



Pennsylvania Natural Heritage Program

information for the conservation of biodiversity

Wild Heritage News

Summer 2015



Much Ado About Mice, Moles, Mustelids, and Myotis!

by

Charlie Eichelberger

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Photo Banner:
Charlie Eichelberger

Streams lined with overhanging banks, or rock and root crevices are prime habitat for water shrews.

January 1, 2015 was a significant date for Pennsylvania's mammals, marking the official start date for field collection of the Pennsylvania Mammal Atlas. The initiation of the project was spearheaded by retired Pennsylvania Game Commission (PGC) Wildlife Diversity Supervisor, Jerry Hassinger, and with his enthusiastic rousing of the state's mammalogists, a ten year project began to take form as a collaboration between the PGC and the Pennsylvania Biological Survey's Mammal Technical Committee.

On the heels of the 2nd Breeding Bird Atlas (BBA) completion, a natural move was for the PGC to model the survey efforts for the mammal atlas after the BBA. However, for the most part, bird surveys for the 190 resident breeding birds in the state all involve the same survey technique. On top of that, the 2nd BBA employed the help of more than 2,000 volunteers who were all knowledgeable (many of whom are world-renowned experts) in the nuances of bird identification. Mammal surveys on the other hand, require dozens of different

survey techniques and there are far fewer subject matter expert volunteers.

With the exception of the species that PGC actively monitors (mostly listed species such as the Allegheny woodrat and Indiana bat) our mammals have not received the attention they deserve given the vital ecological roles they play. Pennsylvania's mammals are valued not only as game species, but are important predators, prey, scavengers, herbivores, seed dispersers, soil aerators, and even tree planters (think gray squirrels) and play huge roles in the ecology of our forests, fields, and backyards.





Pennsylvania's largest bat species, the hoary bat (*Lasiurus cinereus*), is found foraging in open habitats and thin forests that allow for their fast flight.

Charlie Eichelberger

The Pennsylvania Mammal Survey conducted from 1946 to 1951 comprehensively inventoried and loosely mapped the state's mammals, but much has changed in the nearly 70 years since that project's beginning. Habitats have been degraded or improved, raptors have rebounded, fur-trapping has declined, invasive species have

flourished, and once extirpated species are now common – all adding to the complex, yet seemingly simple question of “who lives where?”

Mammal survey techniques have also changed. Seventy years ago remotely triggered cameras were used experimentally only by a handful of mammalogists, whereas today these compact and inexpensive trail-cams are a staple of the mammal surveyor's toolbox. Pygmy shrews (*Sorex hoyi*) were unknown in Pennsylvania, despite the Mammal Survey trapping efforts, until pitfall traps targeting them were deployed in the 1980s.



Ryan Miller

Inexpensive remote trail cameras allow for months of continuous data collection. These cameras are now a staple for detecting reclusive animals such as the Allegheny woodrat and eastern spotted skunk.

Late in 2013, the PGC hired Lindsey Heffernan to coordinate the Mammal Atlas effort. In order to address some of the problems that are bound to arise in an effort of this magnitude, Lindsey and other Wildlife Diversity staff opted to begin with a smaller scale pilot project, keying in on the Central Mountains Important Mammal Area (IMA #20, see www.pgc.state.pa.us and look under the “wildlife” tab), deploying Mammal Atlas arrays in 20x20 km atlas blocks, using a mix of live traps, lethal traps, and camera traps intended to document the majority of our most under-surveyed species. Selected atlas arrays, based on GIS habitat classification schemes will be surveyed for three trap nights, using methods intended to document Pennsylvania's smallest mammal (pygmy shrew – as small as 0.08 ounces) on up to the largest (black bear – Pennsylvania specimens have exceeded 800 pounds).



Charlie Eichelberger

The pilot study area follows the southern limit of the northern water shrew, and our survey results should allow for a better understanding of just where that line is, and perhaps what limits the species distribution. By targeting ideal habitats, such as this Mifflin County stream, over a wide area on either side of the delimited range we hope to clarify where this cryptic species exists.

With fieldwork beginning in 2015, PNHP began assisting Lindsey with survey efforts within the pilot study area thanks to a Wild Resource Conservation Program grant allowing multiple approaches to assessing the mammal composition of this rugged and biogeographically interesting area. For mammals, the pilot study area is a north meets south and east meets west crossroads, with a unique mix of potential species and a wide range of habitats to be surveyed. The region also has many public lands, allowing simpler access to conduct our surveys. The atlas blocks surrounding IMA #20 also range over varied habitats including deciduous forests, coniferous forests, marshes, streams, lakes, agricultural fields, fallow fields, and suburban landscapes – landscapes that one could say are typical of much of our unique state.

Thus far, PNHP staff have run 22 small mammal lines, targeting the northern water shrew (*Sorex palustris albibarbis*) and the long-tailed shrew (*Sorex dispar*). While the long-tailed shrews have eluded us so far, we were able to document nine new northern water shrew occurrences. Our results are beginning to suggest the northern water shrew is restricted to distinct geographic patterns, and is more limited in the region than we had surmised at the beginning of the project.



Charlie Eichelberger

Northern water shrews have poor eyesight and sense underwater prey by using a well-developed thicket of whiskers and by partially exhaling and inhaling air bubbles.

Additionally, while we're getting to know the area, we're also noting where potential habitat appears suitable for our other target species. As the field season progresses, we'll be conducting surveys in these areas for other lesser known mammals including the eastern small-footed bat (*Myotis leibii*), least weasel (*Mustela nivalis*), hairy-tailed mole (*Parascalops breweri*), and southern bog lemming (*Synaptomys cooperi*).



Charlie Eichelberger

The hairy-tailed mole (*Parascalops breweri*) is well equipped for trenching, with large paddle-like forelimbs tipped with impressive claws.

With the hope for a clearer picture of the distributions of the region's mammals, the Pennsylvania Mammal Atlas will start moving statewide in 2016.



Joe Wisigo

Fleshy appendages covered with Eimer's organs allow star-nosed moles to detect prey in their subterranean habitat.

Complementing the results of PGC and PNHP's trapping efforts, the public will be able to provide a critical piece of information by providing photo-vouchered records through a web portal. Trail camera photographs and even high quality track and scat photographs (depending on the species) will be used to not only provide a snapshot of verified mammal distributions, but also allow for habitat modeling to project the potential range and density for some species.



Charlie Eichelberger

Recent bat surveys have been successful at documenting a new occurrence of the state-threatened eastern small-footed bat (*Myotis leibii*). We will conduct additional bat surveys later this summer.

The Pennsylvania Mammal Atlas is a massive-scale and complex project. It will require the input of professionals and volunteers alike to make the results as robust as possible, providing us with a much better view of the statuses of the commonwealth's mammals as well as the contributions and impacts these understudied species have on the ecology of Pennsylvania's landscapes. Stay tuned for more information on the project as the website is nearing launch, and volunteers are sought to help with this unique and challenging citizen-science and professional-science effort.

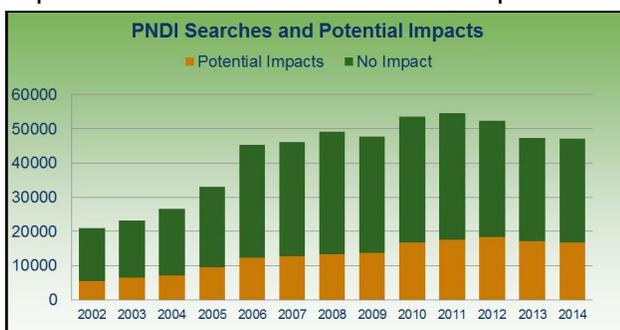
DCNR to Release Major Upgrade of Online Environmental Review Tool

by
Kent Taylor

DCNR is preparing to launch a major update to the online screening tool that a decade ago helped establish Pennsylvania as a national leader in the protection of threatened, endangered, and rare species. Following a year-long planning and website development effort, the state-of-the-art mapping application will utilize the latest geographic information system technology and extensive biological and ecological information to help conserve the commonwealth's rich natural heritage.

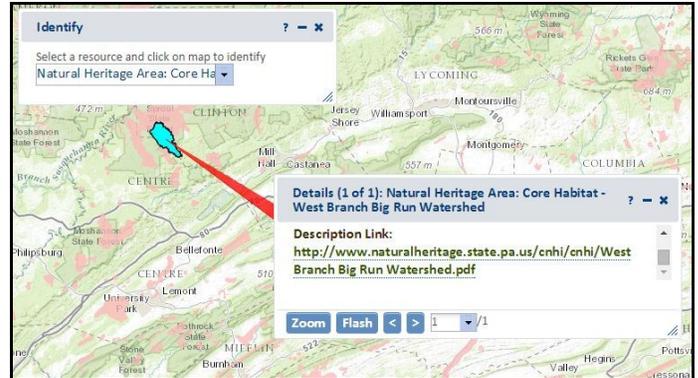
“To protect and conserve our natural heritage, Pennsylvania’s resource agencies work together to provide current, reliable, objective information about rare plant and wildlife species and their locations,” according to DCNR Bureau of Forestry Director Dan Devlin. “Natural heritage information should always be used to help guide decisions about proposed land and water development.”

Pennsylvania Conservation Explorer—for Conservation Planning and PNDI Environmental Review, generates custom reports of potential impacts, informing site selection and pre-permitting for most any type of project. The tool is currently used to search for possible conflicts on approximately 50,000 project locations per year. About 16,000 of those searches result in Department of Environmental Protection permits.



The number of PNDI searches and potential impacts have gradually increased over more than a decade.

The new tool’s enhancements include improved map visualization, access to more geographic data, including protected lands, high-value surface water resources, threatened and endangered species (while withholding and protecting information about species that are at risk for collection or over-visitation), custom Natural Heritage Area reports, and more accurate and detailed, site-specific conservation measures and recommendations.



Conservation Explorer info-windows provide useful links and quick information.

Conservation Planning on Demand

The new PNDI tool includes a free conservation planning report function. The application automatically generates formatted reports that are specific to user-defined geography, providing valuable information for avoiding impacts and carrying out responsible development and management of land and water resources.

The conservation planning feature is available to anyone visiting the website, and it does not require registration or login. Anyone can view and create maps of Natural Heritage Areas and search the heritage database for information useful for land use planning. The system uses a spatial database engine for delivering location information that planners need. Just click on the interactive map, and details about the selected features, e.g., Natural Heritage Area core habitats or state forest lands, appear in an info-window. Click on links in the info-window and the tool will redirect you to specific passages from the latest County Natural Heritage Inventory reports, all of which are available online as downloadable pdf documents.

Environmental Review at Your Fingertips

Most visitors to the website will want to create an account in order to view environmental review polygons and generate PNDI receipts for pre-permitting. You must be a registered user to view known locations of threatened, endangered, and special concern species and/or submit a project footprint for analysis and agency review. Projects may require avoidance measures, conservation measures, or other

agency-specific responses. Registering is easy, and all potentially sensitive data and information, such as project locations and sensitive species names, are protected and never shared outside of the reviewing agencies.

Once finalized and submitted, project reports (called receipts) are managed through a powerful user interface. Users can search electronic versions of their project receipts, print them, attach documents, and drill down for additional project notes and details with just one or two clicks. The status of each project review can be updated by agency reviewers and monitored by applicants in a common and transparent internet dashboard. Communication is facilitated with email functions built right into the tool for use throughout the duration of a project review.

Keeping Costs Manageable

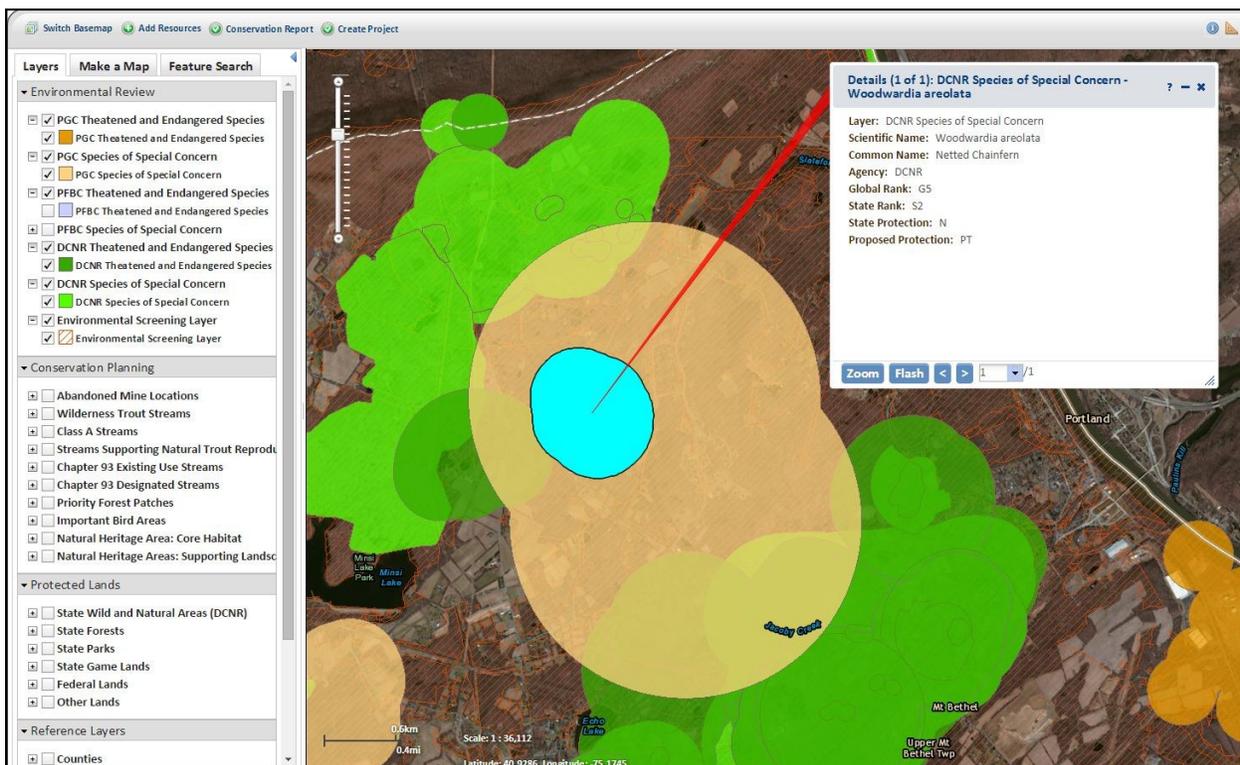
There are costs associated with the tool, but the return on the investment will be considerable. Project applications will be processed faster, meaning fewer delayed projects and higher customer satisfaction. Thousands of projects will move to construction sooner as the result of using the online tool, and that will potentially save businesses, local governments, and

taxpayers a lot of time and money. In addition, state and federal agency staff will be able to focus on high priority site surveys and spend less time reviewing projects that are not likely to have a significant impact on threatened, endangered, and rare species of concern.

DCNR is currently considering charging a fee for the convenience of using the online tool for submitting projects for environmental reviews. The proposed fee would generate needed revenue to recover some of the costs of the software, hardware, and data management.

In summary, the new online tool will offer a collection of new features and functions that will help the growing community of PNDI users to explore project locations for potential impacts on threatened and endangered species, leveraging over 20 years of field-verified biological inventories. The new tool combines both a planning function and a project screening function. It will streamline project submission, document management, and improve natural resources visualization for a better overall user experience.

For more information and upcoming announcements, visit www.naturalheritage.state.pa.us or contact Kent Taylor at kenttaylor@pa.gov.



The web-map application provides improved access to conservation information while helping to protect species from potential impacts.

Management Practices Affecting Bryophyte and Lichen Diversity

by
Scott Schuette

Bryophytes and lichens are ubiquitous but overlooked organisms living in our forests despite the documented evidence of their ecological importance. They are excellent organisms to study as indicators of habitat quality due to their direct uptake of nutrients from the atmosphere or microhabitat substrate. Many of these organisms require particular types of microhabitats and are sensitive to changes in them; species richness and abundance are directly correlated to microhabitat quantity and quality.



Lichen (*Usnea* sp.)

In addition, many species take decades to establish viable populations on woody plants making them very susceptible to forest management practices. For example, populations of the moss *Leucodon julacea* and lichens in the genus *Usnea* are positively correlated with trees greater than 50 years old in forests with little air pollution. Because of these traits, it is suggested that bryophytes and lichens make good surrogates for determining overall forest quality and integrity. However, there is a great need for research on species in undisturbed forests to establish these organisms for use as reliable indicators. Very little is known about bryophyte and lichen diversity and the ecological roles that these organisms play in Pennsylvania's forests.

To advance our knowledge, PNHP staff conducted a research study in 2014 to examine the impacts of Marcellus Shale gas development and current timber management practices on the biodiversity of bryophytes and lichens in the dry oak-heath forests of the Tiadaghton State Forest. The primary goal was to identify species indicative of forests of good quality and integrity. In particular we examined and compared late



Miller Run Natural Area is a good example of late successional dry-oak heath forest.

successional second growth forest stands from Miller Run Natural Area to disturbed forests in an area nearby with disturbance from both timber management and gas development. Disturbances, such as selective timber stand thinning and clear-cutting either for timber sales or for gas well pad development, will alter the temperature and humidity regimes of many different microhabitats in a forest. The result of these alterations will likely exceed the limits of tolerance for some species, thereby changing the species assemblages in the forest.

We selected three sites at two locations in Tiadaghton State Forest for this study. One site is located in a contiguous (unfragmented) stand of dry-oak heath forest within Miller Run Natural Area, but outside of the area that experienced a series of intense wildfires.



Location of three study sites in Tiadaghton State Forest

Scott Schuette

Scott Schuette

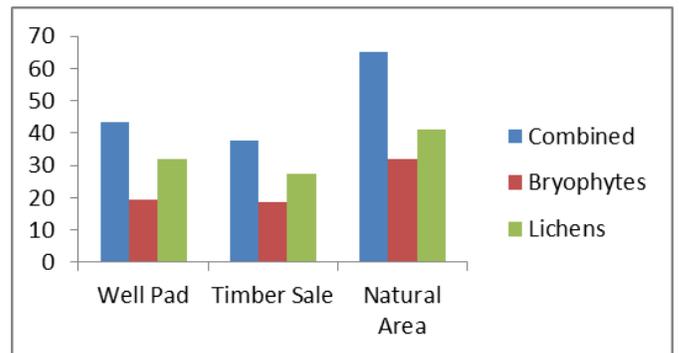
The other two sites are located in a fragmented dry oak-heath forest stand. One site is experiencing development for natural gas extraction including several well pads, a large compressor station, and roads paralleled by pipelines. The second site is recovering from a low thinning timber sale that occurred in 2004 where red maple was removed from the subcanopy and understory. Subsequent treatment of the maple stump sprouts with basal bark application of herbicide occurred in late 2013 at this site. At each site, we sampled four plots of 400 m² each for all bryophytes and lichens and recorded forest stand characteristics and environmental variables. We then analyzed this data to determine patterns in species diversity attributable to site differences due to disturbance.



The study site at the timber sale location demonstrates an open canopy, high light intensity habitat that is low in species diversity.

Dry oak-heath forests lack species richness, but this traditional assessment usually references vascular plant species and excludes bryophyte and lichen species. If bryophytes and lichens are included in total species richness, then dry oak heath forests have much greater diversity than previously thought for this community

type. A total of 186 species, including 114 lichens and 72 bryophytes, are present from the combined study site plots in Tiadaghton State Forest. The highest average species richness was found in the natural area compared with the well pad and timber sale sites. These differences in combined total number of species were statistically significantly different between Miller Run Natural Area and the disturbed sites, while there was no statistical difference between the disturbed sites. Another way to look at species diversity is to compare an index value that averages the number of different species relative to the total species present at a site.



Average species richness of bryophytes and lichens at each study site. Natural area plots supported significantly higher richness values for both bryophytes and lichens.

When we calculated and analyzed this diversity index, it showed that the natural area is only statistically different from the timber sale site. However when bryophytes and lichen diversity indices were analyzed separately, bryophytes are significantly different between natural area and disturbance sites, while for lichens the natural area is significantly different from only the timber sale. This suggests that few bryophyte species are shared between the natural area and disturbance sites. Likewise few lichen species are shared between the natural area and timber sale. However while lichen species richness in the natural area is significantly different from the well pad, the diversity index for lichens from these two sites suggests little variability in species composition. Nonetheless, overall there are species differences among the sites.

The next question addressed in this study was to determine if there are indicator species of disturbed and natural sites. When the sites were analyzed for indicator species, there were no significant and meaningful indicator species found in any of the sites. There was considerable overlap in species composition requiring a much larger sample size than we used in this study to fully tease out the minute species differences necessary to identify any significant indicator species.



The plots at the well pad study site were located 25 meters off the developed pad to avoid edge effect of the grassy buffer.



Scott Schuette

However these results suggest that something attributable to each site is driving the difference in species richness and diversity. When the environmental variables and site characteristics were analyzed with the species diversity, a pattern emerged that helped explain the differences among the sites. Using a method that made no assumptions about the variability of the sites, it showed that the presence of rocks, exposed soil with high light intensity, and coarse woody debris were important variables in separating the sites based on their species composition. This suggests that forest management practices can play a significant role in altering substrate quality and availability for bryophyte and lichen species establishment.



Scott Schuette

The moss *Dicranum montanum* can be found on rotting stumps and logs, tree bases, and occasionally soil or humus over rock. This moss was one of the three most common species encountered during this study.

Evidence from this study indicates that clear-cutting a forest, whether for a timber sale or natural gas development, greatly alters the dry oak – heath forest community structure and helps define the subsequent succession of that community following disturbance. These activities on the forest ecosystem altered the bryophyte and lichen communities, affected

temperature and humidity levels, and removed or disrupted microhabitat and substrate continuity.

If bryophytes and lichens are considered important to the forest ecosystem then management practices in those forests should incorporate factors that promote and maintain their biodiversity. To facilitate this, a reduction in the number and size of machinery access roads (skid paths) and staging areas should be considered when forest stands are selected for harvest. This practice alone leaves forest patches that escape substrate disturbances, providing refugia within harvested lands that can promote bryophyte and lichen survival by reducing dispersal distances and recolonization times.

Additionally, large tracts of late successional forest should be preserved around disturbed sites to maintain extensive propagule sources for regeneration. If these types of practices are employed, bryophyte and lichen diversity may benefit and possibly even increase over time in the Tiadaghton State Forest. Bryophytes and lichens may hold the key to fully understanding and following changes in forest community structure related to changes in microclimate, pollution levels, proximity to pad run-off, and proximity to catchment ponds.

Notes from the Field

Wood Turtle Monitoring

Interest in the distribution and condition of wood turtle populations in Pennsylvania and the Northeast has been renewed this spring through the implementation of a Competitive State Wildlife Grant called “Conservation Planning and Implementation for the Wood Turtle (*Glyptemys insculpta*) and Associated Riparian Species of Greatest Conservation Need from Maine to Virginia.”



Kathy Gipe

PNHP staff mark a captured wood turtle by notching its outer shell in order to identify it in future surveys. Shell shavings are collected and preserved for analysis of DNA.

The Pennsylvania Fish and Boat Commission is leading the state’s participation in the project and PNHP will conduct the majority of the field sampling. The purposes of the project in Pennsylvania are to obtain rigorous abundance estimates for a sample of wood turtle populations in the state, assemble detailed population data for a network of reference sites, and collect genetic samples to provide to University of Massachusetts researchers for analysis of genetic structure and relatedness of wood turtle populations within the Northeast.

The basic sampling framework incorporates two tiers of survey intensity. The regional network of study sites will encompass a network of ≥ 20 long-term (LT) and ≥ 50 rapid assessment (RA) research sites. Field surveys commenced this spring to establish up to five LT sites that indicate robust populations and to sample RA sites on a broad geographic distribution, including data deficient regions. We visited ten sites across central and western Pennsylvania multiple times in April and May of 2015 to survey for wood turtles. Volunteers

interested in the program visited additional study sites during the same period. Data is being entered and genetic samples are undergoing preliminary analysis this summer in order to direct additional efforts in the fall of 2015, and spring and fall of 2016.

Northern Long-Eared Bat Update

On April 1, 2015 the United States Fish and Wildlife Service (USFWS) announced that it was listing the northern long-eared bat (*Myotis septentrionalis*) as a threatened species under the Endangered Species Act (ESA). The listing took effect on May 4, 2015 following a 30 day period after the final listing determination in the Federal Register. Under the ESA, the USFWS is able to enforce regulations necessary to provide increased protection for the northern long-eared bat and further range wide conservation efforts.



Charlie Eichelberger

Northern long-eared bat (*Myotis septentrionalis*) roosting.

This decision was made following the recent but dramatic decline of northern long-eared bats caused by the introduced, cold-loving fungus *Pseudogymnoascus destructans* (otherwise referred to as Pd). Pd causes White-nose Syndrome (WNS) in hibernating bats which produces lesions on the patagia (wing membranes) and frequent bouts of awakening during hibernation. Since stored energy is burned in excess during these aroused states, hibernating bats deplete their fat stores and essentially starve to death during winter months when insects are unavailable. WNS was first documented in Pennsylvania during the winter of 2008-2009. While a definitive cure has yet to be discovered for WNS,

protection of known hibernacula and preservation of summer habitats can help mitigate the effects of WNS by providing minimal disturbance during hibernation and ample foraging areas.

Currently, PNHP staff are working with our agency partners to not only document occurrences of this species, but also to keep our PNDI environmental review tool current. We receive a constant influx of data from both the USFWS and the Pennsylvania Game Commission regarding the locations of hibernacula, maternity roosts, and foraging areas utilized by the northern long-eared bat. This data is processed and reviewed by our staff and then entered into our PNDI tool which aids in the protection of habitats critical to the life history needs of this species. While it is apparent that the damage caused by WNS isn't likely to be reversed anytime soon, the federal listing of these resilient survivors is an important step toward the future conservation of this species.

A Closer Look



Steve Grund

The individual stems on the top of this *Sphagnum capillifolium* moss may be signs that a bird or small mammal has been foraging for insects and other invertebrates living in the peat moss.

The peat mosses (genus *Sphagnum*) are a large group that exhibit many interesting variations in form and color. *Sphagnum capillifolium* (above) has been given several common names, including small red peat moss, which describes it well. Red coloration in mosses, as well as in vascular plants, is usually an expression of a group of pigments called anthocyanins. The red color is more pronounced when the plant is exposed to high light levels.



Steve Grund

Ptilium crista-castrensis, Potter County

Knights plume moss (*Ptilium crista-castrensis*) is a very elegant forest species with leaves that curl toward the base of the plant. If you don't get small, you will miss much of the beauty and interest in nature!

Bedford County Inventory Update

Field work for the Bedford County Natural Heritage Inventory Update began this spring with vernal pool surveys. Approximately 225 vernal pools had been identified over the winter, using a combination of aerial photography and LIDAR-derived topographic contours. PNHP staff began visiting those pools this April to document which obligate vernal pool breeding animals might be using them. In numerous pools, we found the eggs and larvae of spotted salamanders and wood frogs, as well as invertebrates such as fairy shrimp and pea clams. Other 'potential pools' were dry depressions,



Pete Woods

Fairy shrimp and wood frog tadpoles among empty wood frog eggs

although they may hold water in wetter years. A few pools were identified as having potential to support the federally endangered northeastern bulrush (*Scirpus ancistrochaetus*). We will revisit these sites in the late summer when that species is identifiable. Surveys of pools will continue next spring. After the 2016 field season, Natural Heritage Areas (NHAs) will be designated for high quality complexes of vernal pools: those with a combination of many pools in one complex, a high abundance or diversity of vernal pool obligate breeding species, and an intact envelope of forest surrounding the pools.



A section of the scrub oak barrens that was burned in 2013

Pete Woods

PNHP staff also conducted moth surveys for the Bedford County Natural Heritage Inventory Update this spring at a large scrub oak shrubland on State Game Land #48. On the south-facing end of a ridge of Wills Mountain, the very dry and acidic conditions prevent many plant species from growing there, and trees grow very slowly. As a result the area is dominated by dense scrub oak, with scattered pitch pines.



A moth (*Cladera* sp) in the scrub oak barrens

Pete Woods



Pete Woods

A luna moth in a pocket of grassland within the scrub oak barrens

For several years the Pennsylvania Game Commission has been cutting and burning patches of this rare natural community in order to set back succession and maintain the distinctive habitat. Little is known about the invertebrates that live here and as other similar ridge-top barrens are known to host numerous rare moths, this site became a focal area for this year's moth trapping. Beginning in April, we placed black light traps in four locations and run overnight to lure moths. Trapping will be repeated every month or so until fall, because different moth species fly at different times of the season.

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 (2015)	1st Quarter	2nd Quarter	Cumulative Total	Percent of Annual Goal
Biotics Records Updated	300	115	78	193	64%
New EOs Documented	800	137	173	310	39%
New Records Entered into HGIS	350	65	84	149	43%
Field Surveys Reported	300	0	73	73	24%
New CPPs Developed	400	0	149	149	37%
NHAs Updated	150	95	18	113	75%
Sites Actively Monitored	35	0	25	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 HGIS 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.