Pennsylvania Natural Heritage Program

information for the conservation of biodiversity

WILD HERITAGE NEWS

Winter 2016-2017

## A Busy Year

**by**

**Jeff Wagner**

Inside This Issue



Photo Banner:
Scrub oak shrublands on State Game Lands #48 in Bedford County

Pete Woods

Every year unfolds a little differently and 2016 certainly began with challenges as we waited for the state budget to pass and news of various grant proposals to come in. That delay did complicate planning for the field season and made us shift projects around to some degree but as in other years, we knew what we were committed to do and made plans for those projects. As new projects evolve, sometimes quickly, we add those to the schedule. This past year was no exception and our staff made it work, doing a great job holding together a very busy field season.

We wrapped up the final field season for the Bedford County Natural Heritage Inventory update, revisiting many sites and documenting new finds. This has been a real focus of our inventory work and overall we updated and/or discovered 307 Element Occurrences (i.e., the locations of species and natural communities that we track), many of which are indicators of unique natural communities. Shale barrens are just such communities and in Pennsylvania are limited to several counties in south central Pennsylvania and a small area along the Delaware River escarpment. These dry, harsh habitats limit competition, especially from woody vegetation and allow a number of unique plants and animals to flourish. One plant, nearly endemic to shale barrens, is Kate's mountain clover (*Trifolium virginicum*). With over 500 plants, a location in Bedford County that we have documented is one of the largest populations known. This is also a population that has received special attention from John Kunsman, PNHP Botanist, who visits the site often and weeds the invasive species he finds (see the update in this issue for more details).

Another plant that we discovered in large numbers in a very different habitat was shooting star (*Primula meadia* = *Dodecatheon meadia*). This plant grows on limestone rich slopes, meadows, and open areas and in much less harsh conditions than shale barren plants.

Carol MacDonald

Shooting star

We found this striking wildflower growing prolifically on the slopes above Evitts Creek and believe it to be the largest population in the state.

Jack Ray

Upland chorus frog (*Pseudacris feriarum*)

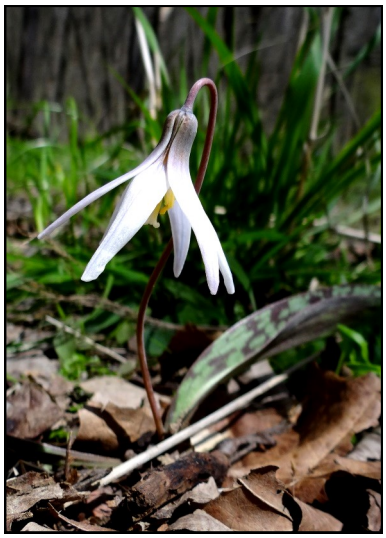
In addition, we documented a new population of the upland chorus frog in Bedford County. Although not a county record, it was an important find. Bedford County has proven to be very biologically diverse and we hope to continue more work in the Ridge and Valley Province of Pennsylvania over the next few years.

Peatlands were a focus of one of our biggest and most demanding projects involving the assessment of high elevation peatlands throughout the state. This EPA funded project is considering the community composition and eventual response to climate change. Given their elevation, composition favoring northern tending species, and their sensitivity to changes in precipitation, these peatlands may show effects from climate change earlier than other, more common communities. Because the number and extent of peatlands in the state has not been well defined or mapped, we took this opportunity to begin a more comprehensive mapping of peatlands, adding more than 150 potential high quality peatland locations, some of which are still awaiting field confirmation. Our inventory efforts in Monroe and Wayne counties have also helped us identify and survey peatlands in the state. With a lot of work to accomplish across 46 sites, nearly all of our field staff were involved in one way or the other. Beyond vegetation and plot work, we also designed protocols and conducted bird and bryophyte surveys for these communities, giving a more complete picture of the communities we sampled.

Rocky Gleason

Marsh Run Bog, Bradford County

To help support DCNR in the process of plant regulation revisions, we nearly completed two back to back Wild Resource Conservation Program funded projects which looked at 55 plants with issues related to quality, currency, and/or number of records. We addressed these issues through a combination of field work and more careful analysis of existing data. We have so far made some interesting discoveries, not just on the ground but in the way we think of certain species. White trout lily (*Erythronium albidum*), for instance, is a spring wildflower that often grows among a much more common sister species – yellow trout lily (*Erythronium americanum*). That makes finding it difficult as the leaves are identical. Through our analysis, we came to understand that the species has a very short and early blooming window, has fruit that are distinguishable from its sister species, and prefers richer sites. Armed with that knowledge, we can have better targeted surveys.



Pete Woods

White trout lily

One snag in our planned work for the year was the accelerated need to finish our small mammal work in response to the Pennsylvania Game Commission's decision to put the PA Mammal Atlas project on hold and finish all outstanding work by July. Our zoologists rescheduled work and completed their surveys and write-ups. In total, our work documenting small mammals involved 29 small mammal surveys (three northern water shrews captured!), 59 woodrat surveys (one new site documented!), and 12 bat surveys. The bat surveys in Bedford County yielded one northern long-eared bat (just recently listed as federally threatened) and one tricolored bat (also in decline due to White Nose Syndrome).

Charlie Eichelberger

Joe Wisgo searches for Allegheny woodrat sign at a historic site in Clinton County. The last reported activity at this site was in 1988; unfortunately no sign was found on this visit.

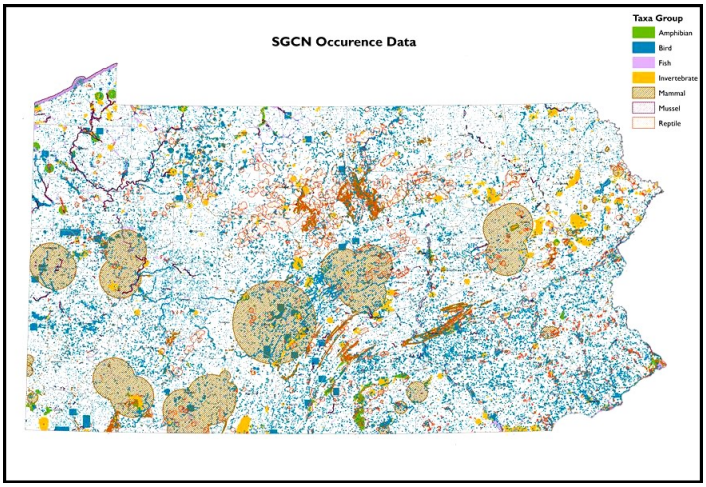
We are hopeful that the PA Mammal Atlas will eventually be resurrected and the work done so far can serve as a pilot for further survey work.

After several years of work with the Maryland Natural Heritage Program, other state programs, and two submissions of a regional State Wildlife Grant proposal, we were funded for wetland butterflies work. The project includes modeling of potential habitat for 12 species of wetland dependent butterflies as well as surveys of existing and potential locations for presence of these species. Also included will be management of various potential habitats specifically for target butterfly species. One target wetland butterfly is the bog copper, a tiny butterfly found only in boggy habitats with abundant large or small cranberry (*Vaccinium macrocarpon* or *V. oxycoccos*), which they use for all stages of their life cycle. The bog copper is a species of the northern U.S. and Canada with Pennsylvania being close to its southern limit. This species may be exceptionally vulnerable to increased temperatures associated with climate change.

Betsy Leppo

Female bog copper butterflies lay their eggs on cranberry plants that are nestled in sedge and sphagnum hummocks. Eggs may experience periodic immersion as the bog waters rise and fall. Adults emerge in June and July when the cranberry is in bloom and nectar almost exclusively from cranberry flowers.

One of the most intensive projects we began involved no field work but focused on collecting a huge amount of data from numerous sources, including the PNHP database (Biotics). With over 273,000 records so far, this dataset represents one of, if not the largest conservation datasets in the state. The Conservation Opportunities Areas (COA) project involves creating a tool that will help landowners make better decisions about management practices most suited for the Species of Greatest Conservation Need (SCGN) that are associated with an area or property of interest. The project will be completed in 2018.




SGCN occurrence data were compiled across seven broad taxa groups representing 273,926 records.

Overall, we entered over 1,400 new records into our database in 2016. Our biologists get credit for preparing and submitting their data but our Information Management staff entered our program's data plus data from numerous other sources and for that get a ton of credit for the accomplishment.

We had many more projects and commitments in 2016 than those previously mentioned and, as usual, staff had to weave their schedules to make it all fit together. As always, our work requires flexibility, often long hours, and lots of travel to accommodate all the things that the program does as part of its mission. All of our program staff, both independently and together, excel in making it all happen.

# Linking Species to Habitats

**by**

**Christopher Tracey**

Creating accurate maps of the distribution of species and their habitats is one of the long-standing goals of conservation. Many aspects of environmental research, resource management, and conservation planning require species and habitat maps for activities such as inventory and assessment, habitat management and restoration, design of protected areas, and predicting the effects of environmental change on species and ecosystems.

One relatively simple way to determine the distribution of a species is through a range map: a coarse representation of the area where a species may be found. These maps typically include both suitable habitat and lands not suitable for habitat (such as agricultural and urban development). Another method describes where a species might be found using habitat associations or descriptions, similar to what might be found in a field guide. These are typically driven by expert knowledge and are not based on standardized vegetation types. While they provide fine scale information, they are usually difficult to translate into maps.

The more advanced method of mapping a species' distribution is species distribution modeling (SDM). Recently, there has been increased interest in the development of species distribution modeling using statistical techniques such as random forests or maximum entropy. PNHP has used these techniques for modeling several animal and plant species. Although these models produce excellent results, they are labor-intensive and do not scale well to large geographic areas or high numbers of species.

We encountered this issue during our work on the Pennsylvania Wildlife Action Plan (WAP), where, in addition to mapping the extent and condition of the terrestrial and aquatic habitats in the state, we were also working to create a list of habitat associations for 664 Species of Greatest Conservation Need (SGCN). Habitats for the WAP were defined by two northeast regional habitat maps: the Northeast Terrestrial Habitat Classification (NETHC) and the Northeast Aquatic Habitat Classification (NEAHC) developed by The Nature Conservancy (TNC). These two mapping products provided a unified framework for understanding and discussing the habitats of the region.

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Hemlock—Mixed Hardwood Palustrine Woodlands, such as this one, provide habitat for a number of wildlife species.

Our initial plan was to overlay more than 120,000 SGCN presence points with the underlying habitat maps, and use this to identify which habitats were commonly associated with each species. However, the results of this analysis did not create a clear picture of habitat associations or mesh with known associations by zoologists. Three of the main reasons are (1) errors in classification or spatial accuracy of the habitat map, (2) errors in location of the SGCN point locations, and (3) imperfect survey effort for these species across all of Pennsylvania. In an effort to overcome these issues, we began to investigate other potential methodologies.

We developed a method to link habitats and species as a result of conversations with Mark Anderson of TNC, one of the original developers of the habitat maps we were utilizing. Based on these discussions, we created a method for mapping species distribution that accounts for the differences between expected and observed species occurrences with each habitat. For example, imagine a particular type of forest covers 35% of Pennsylvania. If you were to take 100 occurrences of a species, and randomly distribute them across the state, you would expect that 35 of them would end up in that forest type. However, we know that all species are not distributed randomly and that they often aggregate into specific habitats. If all 100 occurrences of the species in our example ended up in that particular forest type, we would expect that would be the preferred habitat of the species. Conversely, if none of them ended up in a particular habitat, we could consider that forest type as non-habitat. This method is similar to a "Chi-Square"

analysis in statistics. So, using each habitat classification across Pennsylvania, we were able calculate the preferred habitats for the SGCN in the state, which was then integrated with the WAP.

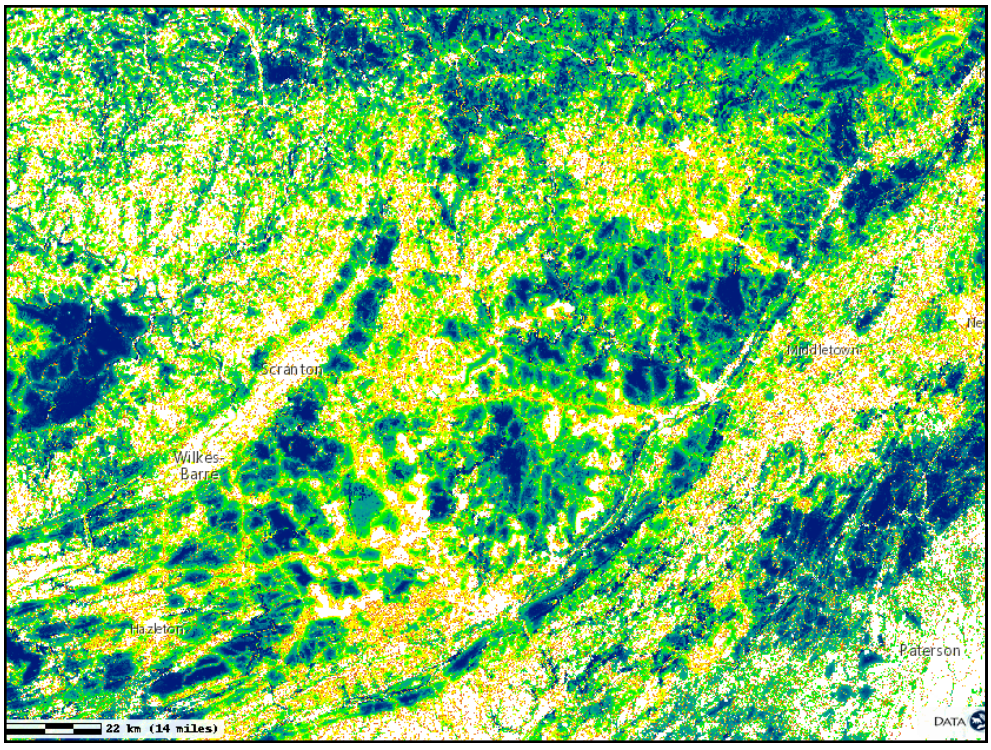
The method was further refined for use in our work with the Regional Conservation Opportunity Areas (RCOA; http://northatlanticlcc.org/teams/rcoa/) project coordinated by the North Atlantic Landscape Conservation Cooperative (NALCC). The RCOA project brings together experts from states, conservation organizations, and universities to identify places where the actions of individual agencies to support imperiled species and Species of Greatest Conservation Need, restore priority ecosystems, protect core landscapes, and promote connectivity between them, will have the greatest benefit for fish and wildlife across the region.

We made several improvements to the habitat association methodology in the RCOA project. One of the major improvements was the ability to include more spatially explicit mapping (e.g., polygons representing actual habitats versus simply points indicating presence) of rare species. We also developed a method to stratify the results by watersheds to provide a finer grain to the results and limit the

PNHP

Leatherleaf Cranberry Bogs are associated with a multitude of Species of Greatest Conservation Need, including birds, reptiles, amphibians, butterflies and moths, and other insects.

distribution of species. Additionally, we summarized the importance of a particular habitat across groups of species which allowed us to create a list of the most important habitats in the northeast for regionally important species. This project proved that this method scaled well to the region, encompassing the thirteen northeastern states and approximately 3,000 plant and animal species. These results formed the *Species and their Habitats* section of the RCOA. It was also integrated with other sections to form a suite of decision-support tools and regionally consistent datasets. Together, these tools and datasets allow us to offer guidance for partners working at different scales in the northeast region to locate the best opportunities to protect land and restore habitat, and to justify those actions to stakeholders and funders.




Results from the Regional Conservation Opportunities project show the valuation of different habitats in Northeast Pennsylvania. Darker blue colors on the map indicate the association of a greater number of species with that habitat

We are currently making additional improvements to the methodology and underlying source data so that we can update existing analysis and improve conservation outcomes for our rare, threatened, and endangered species using this innovative mapping technique.

# Notes from the Field

## PNHP Plant Stewardship

Thanks to a very cooperative landowner, PNHP has had the opportunity to conduct stewardship work at Pennsylvania's largest known population of Kate's mountain clover (*Trifolium virginicum*), a globally rare and state endangered plant inhabiting dry, sunny, shale slopes that are commonly referred to as shale barrens.

John Kunsman

Kate's Mountain Clover

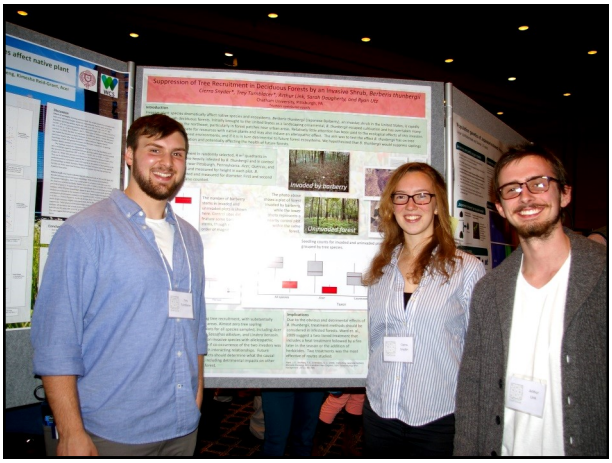
At the start of the work in 2013, most of this site was overgrown with spotted knapweed (*Centaurea stoebe*), a highly-invasive exotic species, and Pennsylvania sedge (*Carex pensylvanica*), which is a native species but was forming dense, carpet-like colonies that were suppressing other vegetation. In places where these two species weren't dominant, the substrate had a layer of fallen leaves, branchlets, and other decaying plant material, which is not a desirable situation in this sort of habitat. All of these together were a perfect negative storm for the low-growing Kate's mountain clover, which was having major competition problems and was struggling to push its way out into the sunlight.

The first step in mitigating the situation involved hand-pulling and digging out a large percentage of the spotted knapweed and Pennsylvania sedge. The site was then raked to remove the accumulated leaves and other plant debris, which also had the added benefit of creating patches of "bare" shale substrate that is highly favorable to Kate's mountain clover as well as other desirable native species of this habitat. Two years later, the results were gratifying: the number of Kate's mountain clover plants documented from the site had more than doubled, mostly due to established plants becoming visible rather than from reproduction, although numerous seedlings were noted. In addition, the vegetative growth of the species was much more vigorous and flowering was greatly enhanced, both in the number of plants producing flowers and the number of flower clusters on each individual plant. But to prove the old adage that no good deed goes unpunished, another invasive plant, an exotic grass known as sterile brome (*Bromus sterilis*), has arrived at the site in the last two years and it is quite obvious that this species was not named for its inability to reproduce itself. Attempting to control it will be a major focus of future work.

## 2016 Botany Symposium

The 2016 Pennsylvania Botany Symposium was held on November 18 and 19, and was a smashing success. This was the third of our biennial (blooming every second year) symposia, and the second to be held in State College. The taxonomy workshops were so popular in the past that we doubled the number to six, and the main complaint this year was that people were unable to attend more than one!

The highlight was the addition of a student poster session. There has been much discussion in recent years regarding the decline in capacity to conduct the research necessary to plan and implement effective plant conservation action. The work of these students is a welcome sign, perhaps an omen that things might be changing for the better. The next symposium will be in



Bonnie Isaac

Students from Chatham University answer questions about their poster.

2018, but we will have field oriented workshops in 2017. Stay in touch at pabotany.org, where you can sign up for emails if you wish. You might also "like" our Facebook page at www.facebook.com/PABotanySymposium. Two years is a long time between botany symposia, so consider attending the Ohio Botanical Symposium on March 24 (www.cmnh.org/obs).

### Updating Amphibian, Reptile, and Fish Data

Western Pennsylvania Conservancy Information Management staff have been working with the Pennsylvania Fish and Boat Commission (PFBC) to expand and update our database information for amphibian, reptile, and fish Species of Greatest Conservation Need (SGCN). Under a grant from the State Wildlife Grant Program (SWG), we have added observations from the Pennsylvania Amphibian and Reptile Survey (PARS), and we are currently working with PFBC to process new and updated records for fish SGCN.

PARS is a web-based atlas project launched in 2013 with the goal of determining the distribution and status of all amphibians and reptiles throughout Pennsylvania. The project is a collaboration between the PFBC and the Mid-Atlantic Center for Herpetology and Conservation. To date, WPC has processed over 2,800 observations of amphibian and reptile SGCN from the PARS database into Biotics. This information was also used to update the new Pennsylvania Conservation Explorer, an online conservation planning and environmental review tool.

While we continue to process the PARS data, we are also beginning to work with a large volume of fish data we recently received from PFBC. The fish data were compiled in preparation for publication of the new book *The Fishes of Pennsylvania*, by Jay R. Stauffer, Jr., Robert W. Criswell, and Douglas P. Fischer (Cichlid Press, 2016). Data sources include the PFBC Agency Resource database, the PFBC Scientific Collectors' Permit database (recent annual reporting of fisheries info from all collectors in Pennsylvania), historic academic data, and others. We have received nearly 2,000 records for over 50 species of fish, and have been working with PFBC to format, prioritize, and process them. Historically, fish were somewhat under-represented in our database because they had not been compiled from the multiple sources and data repositories in Pennsylvania. The authors' work to validate, summarize, and publish the data has made it possible for us to expand the statewide representation of fish records in our Biotics database and Conservation Explorer.

Charlie Eichelberger

The mountain earthsnake (*Virginia valeriae pulchra*) is ranked S3 (Vulnerable) in Pennsylvania; 380 observation records for this species have been received from PARS through this data exchange.

Rob Criswell

The hornyhead chub (*Nocomis biguttatus*) is ranked S1 (Critically Imperiled) in Pennsylvania; PFBC has provided 44 records for this species.

The grant extends through June 2017, and will result in many new and updated records in our Heritage databases. With the implementation of Conservation Explorer and its enhanced options for creating conservation planning reports and submitting requests for permit reviews, this project will result in a more accurate and updated dataset so that occurrences of amphibian, reptile, and fish SGCN will receive the consideration they deserve.

### iMapInvasives Promotes Early Detection Efforts

The iMapInvasives program is known to many as an online tool useful in understanding statewide invasive species distributions and providing a platform to document management/control efforts. However, iMapInvasives serves another important purpose. Staff with the iMapInvasives program have insights into which

species in their state are considered *early detection* and *high priority*. Early detection species are those which are new to a state, and high priority species are known from a state, but are not yet widespread. In both cases efforts to control and eradicate these species are still considered possible and realistic. Reports received for species in these two categories raise red flags, and Pennsylvania iMapInvasives staff quickly notify individuals and organizations that play a role in management and control efforts for that species in the state.

For example, in September 2016, Robert Booth, an Associate Professor of Ecology at Lehigh University, made an important discovery in the Lehigh Canal. He noticed a floating aquatic plant that seemed out of place in the waterway. This plant, known as water lettuce (*Pistia stratiotes*), is a native species of more tropical environments, thought to have originated from Africa or South America. It has been making an appearance in more northerly climates, likely from human introductions as water lettuce is commercially available to pond and aquarium owners. Water lettuce can form dense mats which crowd out native species and reduce the amount of dissolved oxygen in the water, making it less suitable for some fish species. It also hinders recreational activities including fishing, swimming, and boating.

Robert Booth

Water lettuce

Known to be sensitive to freezing temperatures, water lettuce has not been considered a major threat in the Northeast. However in his blog, "Among the Stately Trees," Booth cites scientific literature which points out that water lettuce was found in the lower Great Lakes in three subsequent years, raising concerns about the potential for the establishment of persistent populations in more northerly locations. Additionally, although freezing temperatures usually kill water lettuce, the plant can survive cold temperatures, and seeds of water lettuce can remain viable after a few weeks in solid ice.

Robert Booth

Scattered colonies of water lettuce were observed in the Lehigh Canal in 2016. Water lettuce floats unattached on the surface of slow-moving water often forming dense mats.

As a registered user of the Pennsylvania iMapInvasives program, Professor Booth recorded his finding of water lettuce in iMapInvasives shortly after discovering it in the Lehigh Canal. His report was noted by Pennsylvania iMapInvasives staff as an early detection species in Pennsylvania and notifications were sent out to Lehigh County Conservation District, Pennsylvania Fish and Boat Commission, Pennsylvania Department of Agriculture, Pennsylvania Department of Conservation and Natural Resources, Pennsylvania Department of Environmental Protection, Pennsylvania Sea Grant, The Pennsylvania State University, and the University of Pennsylvania. As a result, staff from the Lehigh County Conservation District offered to provide assistance should management efforts be required in the future. Crawford County Conservation District's Watershed Specialist, Brian Pilarcik, advised that a survey effort in 2017 should be scheduled to discover if the water lettuce does in fact overwinter. Results from the survey will inform the most appropriate actions, which could include treatment efforts or a monitoring program.

It's important to note that one person's report to iMapInvasives triggered essential communication to natural resource professionals who will likely be able to put boots on the ground and act on these important invasive species findings being discovered in Pennsylvania.

For more information on how you can get involved in the Pennsylvania iMapInvasives program, please visit www.paimapinvasives.org or email our administrative staff at paimapinvasives@gmail.com.

## Species Updates from the SWAP

Pennsylvania's updated State Wildlife Action Plan (SWAP) was recently given final approval by the United States Fish and Wildlife Service. The purpose of the plan is "to conserve Pennsylvania's native wildlife, maintain viable habitat, and protect and enhance Species of Greatest Conservation Need" for future generations. During the revision of the SWAP, a large team of staff from conservation organizations, natural resource agencies, academic institutions, along with volunteer citizen scientists, worked together to use the best available science and a rigorous prioritization process to identify 664 species of greatest concern in the state. The plan lays out our current understanding of the distribution of these species across the state, the habitats they use, and the threats they face. Species and habitat management recommendations are provided, along with other conservation actions needed to (1) conserve Pennsylvania's native imperiled species and their habitats, (2) keep common native species common, (3) recognize Pennsylvania's regionally important role in conserving species and habitats, and (4) promote partnerships for wildlife conservation (SWAP 2015). The full State Wildlife Action Plan is available at http://www.fishandboat.com/Resource/StateWildlifeActionPlan/Pages/default.aspx.

Betsy Leppo

The huckleberry sphinx (*Paonias astylus*) was assessed during the SWAP revision. The caterpillars feed primarily on blueberry shrubs (*Vaccinium* spp.) and bog rosemary (*Andromeda polifolia*). The moth is somewhat more widespread and common than previously thought. This moth is a true nighttime species, typically not beginning to fly until after 3 a.m. Moth collectors working a light sheet have usually gone home for the night before then!

The revision of this plan was a monumental effort made possible by the dedication and collaboration of many individuals and organizations. The hard work continues as efforts shift to implementing the recommendations contained within the plan. This work will be accomplished through many steps large and small, exciting and tedious, press-worthy and behind the scenes. This fall and winter, PNHP zoologists and data managers are working on a behind-the-scenes step. We are taking updated species information used in the State Wildlife Action Plan process and incorporating it into our Natural Heritage database (Biotics). Many of these updates are related to taxonomic changes and revised state conservation ranks. These changes are ultimately uploaded into the Conservation Explorer website (https://conservationexplorer.dcnr.pa.gov/), which is Pennsylvania's online tool for conservation planning and environmental review. The changes are also shared with NatureServe, the umbrella organization that connects all the natural heritage and related programs in the United States, Canada, Latin America, and the Caribbean. Information provided by each natural heritage program feeds into a comprehensive dataset that is used for large scale planning and conservation efforts. The NatureServe Explorer website shares species information from this combined dataset at http://explorer.natureserve.org/.

Betsy Leppo

The riffle snaketail (*Ophiogomphus carolus*) was a dragonfly assessed during the SWAP revision. This species is currently stable in Pennsylvania but is threatened in other parts of its range. It is associated with clean, clear, rushing forest streams and small rivers.

The 2015 SWAP contains the results of conservation assessments for 450 invertebrates. Most of the assessed species come from a handful of relatively better known groups including butterflies and skippers, moths, dragonflies and damselflies, tiger beetles, aquatic and terrestrial snails, crayfish, freshwater mussels, and stoneflies. The revision process involved the gathering and reviewing of data for many additional species not mentioned in the SWAP and will ultimately yield revisions in Biotics for over a thousand species of invertebrates. The moths take the prize with over 700 species updates identified so far and more to come!

# 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 (2016) | 1st Quarter | 2nd Quarter | 3rd Quarter | 4th Quarter | Cumulative Total | Percent of Annual Goal |
|---|---|---|---|---|---|---|---|
| Biotics Records Updated | 300 | 66 | 84 | 136 | 184 | 470 | 156% |
| New EOs Documented | 800 | 189 | 407 | 327 | 550 | 1473 | 184% |
| New Records Entered into PACE | 350 | 0 | 0 | 238 | 0 | 238 | 68% |
| Field Surveys Reported | 300 | 159 | 49 | 108 | 118 | 434 | 145% |
| New CPPs Developed | 400 | 0 | 0 | 321 | 333 | 654 | 163% |
| NHAs Updated | 150 | 15 | 0 | 21 | 0 | 36 | 24% |
| Sites Actively Monitored | 35 | 0 | 15 | 10 | 0 | 25 | 71% |

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.