*P. strobus*), pitch pine (*P. rigida*), Table Mountain pine (*P. pungens*), and planted red pine (*P. resinosa*), all occur in the immediate area. In fact, the nearby Meeting of the Pines Natural Area (Michaux State Forest) owes its name to this impressive species overlap. Shortleaf pine is most readily identified through a handful of characters that differentiate it from these other species. A favorite character that sets it apart from all other eastern pine species is resin pockets in its bark, appearing like small craters or pimples and often found in abundance. Since hybridization between multiple species is present in the area, we created a checklist of characters to determine a tree's identity and possible hybrid influence, ranked by ID confidence. We also recorded data on potential hybrid individuals to share with the Bureau of Forestry for potential genetic investigation. This survey effort will continue in early and late 2025 within the four-county footprint. Pine tree surveys make excellent winter fieldwork since they are best spotted when leaves are absent from the canopy!

Shortleaf pine is the only eastern U.S. pine species to produce characteristic resin pockets in its bark.

	Shortleaf Pine (*P. echinata*)	Pitch Pine (*P. rigida*)	Virginia Pine (*P. virginiana*)
Resin pockets on bark	Yes	No	No
Bark pattern	Rectangular plating, with horizontal divisions, somewhat flaky	Deeply furrowed, uneven, geometric plating	Shallow, small, uneven plating, very flaky
Epicormic sprouts on trunk	Uncommon	Very common	None
Cone shape	Lanceolate to ovoid, tapered at base	Wedge-shaped, widest at base	Ovoid, tapered at base
Cone length	4 - 7 cm	5 - 10 cm	3 - 6 cm
Cone prickle	Dull	Sharp	None to slight
Needles per fascicle	Mostly 2 but some 3	Mostly 3 but some 2	2 only
Needle length	5 - 8 cm	7 - 13 cm	2 - 7 cm
Needle twist	None to slight	None	Very twisted
Branch orientation to trunk	Perpendicular	Mostly ascending	Ascending at odd angles
Branch shape	Straight	Sinuous, uneven	Uneven
Persistent low limbs	Uncommon	Somewhat common	Many

Salamander Mussel Silos

Ryan Miller, Senior Zoologist

Recently, PNHP was awarded a WRCP grant to further study the state endangered salamander mussel. The current range of this rare mussel is now restricted to the Allegheny River navigational pools 3-8 and French Creek.

Recent surveys have documented that the navigational pools in the upper Ohio River basin have suitable habitat for the salamander mussel. In addition to records in the Allegheny River's navigational pools, the salamander mussel had been found in the Ohio River in the Belleville Pool approximately 160 miles downstream of the Pennsylvania and Ohio border. One of the main theories for this gap in occupancy of the salamander mussel between the Middle Allegheny and Middle Ohio rivers is legacy pollution causing salamander mussel mortality.

Salamander mussel glochidia (appearing as small white spots) attached to the gills of an adult mudpuppy.

The mudpuppy is the only known host for the salamander mussel. This purely aquatic amphibian with large, external gills has been observed at numerous salamander mussel collection locations in Pennsylvania. Salamander mussel glochidia (larvae) have been observed embedded on the external gills of mudpuppies. PNHP's mudpuppy studies over the past five years revealed mudpuppy populations with relatively high densities in Pennsylvania's portion of the Ohio River while the salamander mussel remains absent.

Juvenile salamander mussel survival could be a factor limiting the dispersal and recovery of the mussel. This new Wild Resource Conservation Program (WRCP) project will study survival of juvenile salamander mussels through the deployment of mussel survival silos. These small concrete dome-shaped structures have a chamber in the middle that will hold a small number of juvenile salamander mussels. We will place the silos in four locations in western Pennsylvania that either currently have salamander mussel populations (control) or locations where salamander mussels are no longer found like the Ohio River. After leaving the silos out for the summer (one growing season) we will remove the silos and examine the juvenile salamander mussels for survivability and growth. This may answer the question if salamander mussels can survive in Pennsylvania's portion of the Ohio River.

Mudpuppies collected from the Ohio River that will be used to propagate salamander mussels at the PFBC Aquatic Conservation Center in Union City, PA.

Hatchery reared juvenile salamander mussels are being cultured at the Pennsylvania Fish and Boat Commission's Aquatic Conservation Center in Union City. Last fall PFBC staff collected gravid female salamander mussels from a robust population in the Middle Allegheny River. Mudpuppies were collected by PNHP staff from the Ohio River. The juvenile salamander mussels produced in the hatchery will be placed in the silos this summer for the study.

If this study finds that juvenile mussel survival is high, it could lead to the next step in recovery, including the repatriation of salamander mussels to the Ohio and other waterways where they are now extirpated like Dunkard Creek. This project will get us one step closer to recovering this rare and unique mussel in Pennsylvania.

Timely Treatment of Tree-of-Heaven

Brian Daggs, Invasive Species Ecologist

Mature tree-of-heaven at Scott Park in Millcreek Township, one of the treatment sites.

A decade-long struggle to halt the spread of the invasive spotted lanternfly comes to a head in Erie County, Pennsylvania. During March of 2025, PNHP and its regional partners targeted tree-of-heaven (*Ailanthus altissima*), an invasive plant and the natural host species for the spotted lanternfly, for late winter herbicide treatments. Coincidentally, these management efforts were quite timely, as spotted lanternfly is now knocking on the door of Erie County's Grape Belt.

Spotted lanternfly is a planthopper insect native to eastern Asia that was introduced to the United States in 2014 in southeastern Pennsylvania. It is widely considered invasive in its introduced range due to its ability to feed on a wide variety of economically-valuable plants, particularly stone fruits, hops, and grape vines. In its home range, spotted lanternfly primarily feeds on tree-of-heaven, also a native to eastern Asia. Tree-of-heaven is also considered invasive in the United States. First introduced to North America in 1784, tree-of-heaven is found all across the continent, including the Lake Erie Grape Belt, the world's leading producer of Concord grapes.

A spotted lanternfly with egg masses.

To reduce the threat that spotted lanternfly poses to the Lake Erie region, PNHP, along with its partners in the Lake Erie Watershed Cooperative Weed Management Area, contracted herbicide treatments for tree-of-heaven in Erie County. By eliminating tree-of-heaven on the landscape, fewer host plant options are available to spotted lanternflies arriving in the region and looking to establish. Without tree-of-heaven, spotted lanternfly would have a difficult time reproducing in the large numbers seen in southern Pennsylvania.

Hack-and-squirt herbicide application on mature tree-of-heaven.

Contracted pesticide applicators were out in March, treating tree-of-heaven with targeted herbicide application methods such as hack-and-squirt and basal bark spray applications. At the same time, elsewhere in Erie County, spotted lanternfly egg masses were discovered by a tree servicing company working in Millcreek Township. The presence of egg masses confirms that spotted lanternfly is finally making an appearance in Lake Erie's Grape Belt. PNHP's management efforts for tree-of-heaven came at a critical time; if these egg masses were to hatch and find living tree-of-heaven, then the spotted lanternfly population would grow exponentially. Although mature tree-of-heaven still exists in the region, these herbicide treatments will help to slow spotted lanternfly's spread into the Grape Belt.

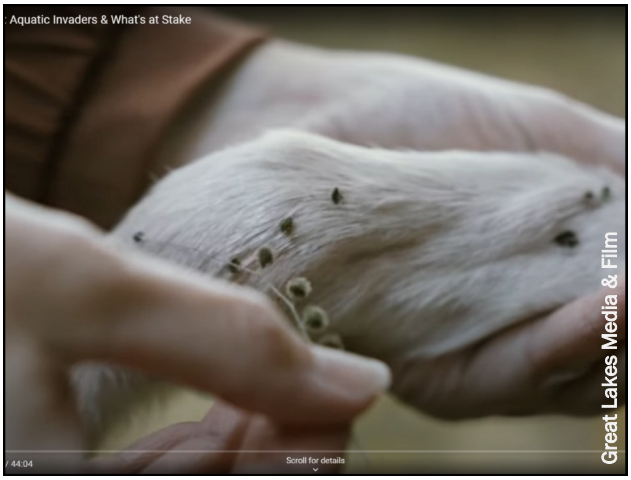
New Documentary Film Highlights Invasive Species Prevention Tips

Amy Jewitt, PA iMapInvasives Program Coordinator

The Western Pennsylvania Conservancy's documentary film "Seeing The Unseen: Aquatic Invaders and What's at Stake" highlights areas in northwestern Pennsylvania that are being impacted by aquatic invasive species. Locations featured include Presque Isle State Park, French Creek, and Lake Pleasant. Amid stunning, scenic views of these and other places from the region, interwoven into the film are tidbits of advice for film viewers to personally take part in stopping or limiting the spread of invasive species. They include the following:

- Dispose of unused fishing bait in trash
- Verify purchased bait is not an invasive species
- Clean, drain, and dry aquatic recreational equipment (boats, trailers, and hunting & fishing gear)
- Report invasive species sightings to iMapInvasives
- Check pets for seeds, plant fragments, and mud
- Never release an unwanted pet or plant into the environment
- Purchase plants native to your area for use in gardens or ponds
- Volunteer at events to remove invasive species

Watch the film for free on YouTube (https://waterlandlife.org/seeingtheunseen/) and share this important information with others. Together, we can make a difference in preventing invasive species from entering into the protected places and prized natural areas that make Pennsylvania so special.

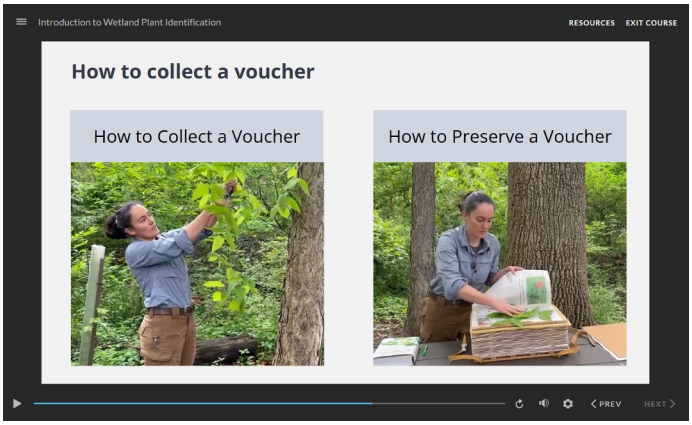


Pets can inadvertently transport seeds and plant fragments in mud or on their fur.

Wetland Plant Identification Training Modules Now Available Online

Claire Ciafré, Ecologist

PNHP staff have been working with Pennsylvania's Department of Environmental Protection (DEP) to develop wetland plant identification training modules. The modules provide a foundation for anyone new to plant identification and focus on plants commonly found in Pennsylvania's wetlands. While the modules are primarily intended for professionals learning wetland determination, they were designed for a broad audience and are meant to be useful to anyone with an interest in learning the basics of wetland plant identification.



The modules include videos on several topics, including how to collect and preserve plants.

Over the last year, two online modules have been completed. They are each approximately an hour in length. The first one introduces plant identification and provides helpful tips such as how to collect and press a plant. It also compares some of the resources available for identifying plants in the state. The second module teaches basic terminology used to describe important features for identification and covers the characteristics of common wetland tree species. The modules are available for anyone to access on the DEP Clean Water Academy website at https://pacleanwateracademy.remote-learner.net/course/view.php?id=1346&section=3

Two additional modules are in development. One will feature the identification of common wetland shrubs; the other will focus on herbaceous plants. Associated resources, such as a glossary and a list of common wetland plant species will also be provided on the website. This work is made possible through an Environmental Protection Agency (EPA) Wetland Development Grant.