



# Pennsylvania Natural Heritage Program

information for the conservation of biodiversity

Wild Heritage News

April—June 2014



## Tracking the West Virginia White Butterfly

by

Peter Woods and Christopher Tracey

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Photo Banner:  
Peter Woods

A West Virginia white nectaring on marsh marigold.

The West Virginia white (*Pieris virginiensis*) is a delicate and rare forest butterfly which flies for a brief period each spring, typically between mid-April and mid-May. It nectars on a variety of spring wildflowers and its caterpillars eat several native flowers in the mustard family, most notably two-leaved toothwort (*Cardamine diphylla*). Because of its increasing rarity and its value as an indicator of high-quality habitats, this butterfly has been a target for PNHP surveys in recent years.

The West Virginia white can be found in mature, rich, undisturbed forests with abundant spring wildflowers. Its wings are white and translucent, with smudges of

gray on the inner corners of the wings and the leading edges of the forewings. On the underside of the wings, scattered dark scales make faint gray or brown lines along the wing veins. The only similar-looking species in Pennsylvania is the cabbage white (*Pieris rapae*), a ubiquitous introduced species that eats a wide variety of plants in the mustard family. Cabbage whites have black dots on the upper surface of the wings, but sometimes the first generation of the year lacks these dots and can be confused with West Virginia whites. The best way to distinguish between the two species is to get a good view of the lower surface of the wings: in cabbage whites, dark scales



Peter Woods



Jon Dombrowski

Notice that the dark scales are concentrated along the wing veins of the West Virginia white (left) and evenly distributed on the cabbage white (right).

are spread evenly across the wings, rather than being in lines, and there is usually a yellowish wash across the lower surface.

Warm sunny days in spring are the best time to see this butterfly. Early in the morning, the butterflies aren't warm enough to be active, but when the temperature rises into the 60s and the sun is shining, there will be a moment when the first one flutters up from where it has been basking in the sun, soon to be followed by others. They are weak fliers, usually staying low to the ground. If you approach slowly you can get close enough to watch them nectar at a variety of spring wildflowers, such as spring beauties, violets, trilliums, geraniums, toothworts, and marsh marigolds. Each adult flies for only a week or two, but a population will be on the wing for approximately one month. During that time, the population relies on several successive waves of wildflowers, so both abundance and diversity of wildflowers are needed to guarantee a steady supply of nectar throughout the flight period.



Two-leaved toothwort, the most common host plant for West Virginia white caterpillars.

Christopher Tracey

Most commonly, West Virginia white caterpillars will use two-leaved toothwort (*Cardamine diphylla*) as a host plant. Cut-leaved toothwort (*Cardamine concatenata*) has also been reported as a host, but the above ground portion of the plant dies back early in this species and there is speculation

that caterpillars might not be able to reliably finish development on it. Nonetheless, there is one population in Beaver County where cut-leaved toothwort appears to be the only host available. Narrow-leaved toothwort (*Cardamine angustata*) and smooth rock cress (*Boechera laevigata*) are known to be hosts in other parts of the range. These two plant species are less abundant in Pennsylvania and we have assumed that they were not important to West Virginia whites here, but this spring PNHP staff found a population at Powdermill Nature Reserve in



Peter Woods

Two species of host plants growing side by side. Two-leaved toothwort is on the left and cut-leaved toothwort is on the right.

Westmoreland County that appears to be using narrow-leaved toothwort as the main host plant.

If you see a West Virginia white fluttering around patches of toothwort, it is a female looking for a plant on which to lay an egg. If she lays an egg on a toothwort, all is well, but all too frequently she will place her egg on garlic mustard (*Alliaria petiolata*), a "toxic decoy" which will kill any caterpillars on it. This exotic invasive plant has spread through most of the range of the West Virginia white and the butterfly has not been able to adapt to its presence.



Peter Woods

The West Virginia white caterpillar that hatches from this egg will not survive, because the egg was laid on garlic mustard.

Garlic mustard is not the only problem faced by West Virginia whites. They only fly in forests, refusing to cross fields, wide roads, or rights-of-way. This isolates populations from each other, which puts small populations at risk. Because many habitat patches are small and support small populations of butterflies, they are at risk of being extirpated over time. If those



Garlic mustard crowds out native nectar and host plants, in addition to being a toxic decoy.

Peter Woods

patches of habitat are connected to others by forested corridors, butterflies may be able to recolonize lost sites, but if they are isolated by fragmenting features they will not be able to recolonize. Additionally, genetic exchange between small

populations can be important for avoiding deleterious effects of inbreeding.

Forestry practices such as clearcutting, and even heavy selective cutting, will make habitat unsuitable for West Virginia whites. Gypsy moth control efforts can impact West Virginia whites because the bacterium used to control gypsy moths can also infect and kill non-target caterpillars. High populations of white-tailed deer are a major threat because they reduce the diversity and abundance of nectar sources. Furthermore, deer browsing has been demonstrated to enhance the spread of garlic mustard.



A hemlock swamp with a dense stand of marsh marigold provides habitat for West Virginia whites near Lake Pleasant in Erie County.

Peter Woods

PNHP has been tracking the West Virginia white since 2006, and NatureServe has recognized it as a globally vulnerable species since 2010. We have been adding an average of three to four records per year to our database. This butterfly appears to have disappeared from most of its

former range in eastern Pennsylvania. It is present in many sites in western Pennsylvania, though most populations are quite small and isolated. Larger populations are known from the Laurel Highlands and the northern tier of the state.

Looking to the future, PNHP has several goals for our work with the West Virginia white. First, we want to improve our knowledge of the current distribution of the West Virginia white in Pennsylvania. We will continue to document new populations, and plan to build predictive models to guide survey efforts. Second, we hope to develop and implement a protocol for



Peter Woods

monitoring populations of West Virginia whites, their host plants, their nectar sources, garlic mustard, and general forest condition. This will allow us to detect changes in populations, and hopefully understand what factors are driving them. Third, we want to establish or encourage management for the West Virginia white at key sites. At sites with good populations and good habitat condition, we want to engage with land managers and establish volunteer networks to deal with garlic mustard infestations and other issues. With careful management, the West Virginia white will continue to fly in our forests each spring for generations to come.

## Piping Plovers on Presque Isle: We Built It... Will They Come?

by

Cathy Haffner, Sarah Sargent, and Ephraim Zimmerman

(modified from an article by that will be published in the winter 2014 issue of Pennsylvania Birds)

Piping plovers from the Great Lakes population of the inland subspecies (*Charadrius melodus circumcinctus*), listed as endangered by the U.S. Fish and Wildlife Service (USFWS), once nested at Presque Isle State Park, Pennsylvania along the Lake Erie shore. Until the mid-1950s approximately 15 pairs nested annually on these beaches, primarily at the tip of the peninsula, in what is today the Gull Point Natural Area. The mid-20<sup>th</sup> century loss of this species in Pennsylvania mirrors documented declines from throughout its breeding range, attributed to increasing recreational beach use and shoreline development, predation, and environmental contaminants.

Recently, migrating individuals have been seen regularly at Presque Isle State Park and with populations expanding in the Great Lakes due to successful captive rearing and habitat protection programs in the Great

Lakes Region, there is hope that Presque Isle may once again serve as a nesting site for the plovers. In 2001, USFWS designated critical habitat for piping plover along 3.7 miles of the shoreline. However, a 2007 assessment found that habitat quality in portions of this area was impaired by vegetation encroachment.



Ephraim Zimmerman

Great Lakes Region Palustrine Sand Plain invaded by native, but aggressive willows and cottonwood at Gull Point Natural Area, Presque Isle State Park.

Beginning in 2011, members of the Pennsylvania Natural Heritage Program including the Pennsylvania Game Commission, USFWS State College Field Office, and the Western Pennsylvania Conservancy collaborated with Audubon Pennsylvania and Presque Isle State Park on a piping plover habitat assessment and restoration project within approximately 33-acres of the Gull Point Natural Area at the eastern-most tip of Presque Isle. The objectives were to restore the natural Lake Erie sand



David yeany

Piping plover

plain communities, the communities used by shorebirds for foraging and nesting, by removing non-native, invasive common reed (*Phragmites australis*), purple loosestrife (*Lythrum salicaria*), narrow-leaved cattail (*Typha angustifolia*), European alder (*Alnus glutinosa*), and native, but aggressive shrub-willow species (*Salix eriocephala*, *S. sericea*, and *S. exigua*) and eastern cottonwood (*Populus deltoides*).

Audubon and WPC ecologists documented the extent and composition of pre-existing vegetation along a series of transects established through the treatment area in order to assess the success of control methods. Audubon also measured beach width and substrate suitability for piping plovers to compare the change in available nesting habitat with data from the 2007 assessment. The transects were also used to provide a

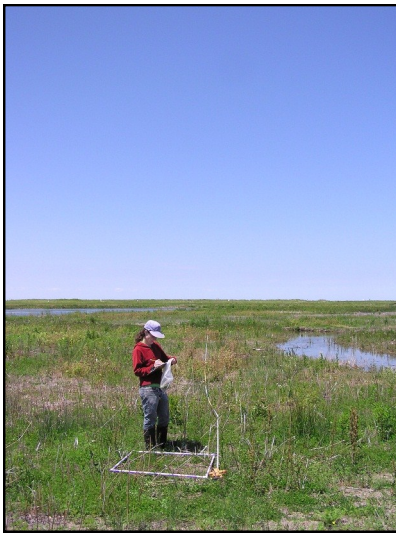


Ephraim Zimmerman

Great Lakes Region Palustrine Sand Plain invaded by common reed (*Phragmites australis*).

detailed map of plant communities associated with the sandy dunes and shores of Presque Isle. Pennsylvania Audubon ornithologists monitored shorebird use of the Gull Point Natural Area during spring migration in 2012 and 2013 and WPC botanists recorded locations of rare plant species.

The team identified and mapped the following plant communities within the treatment area: Mixed Emergent Marsh, Palustrine Sand Plain, Dry Sand Plain, and Great Lakes Beach and Sand Dunes communities. A seepage fed wet meadow was also identified on the north end of the largest beach pool in the treatment area. The team recorded 81 species of vascular plants within the treatment area, including 13 of the 25 species of special concern plants known to occur within the Great Lakes Beach and Dune and Dry and Palustrine Sand Plain communities at Presque Isle.



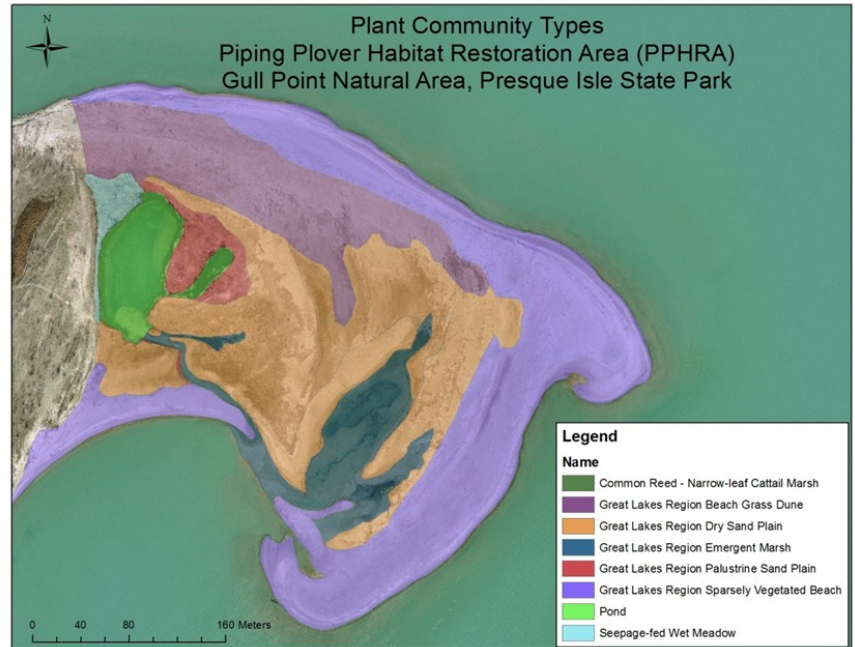
Ecologist Jessica McPherson records plant species within monitoring plots in the treatment area.

Ephraim Zimmerman

These included bush cinquefoil, (*Potentilla paradoxa*), green sedge (*Carex viridula*), umbrella flatsedge (*Cyperus diandrus*), variegated horse tail (*Equisetum variegatum*), silverweed (*Potentilla anserina*), larger Canada St. John's-wort (*Hypericum majus*), Baltic rush (*Juncus arcticus*) elk sedge (*Carex garberi*),

beach grass (*Ammophila breviligulata*), seaside sandmat (*Chamaesyce polygonifolia*), beach wormwood (*Artemisia campestris* ssp. *caudata*), beach pea (*Lathyrus japonicus*), and beach bluegrass (*Schizachyrium scoparium* var. *littoralis*). Locations of these species were noted and measures were taken to avoid impacts during control activities.

Willow species occurred in nearly 50% of the transect plots in the treatment area, including in both wet and



Vegetation communities within the Gull Point Natural Area, Presque Isle State Park, Erie, PA. Aerial photo courtesy of U.S. Army Corps of Engineers—Buffalo District.

dry sandplain communities; eastern cottonwood occurred in over a quarter of the plots, and common reed and purple loosestrife occurred with a 10% frequency primarily in the Palustrine Sand Plain.

Once initial bird and vegetation assessment activities were completed, the team worked with Presque Isle staff and commercial weed contractors throughout the summer months of 2012 to control the invasive vegetation using an herbicide approved for use in wetlands. Presque Isle staff mowed the entire area in November to remove the standing dead plant material.



Presque Isle Weed Management Intern treating common reed (*Phragmites australis*).

Presque Isle State Park



Presque Isle State Park

Presque Isle Weed Management Intern treating purple loosestrife (*Lythrum salicaria*).

The plots situated along the transects through the treatment area were resurveyed in 2013. Comparison of pre-treatment and post-treatment frequency data showed a significant reduction in common reed, eastern cottonwood, and willows. Within the treatment area, the frequency of occurrence of willow species, which occurred most frequently in the treatment area in 2012, changed from nearly half of the quadrats in the treatment area to less than a quarter in 2013. Eastern cottonwood occurred in over 25% of the plots along transects in 2012, but was found in only 6% of the plots in 2013. Likewise, a significant reduction was observed in common reed (11% in 2012 to 3% in 2013).

Most importantly, the quantity of shorebirds recorded during surveys nearly tripled following the treatment activity, including a slight increase in the number of piping plovers observed during routine surveys; however, the species is still quite rare. Dunlin, spotted sandpiper, semipalmated sandpiper, killdeer, and ruddy



Ephraim Zimmerman

Palustrine sand plain within the treatment area following invasive plant control efforts, Gull Point Natural Area.

turnstones were observed most frequently in 2013. While data from the survey suggests the treatment was a great success, only time will tell if the efforts bring piping plovers back to the Presque Isle Peninsula. Additionally, continuous treatment activity will be needed to maintain the open sand plain habitats.

Although there was a significant reduction in observation frequency of several of the target species, there were several areas where problematic native and exotic species were present in the treatment area. Regrowth of vegetation on much of the point occurred rapidly in the summer of 2013, including, unfortunately, an increase in several undesirable species that had possibly been kept in check by the extensive stands of common reed. These specific occurrences were relatively small, but dense. Also, dense willows came back strongly in places where they had been well established. Additional vegetation control efforts in 2013 were implemented and future actions were recommended as part of a 10-year adaptive management control plan provided to Presque Isle State Park to manage invasive plant regrowth over time.

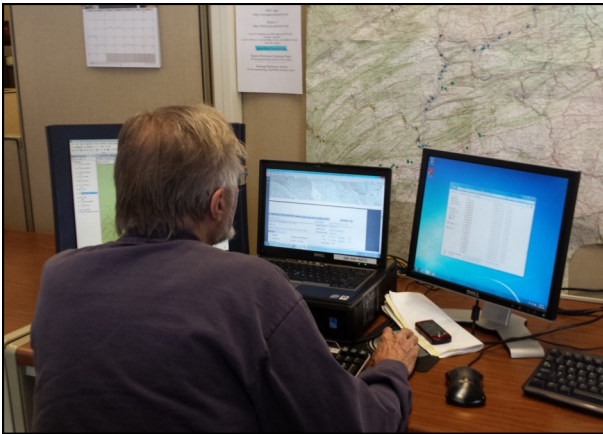
Continuing control activities for invasive plant species in the treatment area of the Gull Point Natural Area will maintain the restored Palustrine Sand Plain and Dry Sand Plain communities and maintain the habitat quality for piping plover, common tern, and migrant shorebird species. These activities should lead to ecosystem-wide improvements. Most of the plant species associated with this habitat are disturbance tolerant and are expected to respond quickly and positively to the changes. In June 2014 a male piping plover was sighted flying and foraging at Presque Isle State Park. Although this bird did not stay to nest, piping plovers have been seen at Presque Isle each year for the past four years, which may indicate that the habitat is improving and their population is growing. The population of Great Lakes piping plovers has now increased to 66 nesting pairs with 124 chicks fledged in 2013, and as it continues to increase, breeding birds will hopefully return to Pennsylvania once again.

## Notes from the Field

### Volunteers in Data Management

Over the past 15 years, 18 people have donated approximately 2000 total volunteer hours to the Western Pennsylvania Conservancy Heritage Program's Information Management Section. What have they done with all of that time?

Volunteers can work in Heritage Information Management in a variety of capacities, depending on previous experience and current interests. Everything from simple filing to major system overhauls has benefitted from their efforts.



Kierstin Carlson

John Olmsted, Information Management volunteer since 2009, draws survey area polygons in GIS.

In 2005, the largest project undertaken to date with PNHP Information Management volunteers was initiated to create a GIS-based field survey data system and to make legacy data in the Heritage Program more secure and useful.

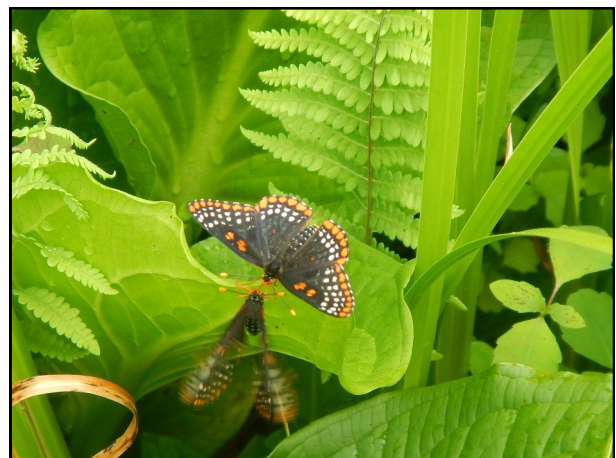
Since its inception in the early 1980s, the Heritage Program has kept its biological survey data in an evolving array of formats, from paper to punch cards to word documents to Access databases to GIS. In 2005, University of Pittsburgh Information Systems graduate student volunteers, Zhiwen Yu and Susan Fineman, assisted with the early design of FIND, our current field survey geodatabase implemented in 2012.

To bring the legacy data into the new millennium and make it easy to use with current geodatabase information, we developed a three-step strategy. By scanning all of the paper field survey forms existing as single copies in file drawers, volunteers enabled all of

that information to be backed up and shared easily when needed. Creating survey area polygons in GIS for each of those surveys has made it possible for the Heritage Program to start to see for the first time all of the places we have been, and where we still need to go. By combining the first two steps with entering all of the species observed during a field survey into the survey's database abstract, the Heritage Program can mine data from throughout its history for locations of species that may not have been imperiled before, but are now. This process is complete for 60-70% of the data collected during the history of PNHP, resulting in over 34GB of scanned data, and over 7500 survey area polygons! This could never have been accomplished without these amazing volunteers: John Giovengo, Nicole Persson, Geri Misch, Katie Schill, Tom Quigley, Tom Miller, Leah Zeidler, Joanne Foerster, Alex Hess, Kaley DuCoeur, Dana Dudra, and John Olmsted.

What do the volunteers get out of it? Many are looking for a chance to learn more about current GIS or database technology. All want to give their time to work with PNHP staff on the cutting edge of conservation in Pennsylvania and beyond. If you live in the Pittsburgh area and would like to get involved as a volunteer, please see the volunteer page on the WPC website: <http://waterlandlife.org/64/>

### Baltimore Checkerspot



Steve Grund

This pair of Baltimore checkerspots (*Euphydryas phaeton*, G4 S3) was photographed in a calcareous marsh in Bedford County in June of 2014. The two are engaged in a courtship ritual.

## Conservation Status Assessment of Odonata

The New York Natural Heritage Program released the final report detailing a conservation assessment of Odonata (dragonflies and damselflies) in the Northeast United States. This project was a collaborative effort among all the states in the Northeast Association of Fish and Wildlife Agencies Region, which ranges from Maine to Virginia. Staff of the Pennsylvania Natural Heritage Program supported this effort by sharing data and reviewing the results of the assessment.



Betsy Leppo

A male tiger spiketail (*Cordulegaster erronea*), Cumberland County

Our region supports an impressively diverse suite of odonate species for a temperate region and includes both relictual (surviving over long periods and many changes) species of ancient lineages and younger, still evolving groups. The distribution and habitat requirements of our odonates are relatively well known and many species are vulnerable and/or in decline due to narrow distributions, low population abundance, and stress from a variety of threats.

A modified version of NatureServe's conservation ranking methodology was developed to determine the relative risk of extinction for 228 odonate species native to the Northeast Region. This science-based and repeatable methodology was tested using the odonates and could eventually be applied to other invertebrate taxa. The conservation assessment was based on three rarity factors (range extent, area of occupancy, and habitat specificity), one threat factor (vulnerability of occupied habitats), and one trend factor (relative change in range size). Regional responsibility for each species was calculated based on the proportion of the U.S. and Canadian range that occurs within the Northeast Region. A matrix was created that groups species by three species vulnerability and three regional responsibility categories. Recommendations and guidance on interpreting the matrix is provided to assist

users in determining conservation strategies based on their priorities and resources.

In Pennsylvania the species that fell into the two highest vulnerability plus responsibility categories are Appalachian jewelwing (*Calopteryx angustipennis*), tiger spiketail (*Cordulegaster erronea*), brown spiketail (*Cordulegaster bilineata*), sable clubtail (*Gomphus rogersi*), Septima clubtail - northern subspecies (*Gomphus septima delawarensis*), and the Appalachian snaketail (*Ophiogomphus incurvatus*). Habitats found to support a disproportionate number of imperiled species in the Northeast include peatlands, low gradient streams and seeps, high gradient headwaters and larger rivers.

For more information and copies of the report, please contact Erin White of the New York Natural Heritage Program at [elwhite@gw.dec.state.ny.us](mailto:elwhite@gw.dec.state.ny.us). The completed report will eventually be posted on the Northeast Regional Conservation Needs Grant website at <http://rcngrants.org/project-final-reports>.

## Conservation Planning for Great-spurred Violet



Ephraim Zimmerman

Great-spurred violet in Susquehannock State Forest, Potter County

In 2013, we began a two-year study of great-spurred violet (*Viola selkirkii*), in north central Pennsylvania. Funded through the Wild Resource Conservation Program, the goal of this project is to document habitat conditions in forests supporting great-spurred violet, and to develop appropriate conservation plans for this species on State Game Lands and State Forests.

This spring, we conducted new surveys for great-spurred violet at 37 randomly selected locations in Susquehannock and Loyalsock State Forests, and State Game Lands in Bradford and Lycoming counties. We documented ten new populations of great-spurred

violet: combined with new populations that were documented in 2013, we have documented 16 new populations of great-spurred violet over the course of this study.

All new surveys were conducted in hardwood dominated forests: these forests are often dominated by sugar maple, beech, black cherry, and/or sweet or river birch. We hypothesize that great-spurred violet occupies richer northern hardwood forests, a less common forest community sub-type where basswood and ash make up a significant component of the forest canopy, and where herbaceous species richness is noticeably greater. We are hopeful that these new data will clarify the relationship (if any) between great-spurred violet and forest communities, which will allow us to map and conserve potential habitat.

### Stream Salamander Surveys

Zoologists Ryan Miller, Charlie Eichelberger, Joe Wisgo and Pete Woods were busy conducting streamside salamander surveys during the month May. They conducted 31 assessments in 13 focal areas for a project looking at the effects of shale gas development on species and natural communities. Each assessment entailed a detailed search of two 15 meter stream segments. Rocks, logs, and leaves were lifted to find small salamanders in their refuges. Aquatic larval salamanders were also dip-netted from the stream.



Peter Woods

Zoologist Ryan Miller and volunteer Dana Dudra survey for salamanders along a small stream in southwestern Pennsylvania. Two-lined salamanders and northern dusky salamanders were encountered at this site.

These small (1-2 centimeter) young salamanders hatch and grow in the streams and breathe with external gills. As they grow older they lose their gills and are able to breathe directly through their constantly moist skin. All of the salamanders captured were identified by species, had their length measured, and were released back into

their habitats.

Stream salamanders can act as ecological indicators. They are “canaries in coal mines” because they have small home ranges, maintain relatively stable populations, and tend to maintain abundance and ubiquity over time. Other studies have found that increased development, over time, has reduced their abundance. The data collected from this project will provide detailed information about sensitive streamside ecosystems and their inhabitants that can be compared to data collected from future surveys.

### Updating Historical Plant Records

The Pennsylvania Natural Heritage Program maintains a database of Pennsylvania plants, animals, natural communities, and geologic features that are of conservation concern due to their rarity, apparent decline, imminent threat, or lack of information or understanding of their status. Since our beginning in the 1980s, the Heritage Program has collected over 23,000 records.



Scott Schuette

The Cyperus-like sedge (*Carex pseudocyperus*) is one of hundreds plant EOs we are targeting as part of this initiative.

Our data come from a variety of sources, including field surveys by our own staff and partners, as well as many other professional biologists. While recent field surveys contribute to our current data, we also maintain historical records gleaned from museum and herbarium collections, publications, and other sources. Having access to historical data to compare with our current data allows us to look at changes over time across the commonwealth to identify vulnerable areas where populations seem to be declining and prioritize new locations for further investigation and conservation.

As a program, we are always working to improve the quality and currency of our information to facilitate planning, save time in the environmental review process, and help update the (rarity) status of species.



Scott Schuette

Although the location of some old records are inaccurately mapped due to the technologies that were used at the time, the search for the target species may lead to new discoveries such as this previously undocumented vernal pool on public land.

We are continually adding new records to our database, while our oldest records continue to ‘age.’

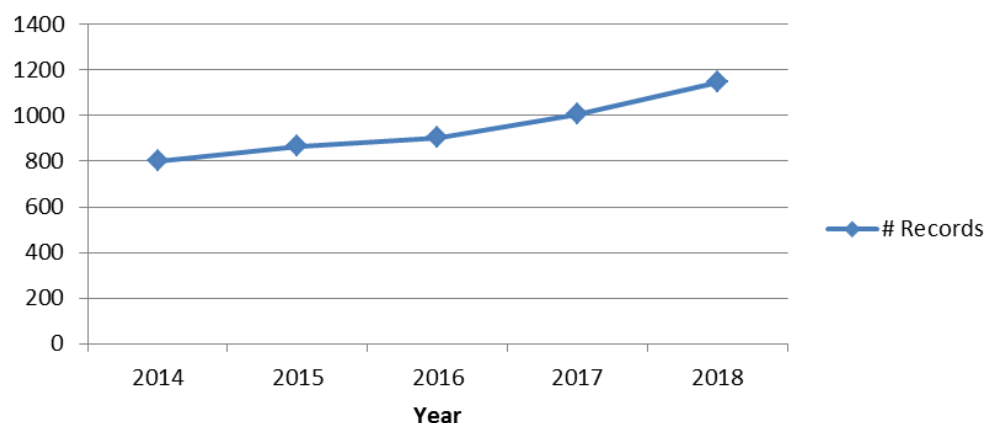
In the past year, we have begun to re-evaluate our historical plant data to determine if the reported species are still present and update our database to reflect our current knowledge about these plants. Currently we consider records over 50 years as historic. As we consider changing this cutoff to 25 years, we will be looking at plant records 25 – 50 years old. We will target as many of these as possible in our current survey work to determine the level of effort needed to accomplish our goal of updating these records in future field seasons. During the early stages of this program-wide effort, we reviewed the plant

records to identify those that have been updated in the field, but not entered into the database. The remaining records were prioritized according to age, global and state rank, and precision of the existing data, giving us a final subset of 400 plant records needing surveys.

This year we considered our approach to updating and essentially piloted some work to better understand the issues that we might face when trying to update hundreds of records every few years. We knew that we had to be strategic and update the most important records in as little time as possible. We are in the middle of our field season and have updated approximately 10% of the records so far and anticipate a much more substantial effort next year.

Many of the earlier records were mapped using older technologies, with the surveyors relying on paper topographic maps and the surrounding features to identify the locations of their records. In revisiting these records, we have found that occasionally the mapped locations are outside of suitable habitat for a particular species and need to spend extra time searching for the correct habitat and then surveying for the plant in that area. This has been a slow, but relatively successful method of relocating some of our oldest plant records. As this effort progresses our success rate will undoubtedly increase as we begin surveying for records that were initially located using GPS and other newer mapping technologies.

**Number of Target Plant Records that will become  
25 - 50 Years Old within the Next 5 Years**



PNHP has set a goal to update records that are 25 – 50 years old. Without review and updates, the total number of older records in our database would continue to increase into the future.

## 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 (2014)	1st Quarter	2nd Quarter	Cumulative Total	Percent of Annual Goal
Biotics Records Updated	300	213	158	371	100%+
New EOs Documented	800	166	170	336	42%
New Records Entered into HGIS	350	72	71	143	41%
Field Surveys Reported	500	4	46	50	10%
New CPPs Developed	400	160	597	757	100%+
NHAs Updated	120	0	73	73	61%
Outreach to Local Government	20	4	4	8	40%

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 Performed** 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.

**Outreach to Local Government** is a measure of our initiative to increase interaction with local government and reflects our commitment to seeing our information used and refined to meet the needs of planning efforts within the counties and municipalities of the commonwealth.