Pennsylvania Natural Heritage Program

information for the conservation of biodiversity

WILD HERITAGE NEWS

Spring 2017

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Photo Banner:
Wood turtle
(*Glyptemys insculpta*)

Greg Lipps

Population Assessment of the Wood Turtle in Pennsylvania

by

Kathy Gipe

The Pennsylvania Natural Heritage Program (PNHP) and Pennsylvania Fish and Boat Commission (PFBC) just wrapped up their involvement in a two-year, multi-state assessment of wood turtle populations across the northeast states. For several staff of PNHP, this meant many days of field surveys along some of the commonwealth's most bucolic habitats; forested clear and gentle-flowing streams.

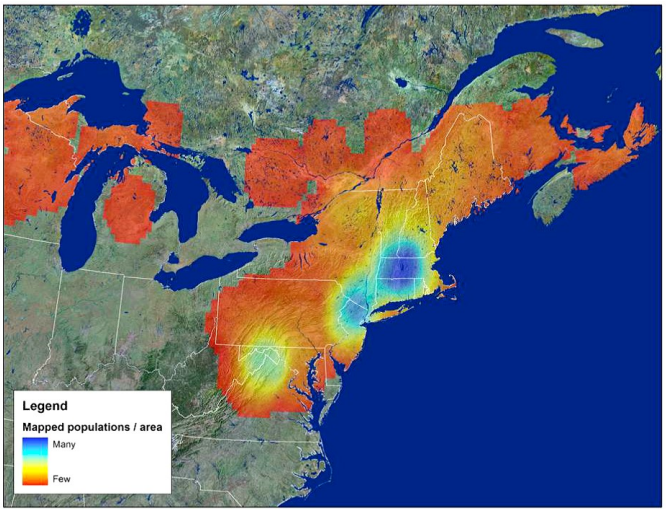
The Wood Turtle

The wood turtle (*Glyptemys insculpta*) is a handsome, medium-sized, semiaquatic turtle with a brownish or grayish sculpted shell, and a black head with brilliant orange on the neck, forelimbs, and hind legs. Wood turtles are long-lived, with ages in the wild occasionally documented as much as 50 years old. They reach sexual maturity around age 15 and females only lay one clutch of 7-11 eggs per year, so like many turtle species, population growth is very slow and limited by high rates of nest depredation along with low hatchling and juvenile survival.

Wood turtles occupy a variety of clear, cold, wooded rivers, creeks, and streams with substrates consisting primarily of sand, gravel, or cobble. The waterways are used for overwintering, foraging, and mating, and adjacent terrestrial riparian zones - typically within about 300 meters of the waterway - are utilized by turtles for spring, summer, and fall foraging, basking, and nesting. Wood turtles use a mix of upland habitats, including many forest types, isolated wetlands, meadows, fallow fields, and even active agricultural lands. The wood turtle is distributed primarily in the northeastern U.S. and into Canada, extending as far south as Virginia

JoAnn Albert

Wood turtle (*Glyptemys insculpta*)



The approximate range of the wood turtle shown as a density surface based on available data in 2009 (Jones and Willey 2015). Wood turtle data at the time was not well developed in the Natural Heritage database; thus, populations in Pennsylvania have poor representation on this map despite their prevalence in the state.

and west to the Pennsylvania-Ohio border, with the exception of population segments in some of the Great Lakes states.

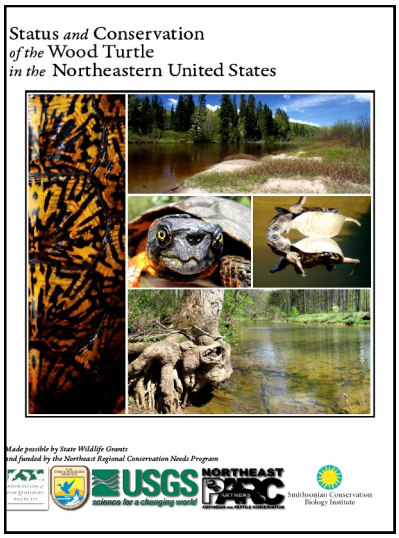
Regional Status Review

Major threats to wood turtle populations include habitat fragmentation and loss, road mortality, illegal collection, predation by increasing predator populations (e.g., raccoons), and disease. For decades, herpetologists throughout the region have expressed concern over apparent declines in the distribution and populations of the wood turtle, while also lamenting the lack of data to support these concerns. A 1995 U.S. Fish and Wildlife Service status review also concluded that there was insufficient information to warrant federal listing. In Pennsylvania, the status of wood turtles had been undetermined, although it was generally known to be distributed throughout most of the state. PNHP did not officially begin to track wood turtle occurrence data until 2007. In response to these collective state and national concerns, the Northeast Partners in Amphibian and Reptile Conservation organization (NEPARC) created a regional working group for wood turtle conservation. In 2011, this group proposed and received a Regional Conservation Needs grant to conduct a northeast regional wood turtle status assessment.

Kathy Gipe

This large male wood turtle had markings that identified him from a late-1980s study, putting his age at least at 45.

Pennsylvania's involvement in this initial assessment was to provide our limited wood turtle data to the principal investigators at the University of Massachusetts (UMass) and to establish a few long-term monitoring sites with the help of volunteers. One of the sites I surveyed was first established by John Kaufmann in the 1980s. Kaufmann's research was a fundamental contribution to our understanding of the natural history and habitat use by wood turtles. Two of the turtles I found at this site were recognizable from Kaufmann's research, an exciting find and additional evidence that wood turtles can live at least 45 years in the wild.



This report from the 2011-2013 status assessment (Jones and Willey 2015) led to the follow-up monitoring effort that Pennsylvania participated in from 2015-2016.

From 2011 to 2013, biologists at UMass compiled the information provided by the cooperating states and modeled wood turtle distribution against landscape factors considered to be threats to the turtle, namely urbanization and fragmentation of riparian forests. The results predicted widespread present and future declines due to the prevalence of impaired habitats throughout most states. Pennsylvania had a higher proportion of optimal habitats than the other cooperating states, establishing it as a critical partner in the conservation of the species (Jones and Willey 2015). The initial regional status assessment concluded that a conservation plan was needed in order to better understand and maintain remaining wood turtle populations.

Kathy Gipe

This photo of a Pennsylvania stream depicts typical wood turtle habitat: clear, cold, flowing streams with rocky bottoms and forested riparian zones.

Surveying for the Conservation Plan

Then in 2014, the NEPARC working group designed a follow-up project, "Conservation Planning and Implementation for Wood Turtle in the Northeast" funded by the Competitive State Wildlife Grants program. The PFBC used a portion of this grant to contract PNHP to conduct assessments and monitoring for wood turtles across the commonwealth over a two-year period, as well as to continue to bring together occurrence data.

Priorities of this regional follow-up project included improving occurrence data and distribution models, assigning quality ranks to populations for conservation prioritization, setting up a bigger network of monitoring sites with an emphasis in data deficient regions (e.g., western Pennsylvania), analyzing region-wide genetic data for conservation planning, and developing habitat management guidelines and technical assistance to landowners. In Pennsylvania, this translated into a push for improving our wood turtle occurrence data and surveying an extensive array of streams for turtles.

Surveys were conducted during the spring and fall survey windows in 2015 and 2016. We targeted sites based on known occurrence data, likely habitat, and access to land and properties. The protocols established by the regional status assessment were followed, surveying a 1-km length of stream at the rate of 1 km/hour and collecting data from any wood turtles observed. Each turtle was measured and marked with an identifying filed shell notch that allows it to be individually recognized whenever it is recaptured.

PNHP surveyed 24 sites over the course of the project and marked 132 individual wood turtles. Volunteers and federal partners contributed additional data. A subset of sites was established as "Long-Term Reference" sites. These sites were good candidates for measuring trends through monitoring, and have good potential for effective wood turtle habitat management. These long-term reference sites averaged 21 individual wood turtles, showed evidence of reproduction, and are located on generally protected state, federal, or private lands with cooperative landowners.

We surveyed another subset of "Rapid Assessment" sites for only one season in order to capture a snapshot of the population status. PNHP surveyed 19 rapid assessment sites, which yielded an average of just four wood turtles with limited evidence of reproduction. Many of these rapid assessment sites had habitats that were more challenging to effectively survey; nonetheless, the

Brad Georgic

Kelly Malloy

PNHP staff collected measurement and condition data for each wood turtle captured.

Amy Miller

Ryan Miller of PNHP illustrates methods for measuring and marking wood turtles for a group of volunteers.

results suggest that despite widespread distribution, many wood turtle populations are at very low levels that could be declining at local scales.

As a result of these surveys, as well as records contributed by volunteers to the Pennsylvania Amphibian and Reptile Survey (paherpsurvey.org), over 260 occurrences of wood turtles were added to the PNHP Biotics database over the course of the status assessment and monitoring projects.

The Future for Wood Turtles

This project has greatly contributed to our knowledge and understanding of the status of the wood turtle in Pennsylvania, while at the same time creating a critical to-do list for continuing the regional assessment. First, the UMass project leaders will be completing the regional conservation plan and conducting analyses to examine potential causes for the variation in survey results, considering landscape and habitat variables. Second, the development by UMass of active management guidance has generated interest within DCNR and PFBC in managing nesting habitats for improving wood turtle reproductive success. Aura Stauffer, wildlife biologist at DCNR, is already leading the charge to manage habitats for turtles on some state forest lands. Finally, PFBC will be on the hook to repeat the monitoring effort again in a few years in order to achieve the project's long-term monitoring goal. Due to its designation as a State Wildlife Action Plan priority species, and because our data suggests that there may be declining populations in some areas, the wood turtle needs continued attention even though it is considered somewhat common in parts of the state. The PNHP data collection efforts will be an important contribution to an upcoming revised wood turtle federal status review, and our local management efforts will continue to try to keep a unique part of Pennsylvania's wild heritage alive and well.

JoAnn Albert

We are hopeful that monitoring efforts for wood turtles and efforts to improve declining populations will continue into the future to meet the State Wildlife Action plan goals.

About the Author:

Kathy Gipe is the herpetologist and nongame biologist for PNHP and PFBC. She has worked in this position in some capacity since 2002, with a short hiatus as a mom and with the PNHP as an inventory biologist. Kathy received her BS in zoology from Duke University and her MS in wildlife and fisheries science from Penn State University.

Teaming Up to Create Healthier Habitats for Vernal Pool Wildlife

by

Betsy Leppo

Machines in the Forest

A John Deere 50 excavator dug its jaws into the earth and pulled up a mouthful of dirt. The operator swung the arm of the tractor in a smooth arc, and placed the topsoil onto a growing pile at the edge of a clearing in the woods. A second excavator worked nearby, digging a long narrow trench along the opposite edge of the clearing. The two machines moved quickly and efficiently. A group of people wearing hard hats and bright safety vests observed from nearby. From time to time, the excavators stopped their work, and the group of people moved in to inspect a shallow depression in the center of the clearing. It looked like a typical construction site, but instead of building a house, this crew was building a special kind of wetland, for a very unique kind of wildlife.

JoAnn Albert

Two John Deere 50 excavators were used to shape the new wetland basins.

The construction team was creating a vernal pool wetland that they hope will fill with water over the winter and dry up each summer. Ephemeral wetlands are used by amphibians that do not thrive in permanent ponds and lakes, where competition and predation pressures are high. Animals that require temporary aquatic habitats for reproduction and development of their young are called *vernal pool indicator species*. Pennsylvania has four species of large and secretive mole salamanders that are all vernal pool indicators, along with two species of frogs and several species of small freshwater crustaceans. *Vernal pool facultative species* are animals that breed in seasonal pools, but can also use permanent wetland habitats.

Creating and Restoring Wetlands

Historically Pennsylvania had an estimated 1,127,000 acres of wetlands. Over the course of several hundred years we lost approximately 56% of those wetlands, leaving us with less than 500,000 acres today (Association of State Wetland Managers 2015). Small wetlands such as vernal pools and wet meadows likely experienced a higher rate of loss since they are easily overlooked and simple to drain or fill. The Pennsylvania Natural Heritage Program has been working with landowners, partners, and volunteers on a variety of vernal pool outreach and habitat management initiatives. One of these initiatives is to provide training opportunities where participants can learn how to apply restoration and management techniques to create, restore, and maintain the health of vernal pool wetlands.

Gifford Pinchot State Park (GPSP) is a 2,238-acre state park in Warrington Township, York County, Pennsylvania. The park contains wooded hillsides, old farm fields, and the 340-acre Pinchot Lake. Natural wetlands in the area were modified by former residents, and some wetlands were likely inundated by the construction of Pinchot Lake in the early 1960s. Some small wetlands were excavated into deeper ponds to provide livestock with water; others were drained with ditches and drain lines or filled with soil to improve conditions for farming. Today there are ten small wetlands known to attract vernal pool amphibians in the spring, but all of the sites appear to be manmade. The vernal pool species at GPSP have adjusted to using a variety of manmade excavations that capture and hold water for part of the year.

Sally Ray

Vernal pools are a rich source of food and water in the forest for wildlife such as this eastern box turtle (*Terrapene carolina*).

Vernal Pool Indicator Species

Spotted Salamander
(*Ambystoma maculatum*)

Marbled Salamander
(*Ambystoma opacum*)

Jefferson Salamander
(*Ambystoma jeffersonianum*)

Wood Frog
(*Lithobates sylvaticus*)

Springtime Fairy Shrimp
(*Eubranchipus vernalis*)

Variable Clam Shrimp
(*Eulimnadia diversa*)

Vernal Pool Facultative Species

Spring Peeper
(*Pseudacris crucifer*)

Gray Tree Frog
(*Hyla versicolor*)

American Toad
(Anaxyrus americanus)

Swamp Darner Dragonfly
(*Epiaeschna heros*)

Phantom Midge
(*Mochlonyx* sp.)

Log-cabin Caddisfly
(Family Limnephilidae)

Local citizen scientists have been monitoring some of these sites for years, even decades. With this information, we could determine that some sites did not hold water long enough for amphibian larvae to develop, metamorphose, and exit as air-breathing adults before the pools dry up in the summer. Other sites were degraded by erosion and sedimentation, a high density of invasive plants around the perimeter, and heavy deer traffic. PNHP staff partnered with the Pennsylvania Bureau of State Parks to restore some of these impacted sites to healthier vernal pool habitats. PNHP received funding support from the DCNR Bureau of Recreation and Conservation's Community Conservation Partnerships Program (C2P2) and the Amphibian and Reptile Conservancy. We were able to enlist the assistance of Thomas Biebighauser, founder of the Center for Wetlands and Stream Restoration, to help us develop and implement a plan to create functioning vernal pools at five locations in the park. We hosted a two-day workshop during the restoration week to provide a hands-on training opportunity for others interested in planning their own small wetland restorations.

JoAnn Albert

Tom Biebighauser (at left) describes the soils of a core sample taken at a potential wetland restoration site.

Implementation of the GPSP vernal pool restoration plan took place the week of August 1-5, 2016. Forty people participated in the workshop including land managers, conservation planners, wildlife biologists, environmental scientists, foresters, hydrologists, engineers, regulators, educators, students, private landowners, and private consulting and landscaping companies. We discussed how to select locations for building wetlands, test soil texture, choose appropriate construction techniques, work with heavy equipment operators, and establish native flowering plants. The Upper Susquehanna Coalition's skilled wetland work crew operated the heavy equipment needed to restore the wetlands.

JoAnn Albert

Forty participants attended this hands-on restoration workshop to learn practical, low cost techniques for building wetlands.

Construction Techniques

There are different methods to create and restore vernal pools depending on the type of soils present on site, and whether the wetland receives water primarily from surface flow or from ground water. Three common restoration techniques are illustrated in trailside kiosks at The Nature Conservancy's Forest Pool Preserve near Kings Gap State Park in Cumberland County. You can download pdfs of the kiosks which describe the artificial liner, ground water, and surface water techniques used to restore different pools on the preserve at http://www.naturalheritage.state.pa.us/VernalPool_Education.aspx.

At GPSP we primarily used the surface water technique since we had abundant clay soils at each site that we could use to seal the pool basins. In several cases we created groundwater dams by compacting clay soils into a trench along the downslope edge of the basin. This prevents subsurface water from seeping out of the basin. The top of the dam is designed to be very low so that it blends into the natural slope at the basin edge and will not erode over time. We also installed buried vertical grade structures made of native rock at sites with unstable inlets or outlets. The rocks stabilize these areas to prevent future erosion.

We used two John Deere 50 excavators to complete the restoration work. That may seem like a lot of machine for creating little wetlands in the woods, but there are many advantages to using this type of equipment. These excavators run on tracks, which compact the soil less than wheeled vehicles. The body of the excavator swivels on its base and has a long extendible arm. This allows the operator to work from

one position without constantly driving around the site, which also minimizes soil compaction. The excavators began each restoration by clearing the vegetation and removing the topsoil around the site. The topsoil was placed in temporary piles during the restoration process. When the basin work was complete, the topsoil was returned to the basin because that soil contains the seeds of aquatic plants and the dormant eggs of tiny invertebrates. Wetland plants, shrubs, and small trees were also set aside temporarily and later replanted in and around the pool basin after construction was complete.

After the site was cleared, we implemented the specific restoration measures that Mr. Biebighauser selected for each site. The final vernal pool basins have gently sloping edges with an average depth of 15-18 inches in the center. Our goal is to have the pools completely or mostly dry up every year by late summer to prevent fish and bull frogs from establishing populations in the pools. The soils of the basin floor were not graded into a smooth surface, but rather were arranged loosely and messily so that they were not compacted. The excavators also placed mounds of dirt throughout the basin to create a diverse topography where aquatic plants and animals can find a perfect niche. Disturbed soils were reseeded with an annual wheat seed which grows quickly to stabilize the soils. We also seeded with native perennial grasses a few weeks after the restoration took place. We will continue to control invasive species and are replanting the site this spring with a variety of flowering plants and shrubs that will benefit insect pollinators, song birds, and other wildlife.

Betsy Leppo

Restored pools will be monitored with the help of citizen scientists like Sally Ray, who has monitored some of the park's vernal pools since the late 1970s. Here she indicates the typical depth of this vernal pool when it is fully flooded in the spring.

A Winter Drought and a Springtime Surprise

York County was in a drought watch for several months from November through February. Rains in February brought relief and ground water levels slowly began to recover. Warm weather in late February triggered the start of vernal pool amphibian migrations. In northern York County wood frogs were first heard calling on February 24 and spring peepers began chiming in a few days later. Vernal pool amphibians were returning to their wetlands to breed, but some shallow wetlands in the region were still dry or had very little

Betsy Leppo

This shallow pool (above left) did not hold water long enough for vernal pool organisms to mature. The restored pool (above right) was deepened and included a groundwater dam made of compacted clays to prevent water from draining out of the pool through rocks that had been buried when the area was a farm.

water. Three of the five restored pools partially filled with water during the winter, but two remained dry until winter storm Stella dumped approximately 18 inches of snow on the region on March 14. After several days the snow began to melt and the arrival of steady spring rains finally filled all of the pools.

Two of the restored pools had been flooded for just a couple of weeks when we conducted a monitoring visit on April 2. In past years, one of these pools never held water long enough for successful amphibian breeding. We expect it will take a few years for this pool to build a population of vernal pool insects and amphibians. The second pool has a fairly short hydroperiod; most years it dries in July just after the young frogs and salamanders exit the pool. Adult marbled salamanders arrived last September and we counted over ten egg clutches nestled under rocks and logs. The females try to stay with their eggs until the pool floods to protect their eggs from desiccation, small predators, and even fungal growth. This year the pool didn't flood in early winter as it usually does due to the drought, and the females eventually had to return to their upland burrows. The eggs waited in the dry pool basin for nearly six months. We did not expect any of the eggs to survive an entire winter out of water. But when we stepped up to the edge of the pool we were surprised to see an inch-long marbled salamander larva sunning itself in the shallow waters. As we walked around the perimeter we saw a half dozen more. Nature is full of surprises!

Betsy Leppo

Female marbled salamanders tend their nests of eggs in dry pool basins in the fall.

On a revisit on April 14 we saw several dozen marbled salamander larvae darting about in the leaves. They are growing quickly and have already formed front legs and toes. We also found spotted salamander egg masses in four of the restored pools and wood frog tadpoles in all five pools. We hope the pools hold water long enough for the larvae to emerge as terrestrial juveniles. But even if drought strikes again this year, vernal pool amphibians are adapted to the risks they encounter in ephemeral wetlands. The adults will return again next year. As long as they encounter good conditions most years, there will be young surviving to revitalize the local population.

Betsy Leppo

Marbled salamander larvae are the largest amphibian larvae in a vernal pool in the spring. The branching external gills of the marbled larvae pictured here makes them easy to separate from the single wood frog tadpole at bottom left.

Acknowledgements

This project was made possible by funding from the Amphibian and Reptile Conservancy, the PA Department of Conservation and Natural Resources, Bureau of State Parks Resources Management and Field Services Section, and the Community Conservation Partnerships Program, Keystone, Recreation, Park and Conservation Fund, administered by the PA Department of Conservation and Natural Resources, Bureau of Recreation and Conservation. We gratefully acknowledge the PA Parks and Forests Foundation, the Friends of Pinchot State Park and other volunteers, and the staff at Gifford Pinchot State Park for their ongoing support.

About the Author:

Betsy has worked with the Pennsylvania Natural Heritage Program for over 20 years and since 2005 as an Invertebrate Zoologist. Betsy conducts surveys for terrestrial and aquatic invertebrates, maintains in-house specimen collections and databases, and develops conservation recommendations for species and habitats.

Notes from the Field

A New Species for Pennsylvania

Narrow-leaved reedgrass (*Calamagrostis stricta* ssp. *inexpansa*) was not known from Pennsylvania until Jessica McPherson and Steve Grund recently discovered it at a site already known for high biodiversity value. During the update of the Bedford County Natural Heritage Inventory we revisited a complex of fens in the northern part of the county. The dolomite bedrock in this area raises the pH of the groundwater and when groundwater seeps from the surface and collects in a wetland, a rich fen results. This particular fen has been known to botanists for many decades. There were no less than seven rare plants already known from this fen; all to a greater or lesser degree species of northern affinity.

Matt Lavin

Narrow-leaved reedgrass becomes rather conspicuous by mid-summer when the grains ripen and the fruiting plants take on a golden-brown color.

Paradoxically, this was not the first time this species was collected at this site. Two previous collectors thought it was the closely related, and much more common, *Calamagrostis canadensis*. *Calamagrostis stricta* ssp. *inexpansa* is much more of a habitat specialist than *C. canadensis*, and is typically found in high quality fens. We examined all the other specimens of *Calamagrostis canadensis* at the Carnegie Museum and found only the two earlier collections, both from this site, that were actually misidentified specimens of *C. stricta* ssp. *inexpansa*.

This discovery illustrates the principle that rare species tend to be habitat specialists, and good examples of specialized habitats often host multiple rare species. Unfortunately, even our best sites have not been visited often enough and during different seasons to assume that all the rare species at the site have been documented. This story also illustrates that careful botanizing is essential to good data!

Peatland Invertebrates

PNHP staff have been working on moth identifications as part of the Headwaters Peatland project. The purpose of the peatlands project is to develop a baseline profile for each site, against which future changes can be compared. At selected peatlands, invertebrate surveys were part of this baseline assessment. One of our goals was to sample moths from each natural community type within a peatland, to determine which species were present and how abundant they were.

During the summer of 2016, one to several blacklight traps were placed in each peatland, depending on the size of the peatland and the number of different natural communities that were present. Moths were attracted to the ultraviolet lights, entered the trap, and were collected the next morning. We stored the moths in freezers until the winter, when staff had time to examine them. We thawed the samples, sorted them, and identified the species. Our expert consultant, Steve Johnson, greatly sped up the process of identification because of his familiarity with Pennsylvania's 2,000 moth species.

Pete Woods

A moth trap at Titus Bog, a high quality acid bog in western Pennsylvania

This baseline assessment will inform us about both the common and rare moths at these sites. It will also add to our understanding of the status of these moths in Pennsylvania. For example, the Epigaea looper moth (*Syngrapha epigaea*) is a boreal species that we thought barely made it into northern Pennsylvania. This study found the moth at Christner Bog, near the southern border of Pennsylvania, expanding the known range of the moth.

Pete Woods

This arched hooktip (*Drepana arcuata*) was attracted to the blacklight trap but perched on a nearby shrub instead of entering the trap.

Data Exchange with NatureServe

To keep Heritage network data useful, we need to reconcile our species names between network programs and the latest updates from taxonomists, and keep our assessments of the conservation status of species and communities of concern current.

Over time, different scientific names can be attached to the same species by different taxonomists. One way this could happen is when one person describes and names a new species, unaware that someone else had already done so perhaps years earlier or far away. The published descriptions of the species (called a Concept), including factors that differentiate it from other similar species, can be used to determine whether the names represent the same or different species.

The conservation status (sometimes called the Heritage Rank, S Rank, or G Rank) is an estimate of extinction risk. "Determining which species and ecosystems are thriving and which are rare or declining is crucial for targeting conservation towards elements of biodiversity in greatest need. NatureServe and its member Natural Heritage Programs have developed a rigorous and consistent method for evaluating the relative imperilment of both species and ecosystems based on the best available science" (NatureServe Explorer, 2015). The estimate is assessed using a range of factors at three geographic scales: global (G), national (N), and state/province (S) on a one to five scale, ranging from critically imperiled (G1) to demonstrably secure (G5). There are also ranks for extirpated species and other situations. For more detailed information about conservation status ranks visit NatureServe Standards and Methods (http://www.natureserve.org/conservation-tools/conservation-status-assessment).

In the past, exchanging this information between NatureServe and a member program was a task that could take months from start to finish, and did not happen every year. Because every member program's database was physically separate from every other and is administered locally, species names and conservation statuses would change on both ends of this relationship and have to be re-matched at every data exchange: an onerous task!

Part of the Network's upgrade to the current Heritage database platform, Biotics 5, involved large structural changes that affect how we can share data across the network. Over the past several years, NatureServe has been building the architecture to enable real-time data exchange of species and conservation status information between member programs and NatureServe. The first part of the implementation has now been completed in Pennsylvania, with the loading of tens of thousands of hemisphere-wide global records on species and communities (Scientific Names and G Ranks) into our local database. As a result of this exchange, we now have updated Global Conservation Status rankings within our local Biotics database.

Loree Speedy

Virginia bunchflower is an example of a species concept that has different scientific names at the state and global level. The Global Scientific Name recognized by NatureServe is *Melanthium virginicum* (G5) and the State (Subnational) Scientific Name used in the Pennsylvania Heritage Biotics database is *Veratrum virginicum* (S1).

Also, our global species records have been mostly synchronized with NatureServe's which greatly streamlines the process of adding new species to our state list. The next step will be to complete the cross-walking of all of our unmatched state species and community descriptions with the global ones, which may happen by the end of the year. Once everything is matched up and the necessary tools have been built, data sharing between NatureServe and the member programs can happen almost instantly and automatically; a huge improvement in the currency of the data and a time-saver for information management!

EYE Con Science Camp

Last June, PNHP staff from the Western Pennsylvania Conservancy (WPC) was proud to co-host EYE Con 2016, a summer science camp at Jennings Environmental Education Center. EYE Con (Experiencing Your Environment through Conservation) is collaboratively designed and facilitated by Heritage staff and staff from DCNR state parks, and provides experiences in student guided inquiry with emphasis on regional conservation topics. EYE Con also allows students to work with professional biologists who are on the forefront of conservation in Pennsylvania, with a goal of kindling student interest in conservation careers.

JoAnn Albert

Campers measured the crayfish population of a stream segment to see if impacts from a beaver dam made the stream suitable for queen snakes which feed exclusively on crayfish.

The theme of EYE Con 2016 was forest change. Students designed and conducted field experiments to 1) assess habitat quality for queen snake (*Regina septemvittata*) in riparian plant communities that have experienced different levels of impact from beaver (*Castor canadensis*), and 2) assessed forest communities for their potential for habitat enhancement (through prairie expansion) for the eastern massasauga rattlesnake (*Sistrurus catenatus*). In 2016, students not only conducted great conservation research, but also participated in a number of recreational activities; kayaking at Moraine State Park, a scavenger hunt focusing on the Center's natural features, orienteering, and a number of team building activities that encouraged social interaction among students.

Adam Hnatkovich

Changes in a forest community resulting from the invasive emerald ash borer led campers to examine whether the area could be managed as habitat for the massasauga rattlesnake, a federally threatened species.

In April we received a grant from the PA DEP Environmental Education Grants Program that will fund a regional expansion of EYE Con to additional state parks through 2019. EYE Con will be returning to Jennings in June 2017 with a theme of conservation in a changing climate. To find out more about the Jennings camp and to register, visit https://eyeconcamp.wordpress.com/experience/. We will also cohost an EYE Con camp in August 2017 at Raccoon Creek State Park. Information on this camp will be available soon. Looking ahead, EYE Con camps will be offered at Jennings and Ohiopyle state parks in 2018 and at Jennings in 2019.

Wil Taylor

EYE Con 2016 campers and staff

Spreading Population of New Zealand Mudsnail

Never underestimate the power of a citizen scientist.

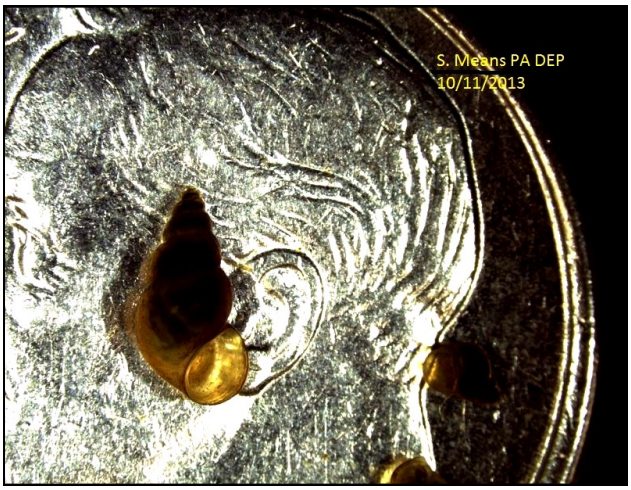
In the winter of 2016 and spring of 2017, Nick Macelko of Penn State's Eco Action program made several notable observations of an invasive species known as the New Zealand mudsnail (NZM) (*Potamopyrgus antipodarum)* near Penn State University in Centre County. Using the Pennsylvania iMapInvasives database to record findings, he documented 10 observation records that indicate a spreading population of NZM in Spring Creek as well as newly documented findings in portions of Slab Cabin Run (a tributary of Spring Creek), Thompson Run, and an unnamed waterbody along E. College Avenue near Porter Road. These findings (confirmed by a snail expert at South Carolina's College of Charleston) present a concern to the fishing community as well as to natural resource professionals as they indicate a continued threat to native fish and wildlife populations in central Pennsylvania.

Nick Macelko

Thompson Run

If you're not familiar with what the New Zealand mudsnail looks like, think small: tiny enough to sit on the face of a dime. This aquatic invader reproduces rapidly, which displaces native species of mollusks and invertebrates. The NZM also has the ability to alter the food web by impacting food sources critical to native trout and other fish populations by offering little nutritional value to the fish that consume it. Lastly, the NZM has a negative impact on water quality as it alters ecosystem structure and natural cycles which include the nitrogen cycle.

Discovered in Spring Creek in 2010, the occurrence of NZM in this world-famous angling location made headlines since it was the first time it was found in the Atlantic drainage (excluding the Great Lakes). News



Steven Means

The New Zealand mudsnail on this dime is only a little bigger than the ear (on the coin) of Franklin Delano Roosevelt.

reports highlighted the severe impact this tiny aquatic snail would have on the creek's native trout population. Fishing and nature enthusiasts were (and still are) encouraged to do their part in slowing NZM's spread by inspecting and cleaning fishing gear and being diligent about understanding the ways in which invasive species are accidentally transported by humans.

Currently, there is limited funding and staff capacity from state agencies such as the Pennsylvania Fish and Boat Commission and the Pennsylvania Department of Environmental Protection to initiate efforts for control of this particular invasive species. However, state agencies as well as several non-profit groups are interested in remaining up-to-date on when and where this species is found, especially if being discovered in new locations.

To submit your findings of this or other invasive species, please send a Public Report to Pennsylvania iMapInvasives or contact the Pennsylvania iMapInvasives administrator directly at imapinvasives@paconserve.org.

Nick Macelko

New Zealand mudsnails

Massasauga Habitat Restoration

From the beginning of February through the end of March, Heritage Zoologists Ryan Miller, Charlie Eichelberger, and Joe Wisgo, as well as agency personnel from the Pennsylvania Fish and Boat Commission worked to restore approximately eight acres of previously unsuitable eastern massasauga habitat to quality herbaceous meadow. This work was completed through a contract with a private landowner in Venango County that had just enrolled in an NRCS Wetlands Reserve Easement program. Each easement has a 100% cost shared project to restore the habitat conditions on that property.

The federally threatened eastern massasauga is facing habitat loss at an alarming rate due to natural woody vegetation succession. The area that was restored was an old farm that once had grazing animals that kept the tree growth and regeneration in check. Once the farm was abandoned, brush and trees like hawthorn, crabapple, shingle oak, and black cherry overtook the fields and created shaded conditions that are not favorable for the massasauga. It was the landowner's wish that no heavy equipment be used to remove the trees and brush. Therefore, our staff and numerous helpers spent days felling trees with chainsaws, untangling canopies of hawthorn, dragging the cut brush, and creating brush piles for other wildlife that lives on the property. All this happened while the massasaugas hibernated safely in crayfish and mammal burrows below. Also, given such a mild winter with minimal periods of frozen ground, hand clearing left a negligible footprint in comparison to heavy equipment.

We also received a small donation from a private foundation to restore habitat for the massasauga. With this generous gift we were able to restore approximately seven acres of habitat on three properties in Venango County. This work gives us an opportunity to build relationships with landowners, educate them about the massasauga, and restore degraded habitat that would have been left to become overgrown and unsuitable for the snakes.

Ryan Miller

Massasauga habitat restoration consists of removal of brush and trees that create shade in grassy meadow habitats. The photos show the area before (top) and after (bottom) the restoration.

Measures of Progress

The following Measures of Progress represent a significant cross-section of results of the work that we do as a program. These measures will be reviewed and updated, as needed, to best reflect the activities and goals of PNHP. Progress for these measures reflects seasonality of program activity.

Measure of Progress	Annual Goal (2017)	1st Quarter	Cumulative Total	Percent of Annual Goal
Biotics Records Updated	300	132	132	44%
New EOs Documented	800	234	234	29%
New Records Entered into PACE	350	0	0	0%
Field Surveys Reported	300	76	76	25%
New CPPs Developed	400	275	275	69%
NHAs Updated	150	0	0	0%
Sites Actively Monitored	35	0	0	0%

PNHP performs many functions and provides many services as part of its mission. The measures of progress that are detailed here are meant to capture a number of important program activities and provide a picture of our progress in achieving our essential goals. The program goals and the measures provided for those goals will change over time as we complete certain aspects of our work and as new program responsibilities arise.

Biotics Records Updated indicates the amount of activity expended in improving and updating the more than 20,000 records in the PNDI database.

New EOs Documented is a way to measure the success of our inventory effort in finding new occurrences of elements of ecological concern (plants, animals, and exemplary natural communities). Biotics records are created for each new Element Occurrence documented.

New Records Entered into Pennsylvania Conservation Explorer (PACE) indicates our level of activity in reviewing, quality controlling, and entering biotics records into the environmental review data layers. The timely and consistent refreshment of these data are critical to providing protection to the state's species of greatest concern.

Field Surveys Reported is a strong indicator of the effort expended on one of the basic functions of the program – inventory of the state's flora and fauna. Every field visit results in the entering of a field survey, regardless of the outcome of the survey.

New Conservation Planning Polygons (CPPs) Developed is a measure of our progress in creating ecological based mapping for the species and natural communities that we track as part of the PNDI database. Our goal is to have CPPs for all species and communities that we track.

NHAs Updated is a measure of our effort in developing, mapping, and describing sites (Natural Heritage Areas - NHAs) that are important to conservation of Pennsylvania's biodiversity. This process began with County Natural Heritage Inventory projects and will now continue at a statewide level with the updating of existing sites and the creation of new sites. Site polygons will be based upon and consistent with CPPs.

Sites Actively Monitored indicates how many established geo-referenced plots that we visited and sampled. These sites allow us to collect data on structure, species composition, and physical context (soils, hydrology, etc.) in a systematic way and by following the same protocols to directly compare future data to previous data.