



Pennsylvania Natural Heritage Program

information for the conservation of biodiversity

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Taking on Conservation Ranks for a New Group of Species, the Spider Wasps

by
Pete Woods, Senior Invertebrate Zoologist

If I asked you to think of the role that spiders play in an ecosystem, what would you think of first? You might think of a spider as a predator of insects and other small invertebrates. But the food chain doesn't end there! Spiders can be food for a variety of animals, from other spiders to birds, but if spiders have nightmares, the boogeyman of those nightmares might be a spider wasp.

Spider wasps are a family of parasitoid wasps (family Pompilidae) that specialize in hunting spiders to provision their young. A spider wasp will sting and paralyze a spider, drag it into a burrow, and lay an egg on it before sealing up the burrow. The spider remains alive while the wasp larva consumes it, solving the problem of keeping meat fresh for the larva. If you watch one of these wasps while it hunts, it appears to be filled with nervous energy, frequently flicking its wings, and quickly running around and under leaves and other obstacles searching for spiders. Anyone who has tried to capture one of these wasps knows they are tricky to catch, and even when you get one in the net there is no guarantee it will stay there.

Unlike most insects, which fly upward when captured, a netted spider wasp frantically runs and wriggles into the folds of the net, and sometimes escapes. They are not at all aggressive toward humans if you leave them alone, so no one except an insect collector is likely to learn that their stings are exceptionally painful. Spider wasps are very common members of terrestrial ecosystems, but until recently PNHP had not tried to determine which spider wasps are species of conservation concern in Pennsylvania.



Julian Fuchs

Just like a butterfly, this *Anoplius cleora* wasp is a nectar drinker as an adult, and can carry pollen between flowers. Unlike a butterfly, this wasp ate a single shoreline wolf spider (*Arctosa littoralis*) when it was a larva.

For several years, PNHP biologists have been working toward the goal of completing conservation ranks for 1,000 previously unranked invertebrate species. This work has fed into the 2025-2035 Pennsylvania Wildlife Action Plan, and was supported by a State Wildlife Grant as well as two Wild Resource Conservation Program grants. This work started by identifying taxa groups that had a lot of existing data available, making species lists for those groups, and then filtering out a smaller set of species that are probably rare for a more detailed analysis. Spider wasps are one of the groups that we focused on.



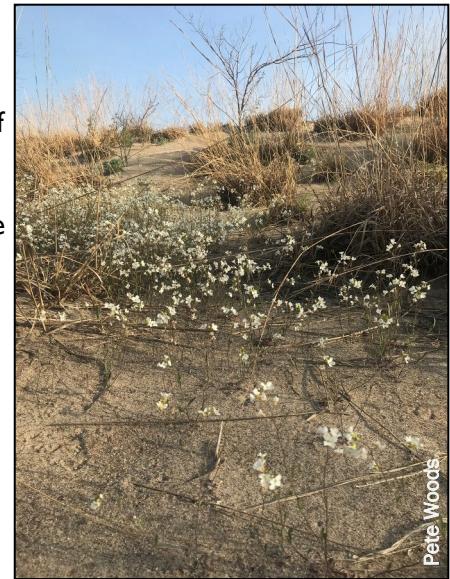
Katja Schulz

This banded spider wasp (*Caliadurgus fasciatellus*) has subdued an orb weaver spider. These wasps only eat spiders in the orb weaver family, but are not picky about which species they use. This species is widespread in eastern North America, and is probably not rare in Pennsylvania.

We started by creating a list of 74 species of spider wasp reported from Pennsylvania, compiling records of those species from a variety of sources, and researching the habitat needs (if they were known) of each species. Some of those species are broadly distributed in Pennsylvania and have numerous records, so we removed those species from our target list because they are clearly common. For species that use common habitat types but have few records, it is difficult to know if the species is rare, or if it is merely under documented because there has not been enough survey effort. Species that are smaller, or harder to identify to species, tend to be collected and identified less often. These relatively obscure species are too data deficient to determine conservation ranks, so we removed these species from our target list.

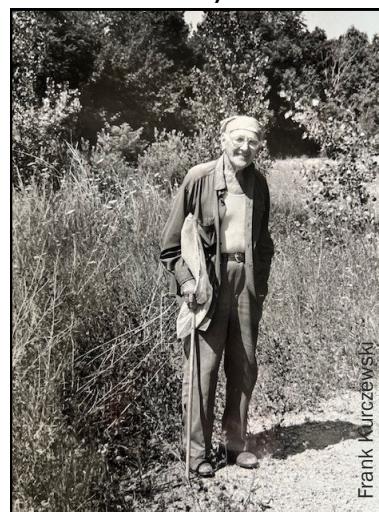
The remaining species include ten specialists of sandy habitats or rare spider hosts, and one species that is considered by experts to be rare everywhere. We ranked these species according to NatureServe's conservation ranking protocol, which determines a rank

between S1 (critically imperiled) and S5 (secure), or one of several other categories. In the end, three of these species were ranked SU (Unrankable) because of uncertainty about how rare the host spiders are, or uncertainty about the wasp's affinity for rare deep sand habitats. The remaining eight species have ranks between S1 and S3 (vulnerable), and will be categorized as Species of Greatest Conservation Need in the new State Wildlife Action Plan and will be tracked as rare species by PNHP.



Presque Isle's sand dunes are habitat for a diverse group of spider wasps. In spring the dunes are covered with blooming lyre-leaved rockcress (*Arabidopsis lyrata*).

Seven of the eight tracked wasps occur on Presque Isle, a sandspit that juts into Lake Erie and contains Pennsylvania's most unique and extensive sandy habitats. For this reason, Presque Isle is a biodiversity hotspot for the state, and the area has been the focus of many biological inventory efforts. The spider wasp fauna of Presque Isle is probably more completely known than at any other site in Pennsylvania. This is



Frank Kurczewski

This photo of Edmund Kurczewski was taken by his son Frank Kurczewski in 1984 at Wintergreen Gorge Cemetery. This site, along with Presque Isle, were his preferred places to collect insects.

mostly due of the efforts of Ed Kurczewski (pronounced Kur-CHEF-ski), who avidly collected insects during his retirement, from 1959 to 1986, with Presque Isle being one of his main collecting sites. Ed had worked at a dairy in Erie, and had never formally studied biology or entomology, but his son Frank Kurczewski was a wasp researcher and a professor of entomology at SUNY Syracuse, who

encouraged his father's retirement project. Ed collected an astounding 50,000 specimens, including 7,000 spider wasps. He co-authored many papers on the distribution, behavior, ecology, and host selection of spider wasps and other wasps with his son and other researchers.



Pete Woods

At approximately 5 millimeters long, this white-lipped ornamented jumping spider (*Habronattus cognatus*) is the smallest of the seven rare spiders at Presque Isle. The large pedipalps (the clublike appendages in front of the spider's face) identify this individual as a mature male.

At least 37 species of spider wasps occur at Presque Isle. The prey base for these wasps are the 137 species of spider known from Presque Isle. The spider fauna of Presque Isle was first studied by L.C. Truman, who published a list of 96 spiders there in 1942. In the mid-1990s, Jim Buchkovich of Erie repeated Truman's survey and added 41 species to the list. The 2015-2025 iteration of the Pennsylvania Wildlife Action Plan recognized six of Presque Isle's spider species as rare, and when we were working on the current version of the Plan, we added one more spider to that list, the white-lipped ornamented jumping spider (*Habronattus cognatus*), a sand-adapted spider that has not been found anywhere else in Pennsylvania. Some of these rare spiders are the sole hosts used by some of the rare spider wasps.

The eight rare spider wasps are each described briefly below. Of the eight, only one has a common name.

- The one wasp not known from Presque Isle is *Anoplius hispidulus*. It is known from a very small number of records in the mid-Atlantic and Great Lakes regions, and although it does not have a global conservation rank yet, it is probably globally rare.
- The five spotted spider wasp (*Episyron quinquevittatus*) preys on orb weaver spiders, and is known from

Presque Isle as well as a few other sites along the Lake Erie shore and a few other sites in Pennsylvania.

- *Arachnospila scelestus* preys mostly on wolf spiders and sometimes other spiders. Aside from two very old records, this wasp is known in Pennsylvania from only Presque Isle.
- *Anoplius bengtsoni* is the largest spider wasp in our region. Ed Kurczewski observed these wasps flying at dusk behind the beaches of Presque Isle, but due to the difficulty of following wasps in the failing light, no one has ever determined which spiders this wasp uses.
- *Anoplius splendens* preys on a wide variety of spiders at Presque Isle, and hasn't been seen anywhere else in Pennsylvania for over a century.

The remaining three wasps are unusual cases of a rare species that obligately depends on another rare species. This does not happen often, because a rare host species usually does not have large enough populations to support a dependent species. This author is only aware of ten such cases in Pennsylvania, and, oddly, five of those occur on Presque Isle (the other Presque Isle examples are moths that depend on hoptree, *Ptelea trifoliata*).



Pete Woods

Wright's burrowing wolf spiders (*Geolycosa wrighti*) are not normally found above ground during the day; this individual was removed from its burrow to be documented.

One of those wasps is *Anoplius cylindricus*, which exclusively hunts burrowing wolf spiders in the genus *Geolycosa*. Presque Isle may be the only site in Pennsylvania that has burrowing wolf spiders, and it has two species. The turreted wolf spider (*Geolycosa turricola*) used to also be found at Scotia Barrens in Centre County, but it has not been seen there in many years. Wright's burrowing wolf spider (*Geolycosa wrighti*) is not known from any other site in Pennsylvania. These

large spiders dig deep burrows in loose sand and hunt from the mouth of the burrow. Unlike other spider wasps, *A. cylindricus* does not dig its burrow; it pulls the spider into its own burrow and lays its egg there. These spiders literally dig their own graves.



Shoreline wolf spiders (*Arctosa littoralis*) are superbly camouflaged against a sandy background. They attempt to use this camouflage to avoid the notice of spider wasps, but at least two species of spider wasps at Presque Isle specialize on this large spider.

Two wasps *Anoplius apiculatus* and *A. cleora* specialize on the shoreline wolf spider (*Arctosa littoralis*). This large spider hunts on sandy beaches at night, and is very well camouflaged against sand. Within Pennsylvania, the spider is limited to sites along the Lake Erie shore.

This effort to determine conservation ranks for the spider wasps resulted in a preliminary state list, and ranks for some of the rarest species in the state. It also showed us where the data gaps are, so we can work toward ranking the rest of the spider wasps. Further



PNHP collected these spider wasps in the 1990s, but the specimens were stored in jars of mixed invertebrates until recently. While we were pulling bees out of the mixed jars for a recent project, we also separated out the spider wasps and pinned them, with the goal of getting them identified.

progress will require more specimens, the taxonomic expertise to identify them, and further research into the ecology of the wasps.

About the Author

Pete Woods works as an Invertebrate Zoologist for the Western Pennsylvania Conservancy. His recent work has focused mostly on bees, moths, butterflies, dragonflies, tiger beetles, and lichens, and he aspires to be an everything-ologist. When he is not swinging a net and trying to avoid spider wasp stings, he can be found photographing nature, doing pottery, reading science fiction, and being in the outdoors with his family.



An Update on the PA Plant Conservation Alliance and Where We're Headed

by

Scott Schuette, Botany Manager

Cheyenne Moore, Plant Conservation Alliance Coordinator

With the reinvigoration of the Pennsylvania Plant Conservation Alliance (PCA) in 2022, the joint Department of Conservation and Natural Resources (DCNR) and PNHP program has evolved by expanding its focus to implement stewardship and recovery of 17 globally rare plant taxa in Pennsylvania, including curating partnerships outside of DCNR to help us achieve species' conservation goals.

Stewardship and conservation efforts for each PCA species are guided by Recovery Plans that are typically developed by WPC staff. These plans are modeled after U.S. Fish and Wildlife Service Recovery Plans and include a Species Status Assessment detailing ecology and natural history information for the populations in Pennsylvania, and a Recovery Implementation Strategy to outline stewardship and recovery actions. The plans identify knowledge gaps and actions where volunteer engagement or new partnerships could be helpful.



Bureau of Forestry technician Matt Martin and Pennsylvania Game Commission foresters installing a fence to protect white monkshood (*Aconitum reclinatum*) from wildlife browsing on a state game land.

Beyond the core work of developing and implementing recovery strategies, we are now prioritizing both in situ and ex situ conservation. This means that in addition to active management to conserve plants in the field, we are also curating plant collections to be held in botanic gardens for safeguarding. Our in situ toolbox includes several common practices: fencing to protect from wildlife browsing, invasive species removal and treatment, and canopy opening (daylighting). DCNR



Trailside where vegetation was cleared to allow for greater light levels to benefit running buffalo clover (*Trifolium stoloniferum*).

often carries out these stewardship activities, though occasionally we contract this work, or request assistance from partner agencies like the Pennsylvania Game Commission or DCNR Bureau of State Parks on the lands they manage once the PCA familiarizes them with the species and its management needs.

To assist with ex situ conservation goals the PCA is partnering with several regional botanic gardens and field stations. Currently, we work with Longwood Gardens, Powdermill Nature Reserve of Carnegie Museum of Natural History, Natural Lands, Mt. Cuba Center, and Pittsburgh Botanic Garden for assistance in holding and curating ex situ living collections of PCA focal species.



Peter Zale examining bog Jacob's-ladder (*Polemonium vanbruntiae*) seedlings in a cold frame at Longwood Gardens. These collections allow us to have populations represented outside of the wild in the event that a population would experience decline or loss. Another form of long-term ex situ conservation is the use of

seed banks that store seeds in controlled conditions. Currently the PCA seedbanks with both Longwood Gardens and the Missouri Botanical Garden. These different types of ex situ collections are an increasingly valuable tool in plant conservation that encourage collaborations between conservation practitioners and gardens. For example, Longwood Gardens is propagating plants from seeds and cuttings to plant back into parent populations to ensure their viability and persistence. This has helped us to learn more about the germination needs and ecology of these globally rare species as well as augmenting rare plant populations in Pennsylvania.

PCA species have both common and unique needs. Common needs include landowners' willingness to protect and advance conservation of the plants, and partners interested in projects to better understand the species current status in Pennsylvania and beyond. The unique needs of a species are related to their biology and ecology and sometimes vary across populations based on their site-specific conditions. Below we highlight the success of projects that involved multiple partners and landowners for two of the PCA focal species.



Canby's mountain-lover

Canby's mountain-lover (*Paxistima canbyi*) is an ancient, low growing shrub that reaches the northern end of its Appalachian range in southern Pennsylvania. There are only three populations in the state, two of which are on protected land. This globally imperiled species suffers from multiple stressors including small, scattered populations, invasive plants and an insect pest, and wildlife browsing. Each of these have a negative impact on the species, whether it be a reduction in genetic diversity or reduced vigor and successful reproduction. PCA is monitoring this species with a newly implemented protocol using quadrats and photo plots



Rachel Goad and Steve Grund using new protocol to monitor *Paxistima canbyi*.

that allows us to track plant health and density through space and time. One important aspect of monitoring and adaptive management is the treatment of the invasive euonymus scale insect that impacts this species. We have implemented active treatment of both invasive euonymus scale and competing invasives species, particularly Asian bittersweet (*Celastrus orbiculatus*), which is an alternate host for the scale.

To reduce risk of extirpation of the species in Pennsylvania, we are working with landowners of Canby's mountain-lover populations, Bucknell University, and Longwood Gardens to better understand and conserve populations. We identified that getting populations into ex situ collections was a conservation priority. Not all species lend themselves to seed collection, including Canby's mountain-lover which does not produce viable seed in Pennsylvania. One alternative we implemented is taking spring cuttings of the plants and rooting them in moist soil in a mist chamber. Once rooted, the cuttings can be divided to increase the number of plants. Dr. Peter Zale at Longwood



Canby's mountain-lover growing at Longwood Gardens from wild-collected cutting.



A patch of Canby's mountain-lover

Noah Yawn

Gardens has been instrumental in establishing these protocols and now all three state populations of *Paxistima* are in a living collection. We're also now helping to connect Longwood to other states with struggling populations of these species. Chris Bedel, steward of an Ohio population, said it best, "These collaborations are exciting because conservation of plant species works best at the range wide scale not just the state scale." In addition to serving as an insurance policy, these ex situ collections can potentially increase genetic diversity. With *P. canbyi* being a long-lived, clonal shrub, genetic diversity within the populations is expected to be low and limit the ability for successful sexual reproduction. However, this can be mitigated by controlled crossing of ex situ plants with hopes of producing viable seeds. Stay tuned!

Small whorled pogonia (*Isotria medeoloides*)

Noah Yawn

While some species require an intensive, multifaceted approach to their conservation, others need consistent attention to their life history for us to understand the most critical factors to address for effective conservation. The small whorled pogonia (*Isotria medeoloides*) is a federally threatened orchid widespread throughout the

eastern U.S., but only a single extant population that consists of 14 plants is known in Pennsylvania.

Unlike *Paxistima* which has very specific habitat requirements, *Isotria* grows in a variety of forest types that have varying compositions of tree species, but is present when there are specific fungi in relatively high concentration associated with the trees. This factor is dependent on the amount of decaying woody debris on the forest floor. Additional factors for *Isotria* persistence include acidic dry-mesic soils in second growth forests or woodlands that have diffuse canopies that allow good light penetration to the soil. Although there is a substantial amount of available habitat with these conditions, there are very few historical populations for the species, and most are now extirpated.



Cages were installed over small whorled pogonia plants to protect them from wildlife browsing and damage from falling branches.

Cheyenne Moore

PCA in conjunction with the Pennsylvania Game Commission (PGC) and U.S. Fish and Wildlife Service (USFWS) are studying the habitat conditions of our single extant population to help inform other possible locations for this species. We began annual monitoring of the species in 2020 to determine the habitat conditions and census the population, which at that time was eleven plants. All of the plants were caged to protect them from wildlife browsing and potential damage from falling tree branches.

Initial assessments indicated the forest conditions were too shady and lacked adequate woody debris on the ground for fungi to colonize and grow. Invasive species were also an issue in the population. We worked closely with Dan Heggenstaller from PGC to develop a treatment plan for invasive species and perform selected canopy thinning to simultaneously increase light penetration and add woody debris to the site. We also started visiting the population at least two times per year to document phenological changes and any insect or fungal damage to the plants. Since these

activities were implemented, there's been a small increase in the population size, and plants that had been "missing" from the population reappeared.

Whether it's the work we've been doing over the past five years or natural population dynamics, we are unsure, but we are happy to see this orchid showing signs of recovery

at this one site. We can take what we've learned here and put that into action at other potentially suitable sites as well as some of the historical sites to help keep this orchid from going extinct in Pennsylvania.

Work for our PCA species will continue through site stewardship and landowner engagement. Future goals are to work with more private landowners with PCA species on their lands, provide site conservation plans, and potentially assist with management. We want to grow our list of partners and volunteers as we standardize protocols and find new areas for collaboration so that we can save all the globally vulnerable and imperiled plant taxa in Pennsylvania.



Scott Schuette enters monitoring data for small whorled pogonia.

About the Authors

Cheyenne Moore started as the PA Plant Conservation Alliance Coordinator with DCNR in 2022, and since then has been reconfiguring and growing the program. Prior to her work at DCNR Cheyenne has worked on invasive species ecology, rare plant genetics, other botany and plant ecology projects.



Scott Schuette has worked with the Pennsylvania Natural Heritage program for 14 years as an inventory botanist and bryologist. He currently serves as the Natural Heritage Botany Program Manager at Western Pennsylvania Conservancy. He received his PhD in Plant Biology from Southern Illinois University. His projects focus on rare plant inventories, monitoring and stewardship, climate change impacts to plant species, and bryophyte inventory and conservation.



Notes from the Field

Wrapping Up Work in the Four Counties

Rachel Goad, Botanist

The Four County Inventory Project, which has involved desktop data work and field updates across Adams, Cumberland, Franklin, and York counties, is wrapping up after our last field season in 2025. We have conducted over 115 surveys across this region and will be using this data to create new and update existing Natural Heritage Areas. Land managers, planners, and other conservation-minded folks will be able to reference these NHAs, as they have in the past with our pdf-based county inventories, to make informed decisions that consider the most up-to-date biodiversity information.

A few interesting and notable finds:

- PNHP only knew of historic locations of compact dodder (*Cuscuta compacta*) in this region, but surveys revealed two extant locations along soggy peaty streams of south mountain. While there are very common members of the dodder genus that can occur in weedy places, which are easily recognized by their bright orange vining habit – sometimes affectionately called “nature’s silly string” – there are also rare members of quality natural communities. Compact dodder is proposed as Threatened in Pennsylvania.



Compact dodder

- Slender spikerush (*Eleocharis elliptica*) is a state endangered sedge of calcareous meadows, previously known primarily from the western part of the state. Surveys in 2025 found a population in a wet meadow in Adams County, which is to our knowledge the first occurrence of this species in the county.



Slender spikerush

- Smooth axil-bristle lichen (*Myelochroa galbina*), a rare species in Pennsylvania that grows on tree bark was found in York Township by community scientists Tom and T Herman via iNaturalist in spring 2024. This species is the target of a soon-to-be-announced rare lichen challenge.



Black star fungus

- Black star fungus (*Glonium stellatum*) was found twice on South Mountain over the course of the project. This species is apparently rare in the state, and possibly range-wide, with fewer than five observations known from the state and fewer than 50 known globally.
- A vesper sparrow (*Pooecetes gramineus*) was found during 2025 surveys in York County. This bird of grasslands and fields has experienced a decline in available habitat in Pennsylvania. As a breeding occurrence, this bird is ranked as S2, or imperiled in the state.



Vesper sparrow

We'll be packaging up data on these species and more over the next six months as we work to make this information useful to regulators, planners, land managers, and all of us who care about the conservation of biodiversity in south central Pennsylvania.

Annual Conference Comes to Pennsylvania

Kathy Gipe, Senior Non-game Biologist/Herpetologist

PNHP staff Kathy Gipe was the primary planner for the annual meeting of the Northeast Partners in Amphibian and Reptile Conservation (NEPARC). This three-day meeting is hosted by each of the northeast states in turn and it was time to bring it back to Pennsylvania this year. We had it at the Pocono Environmental Education Center and had record attendance of 175 people, including seven participants from the Pennsylvania Natural Heritage Program partnership. We organized and led field trips the first day of the meeting. WPC Senior Zoologist Ryan Miller presented the results of a Wild Resource Conservation Fund study on the green salamander, while PFBC staff presented a poster about a study of wildfire impacts on a box turtle population in Berks County. Charles Bier, WPC retired Senior Director of Conservation Science, gave the keynote presentation "Slowly Shifting Paradigms: A Career in Biodiversity Conservation."



The NEPARC meeting included a poster session where attendees could share research, techniques, and projects related to amphibian and reptile conservation.

Placed Mudpuppy Habitat Attracts Multiple Rare Species

Ryan Miller, Senior Zoologist

In early June 2023 PNHP zoologists purchased and placed numerous large flat rocks to be used for mudpuppy habitat in four Western Pennsylvania waterways. This was part of a Wild Resource Conservation Program grant to gauge the efficiency of

attracting mudpuppies and (hopefully salamander mussels) to created habitat.

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 imbedded on the external gills of mudpuppies. PNHP's mudpuppy studies over the past seven years revealed mudpuppy populations with relatively high densities in Pennsylvania's larger river systems.

Large flat sandstone rocks were purchased and placed at four sites that were known to have mudpuppy populations. Three of the sites had known salamander mussel populations as well. In August 2025 the rocks were gently lifted and checked to see if they attracted mudpuppies or salamander mussels.

After a little over two years, four species of greatest conservation need (SGCN) were discovered living under our placed rock habitats. Mudpuppies were observed at two sites. Three eastern hellbenders were observed at one site. A federally endangered rayed bean mussel was observed under the edge of one of our rocks. Lastly, numerous rainbow mussels were observed under the placed habitat at one of the locations. Rainbow mussels are



Mudpuppy

Ryan Miller



Eastern hellbender

Ryan Miller



Rayed bean

Ryan Miller

known to live under rocks in flowing water situations. This certainly demonstrates that placed habitat in the right areas will attract and benefit numerous species rare and common.

Although no salamander mussels were observed during this check, it may have been too early for them to colonize the new sites. Another investigation of the placed habitat may be warranted in five years after they have become well established.

New Discoveries of Fogg's Goosefoot

Jessica McPherson, Senior Botanist



Fogg's goosefoot

Invasive Species Ecologist Brian Daggs discovered a new population of the globally rare and highly elusive Fogg's goosefoot (*Chenopodium foggii*) on a dry ridge in central Pennsylvania. Prior to this year we knew of only one extant location for this species in the state, and now we have a tally of four sites. Brian's discovery started a quest to find someone who could

confirm the identification, which uncovered another population that Scott Schuette had found a few years ago and requested help from Virginia botanist Johnny Townsend to identify. Identification was confirmed for both populations, and we also realized that an additional population was documented in Northeastern Pennsylvania on iNaturalist. This species is endemic to northeastern North America, and was described by Pennsylvania botanist H.A. Wahl in 1954. It closely resembles the western species desert goosefoot (*Chenopodium pratericola*), to the point that it's hard for anyone to write a reliable key. However, Wahl saw subtle differences in wild plants of remote areas of the northeast. In our region, desert goosefoot is a rare introduction of anthropogenic habitats, especially salty ones. Wahl thought these were good enough reasons to consider Fogg's goosefoot a new species, and the distinction is still accepted by modern botanists. It could be an interesting subject for further research now that we actually know of live material to assess.

Tall Larkspur Revisited

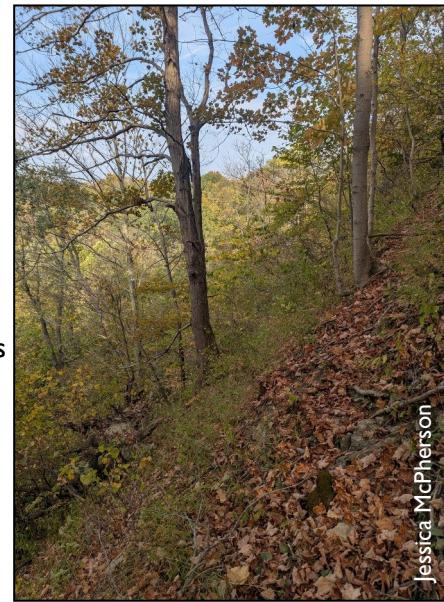
Jessica McPherson, Senior Botanist

This summer we kicked off efforts to revisit, assess, and monitor populations of the globally rare tall larkspur (*Delphinium exaltatum*). This species of dry calcareous slopes is often affiliated with a great deal of other plant diversity. We revisited four known sites that had not been visited in 9-30 years and

fortunately found plants at all sites. At the two steepest sites, populations numbers seemed similar to those observed in the 1990s, including a significant fraction of seed-producing plants. Seeds from these populations were sent to Longwood Gardens for off-site safeguarding. At two other sites, however, succession

and deer browse had greatly reduced the size of the plants, and almost none produced seed. In Missouri, at sites with regular prescribed burns, this species grows waist high; our plants were mostly less than 6" tall. Restoration work to limit deer browse and open the canopy could make a big difference in restoring their viability. The

Pennsylvania Turnpike Commission owns the largest known population in the state, and we are collaborating to ensure the long-term viability of this population.



Steep, calcareous cliff habitat of tall larkspur.



Many tall larkspur plants were very small and browsed, like this individual.

Pitch Pine Takes a Big Hit from a Tiny Beetle

Betsy Leppo, Senior Invertebrate Zoologist

Starting in 2017 there have been a series of outbreaks of the southern pine beetle (*Dendroctonus frontalis*) in the State Line Serpentine Barrens of southeastern Pennsylvania. The southern pine beetle (SPB) is a tiny bark beetle (2-4 mm) that infests healthy pine trees, primarily hard pines like pitch and Virginia, but also white pines and other conifers during major outbreaks. The SPB was historically native to the southeastern U.S. In recent decades, climate change has created suitable conditions for it further north, including New Jersey, Pennsylvania, New York, and New England. The SPB is capable of causing massive mortality of pitch pine (*Pinus rigida*), especially in dense stands. With pitch pine under attack in the serpentine barrens, the DCNR Bureau of Forestry initiated a study to monitor SPB population dynamics, changes in forest conditions (plant composition, production, nutrient cycling, and succession), changes in soil composition and microbes, and changes in wildlife communities.



Previous surveys at Goat Hill have collectively documented 17 moth and 1 butterfly species with caterpillars that feed primarily on pines, including the four species above. Seven of the moth species were re-found during the 2025 surveys. Some of the moths we are looking for can be challenging to find, so continued monitoring is needed to better discern which species are truly absent due to the loss of mature pitch pines, versus present but missed during a particular survey.

Photographers (clockwise from top left): John Morgan, iNaturalist; frannysopranny, iNaturalist; jayrand iNaturalist; Betsy Leppo, PNHP



In 2025 there were many dead and dying pitch pines at Goat Hill. Yellowing needles in the crown is a late stage symptom, with complete browning of the needles soon to follow.

Serpentine barrens are noted for supporting diverse Lepidoptera (moths and butterflies), with many state and globally rare species. PNHP and our collaborators have conducted lepidoptera inventories at the stateline barrens since the 1970s. This work provides us with a reasonably comprehensive list of the lepidoptera that occur there. This year, PNHP collaborator and moth expert Steve Johnson conducted surveys at Goat Hill to document the pine feeding moths present as the SPB damage takes hold. We plan to run these surveys again once the pitch pine mortality stabilizes. The information we collect will help guide future stewardship and management activities, especially if the SPB populations spike in pine forests elsewhere in Pennsylvania.

“Seeing The Unseen” Film Reaches Audiences Far and Wide

Amy Jewitt, PA iMapInvasives Program Coordinator
Mary Walsh, Invertebrate Zoology Manager

In 2023, staff with the Western Pennsylvania Conservancy and Pennsylvania Natural Heritage Program in partnership with the Emmy Award-winning film company, Great Lakes Media & Film, set out to create a documentary film titled “Seeing The Unseen: Aquatic Invaders & What’s at Stake.” The film features narration by Charles Bier, retired Senior Director of Conservation Science at WPC, and features local experts from Pennsylvania Sea Grant, Pennsylvania Department of Environmental Protection, Allegheny College, Western Pennsylvania Conservancy, and other organizations that advise viewers about invasive species threats and prevention.

By using videography to highlight the impacts of aquatic invasive species (AIS) on the Lake Erie watershed and surrounding areas, the film transcends typical communications about invasive species by telling a story



Mary Walsh, PNHP Invertebrate Zoology Manager, participated in a recent panel discussion at the Dive Deeper Summit, along with colleagues from PA Sea Grant and Penn State Extension.

that many who enjoy outdoor recreation can relate to. In January 2024, the film was released online and has since garnered nearly 4,000 views on YouTube. The film has also won multiple awards from several renowned film festivals, including the 2024 Humanitarian Award from the Best Shorts Competition and an Industry Award for Best Educational Media from the Raw Science Film Festival. Viewers of the film praise its ability to make the topic of AIS more relatable to the public. It showcases outdoor recreationists and experts, and singles out invaders to be on the lookout for in the state.

Sharing the film with audiences far and wide, program staff have arranged screenings and panel discussions at conferences, film festivals, universities, and libraries, among other places. Recent showings of the film have occurred at the French Creek Valley Conservancy's Woods and Waters Film Festival in Edinboro, the Carnegie Museum of Natural History's NatureFest event in Pittsburgh, Penn State Extension's Dive Deeper Summit in Harrisburg, and the Ohio University's Sustainability Film Series in Athens, Ohio.



A cinema marquee in Athens, Ohio features the "Seeing The Unseen" film as part of the Ohio University's 2025 Sustainability Film Series.

Monitoring Avian Productivity and Survivorship (MAPS) – 2025 Season

David Yeany, Avian Ecologist

PNHP again partnered with Bird Lab to complete year two of monitoring bird populations at two MAPS (Monitoring Avian Productivity and Survivorship) bird banding stations at WPC-owned preserves – Tom's Run Nature Reserve (Allegheny Co.) and Bear Run Nature Reserve (Fayette Co.). The purpose of this continued monitoring is to fill-in geographic gaps in the long-term data collection network of breeding season banding sites in the MAPS program. MAPS collects data used to estimate key demographic parameters known as vital rates, such as productivity, recruitment, and survival of individual bird species. This information aids in understanding which life-stages may be most important for causing population change.



Collaborators from Bird Lab, Avian Ecologist Nick Liadis (R) and Bird Bander Shaina Kenny (L), work to band a red-bellied woodpecker and record its measurements at the Tom's Run Nature Reserve MAPS station.

In 2025, across both sites we banded 185 new birds while recapturing 79 previously banded birds. In total these 264 captures represented 30 different species, including 12 Species of Greatest Conservation Need (SGCN). The five most abundant birds captured were all forest interior species and four of these were SGCN with hooded warbler being most abundant, followed by wood thrush, ovenbird, Louisiana waterthrush, and black-throated blue warbler. Hooded warbler (24 individuals) and wood thrush (6 individuals) also had the most recaptures. We also captured six new species, including three SGCN: Kentucky warbler, northern waterthrush, and scarlet tanager; as well as common yellowthroat, eastern phoebe, and rose-breasted grosbeak.



Kentucky warbler - Tom's Run

At Bear Run, we continued our monitoring of Pennsylvania's only confirmed breeding population of Swainson's warbler with recaptures of three individuals banded in previous years (2022, 2023, and 2024) and one new bird banded. The new Swainson's warbler was a hatch year bird, confirming the species breeding for the third year in a row at the site. The recaptured male from 2022 was banded in July and aged as an after second year bird, making this individual at least six years old and possibly returning to the site for the fourth consecutive year.



Swainson's warbler - Bear Run

We also recaptured six wood thrush previously banded in 2024, including one of the birds from Tom's Run that was outfitted with a Motus nanotag transmitter #361. In total during this second MAPS season, we detected five of the 25 wood thrush that were tagged across the two sites. We checked Motus detections for #361 and found it had migrated last fall to the northwest side of the Yucatan Peninsula in Mexico, taking a route south through the Appalachian Mountains and across the Gulf of Mexico. Early data from Fall 2025 indicate a similar route south for #361.

Pennsylvania Vascular Plant List

Rachel Goad, Botanist

A new botanical resource is available on PNHP's website: an updated list of naturalized vascular plant species in Pennsylvania. Plants on the list are categorized as native or introduced, and the names used are cross-walked between our new taxonomic standard, the Flora of the Southeastern US, and those used in the Plants of Pennsylvania 2nd edition (2007). Associated explanatory materials and resource links contribute to making this a rich resource for botanists in Pennsylvania and beyond. Check it out here: <https://www.naturalheritage.state.pa.us/PlantChecklist.html>

Scientific Name	Common Name	Nativity	Family
<i>Abies balsamea</i>	Balsam Fir, Northern Balsam, Blister Pine, Fir Pine	Native	Pinaceae
<i>Abutilon theophrasti</i>	Velvetleaf, Pie-marker, Butterprint, China-jute	Introduced	Malvaceae
<i>Acalypha deamii</i>	Big-seeded Copperleaf, Two-seeded Copperleaf	Native	Euphorbiaceae
<i>Acalypha gracilens</i>	Shortstalk Copperleaf, Slender Copperleaf	Native	Euphorbiaceae
<i>Acalypha ostryfolia</i>	Rough-pod Copperleaf, Hop-hornbeam Copperleaf	Introduced	Euphorbiaceae

A Summer of Wetland Assessments and Unexpected Finds

Claire Ciafré, Ecologist

Mary Ann Furedi, Ecological Assessment Manager

Noah Yawn, Ecologist

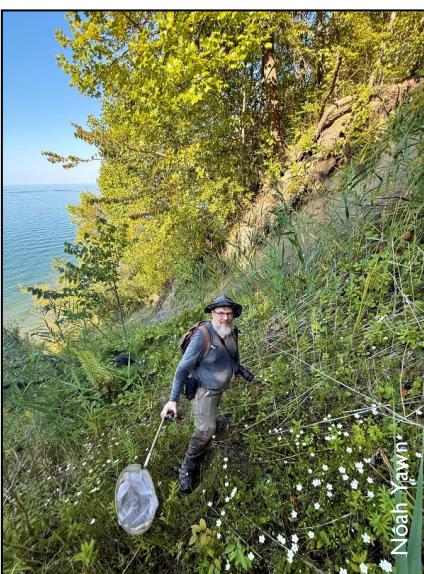
For PNHP ecologists, 2025 was the year of wetland assessments. Through funding from the EPA Wetland Development Grant Program, we were tasked with researching, developing, and field-testing wetland assessment methodology for use on Department of Conservation and Natural Resources (DCNR) lands. A wetland assessment provides a systematic approach to documenting and quantifying the condition of a wetland and the area surrounding the wetland, referred to as a buffer. Wetland condition is defined by multiple metrics which include the composition and structure of vegetation in the wetland and surrounding the wetland, presence of roads, and presence of other stressors that may degrade the functionality of a wetland. The results of a condition assessment provide information that land managers can then use to address issues and better manage and protect the aquatic resource. After researching the methodology used by other agencies in Pennsylvania and surrounding states, PNHP staff chose to field-test the wetland assessment developed by the



PNHP and EPA staff at wetland assessment training at Balsam Swamp in the Thornhurst Tract of Pinchot State Forest.

Department of Environmental Protection (DEP) – Pennsylvania Wetland Condition Level 2 Rapid Assessment. During this field season, we evaluated 46 wetland sites across the state. A preliminary review of the assessment data shows that many of the wetland sites visited are currently in good condition, but that invasive species and increasing infrastructure are the greatest stressors. There is more work to do over the next few months to review the results of the assessments and make modifications to the assessment methodology so that it is more user friendly and applicable to the needs of DCNR.

While conducting the wetland assessments this summer, PNHP ecologists soon realized that



Pete Woods documents a large colony of fen grass-of-Parnassus along the bluffs of Lake Erie.

assessments aren't just about documenting the stressors in a wetland, sometimes you make cool, unexpected discoveries too! Here are a few highlights of rare plants and a previously undocumented plant community found during this year's wetland assessment work.

Compact dodder

Claire Ciafré found two new populations of compact dodder (*Cuscuta compacta*; PA Threatened) along undisturbed, spring-fed headwater streams and seeps in Michaux State Forest (Cumberland County). This species was known from the area but had last been collected from the county in 1945, and the nearest known population (last collected in 1921) was found at least three miles away from the new populations. A parasitic plant, compact dodder primarily uses woody plants like highbush blueberry (*Vaccinium corymbosum*) as a host.



Compact dodder
Claire Ciafré



Foxtail clubmoss was found growing among peat mosses in a re-establishing bog.

Foxtail clubmoss

Claire Ciafré also found a new population of foxtail clubmoss (*Lycopodiella alopecuroides*; PA Endangered) in a re-establishing, bog-like wetland in Michaux State Forest (Cumberland County). This find is particularly notable because the location of the population is disjunct (geographically separated) from the majority of this species' range on the Coastal Plain, and because it was found co-occurring with two other species of clubmoss. The wetland where this new population was found is recovering from being impounded by a dam that was removed over 25 years ago.



Fen grass-of-Parnassus

Noah Yawn

Fen grass-of-Parnassus along the Erie Coast

Pete Woods and Noah Yawn visited a handful of vertical bluff seep wetland communities in the Erie drainage to continue testing the wetland assessment protocol in a variety of wetland types. During these site visits, they documented an estimated 10,000+ individuals of fen grass-of-Parnassus (*Parnassia glauca*; PA Endangered) within a large bluff seep complex along the Lake Erie coast. This exciting discovery represents a new occurrence for the species, as well as one of the largest known populations of fen grass-of-Parnassus in the state.

Minniebush and Roan Mountain goldenrod

During wetland assessment visits to poor fen communities in the Mount Davis area, Noah Yawn located new occurrences of minniebush (*Rhododendron pilosum*; PA Rare) and Roan Mountain goldenrod (*Solidago roanensis*; PA Threatened). Both species, while not found in wetlands, are endemic to the central Appalachians and are at their northern range limit in the Allegheny Mountains of southwestern Pennsylvania.



Minniebush in flower

Noah Yawn

Cottongrass Poor Fen and twisted screwstem

PNHP and DCNR Bureau of Forestry ecologists visited poor fen community wetland complexes in the Babcock Division of Gallitzin State Forest as a wetland assessment protocol training exercise. During this collaborative visit, we discovered a new occurrence of twisted screwstem (*Bartonia paniculata*; PA Rare) within a previously undocumented Cottongrass Poor Fen community. This large poor fen complex was found near a major highway but had high integrity when assessed under the developing PNHP wetland assessment protocol. While this community is known from the general vicinity, staff ecologists were excited to document a new and substantial example of this wetland type.



Noah Yawn

A large Cottongrass Poor Fen complex where a new occurrence of twisted screwstem was found.

2025 Annual PNHP - NatureServe Data Exchange Completed in August

Susan Klugman, Conservation Information Manager
Kierstin Carlson, Associate Information Manager

Through ongoing research by the scientific community here and around the world, the taxonomy, description, and known distribution of species changes every day. As part of the international Natural Heritage network, Pennsylvania provides information about species names, status and rankings, condition, and species presence by county and HUC 8 watershed to the network hub, NatureServe. In return, NatureServe provides PNHP with the current global and national taxonomy, scientific names, and national and global Heritage rarity ranks.

Within PNHP, the partners contribute to decisions about whether and when to change our taxonomy, names, and subnational Heritage status. These changes are then implemented in the database by information management in compliance with the Biotics data

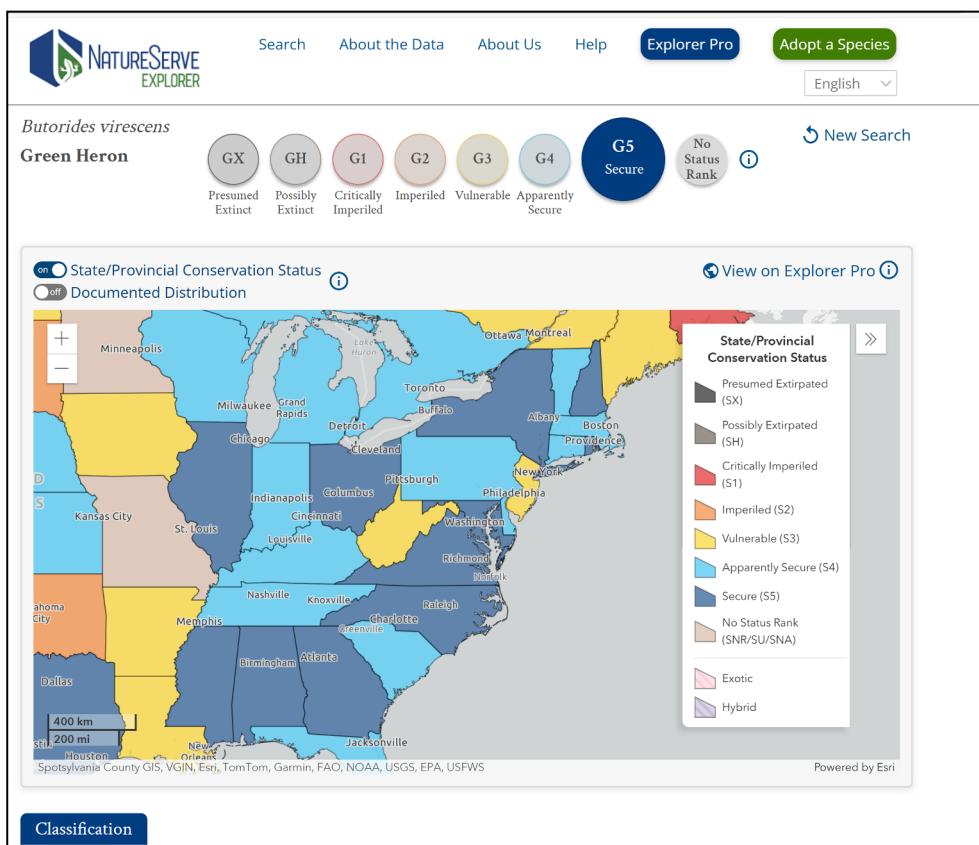
standards. The new information flows out to our downstream products when they are updated – the Pennsylvania Conservation Explorer, Natural Heritage Areas, Conservation Opportunity Areas, and more. Within NatureServe, Pennsylvania information is used to review and update the Global Heritage Ranks and their international products - NatureServe Explorer, ExplorerPro, and the Map of Biological Importance (MOBI) among others.

The completion of each data exchange requires data management and scientific expertise from NatureServe Central Sciences and Central Databases staff, and from each individual Heritage Program. NatureServe maintains species data for the entire U.S. and Canada and facilitates this information exchange with a set of customized computer programs and procedures that have been developed and continue to be refined. PNHP provides NatureServe with updated information on common and rare species in Pennsylvania annually (completed in August 2025), while NatureServe sends weekly updates on global and national names, statuses, and ranks.

Planned Biotics upgrades in the coming years will move the data sharing closer to real-time. This regular exchange ensures both parties maintain current data, enabling effective conservation and a clearer understanding of how local populations fit into global trends.

The process includes a review and reconciliation of taxonomy, conservation status ranks, species distribution, and other supporting documentation for all species and subspecies known to occur in a Heritage Program's state or province. Natural community data is not currently exchanged in the same way, but work is progressing toward that goal.

Currently, the total number in the PA Biotics list of species, communities, and geologic features (collectively called "Elements") is 10,361. NatureServe maintains a global list of 16,2403 Elements. That is a lot of records to keep in sync!



Pennsylvania information displayed in NatureServe Explorer – Green Heron example



Green heron