

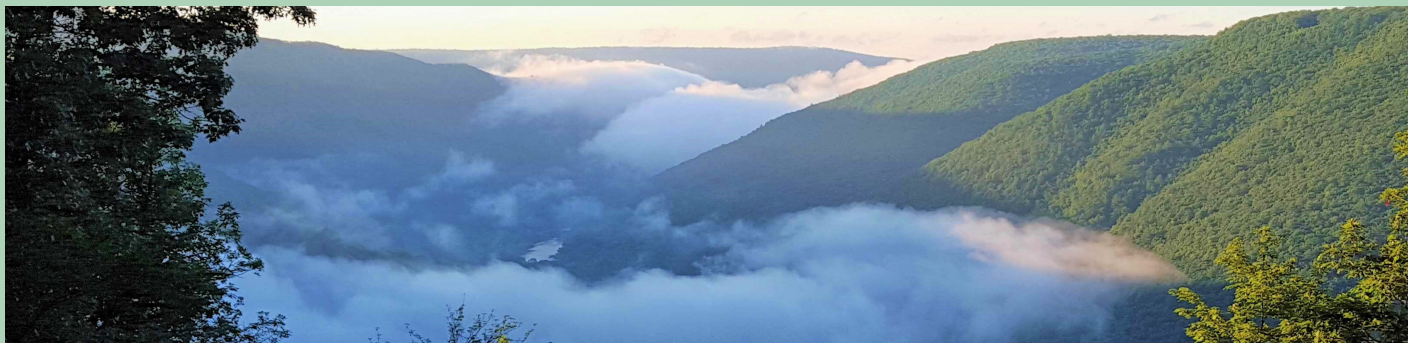


# Pennsylvania Natural Heritage Program

information for the conservation of biodiversity

## WILD HERITAGE NEWS

Spring 2022



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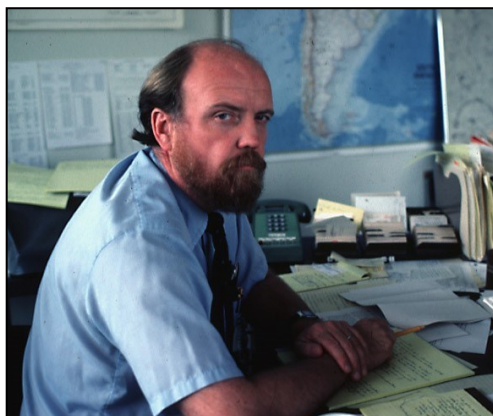
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Photo Banner:  
Tiadaghton State Forest  
David Yeany II

## PNHP Turns 40

by  
Jeff Wagner

What began as a conversation between a few people at the Western Pennsylvania Conservancy (WPC), The Nature Conservancy (TNC), and the Department of Environmental Resources (the precursor to the Department of Conservation and Natural Resources [DCNR]) became the Pennsylvania Natural Heritage Program (PNHP) 40 years ago. With the first contracts and agreements to collect data on the state's rarest species in place, the PNHP joined the growing network of such programs throughout the nation, each following the methodology that was part of the vision of Bob Jenkins, TNC's then Science Director.



Bob Jenkins, the founder of the Heritage network

A few of the people who were part of those earliest days will be offering some reflections as part of the social media posts that we are featuring all year in celebration of this anniversary. But for most of us in the program today, those early days are just stories, photographs, and notes within our early records. We will feature many reflections on the evolution of the program along with comments from founders and people important to the program.

For those of us who have been around for 20 or 30 years, one of the most striking changes in the program is the staffing. What started as small, two to five person offices at TNC and WPC and a central data manager at DCNR, is now an integrated 45 plus person, well-established and increasingly sophisticated program. Fortunately, many of our staff can remember 2006 as the year when the program made some pivotal changes. Beginning in 2005, WPC, TNC, PGC, PFBC, and DCNR undertook high level, professionally facilitated strategic planning. From those sessions, it was agreed that WPC would employ all TNC Science

Office staff and we would go forward as a four-way partnership between WPC, DCNR, PGC, and PFBC. It took time to figure everything out and get comfortable with new roles and positions, but we all knew each other and learned to work within what had been mapped out and agreed to through the strategic planning process.

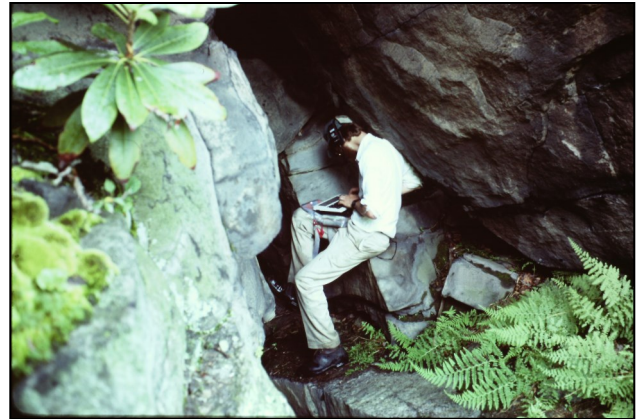
Even before that consolidation in 2006, the program was growing rapidly as the County Natural Heritage Program expanded, largely funded through Bureau of Recreation and Conservation grants. This support was pivotal in accelerating a program that began with TNC and WPC each undertaking a single county with one primary ecologist in the east (Tony Davis) and one in the west (Lisa Smith). We would eventually have eight county inventory ecologists whose primary responsibility was to cover an entire county as thoroughly as possible, enlisting help from various other staff but doing most of the work themselves.



Jeff Wagner, Heritage Director then Community Ecologist, documenting plants in a barrens community in southcentral Pennsylvania.

Although we still do county-based inventories, our staff expertise as well as the projects we take on have grown and diversified. I am amazed to look over the files listing the hundreds of projects we have completed. Still, there are definite themes and applications to our work – those species, communities, and sites that we return to, refreshing data, and ultimately encouraging protection and stewardship. This newsletter features some of the long-term efforts that remain a focus of our work to protect the unique taxa that brought us there in the first place.

As the program slowly accumulated data and started mapping out locations, there were many species and natural communities for which there was little information. Freshwater mussels for instance, were not



Charles Bier, then Assistant Director of Science and Stewardship, utilizing our earliest laptop computer to document green salamanders and habitat in southwestern Pennsylvania.

well documented since the time of Ortmann in the early 1900s. Largely through the study and sheer effort of Charles Bier, WPC's current Senior Director of Conservation Science, the program documented the mussel fauna of the Allegheny drainage, particularly French Creek. Charles was also responsible for confirming the presence of green salamander in southwestern Pennsylvania.

Beginning with Betsy Leppo's graduate work at Shippensburg University while she was working for PNHP (TNC's Science Office at that point), our vernal pool work has continued, moving increasingly toward stewardship and restoration. In a similar way, our work with the eastern massasauga rattlesnake has evolved from pure inventory to management. This effort finding its beginnings once again with the early investigations of Charles Bier as well Paul Wiegman, at that time the Director of Science and Stewardship at WPC.



Community Ecologist Tony Davis inspecting a vernal pool in eastern Pennsylvania.





PNHP

Tom Smith, TNC PNHP Director (L) and Tony Wilkinson, Zoologist, in TNC's science office in the early days of the program.

Tom Smith, one of the earliest program staff, assembled our first natural community classification – one that I used extensively in my early years with the program. In 1995, Jean Fike was hired by the Bureau of Forestry to update the plant community classification for Pennsylvania. With help from many program ecologists, she produced a new classification that came to be known simply as the Fike Classification. This classification was bound and published and served as the primary plant community classification for many years.



Jeff Wagner

Greg Podniesinski, DCNR Chief, Natural Heritage Section then Plant Community Ecologist, and Jean Fike, Ecologist/PNDI Coordinator, next to a very old, very large bur oak during EPA funded floodplains work in the early 2000s along Conodoguinet Creek in Cumberland County.

Work made possible by EPA Wetland Program Development Grants was another very important leg of program funding and growth. These studies allowed us

to update many of the natural communities in the Fike classification and our work on floodplains, seeps, fens, and peatlands were all funded under this program.

Another key to our program stability and growth was our work with both the National Park Service and the Bureau of State Parks at DCNR. Like county inventories, we had three or four ecologists dedicated fairly exclusively to parks work. Eventually, we accomplished the mapping of all national parks in the state including the Delaware Water Gap National Recreation Area and the Appalachian Trail. Our state parks work continues today as we refresh information, update records, and work more collaboratively with state parks managers to implement recommendations from our inventory work.



Jeff Wagner

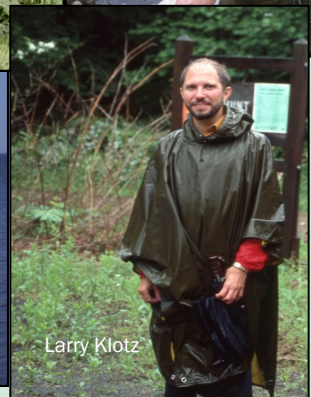
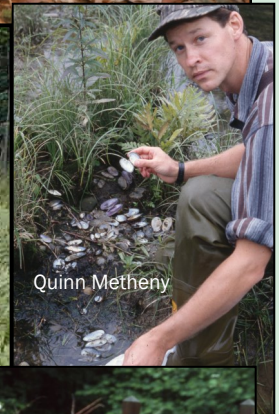
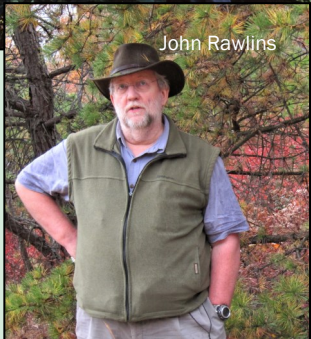
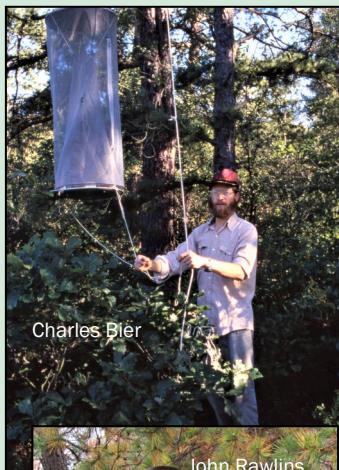
Ecologist Rocky Gleason on a rock outcrop along the Appalachian Trail as part of the Appalachian Trail vegetation mapping project - a collaborative effort by the USGS, NatureServe, and state natural heritage programs.

We do and have done a lot, much more than I can describe here. As a whole, our work is diverse and increasingly sophisticated but still relies on the skills and dedication of our staff. We hope that our readers will find what we offer in this newsletter and throughout the year illuminating; providing perspective into how the program has changed and grown over the last 40 years. By our 50<sup>th</sup> in 2032, there will be a new generation of staff engaged in this work, likely watching over our most important sites and with any luck, finding new ones.



## PNHP People

When it comes down to it, it's really the people who have given their time, often starting long careers in the Natural Heritage Network, who have made the program. As with many network programs, the tenure of our staff is very high. It's a rare dedication to mission and the intimate contact with the plants and animals that are the focus of the mission that seems to drive this dedication. From the earliest days when Tom Smith and Tony Wilkinson were beginning the program for TNC in the east and Paul Wiegman and Charles Bier were doing the same in the west, the standards for our data were high. We built expertise, hiring botanists like John Kunsman and Steve Grund, and established long time collaboration with experts outside the program like Jim Bissell from the Cleveland Museum of Natural History and John Rawlins from the Carnegie Museum of Natural History. A whole host of people contributed data and were constants in our repertoire of skilled field biologists. Quinn Metheny worked with Charles to catalogue the freshwater mussel flora of French Creek and the Allegheny River. Larry Klotz of Shippensburg University provided great amounts of botanical leads and records. Loree Speedy and Mark Bowers, Jack and Janet Holt, Carol Loeffler, James Lendemer, Joe and Bonnie Isaac, Ann Rhoads, Tim Block, and many more have and continue to expand our records and share their findings. Images from the 1980s and 1990s may look dated and the equipment we used, when we had any equipment, may look antiquated but the essential pieces still remain – the people who keep scrambling over boulders and wrangling a headache of data to help conserve what we know is our dearest asset.





## Assessing Aneides

by

Charlie Eichelberger

At the dawn of PNHP, much effort was focused on gathering information from literature, museum collections, and taxa experts on the suspected rarest species in the state. One of the amphibians which rose to the top of this list was the green salamander. Decades earlier, sleuthing by Carnegie Museum of Natural History herpetologists sought to more fully evaluate the northern range limit of the species, yet since 1951 the species had only been documented from their single original collection site. More information was needed to establish the extent of Pennsylvania's green salamander range, its habitat requirements, and population status.



Charlie Eichelberger

The state threatened green salamander has tight habitat requirements, small populations, and a limited distribution in the state, which makes the species highly vulnerable to local extinction.

Following what he could find in the literature and correspondence from experts on the green salamander from elsewhere in its range, recently hired Charles Bier took on the task of more fully assessing the species in Pennsylvania in 1982. Based on habitat characters from the original Pennsylvania collection location, as well as Maryland and West Virginia, and armed with topographic and geologic paper maps and a compass, Bier began methodically searching suspected habitats across the mountainous portions of the southwestern corner of the state. Although he found additional locations for the species and extended the known range 34 km northward, his work supported the original thought that the green salamander was indeed a rare habitat specialist. To date, it appears to be confined to the Chestnut Ridge south of the Youghiogheny River in Fayette County. Numerous field surveys have been undertaken north of the river with no positive results. This information cemented the Fish and Boat

Commission's original decision to provide protection by listing the species as state threatened.



Ryan Miller

Charles Bier continues his 40-year quest through the mountains to more fully understand Pennsylvania's green salamander.

Although they were first discovered in Pennsylvania over 70 years ago, PNHP staff are continuing to fill in data gaps for the green salamander. Even though the compass and paper maps have been replaced with sophisticated ArcGIS tools and drones, stiff boots and a good flashlight remain necessary tools for green salamander surveys. In addition to its inherent rarity, habitat specificity, and threats from habitat alteration and destruction identified at the time of listing, today we recognize climate change, disease, and genetic isolation as adding to the challenges this species faces. Building on Bier's 40 years of programmatic work, we continue to learn more and more with each survey about this intriguing species.



Ryan Miller

Zoologists Joe Wisgo and Charlie Eichelberger take a break from scaling steep slopes in search of green salamander.



## 40 Years of Data Collection and Management: From Paper to Pixels

by

Susan Klugman, Kierstin Carlson, Jeff Wagner

From the very beginning of our program, one of our primary goals has been to inventory the rare and at-risk plants, animals, and natural features (plant communities, geology) of the commonwealth. As we collected the information, we also had to catalog and map the locations of what we found. Our original 'GIS' consisted of file drawers of paper forms and USGS 7.5-minute topo maps. Our biologists collected data in the field by writing in their field notebooks and drawing locations on paper maps. When they returned to the office, the information was transcribed onto paper survey forms, and mapped on our full-size topo maps using color-coded dots to indicate whether the location was a plant, animal, natural community, or geologic feature. For each dot, we calculated the latitude and longitude using a grid lined up with the tick-marks on the paper maps.



USGS Topo Map with dots to indicate where species were found.

All of the information was then entered into our first database, the Biological Conservation Database (BCD). Typical field equipment for our biologists consisted of a compass, various maps, a notebook, a hand lens, binoculars, field guides, and maybe a dichotomous key for plants.

BCD, our first PNHP database.

Forty years later, all of our data are managed in digital databases. Our biologists still jot notes in their notebooks, but most of the data are collected and mapped in the field using GPS units or tablets. The information goes into our on-line Field Information Networked Database (FIND), and is then entered into Biotics, the current Heritage database integrating the tabular and geographic data. Contributors send information on digital survey forms, and our partners share spreadsheets and databases that can be bulk-loaded into Biotics.

To choose places to visit, particularly places that had no records or previous visits, staff would study maps and look at aerial photos through a stereoscope to better understand the landscape. To get a better look at the initial selection of sites, we often flew in single engine planes, so kindly piloted by associates and supporters of the program. The experience revealed



Aerial image of a riparian corridor from a fly over.

Susan Klugman

Susan Klugman

Bud Sechler





Christopher Tracey

A trail camera provides a firsthand view of high water events at a river scour location in Ohiopyle State Park.

remote sections of Pennsylvania that would be difficult to access and without a definitive target, potentially not a good use of our time. Now the quality of aerial images is very high, and we can get as much information from viewing them on a large monitor as we could flying low and slow in a small plane. Also, new digital datasets like LIDAR give us the ability to look even deeper into the landscape. Trail cameras, drones, digital water quality instruments, and radio telemetry have all become integrated into the program.

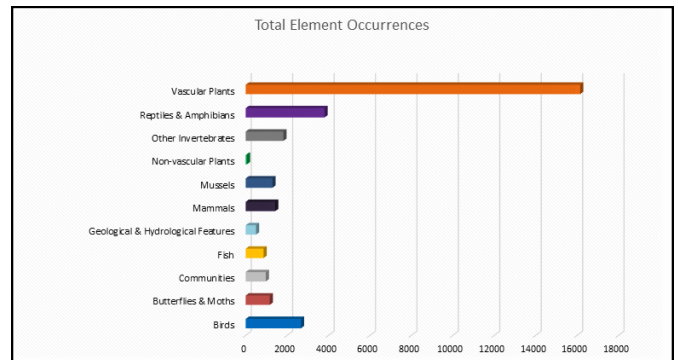


Charlie Eichelberger

GIS Manager Brad Georgic utilizes a drone to survey habitat for species of concern. Images and video are imported into GIS to create a high resolution 3D map providing scientists with the tools they need for accurate monitoring

In our early years, the main focus of our field surveys was on plants, and the locations we surveyed were often determined by funding and our ability to access survey sites. One of our first plant records based on a field survey was for Robbins' Spike-rush in Wayne County, surveyed in 1982. We were also compiling information on other taxonomic groups and researching historical data from museum specimens. One of the

first records processed in BCD was for a 1945 rock vole specimen from Wayne County. As our program has grown, we have continued to add to our list of the species and natural features that occur in Pennsylvania, and expanded our inventory efforts to include more species and taxonomic groups. We have staff with expertise in a wide range of taxa, and our partner agencies have contributed increasing amounts of data.



Total Element Occurrence Records entered in the Heritage Biotics database by taxa group as of March 14, 2022.

Our Biotics database now contains over 30,000 records, representing over 1,700 different species, communities, and geologic feature types. In addition to our primary records in Biotics, we have expanded the extent of our data and the databases that hold that information including our Species of Greatest Conservation Need database which holds over 565,450 records and our vernal pools database that grows every year, now with 7,402 records, capturing the many years of surveys we have done for vernal pools. We are refining the ways that we can extract data from citizen science online databases like eBird and iNaturalist and expect that such data will greatly enhance what we have collected largely through our own staff and associates working under the Natural Heritage program for the state.



## On the Hunt for Nature's Water Filters Turning Information into Conservation Actions

by  
Mary Walsh

When the Heritage Program was initiated in 1982, the data about many aquatic animals in the commonwealth, particularly freshwater mussels, were spotty. Information on the rarity, distribution, and population sizes required to assess the conservation statuses for Pennsylvania freshwater mussel fauna was lacking. Founding staff member of PNHP, Charles Bier, had read historical accounts of freshwater mussels in Pennsylvania by Arnold E. Ortmann, Carnegie Museum of Natural History curator in the early 1900s, and knew that French Creek, a tributary to the Allegheny River, was special. He set out to study freshwater mussels there and to begin filling in data gaps to better understand their status.



Tim Schumann (L) and Charles Bier conducting a mussel survey on French Creek around 1986.

When Ortmann collected specimens of freshwater mussels in the watershed, he declared that French Creek and tributaries “possess a wonderfully rich fauna.” At a time when other streams in the region were experiencing severe degradation due to industrial pollution, timber harvest, and coal mining, the waters of French Creek flowing from the glacial lakes remained clean and clear. Decades had passed since Ortmann’s collections in French Creek and Bier picked up the reins. He started by gathering shells in French Creek and collaborating with malacological experts to search in the best habitats for bivalves. Throughout the 1980s and 1990s Bier documented the distributions of the mussel species in French Creek and compared them to historic records, establishing the current day understanding of the fauna in the watershed.



French Creek is an aquatic biodiversity hotspot.

Some species recorded by Ortmann, such as the purple wartyback (*Cyclonaias tuberculata*) and lilliput (*Toxolasma parvum*), no longer occur in the creek. In contrast, the federally-endangered northern riffleshell (*Epioblasma rangiana*), declining across its range, occurs in great numbers in the watershed. The state-endangered salamander mussel (*Simpsonaias ambigua*), discovered to occur in the basin, is found under large, flat rocks and has a very limited distribution in Pennsylvania.



The endangered northern riffleshell occurs in high concentrations in parts of the French Creek watershed.

As a result of PNHP’s work, the French Creek watershed became recognized as an aquatic biodiversity hotspot, which fueled more interest in the basin and the creation of the Northwest Field Station. Building on the



efforts by Bier, PNHP biologist, Tam Smith, and other staff members at the field station conducted further basin-wide assessments to determine the population dynamics of rare freshwater mussels. The results of the field station's rigorous studies demonstrated that the watershed has some of the most robust populations of the mussels in the region. The long term work by PNHP highlighted the need for regional conservation efforts in French Creek, a watershed with increasing pressure from agriculture and development changes. Areas along French Creek and its tributaries have been part of the 5,657 acres in the watershed protected by the Western Pennsylvania Conservancy.



Mary Walsh

The yellow lampmussel occurs in large rivers in eastern Pennsylvania.

PNHP staff have expanded their efforts to survey for freshwater mussels throughout Pennsylvania and apply the information to management. A five-year project in the Susquehanna River basin of the mussel communities established that the yellow lampmussel (*Lampsilis cariosa*) had expanded its range in the commonwealth.



Alysha Trexler

Staff record mussel data in the Ohio River.

Studying the freshwater mussels in Lake Erie where populations crashed after invasive zebra mussel arrived in the Great Lakes, PNHP staff collaborated with a regionwide project team to analyze the changes in the community post-invasion. In under-surveyed habitats PNHP has expanded information about the species, including the state-endangered pistolgrip (*Tritogonia verrucosa*), inhabiting locations like the murky, deep pools of the navigational channel in the Ohio River.



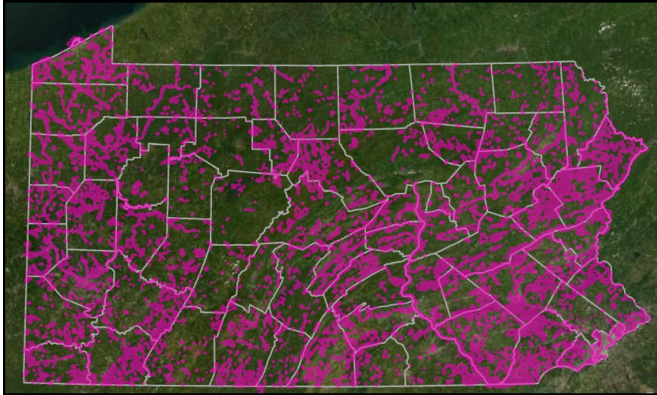
Mary Walsh

PNHP staff identify mussel species during a survey.

Other recent projects included determining the changes in distributions since historical collection for a number of rare species in the state and modeling their habitats. The information from the projects has been applied to the assessments of species for state and federal listings. Additionally, the results of PNHP's freshwater mussel studies are used in species action plans for protected species, for habitat protection during development projects, and for targeted conservation of aquatic habitats.

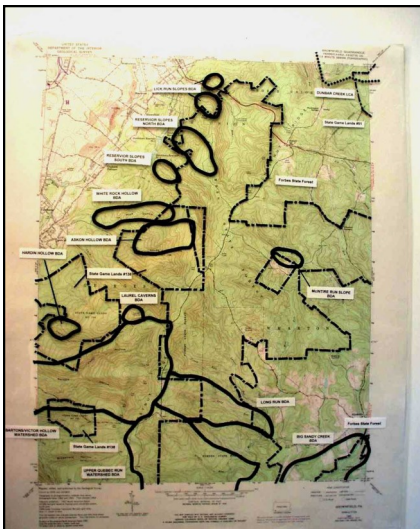
## County Inventories in Pennsylvania Over the Years

by  
Anna Johnson



The current 3,956 Natural Heritage Areas found within all 67 counties in Pennsylvania.

There are 67 counties in Pennsylvania, and all of them have had at least one County Natural Heritage Inventory (CNHI) completed over the 30+ years that PNHP has been publishing them. Our first inventories were begun in 1988, in Centre and Lancaster counties, followed quickly by Allegheny County. These reports—a core data product of PNHP—have changed dramatically over the years, as technology, data reporting standards, and staff capacity has evolved. However, consistent for each site is a spatial polygon layer depicting the extent of critical habitat for species or natural communities, paired with a written description of the characteristics, conservation needs, and composition of each Natural Heritage Area (NHA) site.



An example of how Natural Heritage Areas were originally designated, relying on printed maps and sharpie markers.

While most of PNHP's data is focused on individual species or natural community occurrences, the NHA dataset is our primary method for grouping species of concern into core habitat sites. Having this site-based approach allows our data to be more easily linked to conservation

management, protection, and restoration actions, which facilitates the incorporation of biodiversity data into conservation planning projects. In fact, the majority of Pennsylvania counties now reference our CNHI data directly in their comprehensive plans. Originally, we designated multiple types of Natural Heritage Areas (e.g., Biodiversity Areas, Landscape Conservation Areas, Supporting Landscapes), but we have now simplified our approach and only create NHA Core Habitats. This allows users to focus their attention on the portions of our landscape which are, indeed, at the core of conservation needs in Pennsylvania.



Today we draw our Natural Heritage Areas primarily by aggregating digital, species-specific conservation planning polygons (CPPs). This allows us to more consistently depict habitats and be more precise about boundaries.

While CNHI reports were originally hand-delivered to counties in the form of large, printed documents, we now make them available through our website for download and through the Pennsylvania Conservation Explorer mapping platform (a relatively recent addition to the PNHP tool library, created in 2016 primarily to support online Environmental Review). The ease of updating digital files means that we can also more quickly update NHA reports. In fact, over the last few years much of our efforts in conservation planning and inventory have focused on revamping the reporting process to better align our NHA reporting output with the pace at which new biodiversity data is submitted by our field biologists to our central databases. Through the strategic use of semi-automated scripting tools and informational databases, we continue to be “the most trusted, accurate, up to date, comprehensive source of natural heritage information for Pennsylvania.”



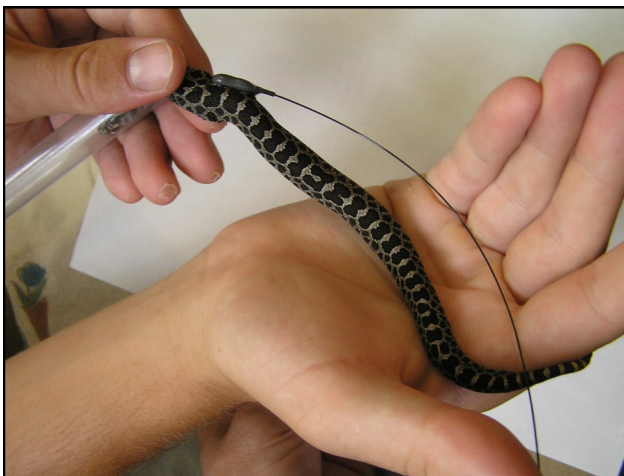
## PNHP Focused Work on Massasauga Turns Losses into Gains

by  
Ryan Miller



An adult massasauga found basking in open herbaceous habitat.

The eastern massasauga has a long history of loss in Western Pennsylvania. It was one of the first reptiles listed by the Pennsylvania Fish and Boat Commission (PFBC) as state endangered in 1978. Prior to that, habitat destruction, fragmentation, wanton killing, and woody vegetation succession on its preferred open habitat, took its toll on the species in western Pennsylvania. The formation of PNHP in the 1980s had Charles Bier initiating the gathering of museum collection data, diving into historic accounts, and visiting sites where the massasauga held on. Zoologist Ryan Evans was hired in the early 2000s and with the help of Bier, began to advocate for a more comprehensive picture of the massasauga in the state.



A neonate massasauga with an external radio telemetry unit attached. PNHP used this new method to publish a paper on neonate movement.

From 2002-2008 PNHP received numerous State Wildlife Grants and Wild Resource Conservation Program funds to conduct multiple scientific studies on the massasauga. Herpetologist Ben Jellen was hired and began a state-wide status assessment. Three years of intensive surveys determined only four of the 19 historic populations remained. The assessment shifted gears into a radio telemetry project to study massasauga movement and habitat use at three of the four remaining populations. This telemetry project included a published neonate movement study which tracked newborn snakes from their birth for up to six weeks.

After five years of intensive research, PNHP shifted gears towards protection of the species and its habitat. Matt Kowalski and Ryan Miller pieced together the Massasauga Habitat Protection Plan, which guided land protection and restoration efforts moving forward. They also conducted a habitat restoration pilot study, which compared habitat restoration techniques efficacy and cost. In 2008, PNHP also partnered with the PFBC on a Landowner



Zoologist Ryan Evans (top), Herpetologist Matt Kowalski (middle), Zoologist Ryan Miller (bottom) all worked to help build an understanding of the status of the massasauga rattlesnake in Pennsylvania.

Incentive Program, in which eight private landowners with massasauga populations received voluntary customized habitat management plans for their properties.

Within the past 10 years the Western Pennsylvania Conservancy (WPC) has purchased three massasauga properties (totaling 60 acres) and has utilized PNHP staff expertise for habitat restoration. Approximately 80 acres of habitat on WPC and private property has been restored through woody vegetation removal.

It's important to remember that a majority of this work was done prior to the federal listing of the massasauga in 2016. Moving forward, it is clear that habitat management will be a never-ending need, important properties may become available for purchase or easement and surveys will guide these protection efforts. After looking at the history of PNHP's past commitments to this species, we are excited to continue working to change the history of losses into gains by protecting the remaining populations of massasauga in Pennsylvania.



Ryan Miller



Ryan Miller

Before (top) and after pictures of a massasauga habitat restoration



## PNHP Celebrates Four Decades of Environmental Review

by  
Kent Taylor

When PNHP was founded 40 years ago, computers were still mostly confined to college and university labs. Geographic Information Systems (GIS) were primitive by today's standards. Biologists collected and stored species location information on paper maps, and areas of interest were often delineated for environmental analysis using transparent mylar, with other information being stored on a mainframe computer the size of a large washing machine.

"Data was kept in a computer from the beginning," says PNHP plant ecologist Chris Firestone. Once the location was mapped on USGS quadrangle maps, information was entered into a rudimentary data storage device at The Nature Conservancy, using a modem. "We would place the headset of the phone into a cradle to transfer the data. No one could call the office until all of the data transferred and the headset was hung up. This could take several hours."

Each jurisdictional agency (PA DCNR then DER, PGC, and PFBC) had to be contacted for information on threatened and endangered species at a project location. When the Pennsylvania Department of Environmental Protection (DEP) began requiring environmental reviews for their permits, the demand for natural heritage information really picked up. Up to that point the information was nice to have but not always required.

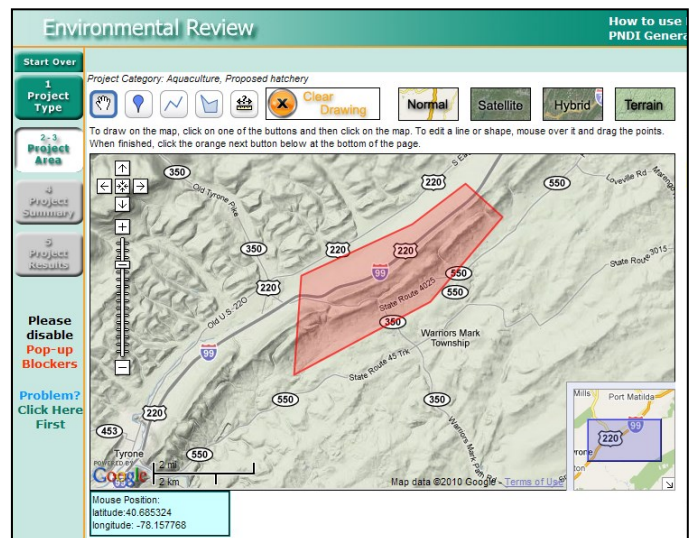


An early PNDI computer used to enter information which was then sent to the database using a telephone and modem.

PNHP was busy inventorying natural diversity throughout the eighties and nineties, using methods still referred to as "PNDI," but any automation of

environmental review using advanced GIS was still a decade in the future.

Then there was a breakthrough in 2004. With technical assistance from Esri, PNHP launched the groundbreaking Environmental Review (ER) Tool. The first of its kind anywhere, the tool allowed public users to draw the footprint of a development project or management practice on a web-map and run an analysis to screen for potential impacts on rare, threatened, and endangered species and habitats. The output was a report that could be shared by all agencies and landowners responsible for biodiversity protection and conservation. That first ER tool took more than two years to develop, cost an estimated \$2 million+, and served approximately fifty thousand users for more than ten years.



A 2010 screenshot of the early generation Environmental Review Tool.

At least a dozen other states followed Pennsylvania's lead, and the technology continued to improve. In March of 2022, PNHP celebrated six years of Pennsylvania Conservation Explorer, which is considered to be the latest and most sophisticated version of PNDI, but with the addition of numerous other planning tools and capabilities that users can deploy to inform decisions and advance our mission to provide up-to-date information, assistance, and expertise for the protection of Pennsylvania's biodiversity.

## Big Contributions from Small Habitats

by

Betsy Leppo



Betsy Leppo

Vernal pools are important habitats all year long, but they are most noticeable in the spring when they are filled with water and bustling with wildlife.

Historically Pennsylvania had an estimated 1,127,000 acres of wetlands. Over the course of several hundred years, we lost approximately 50-85% of our wetlands, leaving us with less than 500,000 acres of wetlands today. Vernal pools and wet meadows are small wetlands that can support specialist wildlife and provide important habitats for pollinating insects. Small wetlands are particularly vulnerable to impacts from invasive species, forest pests, climate change, timber management, development, and other changes on the landscape.

PNHP began mapping vernal pools in the early days of the program, especially those that supported rare plants and animals. But we recognized that vernal pools were



Sally Ray

PNHP staff Betsy Leppo looks overdressed for this shallow pool, but vernal pools are variable and the next one may be three feet deep!

keystone ecosystems in need of comprehensive mapping, assessment, and conservation effort. I began a focus on vernal pools for the program in 2001 when I obtained a Wild Resource Conservation Program

grant and graduate research funds through Shippensburg University to study the vernal pools of the Mount Cydonia Natural Area within Michaux State Forest. That study later expanded into a statewide study funded by the Environmental Protection Agency to map, describe, and classify seasonal pool plant and animal communities across the entire state.



Pete Woods

Fairy shrimp are like freshwater 'sea monkeys' and are small crustaceans only found in vernal pools.



Valerie Tarkowski

PNHP staff JoAnn Albert and Ryan Miller visit vernal pools in the spring to search for amphibian egg masses and document the macroinvertebrate life.

Since 2001, vernal pool work has become an important focus of the program across Pennsylvania. PNHP studies and protects the plant and animal communities of vernal pools by conducting vernal pool inventory and assessment, maintaining an advanced database for mapping and recording vernal pool data, providing educational programming and technical assistance to the public, landowners, and conservation partners, implementing restoration projects, and establishing monitoring programs. These projects have been accomplished with the support and partnership of state agencies, non-profits, universities, landowners, and



volunteers. Much of what we have learned over the years is documented on the PNHP website, under Ecological Communities.



Jack Ray

Spring peepers are often found in vegetated vernal pools. A single male spring peeper can call louder than a food blender.

My interest in vernal pools began as a child. My parents, Jack and Sally Ray, frequently took the family to Gifford Pinchot State Park to explore the woods and to participate in educational programming there. A highlight in the spring was visiting vernal pools at night, using flashlights to look for spring peepers, who called so loudly but were maddeningly hard to find.



Betsy Leppo

Sally Ray collects water chemistry data from a vernal pool in Michaux State Forest.

Over the span of over 45 years, Jack and Sally were active citizen scientists, collecting information on the natural resources of the park. Their photographs and records became instrumental in the development of a wetland restoration plan for five vernal pools in the park. These days, their grandchildren enjoy visiting vernal pools, and participate in volunteer events to monitor and enhance these habitats. We hope that as they grow up they will continue to do their part to help protect the natural places they connected with since they were very small.



Betsy Leppo

Cecil Leppo helps PNHP collaborator Larry Klotz survey a vernal pool during its dry phase. He is now in high school and considering a career in science.

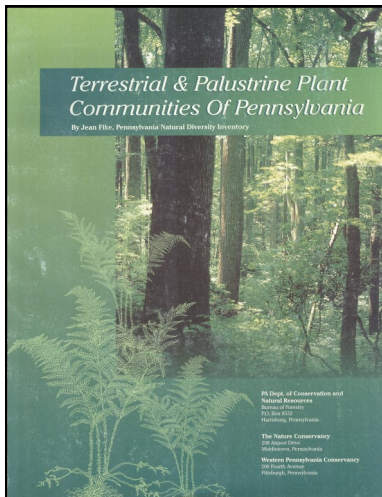


## Improving the Natural Community Classification for the Commonwealth

by

Ephraim Zimmerman

Along with rare plants and animals, PNHP tracks rare plant communities as part of its core activities. These rare plant communities are a significant part of the state's environmental review process – as rare communities often harbor, or are made up by, rare plant and animal occurrences. As defined by PNHP, plant communities are groups of plant species sharing a common environment that interact with each other, animal populations, and the physical environment. Recognizing and documenting plant communities provides information about plant species presence, the structure and composition of the plant community, soil chemistry, geology, presence of wildlife species, and quality of the entire landscape. Understanding the plant communities in an area can be extremely valuable for developing comprehensive, wide-scale land management and conservation plans.



Recognizing plant communities is a little less straight forward than identifying a single species, but plant communities are none-the-less identifiable. Communities are usually identified by key species that are found together more often than they are found apart. To use observations and data

about composition to declare a certain community, you need a guide. In Pennsylvania, this guide is the “Terrestrial and Palustrine Communities of Pennsylvania,” written by Jean Fike in 1999. The classification was a major focus of PNHP in the 1990s and was part of an enormous effort at DCNR to “type” and map all of the state forest lands using a consistent classification and naming convention.

Forest stands across the state were assigned to communities described in the Pennsylvania classification, such as “Northern Hardwood Forest” dominated by sugar maple, beech, and red oak, or “Dry Oak – Heath Forests” dominated by oak species in the canopy over a

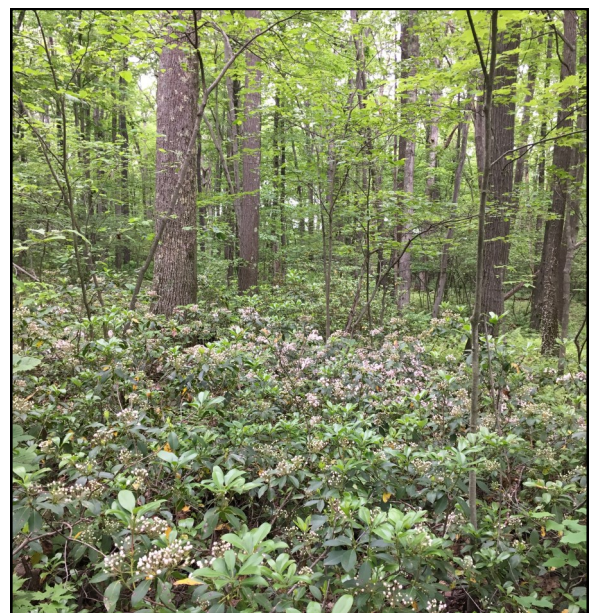


Northern Hardwood Forest

Ephraim Zimmerman

dense shrubby understory of mountain laurel and blueberries – to name just two. In doing so the Natural Heritage Program contributed to development of consistent species-based stand maps for forests within the state forest system. In addition to identifying forest types, these maps are valuable for managing native biodiversity within Pennsylvania's forests.

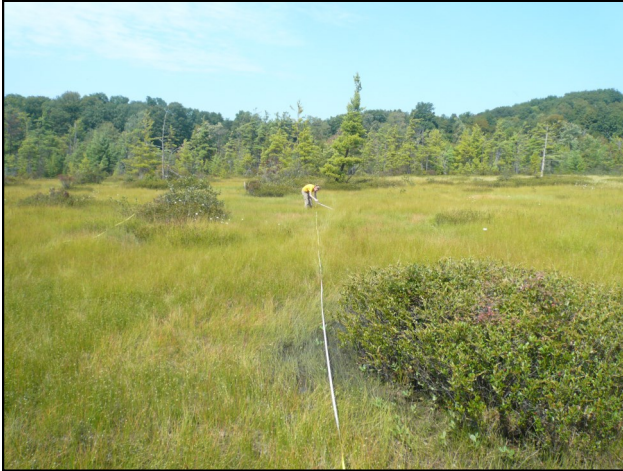
Since then, PNHP ecologists have continued to refine and more comprehensively describe these communities. Several projects have funded the work. EPA's Wetland



Dry Oak–Heath Forest

Ephraim Zimmerman





Ephraim Zimmerman

Botany Intern Lindsey Bocian surveys vegetation to measure change in plant composition over time in Titus Bog, one of PNHP's long term peatland monitoring sites.

Protection Program Grants have been instrumental in refining the wetland (palustrine) portion of the classification and updates to the major wetland groups include floodplains, peatlands, swamps, and vernal pool communities. In 2012, through EPA funds, PNHP published on-line community factsheets. A significant contribution to our upland (terrestrial) portion of the classification came from the National Park Service; PNHP described and mapped the communities of the largest national parks, historic sites, battlefields, and recreational areas in Pennsylvania, including the Pennsylvania portion of the Appalachian Trail.



Ephraim Zimmerman

Old field vegetation plot surveyed in 2004 by PNHP at Fort Necessity Battlefield National Historic Site in Fayette County, Pennsylvania. PNHP worked with the National Park Service to map and describe plant communities of all national parks in Pennsylvania.

All in all, the plant community classification is supported by nearly 2,500 quantitative sampling plots, which document the community composition, structure, and environmental variables of the communities in which

they are located. This data is analyzed to provide statistical support for the community types in the classification. This quantitative community analysis enables us to justify the various types and link to broader community classification efforts like the U.S. National Vegetation Classification (USNVC), spearheaded by NatureServe and the USGS, and community classifications of different states.



Mary Ann Furedi

A happy ecology crew after a long day at Bender Swamp in Tobyhanna State Park.

After over 20 years of using the Pennsylvania plant community classification, we are once again revising the types, staying true to the types described in Fike, but also more accurately representing what is observable in the field. These updates result in the expansion of the number of types and include robust data-supported links to the USNVC. Stay tuned for updates on our website! <https://www.naturalheritage.state.pa.us/Communities.aspx>