

ARMSTRONG COUNTY NATURAL HERITAGE INVENTORY

April 2010

Prepared for:

Armstrong County Planning Commission

402 Market Street
Kittanning, PA 16201

Prepared by:

Pennsylvania Natural Heritage Program

Western Pennsylvania Conservancy
800 Waterfront Drive
Pittsburgh, Pennsylvania 15222



The Pennsylvania Natural Heritage Program (PNHP) is a partnership between the Western Pennsylvania Conservancy (WPC), the Pennsylvania Department of Conservation and Natural Resources (DCNR), the Pennsylvania Game Commission (PGC), and the Pennsylvania Fish and Boat Commission (PFBC). PNHP is a member of NatureServe, which coordinates natural heritage efforts through an international network of member programs—known as natural heritage programs or conservation data centers—operating in all 50 U.S. states, Canada, Latin America and the Caribbean.

This project was funded through grants supplied by the DCNR Wild Resource Conservation Program

Copies of this report are available in electronic format through the Pennsylvania Natural Heritage Program website, www.naturalheritage.state.pa.us, and through the Armstrong County Planning Commission.



Denise Watts, PNHP

Roaring Run supports a diversity of plant and animal species.

Preface

The Pennsylvania Natural Heritage Program (PNHP) is responsible for collecting, tracking, and interpreting information regarding the Commonwealth's biological diversity. County Natural Heritage Inventories (CNHIs) are an important part of the work of PNHP. Since 1989, PNHP has conducted county inventories as a means to both gather new information about natural resources and to pass this information along to those responsible for making decisions about the resources in the county, including the community at large. This County Natural Heritage Inventory focuses on the best examples of living *ecological resources* in Armstrong County. The county must address historic, cultural, educational, water supply, agricultural and scenic resources through other projects and programs. Although the inventory was conducted using a tested and proven methodology, it is best viewed as a preliminary report on the county's natural heritage. Further investigations could, and likely will, uncover previously unidentified areas of significance. Likewise, in-depth investigations of sites listed in this report could reveal features of further or greater significance than have been documented. We encourage additional inventory work across the county to further the efforts begun with this study. Keep in mind that there will be more places to add to those identified here and that this document can be updated as necessary to accommodate new information.

Consider this inventory as an invitation for the people of Armstrong County to explore and discuss their natural heritage and to learn about and participate in the conservation of the living ecological resources of the county. Ultimately, it will be up to the landowners, residents, and officials of Armstrong County to determine how to use this information. Several potential applications for the information within the County Natural Heritage Inventory for a number of user groups follow:

Planners and Government Staff. Typically, the planning office in a county administers county inventory projects. Often, the inventories are used in conjunction with other resource information (agricultural areas, slope and soil overlays, floodplain maps, etc.) in review for various projects and in comprehensive planning. Natural Heritage Areas (NHAs) may be included under various zoning categories, such as conservation or forest zones, within parks and greenways, and even within agricultural security areas. There are many possibilities for the conservation of NHAs within the context of public amenities, recreational opportunities, and resource management.

County, State and Federal Agencies. In many counties, Natural Heritage Areas lie within or include state or federal lands. Agencies such as the Pennsylvania Game Commission, the Pennsylvania Bureau of Forestry, and the Army Corps of Engineers can use the inventory to understand the extent of the resource. Agencies can also learn the requirements of the individual plant, animal, or community elements, and the general approach that protection could assume. County Conservation Districts may use the inventories to focus attention on resources (high diversity streams or wetlands) and as a reference in encouraging good management practices.

Environmental and Development Consultants. Environmental consultants are called upon to plan for a multitude of development projects including road construction, housing developments, commercial enterprises, and infrastructure expansion. Design of these projects requires that all resources impacted be known and understood. Decisions made with inadequate information can lead to substantial and costly delays. County Natural Heritage Inventories (CNHIs) provide a first look at biological resources, including plants and animals listed as rare, threatened, or endangered in Pennsylvania and in the nation. Consultants can then see potential conflicts long before establishing footprints or developing detailed plans and before applying for permits. This allows projects to be changed early on when flexibility is at a maximum.

Environmental consultants are increasingly called upon to produce resource plans (e.g. River Conservation Plans, Parks and Open Space Plans and Greenway Plans) that must integrate a variety of biological, physical, and social information. CNHIs can help define watershed-level resources and priorities for conservation and are often used as the framework for these plans.

Developers. Working with environmental consultants, developers can consider options for development that add value while protecting key resources. Incorporating greenspace, wetlands, and forest buffers into various kinds of development can attract homeowners and businesses that desire to have natural amenities nearby. Just as parks have traditionally raised property values, so too can natural areas. CNHIs can suggest opportunities where development and conservation can complement one another.

Educators. Curricula in primary, secondary and college level classes often focus on biological science at the chemical or microbiological level. Field sciences do not always receive the attention that they deserve. Natural areas can provide unique opportunities for students to witness, first-hand, the organisms and natural communities that are critical to maintaining biological diversity. Teachers can use CNHIs to show students where and why local and regional diversity occurs, and to aid in curriculum development for environment and ecology academic standards. With proper permission and arrangements through landowners and the Pennsylvania Natural Heritage Program, students can visit Natural Heritage Areas and establish appropriate research or monitoring projects.

Conservation Organizations. Organizations that have missions related to the conservation of biological diversity can turn to the inventory as a source of prioritized places in the county. Such a reference can help guide internal planning and define the essential resources that can be the focus of protection efforts. Land trusts and conservancies throughout Pennsylvania have made use of the inventories to do just this sort of planning and prioritization, and are now engaged in conservation efforts on highly significant sites in individual counties and regions.

Natural Heritage Inventories and Environmental Review

The results presented in this report represent a snapshot in time, highlighting the sensitive natural areas within Armstrong County. The sites in the Armstrong County Natural Heritage Inventory have been identified to help guide wise land use and county planning. The Armstrong County Natural Heritage Inventory is a planning tool, but is not meant to be used as a substitute for environmental review, since information is constantly being updated as natural resources are both destroyed and discovered. Planning Commissions and applicants for building permits should conduct free, online, environmental reviews to inform them of project-specific potential conflicts with sensitive natural resources. Environmental reviews can be conducted by visiting the PNHP website at <http://www.naturalheritage.state.pa.us>. If conflicts are noted during the environmental review process, the applicant is informed of the steps to take to minimize negative effects on sensitive natural resources.

ACKNOWLEDGEMENTS

We would like to acknowledge the many citizens and landowners of the county and surrounding areas who volunteered information, time, and effort to the inventory and granted permission to access land.

We especially thank:

Armstrong County Natural Heritage Inventory Advisory Committee including:

Rich Palilla – Armstrong County Planning Commission
Mike Coonley – Armstrong County Planning Commission
Darin Alviano – Armstrong County Planning Commission
Patricia Kirkpatrick – Armstrong County Commissioner
Rich Fink – Armstrong County Commissioner
James Scahill – Armstrong County Commissioner
Dennis Hawley – Crooked Creek Environmental Learning Center
Dave Beale – Armstrong County Conservation District
Dave Rupert – Armstrong County Conservation District
Pam Meade – Cowanshannock Creek Watershed Association
Ron Steffey – Allegheny Valley Land Trust
Donald Smith – Pennsylvania Game Commission
John Linkes – Roaring Run Watershed Association
Daniel Cappo – Roaring Run Watershed Association
Mark Meleason – Environmental Consultant

We would also like to thank the Pennsylvania Department of Conservation and Natural Resources for providing the funding to make this report possible. A special thank-you goes to the people of Armstrong County for their interest and hospitality, especially Grover Pegg and Terry Laux for sharing their extensive knowledge of the county.

We want to recognize the Pennsylvania Natural Heritage Program and NatureServe for providing the foundation for the work that we perform for these studies. Current and former PNHP staff that contributed to this report include Jeff Wagner, Rocky Gleason, Andrew Strassman, Charlie Eichelberger, Chris Tracey, Pete Woods, Rita Hawrot, Shana Stewart, John Kunsman, Mary Walsh, Ryan Miller, Ephraim Zimmerman, Sally Ray, Beth Meyer, Jake Boyle, Megan McKissick, Steve Grund, Jeremy Deeds, Tony Davis, Kathy Gipe, Jim Hart, Betsy Leppo, Matt Kowalski, Susan Klugman, Erika Schoen, Kierstin Carlson, and Karen Bosco.

Without the support and help from these people and organizations, the inventory would not have seen completion. We encourage comments and questions. The success of the report will be measured by the use it receives and the utility it serves to those making decisions about resources and land use throughout the county. Thank you for your interest.

Denise Watts, Ecologist
Pennsylvania Natural Heritage Program



Denise Watts, PNHP

Grassland birds, such as this Bobolink (*Dolichonyx oryzivorus*) are able to utilize habitat created by reclaimed strip mines.

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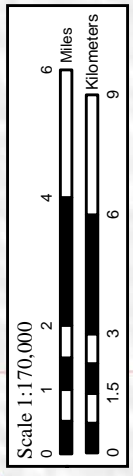
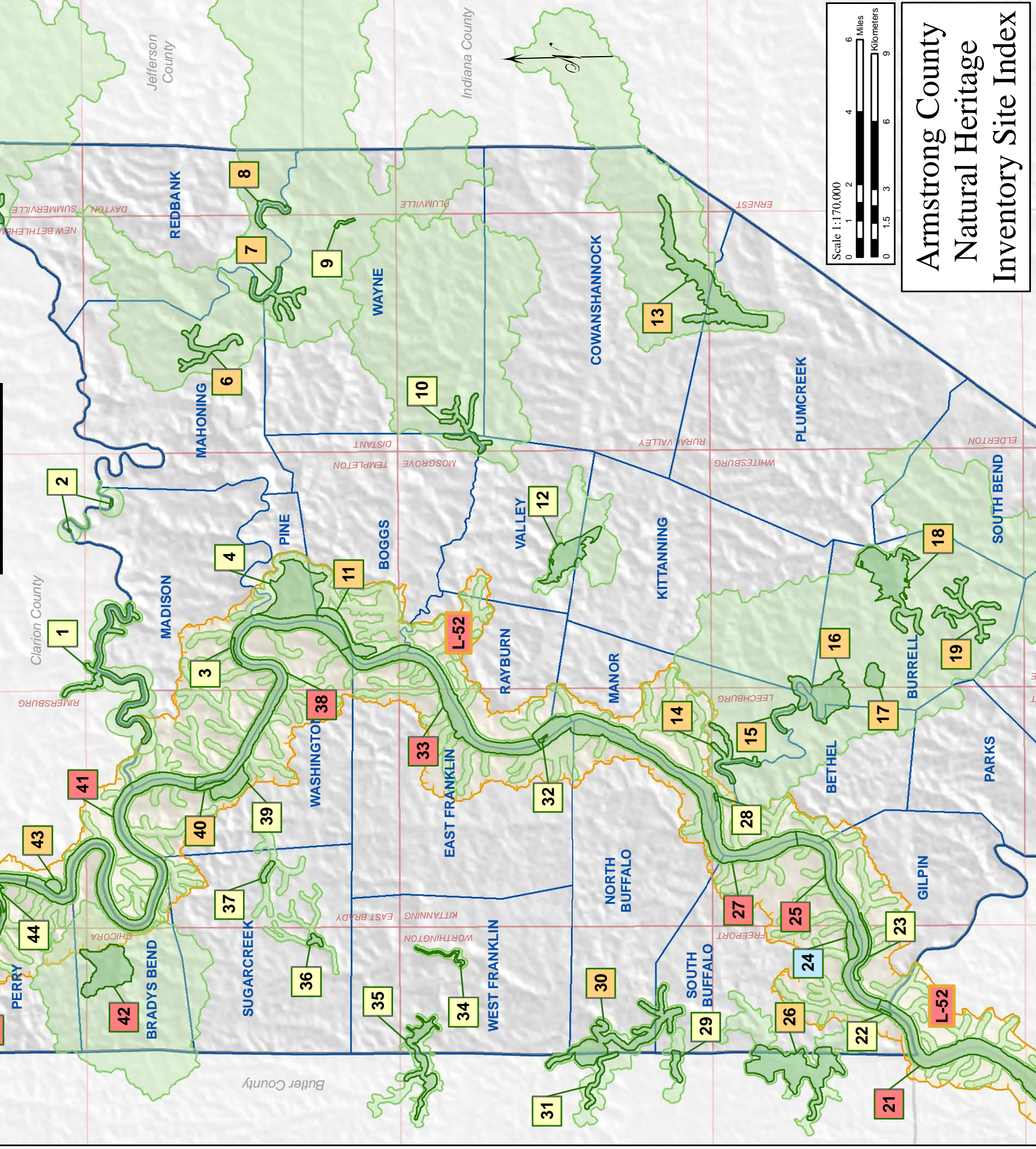
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This reference may be cited as: Pennsylvania Natural Heritage Program. 2010. Armstrong
County Natural Heritage Inventory. Western Pennsylvania
Conservancy. Middletown, PA.

#	Biodiversity Area Name	#	Biodiversity Area Name	#	Biodiversity Area Name	#	Biodiversity Area Name
1	Redbank Creek at Lawsonham	21	Allegheny River Pool #4	35	Buffalo Creek at Nichola	45	Allegheny River shoreline at Upper Hillville
2	Redbank Creek west of St. Charles	22	Allegheny River shoreline at Freeport	36	State Game Lands #259	46	Allegheny River stretch through Parker and Hillville
3	Allegheny River shoreline at Hooks	23	Allegheny River slope at Godfrey	37	Beagle Club Road	47	Allegheny River shoreline at Dutch Hill
4	Templeton Mine	24	Murphy's Bottom	38	Allegheny River Pool #8	48	Bear Creek and North Branch
5	Redbank Creek at Mayport	25	Allegheny River Pool #5	39	Allegheny River Slope at Cosmus	49	Allegheny River shoreline at Parker
6	Mahoning Creek at Putneyville	26	Buffalo Creek Valley	40	Allegheny River shoreline below Lock	50	County Line Ravine
7	Mahoning Creek Dam Outflow	27	Allegheny River Pool #6	41	Allegheny River Pool #9	51	Allegheny River stretch through Emlenton and Foxburg
8	Mahoning Creek Reservoir Shoreline	28	Allegheny River shoreline at Rosston	42	US Steel Mine #2		
9	Glade Run at Dayton	29	Cornplanter Run	43	Allegheny River hillside at Sarah Furnace		
10	South Fork Pine Creek at Oscar	30	Long Run Mine	44	Allegheny River hillside at Hillville		
11	Armstrong Trail South of Templeton	31	Rough Run				
12	Cowanshannock Creek at Stone House	32	Allegheny River Island at Kittanning				
13	Keystone Lake	33	Allegheny River Pool #7				
14	Crooked Creek at Rosford						
15	Crooked Creek Outflow						
16	Crooked Creek Reservoir						
17	Crooked Creek Reservoir Floodplain						
18	Cherry Run at Cochrans Mills						
19	Crooked Creek at Iron Bridge Road						
20	Roaring Run						

#	Biodiversity Area Name	#	Biodiversity Area Name
L-52	Lower Allegheny River		



Armstrong County Natural Heritage Inventory Site Index

Site and LCA Identification # and Significance

- exceptional significance (Red box)
- high significance (Orange box)
- notable significance (Yellow box)
- local significance (Blue box)

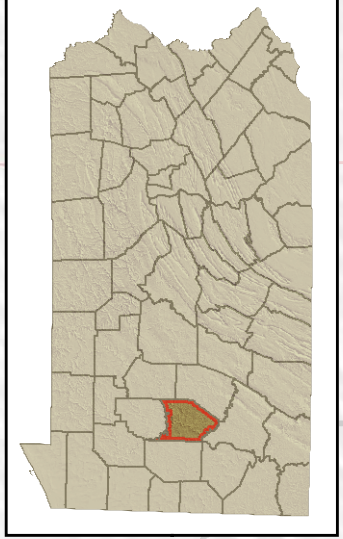
Site and LCA Identification # and Significance

- Landscape Conservation Area (Orange outline)
- Core Habitat (Green outline)
- Supporting Natural Landscape (Light Green outline)

TOWNSHIP BOUNDARIES (Blue line)

USGS Quadrangles (Red line)

PNHP Pennsylvania Natural Heritage Program



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SUPPLEMENTAL EXECUTIVE SUMMARY

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Copies of the complete report are available in electronic format through the Pennsylvania Natural Heritage Program website, www.naturalheritage.state.pa.us, and through the Armstrong County Planning Commission.

Preface

The ability of a community to bring its vision for the future to fruition depends on its capacity to assemble information that will enable it to act effectively and wisely. Since 1989, county natural heritage inventories (CNHIs) have served as a way to both gather and pass along new and existing information to those responsible for land use decisions, as well as to all residents who wish to know more about the natural heritage of their county. The Armstrong County Natural Heritage Inventory focuses on the best examples of living *ecological resources* in Armstrong County. This inventory presents the known outstanding natural features in the county.

The Western Pennsylvania Conservancy (WPC) served as the principal investigator, prepared the report, and created the maps for this study. The Pennsylvania Natural Heritage Program (PNHP), housed within WPC, is responsible for collecting, tracking, and interpreting information regarding the Commonwealth's biological diversity.

Introduction

Our natural environment is key to human health and sustenance. A healthy environment provides clean air and water; supports fish, game, and agriculture; and furnishes renewable sources of raw materials for countless aspects of our livelihoods and economy. One of the first steps in ensuring protection of our natural environment is to recognize environmentally sensitive or ecologically important areas and to provide information regarding their sensitivities to various land use activities.

The Armstrong County Natural Heritage Inventory is designed to identify and map areas that sustain species of concern, exemplary natural communities, and broad expanses of intact natural ecosystems that support important components of Pennsylvania's native species biodiversity. Its purpose is to provide information to help county, state, and municipal governments, conservation organizations, private individuals, and business interests plan development with conservation of an ecologically healthy landscape in mind.

County Overview

Armstrong County's landscapes are an expression of its living organisms (including people) and the physical environment with which they interact. Climate (precipitation, maximum and minimum temperatures, and humidity, etc.), geology (bedrock, soil, and topography, etc.), and chemical factors (fire, acid deposition, etc) play an important role in the development of ecosystems and their physical features (streams, rivers, or mountains). When combined, these factors provide the framework for conducting the County Natural Heritage Inventory, by locating and identifying landscape areas



Rocky Gleason, PNHP

Grasslands along the Allegheny River provide habitat for many species.
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Natural Heritage Inventories and Environmental Review

The results presented in this report represent a snapshot in time; they highlight sensitive natural areas within Armstrong County. The sites in the Armstrong County Natural Heritage Inventory have been identified to help guide wise land use and county planning. The Armstrong County Natural Heritage Inventory is a planning tool, but does not substitute for an environmental review, since information is constantly being updated as natural resources are both destroyed and discovered. Planning Commissions and applicants for building permits can conduct free, online, environmental reviews to inform them of potential project-specific conflicts around sensitive natural resources. A link to the state's free online environmental review tool can be found by visiting the PNHP website, at <http://www.naturalheritage.state.pa.us/>.

If conflicts are noted during the environmental review process, the online service informs applicants of the relevant agencies they need to contact. Additionally, if new information on species of concern becomes available during environmental review, the review may be reconsidered by the jurisdictional agency.

potentially containing exemplary natural communities or species of concern in the county. The following sections provide a brief overview of the geology, soils, vegetation, and waters of Armstrong County.

Armstrong County covers 424,960 acres and lies entirely within the Appalachian Plateau Province. This province is characterized by “high, flat-topped divides separated by steep-sided valleys in which flow deeply entrenched streams” (Willard, 1976). Most topographic relief in this area is defined by streams which have cut valleys over geologic time. The reason that this area does not resemble what one might consider a plateau is due to these valleys created by streams (Van Diver, 1990). This topography results in the Allegheny Plateau being susceptible to flash floods. One of the most notable in Armstrong County, the St. Patrick’s Day flood, occurred in March 1936, causing significant damage. The highest elevations in the county (above 1700 feet) are located in Redbank Township in the northeastern part of the county.

The forests of Armstrong County are dominated by maple, beech, oak, tuliptree, basswood, and hemlock (Braun, 1950). The composition of forests of Armstrong County has undergone significant changes following settlement of the region by Europeans with large scale timber harvesting, human-caused fires and forest clearing. The configuration of the forestland in Armstrong County has also been altered significantly by human development activities with the contiguous forests transformed into relatively small islands, isolated by developments, agriculture, and linear features such as roads and railroads. Approximately 50% (215,160 acres) of Armstrong County is under forest cover (U.S. Geological Survey, 2003), and the mountainous uplands hold the largest remaining contiguous blocks of forest in the county. As is true for most of western Pennsylvania, forests of Armstrong County are largely second-growth.

Twelve major (HUC10) watersheds drain Armstrong County into the Allegheny River basin. Pollutants from abandoned mine drainage, agriculture, urban runoff, and other sources have negatively impacted water quality. No streams in Armstrong County are designated as Exceptional Value Streams.

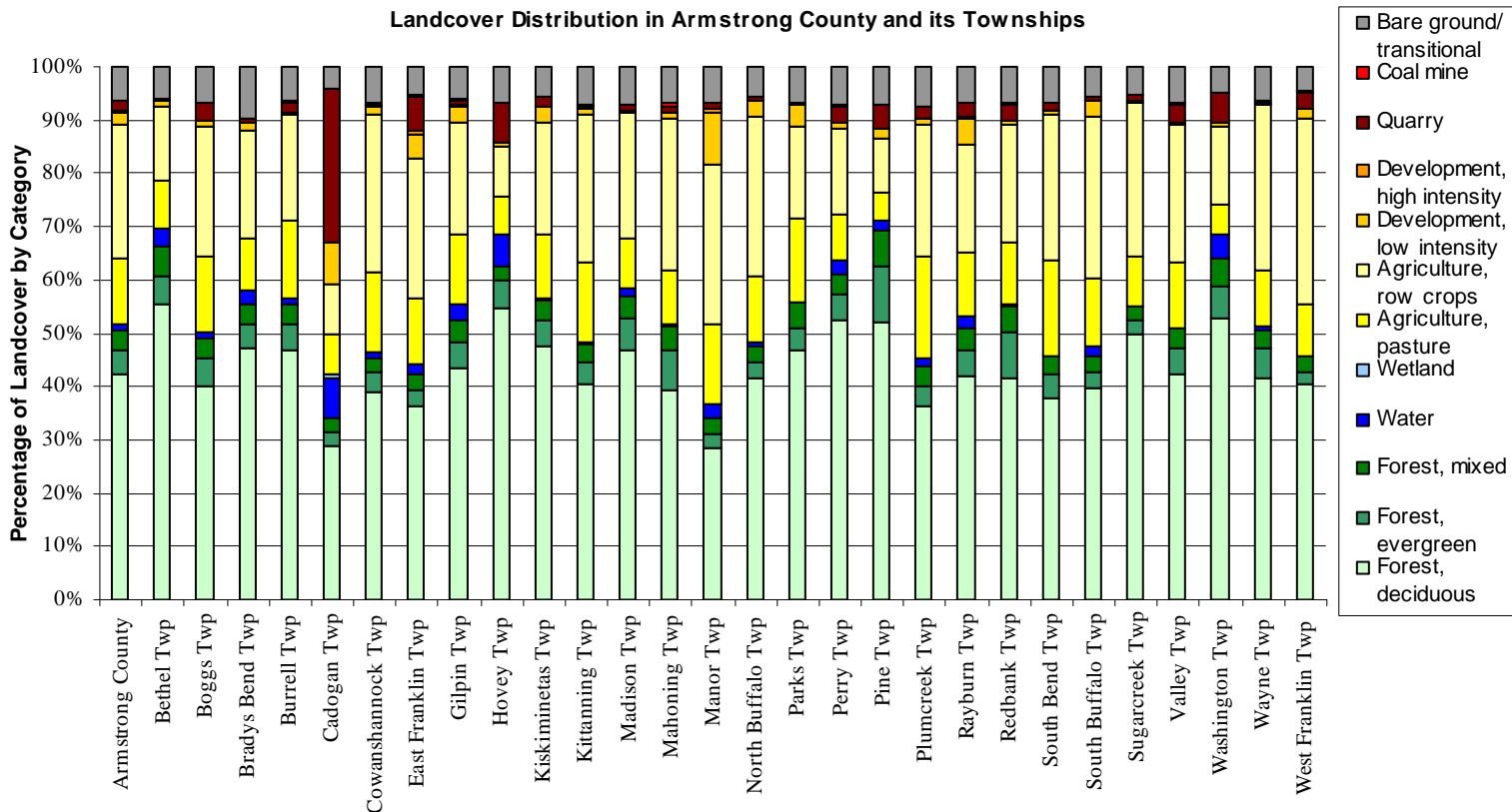


Figure 1. Land cover distribution in Armstrong County’s townships (Homer et al., 2004).

Methods

Natural Heritage Inventories proceed in three stages: 1) site selection based on existing data, map and aerial photo interpretation, recommendations from local experts, and aerial reconnaissance; 2) ground surveys; 3) data analysis and mapping; and 4) conservation recommendations. Site selection for the CNHI was guided by information from a variety of sources including the Pennsylvania Natural Heritage Program database, local citizens, individuals from academic institutions, and state and federal agencies that steward natural resources, and aerial photographs. Areas identified as inventory sites were surveyed in 2007 and 2008 after permission was obtained from landowners. Sites were examined to evaluate the condition and quality of the habitat, and to classify the communities present with boundaries for each site drawn using computer mapping software (geographic information systems - GIS).

Data obtained during the field surveys were combined with existing data and summarized. All sites with species of concern and/or natural communities were selected for inclusion in Biological Diversity Areas (BDAs). Boundaries defining *core* habitat and *supporting* natural landscape for each BDA were delineated based on scientific literature and professional judgment. The Natural Heritage Areas were then assigned a significance rank based on their importance to the biological diversity and ecological integrity of Armstrong County.

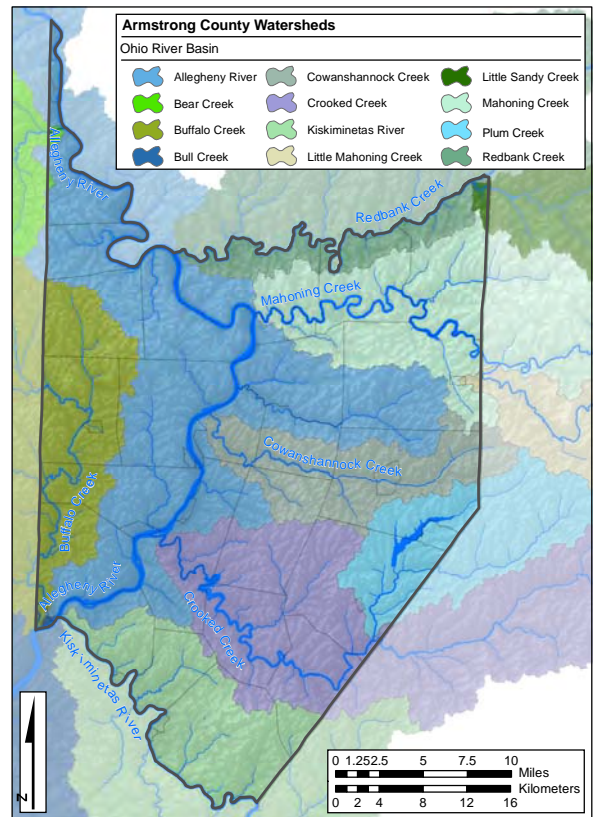


Figure 2: Watersheds of Armstrong County.

Natural Heritage Areas

Biological Diversity Area (BDA):

Definition: An area containing plants or animals of concern at state or federal levels, exemplary natural communities, or exceptional native diversity. BDAs include both the immediate habitat and surrounding lands important in the support of these special elements.

Conservation Planning Application: BDAs are mapped according to their sensitivity to human activities. “Core” areas delineate essential habitat that cannot absorb significant levels of activity without substantial impact to the elements of concern. “Supporting Natural Landscape” is an area that maintains vital ecological processes or secondary habitat; these areas typically can accommodate some degree of low-impact activities.

Landscape Conservation Area (LCA):

Definition: A large contiguous area that is important because of its size, open space, habitats, and/or inclusion of one or more BDAs. Although an LCA includes a variety of land uses, it typically has not been heavily disturbed and thus retains much of its natural character.

Conservation Planning Application: These large regions in relatively natural condition can be viewed as regional assets; they improve quality of life by providing a landscape imbued with a sense of beauty and wilderness, they provide a sustainable economic base, and their high ecological integrity offers unique capacity to support biodiversity and human health. Planning and stewardship efforts can preserve these functions of the landscape by limiting the overall amount of land converted to other uses, thereby minimizing fragmentation of these areas.



Results

Prior to European settlement, forest covered more than 90 percent of Pennsylvania (Goodrich et al., 2003). Today, 62 percent of the state is forested (Goodrich et al., 2003). These forest blocks represent potential contiguous habitat for animals sensitive to all scales of fragmenting features, such as amphibians and interior forest birds. The forest blocks of Armstrong County are presented in Figure 3. According to the National Land Cover Data Set for Pennsylvania (USGS 2003), forest covers approximately half of Armstrong County (Homer et al., 2004). Most of Armstrong County's townships have greater than 50 percent forest cover ranging from a low of 34 percent in Manor Township, to 69 percent in Pine Township. The majority of forestland is dominated by hardwoods, though some mixed and coniferous patches also exist. See Figure 1 for a detailed presentation of Armstrong County land cover. Even though half of Armstrong County is forested, remaining forested areas have been fragmented by roads, residential areas, and other features. Armstrong County has no forest patches larger than 5000 acres in size, and only 15 that are larger than 1000 acres.

Figure 3: Armstrong County forest blocks greater than one acre.

Landscape Conservation Areas (LCAs) represent large areas of the landscape that are of higher ecological integrity than other county areas of similar size. One LCA, representing the Allegheny River and the immediate watersheds, has been identified for Armstrong County. Because of size, ownership of lands within the Allegheny River LCA is divided among many entities: individual, corporate, and public. Almost all of the land encompassed by this LCA is under private ownership, which may present issues in performing large scale management and biodiversity conservation.

- **Development:** A number of options, such as forest stewardship programs, land enhancement programs, and the Sustainable Forestry Initiative, are available to private landowners interested in managing their property for biodiversity conservation, forest health, and forest products.
- **Fragmentation:** Forest fragmentation can be reduced by using existing disturbed areas for new projects and infrastructure. When planning development, avoid division of LCAs.
- **Deer Impacts:** Landowners interesting in bringing deer numbers back into balance may want to consider the PGCs Deer Management Assistance Program (DMAP). More information about this program can be found at <http://www.dcnr.state.pa.us/Forestry/dmap/index.aspx>.
- **Invasive Species:** Control methods for invasive species can take many forms, but chemical control should only be performed by trained and licensed individuals. Specific control methods are detailed by many organizations such as: <http://www.invasive.org/eastern/>.

The preparation of this report has resulted in the identification of 51 Biological Diversity Areas (BDAs) and one Landscape Conservation Areas (LCAs). Most species of concern identified at each BDA mentioned in this report are described by name. The Pennsylvania Natural Heritage Program believes that making this information freely available is generally in the best interest of the conservation of the species, and in the interest of the public; however, some species of concern are the targets of illegal harvest (collection pressure) or intentional disruption, while others are even sensitive to disturbance by well-intentioned visitors. Naming such a species in this report could negatively impact the conservation of the species. The decision to withhold a name is made on a species by species basis by jurisdictional agencies, and if the species is unable to be named it is referred to in this report as a *sensitive species of concern*. The Department of Conservation and Natural Resources (DCNR) is

Table 1: County Natural Heritage Area (BDA/LCA) Significance Ranks

Rank	Description
Exceptional	Sites in this category contain one or more species or community of concern, and are in a relatively undisturbed condition. Sites of this significance merit quick, strong, and complete protection.
High	These sites contain species or communities of concern, and rate as areas with high potential for protecting ecological resources in the county. Sites of high significance merit strong protection.
Notable	Sites in this category contain species or communities of concern that are of lower rank, smaller size, or extent than exceptional or high ranked areas, or are compromised in quality by land use activity or disturbance. These sites merit protection within the context of their quality and degree of disturbance.
Local	Sites that have great potential for protecting biodiversity in the county but where no species or communities of concern have been found. Often recognized because of their size, undisturbed character, or proximity to areas of known significance, these sites invite further survey and investigation and could be revealed as high or exceptional sites. Sites of local significance merit countywide protection.

responsible for all state listed plants. The Pennsylvania Fish and Boat Commission (PFBC) has regulatory authority over reptiles, amphibians, and aquatic animals. The Pennsylvania Game Commission (PGC) has jurisdiction over all state listed birds and mammals. At the request of these agencies, the names of a small set of sensitive species have been removed from this report.

Some of the highest priority areas for biodiversity conservation in Armstrong County are several of the Exceptionally ranked BDAs. They include the entire length of the Allegheny River in Armstrong County, Long Run Mine, and US Steel Mine #2.

Allegheny River BDAs - The Allegheny River and associated shoreline habitat supports a variety of aquatic species, including state and federally listed species. Surveys along the Allegheny River identified 25 species of concern. Almost all of these species share one habitat need: clean, clear, cool, fast flowing water. The shoreline of the Allegheny River, especially in the free-flowing section, also provides a unique habitat for species and natural communities of concern.

Threats and Stresses - Activities that degrade water quality are the primary threat to these sites. This includes land use choices that increase sediment load and change flow regime such as poorly planned forestry on steep slopes, agriculture with inadequate riparian buffers, and development and mining projects without proper runoff control. Invasive species are also a threat to aquatic and terrestrial species.

Conservation Recommendations - Repairing and maintaining the forested riparian buffer along the Allegheny River and its tributaries is critical to preserving water quality that supports these species. Mitigation of abandoned mine drainage impacts will be a critical component of maintaining water quality at these sites over the long run. Development within the 100-year floodplain should be prohibited to preserve the flow characteristics of the river, maintain the forested riparian buffer, and prevent the loss of property and life during flooding events.

Long Run Mine and US Steel Mine #2 BDAs - Both of these sites provide vital habitat for several sensitive species of concern, not named at the request of the agency overseeing their protection. Along with the core habitat, forested stream corridors are needed for foraging habitat.

Threats and Stresses - Disturbance to this site is the biggest threat to the species that reside here. Deforestation and pesticide use would limit the availability for foraging habitat and food.

Conservation Recommendations - This site should be closed to deter access. Maintain riparian buffers where they already exist and plant native trees and shrubs where they do not. Limit the use of broadcast pesticides in these areas.

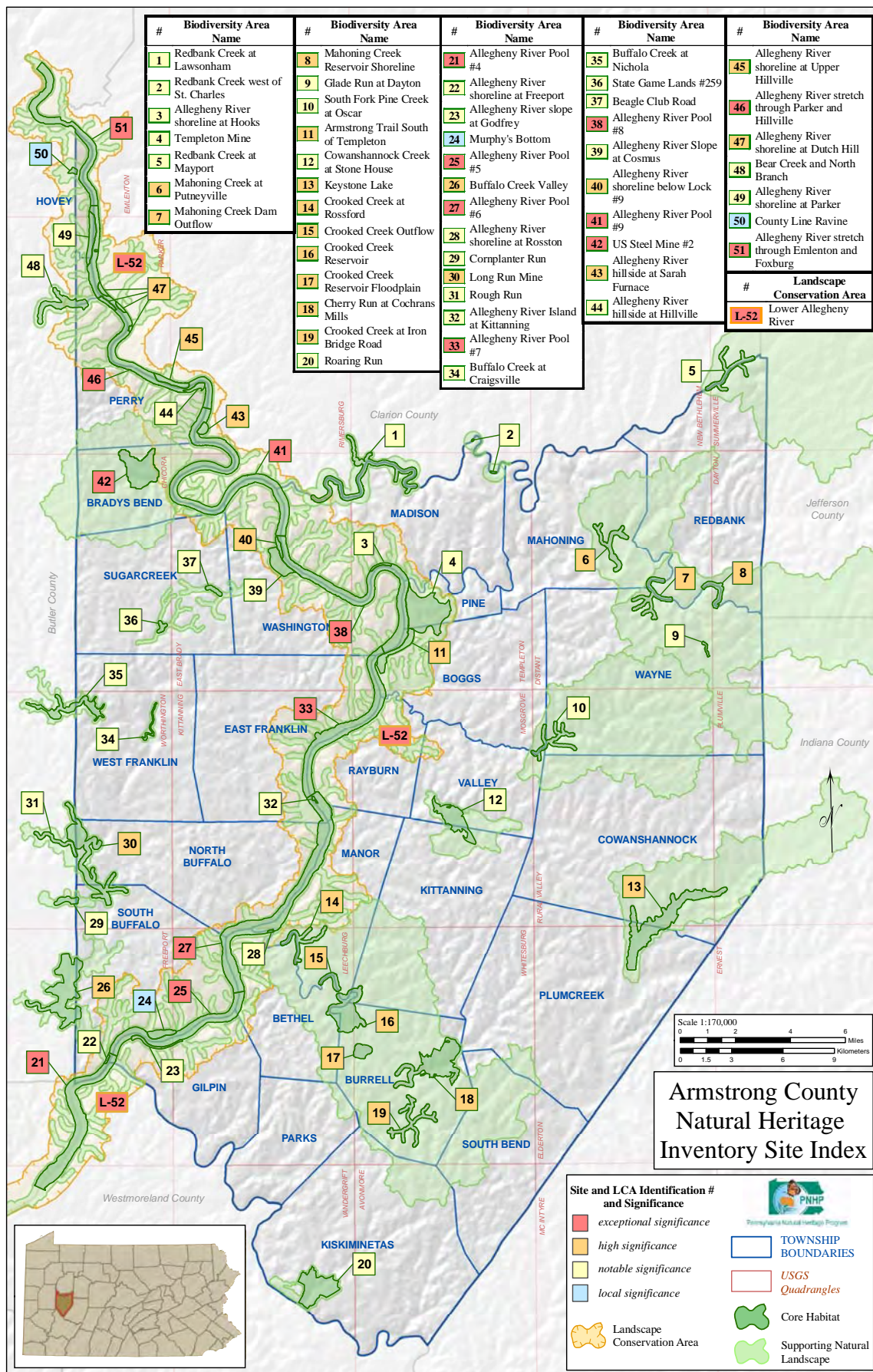


Figure 4: Map of the BDAs and LCAs of Armstrong County, Pennsylvania.

Number of rare, threatened and endangered species by municipality

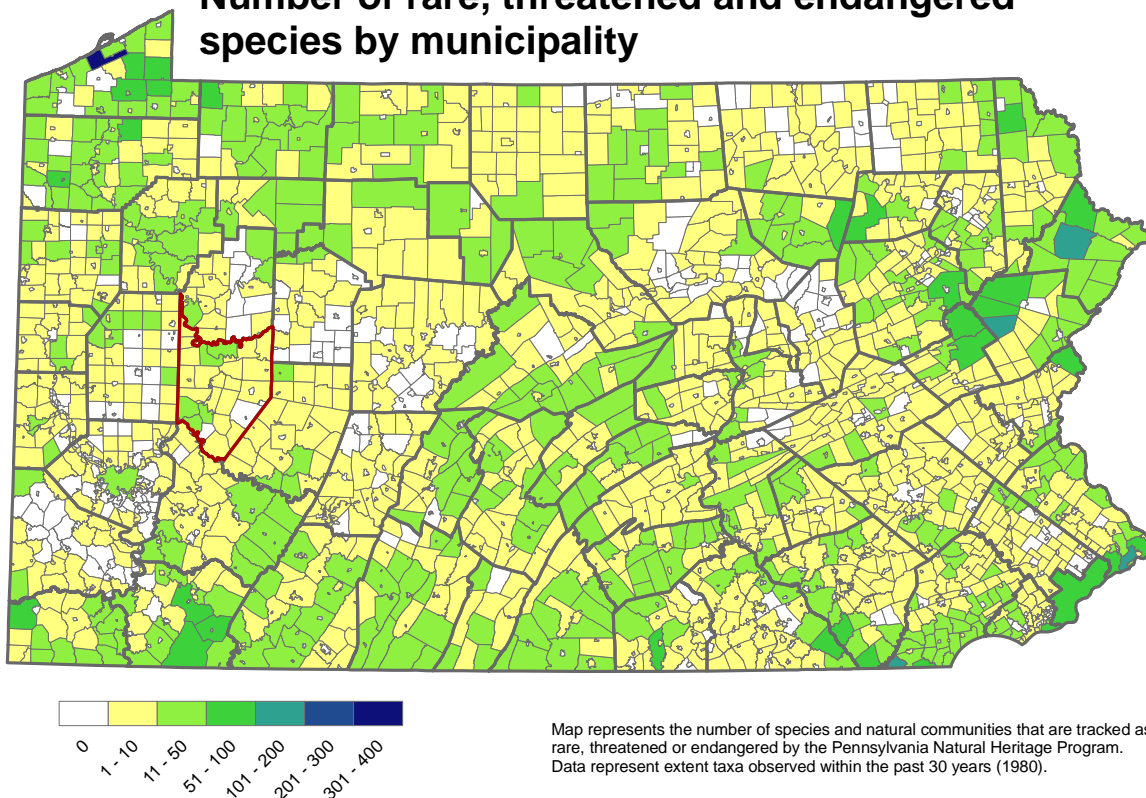


Figure 5: Distribution of endangered, threatened, and rare species by municipality. The darker the color, the more occurrences in a given municipality.

Discussion and General Recommendations

For this County Natural Heritage Inventory Report, the ecologists, zoologists, and botanists of the Pennsylvania Natural Heritage Program and partner organizations have explored the natural resources of Armstrong County. This work represents an organized effort to inventory the biodiversity present throughout the county. Some of the earliest survey work in this area was completed by botanists and other naturalists during the early part of the 19th century. These early explorers provided records that, whenever possible, have been updated in this report. In the surveys conducted for this inventory, researchers have not only identified rare, threatened, and endangered plants and animals, but also many common species, for which no formal records previously existed in museum and agency records.

Armstrong County's contribution to biodiversity in Pennsylvania

Armstrong County has 117 extant occurrences of endangered, threatened, and rare species, ranking 37 out of the Pennsylvania's 67 counties. Figure 5 shows the distribution of these species by municipality across the Commonwealth.

Although Armstrong County is not in the top percentile of biodiversity of Pennsylvania's counties, it contains a number of species of concern and communities that are significant to northwestern Pennsylvania. The county also supports several populations of globally vulnerable aquatic species.

Table 4. State conservation status of species of concern in Armstrong County.

State Status	# of occurrences
PA Endangered (PE)	29
PA Threatened (PT)	28
PA Rare (PR)	4
Watch List (W)	2
Tentatively Undetermined (TU)	2
Unknown Status	27

A breakdown of the officially rare, threatened, and endangered species found in Armstrong County is presented in Table 4.

Future Research in Armstrong County Natural Resources

Though many hours of field research over multiple years were undertaken for this inventory, this is not a comprehensive, final word on Armstrong County's natural resources. The data in this report represents a snapshot of Armstrong County's natural resources at the time the report was written. Any further work in the county will likely yield additional records of species of concern, exemplary natural communities, and sites of local significance while future land use changes may result in the extirpation of species documented in this report. This is partially due to the fact that natural systems are dynamic and constantly changing due to natural and human induced pressures. Also, sites were surveyed only when landowner permission was granted and access to some exemplary sites was restricted. Additional survey efforts are encouraged for these reasons. The PNHP sees this report as a working document – a guide for conservation of known rare, threatened, and endangered species, their habitats, and other resources of conservation importance in Armstrong County. Since this inventory represents known conditions at the time the report was written, it is recommended that future inventory work in the county focus on the following areas and organisms:

- Municipalities without reports of species of concern such as Parks Township, which has species of concern in surrounding townships, but for which none are reported.
- Vernal pools, breeding habitat for species like amphibians. There is a short window during which these pools retain water and are easily recognized and it may not occur every year. Additional surveys for these pools in the spring are warranted.

The Pennsylvania Natural Heritage Program can provide the county with formal updates to this report at regular intervals (typically five years). A series of biodiversity and conservation planning services are available through the PNHP to supplement the results of this inventory. Please contact the Pennsylvania Natural Heritage Program for additional information regarding these services (<http://www.naturalheritage.state.pa.us/>).

A Final Note on Rare, Threatened, and Endangered Species

The rare, threatened, and endangered species highlighted in this report are some of the several hundred species in Pennsylvania that are threatened with extirpation or extinction. If a species becomes extinct, or is lost from a portion of its native range, the ecosystem in which it lived will lose an important element. Often the repercussions of extinctions are not known until the species is gone, and the species is generally irreplaceable in the system. This may be because the habitat has been altered to the point that the biological system no longer functions properly. Species of concern are often indicative of fragile ecosystems that easily degrade; their protection may help monitor the quality of Armstrong County's ecosystems. A great example of a species of concern acting as an indicator of environmental quality is the bald eagle - a species which indicated the deleterious effects of the pesticide DDT in our environment. Banning DDT led to the eventual recovery of the species.

Another reason for protecting species of concern is for their value as unique genetic resources. Every species may provide significant information for future use in genetic research and medical practices. Beyond these practical considerations, perhaps the most compelling reasons for stewardship are the aesthetic and ethical considerations; there is beauty and recreational value inherent in healthy, species-rich ecosystems.

The protection of rare, threatened, and endangered species depends on several factors, including increasing scientific knowledge and concerted efforts from government agencies, conservation organizations, educational institutions, private organizations, and individuals. The following section outlines general recommendations to begin to protect the species outlined in this report.

The Armstrong County Natural Heritage Inventory and Land Use Planning

A good portion of Armstrong County, along with much of northwestern Pennsylvania, remains forested today. However, few municipalities have land use and land development regulations such as zoning (PA's e-library website lists zoning ordinances by municipality; <http://www.elibrary.state.pa.us/elibpub.asp>). The Armstrong

County Comprehensive Plan (Armstrong County Planning Commission, 2005) outlines several goals that can be achieved in conjunction with the Armstrong County Natural Heritage Inventory. The Biological Diversity Areas identified in the county can be used to guide development away from environmentally sensitive areas and cluster development and industry in a way that leaves the most open space for the conservation of biodiversity and use by the county's citizens and tourists.

Natural resource preservation is compatible with many of the county's priorities. These include preserving visual aesthetics, rural landscapes, community pride, and historical heritage in Armstrong County. Well thought out growth and development can strengthen the county while preserving the cultural and natural heritage valued its citizens. This county inventory document will inform the decision makers of opportunities where Armstrong County's growth can occur with this balance in mind. Armstrong County has strong individual community identities, thus regional planning efforts are encouraged to try to connect the decisions at the local scale to a sustainable county-wide plan.

General Recommendations

The following are general recommendations for the protection of the Natural Heritage Areas within Armstrong County. Approaches to protecting a natural heritage area are wide ranging, and many factors should be considered when prioritizing protection of these sites. Prioritization works best when incorporated into a long-term, county- or region-wide plan. Opportunities may arise that do not conform to a plan, and the decision on how to manage or protect a natural heritage area may be made on a site by site basis. Personnel in the Pennsylvania Natural Heritage Program and staff from state natural resource agencies are available to discuss more specific options for preservation. The following are approaches and recommendations for natural heritage area conservation.



Denise Watts, PNHP

Trilliums and other spring wildflowers are commonly found growing on rich slopes in Armstrong County

Consider conservation initiatives for natural heritage areas on private land.

Conservation easements protect land while leaving it in private ownership. An easement is a legal agreement that permanently limits a property's use in order to protect its conservation values. It can be tailored to individual needs, and will not be extinguished with new ownership. Tax incentives may apply to conservation easements donated for conservation purposes.

Lease and management agreements also allow the landowner to retain ownership and temporarily ensure protection of land. There are no tax incentives for these conservation methods. A lease can only protect land temporarily. This can ensure that its conservation values will be maintained help a landowner decide if they want to pursue more permanent protection methods. Management agreements may require landowners and land trusts to work together to develop a plan for managing resources with the land trust offering technical expertise.

Land acquisition by a conservation or governmental organization can be at fair market value, or as a bargain sale where a purchase price is set below fair market value with tax benefits that reduce or eliminate the

disparity. Sites that can serve more than one purpose such as wildlife habitat, flood and sediment management, water supply, recreation, and environmental education are ideal. Private lands adjacent to public lands should be examined when a natural heritage area is present, there is a need of additional land to protect the site, and there is a willing landowner.

Unrestricted donations of land are typically welcomed by land trusts. The donation of land entitles the donor to a charitable deduction for the fair market value, as well as a release from the responsibility of managing the land. Land is donated because of its conservation value will be permanently protected. Land that is not of high biological significance may be sold, with or without restrictions, and the funds used to further the land trust's conservation mission. The Pennsylvania Land Trust Association website offers a search engine to find land trusts (<http://conserveland.org>). The Western Pennsylvania Conservancy is a regional land trust that can be contacted at 412-288-2777 (<http://www.paconserve.org>).

Local zoning ordinances are one of the best regulatory tools available to municipalities. A large and expanding variety of zoning ordinances exist to fit every need and condition. Often, zoning can prevent municipal or county-wide development activities which are undesirable to the majority of the residents, and allow planning to meet the goals of the county residents.

Prepare management plans that address species of concern and natural communities.

Many of the natural heritage areas that are protected are in need of management plans to ensure the continued existence of the associated natural elements. Site-specific recommendations should be added to existing management plans when possible or new plans should be prepared. Recommendations may include: removal of invasive plant species; allowing the area to mature and recover from previous disturbance; creating natural areas within existing parks; limiting land-use practices such as mineral extraction, residential or industrial development, and agriculture; or implementing sustainable forestry practices. For example, some species simply require continued availability of a natural community while others may need specific management practices such as canopy thinning, mowing, or burning to maintain their habitat requirements.

Existing parks and conservation lands provide important habitat for plants and animals at both the county level and on a regional scale. For example, these lands may serve as nesting or wintering areas for birds or as stopover areas during migration. Management plans for these areas should emphasize a reduction in activities that fragment habitat. Adjoining landowners should be educated about the importance of their land as it relates to habitat value, especially for species of concern, and agreements should be worked out to minimize activities that may threaten native flora and fauna.

Protect bodies of water.

Protection of reservoirs, wetlands, rivers, and creeks is vital for ensuring the health of human communities and natural ecosystems. Multiple qualities can be preserved by protecting aquatic habitats which harbor biodiversity, supply drinking water, and provide recreational resources. Many species of concern, unique natural communities, and locally significant habitats occur in wetlands and water bodies; these are directly dependent on natural hydrological patterns and water quality for their continued existence. Ecosystem processes also provide clean water supplies for human communities and do so at significant cost savings in comparison to water treatment facilities; therefore, protection of high quality watersheds is the primary way to ensure the viability of natural habitats and water quality. Scrutinize development proposals for their impact on entire watersheds, not just the immediate project area. Cooperative efforts in land use planning among municipal, county, state, and federal agencies, conservation organizations, developers, and residents can lessen the impact of development on watersheds.

Provide for buffers around natural heritage areas.

Development plans should provide for natural buffers between disturbances and natural heritage areas. Disturbances may include construction of roads and utility corridors, non-sustainable timber harvesting, and fragmentation of large pieces of natural land. Storm runoff from these activities results in the transport of nutrients and sediments into aquatic ecosystems (Trombulak and Frissell, 2000). County and township officials

can encourage landowners to maintain vegetated buffer zones within riparian areas. Vegetated buffers (preferably of Pennsylvania native plant species) help reduce erosion and sedimentation while shading and cooling the water. Preserving water quality in rivers and streams is important to fish, as some species, such as brook trout and some darters, are highly sensitive to poor water quality. Sensitive fish are readily lost from streams when water quality starts to decline. Creating or maintaining a vegetated buffer benefits aquatic animal life, provides habitat for other wildlife species, and creates a diversity of habitats along the creek or stream. Staff at the Pennsylvania Natural Heritage Program (PNHP) or natural resources agencies can provide further guidance regarding buffer considerations appropriate for various kinds of natural resources.

Waterways that include natural heritage areas, identified in the results section of this report are important, sensitive areas that should be protected. For example, conserving natural areas around watersheds that supply municipal water provides an additional protective buffer around the water supply, maintains habitat for wildlife, and may also provide low impact recreation opportunities.

Reduce fragmentation of the landscape surrounding natural heritage areas.

Encourage development in sites that have already seen past disturbances, especially mined and brownfield sites. Additionally, care must be taken to ensure that protected natural areas do not become islands of green surrounded by a sea of development. In these situations, the site is isolated, greatly reducing its value to wildlife. Careful planning can maintain natural environments along with the plants and animals associated with them. A balance between growth and the conservation of natural and scenic resources can be achieved by guiding development away from the most environmentally sensitive areas.

The reclamation of disturbed areas for commercial and industrial projects, known as brownfield redevelopment, presents one way to encourage economic growth while allowing ecologically sensitive areas to remain undisturbed. For example, reclaimed surface mines can be used for development when feasible. Cluster development can be used to allow the same amount of development on much less land, and leave the remaining land intact for wildlife, native plants, and outdoor recreation. By compressing development into already disturbed areas with existing infrastructure (villages, roads, existing rights-of-way), large pieces of the natural landscape can be maintained intact. If possible, networks or corridors of woodlands or greenspace should be preserved, linking natural areas to each other. Preserving greenspace around development can provide ample recreational opportunities and increase nearby property value.

Encourage grassroots organizations.

County and municipal governments can do much of the work necessary to plan for the protection and management of natural areas identified in this report. However, grassroots organizations are needed to assist with obtaining funding, identifying landowners who wish to protect their land, and providing information about easements, land acquisition, and management and stewardship of protected sites. County and municipal governments should engage local land trusts and conservation organizations in activities occurring in their project areas. Increasingly, local watershed organizations and land trusts are taking proactive steps to accomplish conservation at the local level. When activities threaten to impact ecological features, the responsible agency



Denise Watts, PNHP

Glade Run

should be contacted. If no agency exists, private groups such as conservancies, land trusts, and watershed associations should be sought for ecological consultation and specific protection recommendations.

Manage for invasive species.

Invasive species are species that lack natural biological control and they threaten native diversity by dominating habitat used by native species, and by disrupting the integrity of ecosystems. Management for invasive species depends upon the extent of their establishment and the species being managed. Small infestations may be easily controlled or eliminated, but larger, well established populations present challenges. The earlier exotic invasive species are identified and controlled, the greater the likelihood of eradication with the smallest expenditure of resources. Below is a list sources for invasive species information.



Denise Watts, PNHP

The forested slopes of the Allegheny River provide habitat for many species and also improve water quality by filtering pollutants from runoff.

The *Mid-Atlantic Exotic Plant Pest Council* (MA-EPPC) is a non-profit organization (501c3) dedicated to addressing the problem of invasive exotic plants and their threat to the Mid-Atlantic region's economy, environment, and human health by providing leadership, representing the mid-Atlantic region at meetings and conferences, monitoring and disseminating research on invasives, facilitating information development and exchange, coordinating the on the ground removal of invasives, and providing access to training on species identification and management. Information is available at <http://www.ma-eppc.org>.

Several excellent websites exist to provide information about invasive exotic species. The following sources provide individual species profiles for the most troublesome invaders, with information such as the species' country of origin, ecological impact, geographic distribution, and control techniques.

- The Nature Conservancy's Weeds on the Web at <http://tncinvasives.ucdavis.edu/>
- The Virginia Natural Heritage Program's invasive plant page at http://www.dcr.virginia.gov/natural_heritage/invspinfo.shtml
- The Missouri Department of Conservation's Missouri Vegetation Management Manual at <http://mdc.mo.gov/nathis/exotic/vegman/>
- U.S. Department of the Interior, National Park Service invasive species monitoring resources at: <http://www.nature.nps.gov/biology/invasivespecies/> or <http://science.nature.nps.gov/im/monitor/invasives/>
- Invasive species information clearinghouse listing numerous other resources on a variety of related topics: <http://www.invasivespeciesinfo.gov/>

Incorporation of natural heritage inventory information into planning efforts

One of the main intentions of this document is to initiate the integration of conservation information into the planning process, a scenario that balances the need for jobs while also protecting the county's rural qualities including agricultural, recreational, and natural-habitat landuse. Through internal planning, decision making related to land use development, and participation in regional planning initiatives, counties, and municipalities could profoundly shape the land and landscapes of Pennsylvania. Natural Heritage Areas can be readily included in comprehensive plans, greenway and open space plans, parks and recreation plans, and regional planning initiatives. DCNR-funded greenway and open space plans, Heritage Region Plans, and River Conservation Plans

are good examples of planning efforts that reach beyond county boundaries. PNHP staff are available to help incorporate county inventory data and recommendations into county and municipal plans.

Evaluating proposed activity within Natural Heritage Areas

A very important part of encouraging conservation of the Natural Heritage Areas identified within the Armstrong County Natural Heritage Inventory is the careful review of proposed land use changes or development activities that overlap with Natural Heritage Areas.

Always contact the Armstrong County Department of Development before beginning any development project. The County Planning Commission should be aware of all activities that may occur within Natural Heritage Areas in the county so that they may interact with other relevant organizations or agencies to better understand the implications of proposed activities. They can also provide guidance to the landowners, developers, or project managers as to possible conflicts and courses of action.

The Armstrong County Natural Heritage Inventory is *not* intended as a substitute for environmental review, since information is constantly being updated as natural resources are both destroyed and discovered. Applicants for building permits and Planning Commissions should conduct free, online, environmental reviews to inform them of project-specific potential conflicts with sensitive natural resources. Environmental reviews can be conducted by visiting the Commonwealth's Environmental Review website, at <http://www.gis.dcnr.state.pa.us/hgis-er/>.



Denise Watts, PNHP

A waterfall along a tributary to Roaring Run

If conflicts are noted during the environmental review process, the applicant is informed of the steps to take to minimize negative effects on the county's sensitive natural resources. If additional information on species of concern becomes available during environmental review, the review may be reconsidered by the jurisdictional agency. In general, the responsibility for reviewing natural resources is partitioned among agencies in the following manner:

- *U.S. Fish and Wildlife Service* for all federally listed plants or animals.
- *Pennsylvania Game Commission* for all state and federally listed terrestrial vertebrate animals.
- *Pennsylvania Fish and Boat Commission* for all state and federally listed reptiles, amphibians, aquatic vertebrate and invertebrate animals.
- *Pennsylvania Bureau of Forestry* for all state and federally listed plants.
- *Pennsylvania Department of Conservation and Natural Resources (DCNR)* for all natural communities, terrestrial invertebrates, and species not falling under the above jurisdiction.

If a ground survey is necessary to determine whether significant natural resources are present in the area of the project, agency biologist will recommend a survey be conducted. PNHP, through the Western Pennsylvania Conservancy, or other knowledgeable contractors can be retained for this purpose. Early consideration of natural resource impacts is recommended to allow sufficient time for thorough evaluation. Given that some

species are only observable or identifiable during certain phases of their life cycle (i.e., the flowering season of a plant or the flight period of a butterfly), a survey may need to be scheduled for a particular time of year.

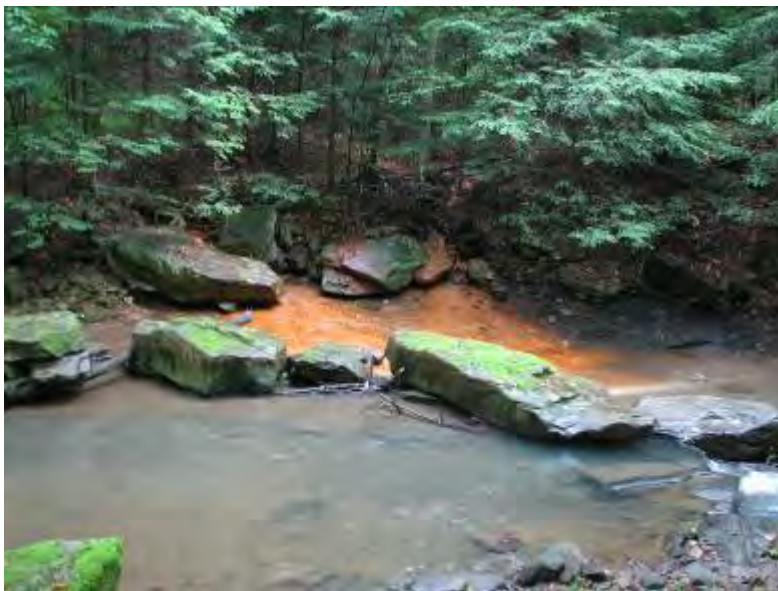
If the decision is made to move forward with a project in a sensitive area, PNHP can work with municipal officials and project personnel during the design process to develop strategies for minimizing the project's ecological impact while meeting the project's objectives. The resource agencies in the state may do likewise. However, early consultation and planning as detailed above can provide for a more efficient and better integrated permit review, and a better understanding among the parties involved as to the scope of any needed project modifications.

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Submitting Additional Data

As the state repository for biodiversity data, the Pennsylvania Natural Heritage Program appreciates all potential data regarding rare, threatened, and endangered species and potential survey sites. Species we currently track are listed on our website at: <http://www.naturalheritage.state.pa.us/>



Denise Waits, PNHP

Dissolved-mineral-rich drainage entering the waterways of Armstrong County lower the quality of the habitat for many species.

Table 1. Natural Heritage Areas categorized by significance.

Site	Municipality(ies)	Description	Page
<i>Exceptional Significance</i>			
Allegheny River Pool #4	Gilpin, and South Buffalo Townships; Freeport Borough	This section of the Allegheny River contains eight aquatic species of concern.	96, 179
Allegheny River Pool #5	Bethel, Gilpin, and South Buffalo Townships	Aquatic habitat for fifteen aquatic species of concern.	52, 96, 179
Allegheny River Pool #6	Bethel, Cadogan, East Franklin, Manor, North Buffalo, and South Buffalo Townships; Ford City Kittanning, and Manorville Boroughs	Stretch of the dammed portion of the Allegheny River that contains ten aquatic species of concern.	52, 80, 90, 130, 136, 179
Allegheny River Pool #7	Boggs, East Franklin, Rayburn, and Washington Townships; Kittanning Borough	Aquatic habitat that contains nine aquatic species of concern.	60, 90, 164, 199
Allegheny River Pool #8	Boggs, Madison, Pine, and Washington Townships	Stretch of the dammed portion of the Allegheny River that contains fourteen aquatic species of concern.	60, 118, 154, 199
Allegheny River Pool #9	Bradys Bend, Madison, Perry, Sugar creek, and Washington Townships	This section of the Allegheny River contains habitat for nine aquatic species of concern.	68, 118, 146, 188, 199
Allegheny River stretch through Parker and Hillville	Hovey and Perry Townships; Parker City	Stretch of the free-flowing section of the Allegheny River that contains twelve species of concern.	102, 146
Allegheny River stretch through Emlenton and Foxburg	Hovey Township	Aquatic habitat that supports seven species of concern	102
Long Run Mine	North Buffalo and West Franklin Townships	Abandoned mine that supports two species of concern.	136, 214
US Steel Mine #2	Brady's Bend Township	Abandoned mine that provides habitat for four species of concern.	68
<i>High Significance</i>			
Allegheny River shoreline at Dutch Hill	Perry Township	Shoreline grassland habitat that supports a species and natural community of concern.	146
Allegheny River shoreline at Upper Hillville	Perry Township	The cobbly shoreline of the Allegheny River provides habitat for a plant species and natural community of concern.	146
Allegheny River shoreline below Lock and Dam #9	Washington Township	Two species and a natural community of concern are located along this stretch of the Allegheny River.	199

Site	Municipality(ies)	Description	Page
Allegheny River slope at Godfrey	Gilpin Township	The forested slopes along the Allegheny River provide habitat for a species of concern.	96
Armstrong Trail south of Templeton	Boggs Township	Two plant, one butterfly, and one moth species of concern were located in the rich forest and along the Allegheny River shoreline at this location.	60
Buffalo Creek Valley	South Buffalo Township	Buffalo Creek and its steep slopes provide habitat for four species of concern.	179
Cherry Run at Cochrans Mills	Burrell Township	Tributary of Crooked Creek and surrounding forest that support two species of concern.	74
Crooked Creek at Iron Bridge Road	Burrell Township	Aquatic and riparian habitat for a species of concern.	74
Crooked Creek at Rossford	Bethel and Manor Townships	Aquatic and riparian habitat for a species of concern.	52, 130
Crooked Creek Outflow	Bethel and Manor Townships	Aquatic habitat below the dam on Crooked Creek that supports three species of concern.	52, 130
Crooked Creek Reservoir Floodplain	Burrell Township	Wetland adjacent to Crooked Creek Reservoir that supports two species of concern.	74
Keystone Lake	Cowanshannock and Plum Creek Townships; Atwood Borough	Reservoir that provides habitat for four species of concern.	86, 160
Mahoning Creek at Putneyville	Mahoning Township	The vegetation along the banks of Mahoning Creek provide habitat for a species of concern.	126
Mahoning Creek Dam Outflow	Mahoning, Redbank, and Wayne Townships	Aquatic and riparian habitat for a species of concern.	126, 170, 208
Redbank Creek at Lawsonham	Madison Township	Aquatic and riparian habitat for three species and one natural community of concern.	118
Upper Buffalo Creek	West Franklin Township	Buffalo Creek supports four dragonfly, one fish, and one sensitive species of concern.	214
<i>Notable Significance</i>			
Allegheny River Island at Kittanning	East Franklin and Rayburn Townships and Kittanning Borough	A species of concern is located on the island and shoreline.	90, 164
Allegheny River shoreline at Freeport	South Buffalo Township	The cobbly shoreline provides habitat for a small population of a species of concern.	179

Site	Municipality(ies)	Description	Page
Allegheny River shoreline at Hooks	Madison Township	A plant species of concern grows along the rail trail.	118
Allegheny River shoreline at Parker	Hovey Township and Parker City	Islands in the Allegheny River that support a population of a plant species of concern.	102
Allegheny River shoreline at Rosston	Bethel Township	A small population of a plant species of concern grows along the banks of the Allegheny River.	52
Allegheny River slope at Cosmus	Washington Township	The steep slopes along the Allegheny River provide breeding habitat for a species of concern.	200
Allegheny River hillside at Hillville	Perry Township	The steep hillside along the Allegheny River provides nesting habitat for a species of concern.	146
Beagle Club Road	Sugarcreek Township	Roadside occurrence of a plant species of concern.	188
Bear Creek and North Creek Valleys	Perry Township and Parker City	This small forested stream supports a dragonfly species of concern.	146
Buffalo Creek at Craigsville	West Franklin Township	Steep rocky outcrops provide habitat for a plant species of concern.	214
Cornplanter Run	South Buffalo Township	Habitat for a fish species of concern.	180
Cowanshannock Creek at Stonehouse	Kittanning and Valley Townships	Forested slopes along Cowanshannock Creek provide habitat for a butterfly species of concern.	112, 194
Crooked Creek Reservoir	Bethel, Burrell, and Manor Townships	Upland habitat around Crooked Creek Reservoir that provides habitat for two species of concern.	52, 74, 130
Glade Run at Dayton	Wayne Township	Two plant species of concern were located along the forested and graminoid habitats of Glade Run.	208
Mahoning Creek Reservoir Shoreline	Redbank and Wayne Townships	Slopes of Mahoning Creek Reservoir provide habitat for two species of concern.	170, 208
Redbank Creek at Mayport	Redbank Township	The shoreline of the Redbank Creek and its tributaries support a species of concern.	170
Redbank Creek west of St. Charles	Madison Township	Riparian habitat for one natural community of concern.	118
Roaring Run	Kiskiminetas Township	The rich woods along Roaring Run provide habitat for a butterfly species of concern.	108

Rough Run	North Buffalo Township	This small stream provides habitat for a species of concern.	136
Site	Municipality(ies)	Description	Page
South Fork Pine Creek at Oscar	Boggs, Valley, and Wayne Townships	Aquatic and riparian habitat for a species of concern.	60, 194, 208
State Game Lands #259	Sugarcreek Township	Floodplain forest supports a plant species of concern.	188
Templeton Mine	Boggs and Pine Townships	An abandoned mine provides habitat for species of concern.	60, 154
<i>Local Significance</i>			
County Line Ravine	Hovey Township	Intact forest block along a small tributary to the Allegheny River	102
Murphy's Bottom	South Buffalo Township	Wetlands formerly used in sand and gravel mining, plus the associated floodplain.	180

INTRODUCTION

Our natural environment is key to human health and sustenance. A healthy environment provides clean air and water; supports fish, game and agriculture; and furnishes renewable sources of materials for countless aspects of our livelihoods and economy. In addition to these direct services, a clean and healthy environment plays a central role in our quality of life, whether through its aesthetic value—found in forested ridges, mountain streams and encounters with wildlife— or in the opportunities it provides for exploration, recreation and education. Finally, a healthy natural environment supports economic growth by adding to the region’s attractiveness as a location for new business enterprises, and provides the basis for the recreation, tourism, and forestry industries, all of which have the potential for long-term sustainability. Fully functional ecosystems are the key indicators of a healthy environment and working to maintain ecosystems is essential to the long-term sustainability of our economies.

An ecosystem is “the complex of interconnected living organisms inhabiting a particular area or unit of space, together with their environment and all their interrelationships and relationships with the environment” (Ostroumov 2002). All the parts of an ecosystem are interconnected—the survival of any species or the continuation of a given natural process depends upon the system as a whole, and in turn, these species and processes contribute to maintaining the system. An important consideration in assessing ecosystem health is the concept of biodiversity. Biodiversity can be defined as the full variety of life that occurs in a given place, and is measured at several scales: genetic diversity, species, natural communities, and landscapes.

Genetic diversity refers to the variation in genetic makeup between individuals and populations of organisms and provides a species with the ability to adapt successfully to environmental changes. In order to conserve genetic diversity, it is important to maintain natural patterns of gene flow through the migration of individual plants and animals across the landscape and the dispersal of pollen and seeds among populations (Thorne et al. 1996). Individual species play a role in sustaining ecosystem processes such as nutrient cycling, decomposition, and plant productivity; declines in native species diversity alter these processes (Naem et al. 1999).

A natural community is “an interactive assemblage of plant and animal species that share a common environment and occur together repeatedly on the landscape, such as a red maple swamp” (Massachusetts Executive Office of Environmental Affairs 2001). Each type of natural community represents habitat for a different assemblage of species, hence identification and stewardship of the full range of native community types is needed to meet the challenge of conserving habitat for all species.

From an ecological perspective, a landscape is “a large area of land that includes a mosaic of natural community types and a variety of habitats for many species” (Massachusetts Executive Office of Environmental Affairs 2001). At this scale, it is important to consider whether communities and habitats are isolated or connected by corridors of natural landscape traversable by wildlife, and whether the size of a natural landscape is sufficient to support viable populations and ecosystems. Because the living and non-living elements of an ecosystem are interconnected and interdependent, it is essential to conserve native biodiversity at all these scales, from genes through landscapes, if ecosystems are to continue functioning.

Pennsylvania’s natural heritage is rich in biodiversity and the state includes many examples of high quality natural communities and large expanses of natural landscapes. Over 20,000 species are known to occur in the state, and the extensive tracts of forest in the northern and central parts of the state represent a large portion of the remaining areas of suitable habitat in the mid-Atlantic region for many forest-dependent species of birds and mammals. Unfortunately, biodiversity and ecosystem health are seriously threatened in many parts of the state by pollution and habitat loss. Of the 3500 species of animals and vascular plants that have been documented in the state, more than one in ten are imperiled; 156 have been lost entirely since European settlement and 351 are threatened or endangered (PA 21st Century

Environment Commission 1998). Many of these species are imperiled because available habitat has been reduced and/or degraded.

Fifty-six percent of Pennsylvania's wetlands have been lost or substantially degraded by filling, draining, or conversion to ponds (Dahl 1990). According to the Pennsylvania Department of Environmental Protection (DEP), sixty percent of those Pennsylvania lakes that have thus far been assessed for biological health are listed as impaired. Of 83,000 miles of stream in Pennsylvania, almost 70,000 miles has been assessed for water quality. From this, nearly 11,000 miles have been designated as impaired due to abandoned mine discharges, acid precipitation, and agricultural and urban runoff (PA DEP 2004). The species that depend on these habitats are correspondingly under threat: 58 percent of threatened or endangered plant species are wetland or aquatic species; 13 percent of Pennsylvania's 200 native fish species have been lost, while an additional 23 percent are imperiled. Among freshwater mussels—one of the most globally imperiled groups of organisms—18 of Pennsylvania's 67 native species are extirpated (locally extinct) and another 22 are imperiled (Goodrich et al. 2003).

Prior to European settlement, over ninety percent of Pennsylvania's land area was forested. Today, sixty percent of the state is still forested, but much of this forest is fragmented by roads, utility rights-of-way, agriculture, and development. Only 42 percent is interior forest habitat, meaning that some of the species that depend upon interior forest habitat are in decline (Goodrich et al. 2003). In addition to habitat fragmentation, forest pests, acid precipitation (which causes nutrient leaching and stunted growth), overbrowsing by deer, and invasive species also threaten forest ecosystem health.

The Pennsylvania Natural Heritage Program (PNHP) assesses the conservation status of species of vascular plants, vertebrates, and a few of the invertebrate species native to Pennsylvania. While Pennsylvania hosts a diversity of other life forms such as mosses, fungi, bacteria, and protists, too little is known of these species to assess their conservation status at this time. Even without information about all of these species, it is possible to protect at least some rare species by conserving rare natural communities. Species tend to occur in specific habitats or natural communities, and by conserving examples of all natural community types we will also conserve many of the associated species, whether or not we even know what those species are. Thus the natural community approach is a "coarse filter" for biodiversity protection, but PNHP uses the "fine filter" of individual species identification for those species for which it is feasible. The goals of this report are to identify areas important in sustaining biodiversity at the species, natural community, and landscape levels and to provide that information to more fully inform land use decisions. County Natural Heritage Inventories (CNHIs) identify areas in the state that support Pennsylvania's rare, threatened, or endangered species as well as natural communities that are considered to be rare in the state or exceptional examples of the more common community types. The areas that support these features are identified as Biological Diversity Areas (BDAs). On a broader scale, these inventories recognize landscape-level features termed Landscape Conservation Areas (LCAs). LCAs identify areas of relatively intact natural landscape, such as large areas of forest unbroken by roads or other fragmenting features; areas which function as a corridor connecting patches of natural landscape; high quality watersheds; or regions in which a high number of other biodiversity features are concentrated.

A description of each area's natural features and recommendations for maintaining their viability are provided for each BDA and LCA. In an effort to provide information focused on planning for biodiversity conservation, this report also includes species and natural community fact sheets, references and links to information on invasive exotic species and information from other conservation planning efforts such as the Pennsylvania Audubon's Important Bird Area project. Together, with other land use information, this report can help guide the planning and land management necessary to maintain the ecosystems on which our natural heritage depends.

COUNTY OVERVIEW

Armstrong County is located in western Pennsylvania. It is bordered by Butler County to the west, Clarion County to the north, Jefferson and Indiana Counties to the east, and Westmoreland County to the south. The county has a total area of 667 mi² (1,721 km²) making it the thirty-fourth largest county in Pennsylvania.

It is composed of 28 townships and 16 boroughs and one city. The 2000 census noted 72,392 people spread out across 29,005 households and 20,535 families (U.S. Census Bureau 2007). Population density is approximately 111 people per square mile (43 people/km²). The population of Armstrong County has decreased by 1086 people (-1.5%) between 1990-2000.

Armstrong County was created in 1800. Today the borough of Kittanning is the county's largest population center, with much of the rest of the population scattered in small villages and rural dwellings. Currently, primary economic activities include mining, agriculture, light industry, and tourism.

The existing land use patterns within the county are influenced and shaped by the region's natural features. Almost half of the land throughout the county is forested, with open areas, including agricultural use (including pasture and row crops) and strip mines, making up much of the rest of the land use in the county (~37%). The vast majority of the land in the county is under private ownership. Only 1.3% of Armstrong County is managed by the state and other organizations as conservation land (Table 2).

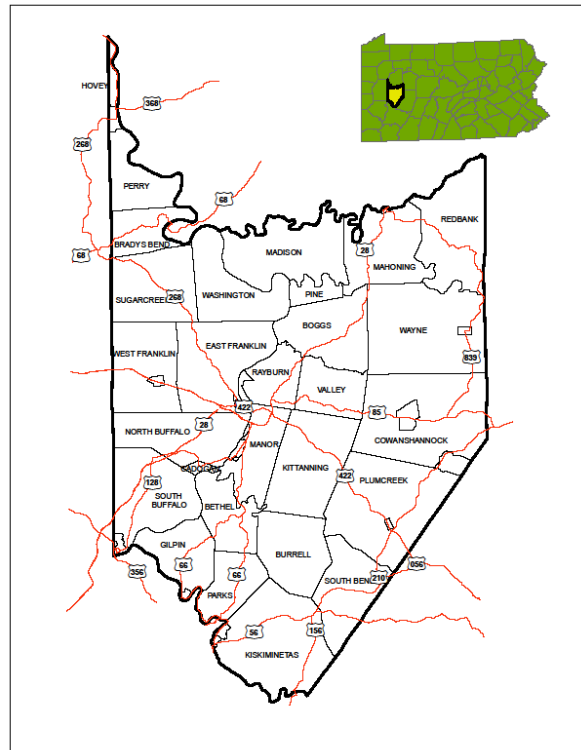


Figure 1. Township and boroughs of Armstrong County. Major roads are shown on this map as well.

Ownership	Area (acres)	% area
Public land	8255	1.9%
Other conservation land	1802	0.4%
Private / unknown ownership	415833	97.7%
Total	425890	

Table 2. Ownership breakdown of land within Armstrong County as of 2007. Figures are approximate and based upon best available data.

OVERVIEW OF THE NATURAL FEATURES OF ARMSTRONG COUNTY

The natural landscape is best described as a series of ecosystems—groups of interacting living organisms and the physical environment that they inhabit. Climate, topography, geology, and soils play an important role in the development of ecosystems (forests, fields, and wetlands) and physical features (streams, rivers and mountains) that occur across the landscape. Disturbances, both natural and human induced, have been influential in forming and altering many of Armstrong County’s ecosystems, causing local extinction of some species and the introduction of others. These combined factors provide the framework for conducting a County Natural Heritage Inventory which locates and identifies exemplary natural communities and species of concern in the county. The following sections provide a brief overview of the geology, soils, surface water, and vegetation of Armstrong County.

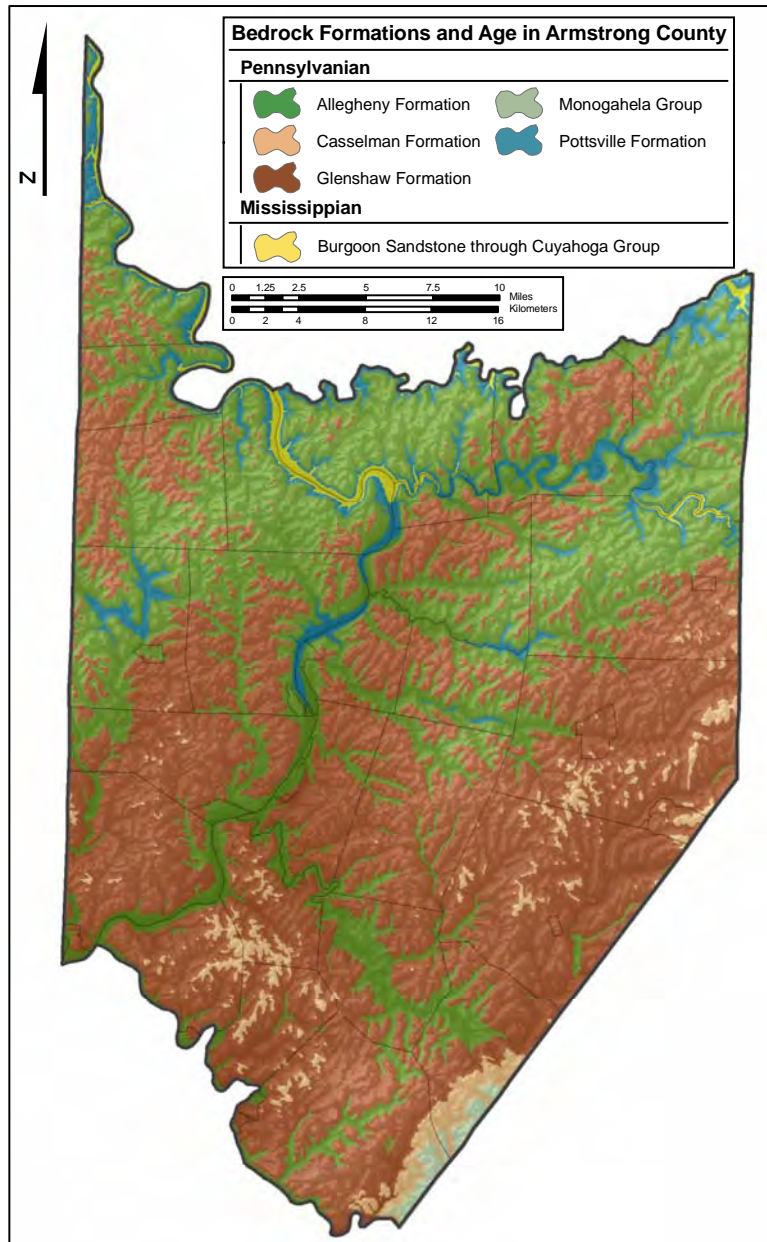


Figure 2. Bedrock Geology of Armstrong County. Much of the county is underlain by Pennsylvanian Age shale, sandstone, and limestone.

Physiography and Geology

Armstrong County lies entirely within the Pittsburgh Low Plateau Section of the Appalachian Plateau Province. This physiographic province covers most of western Pennsylvania and represents a region of similar geologic structure and climate that shares a geomorphic history. The Appalachian Plateau Province is characterized by horizontal layers of rock cut by many stream valleys. Armstrong County’s bedrock is composed of shale, sandstone, and limestone bedrock, with underlying coal deposits.

Armstrong County is primarily underlain by bedrock from the Pennsylvanian periods, with smaller amounts from the Mississippian period (Figure 2,). The oldest rocks in the county are found in the Mississippian age formation found in some places along the Allegheny River, Mahoning Creek, and Redbank Creek.

A region’s topography and climate, along with bedrock type, significantly influence soil development, hydrology, and land use patterns. Both physiography and geology are important to the distribution of plant communities, which, in turn influence animal distribution. Because of the differences in climate, soils, and moisture regimes, certain plant communities would be expected to occur within some physiographic provinces and not others.

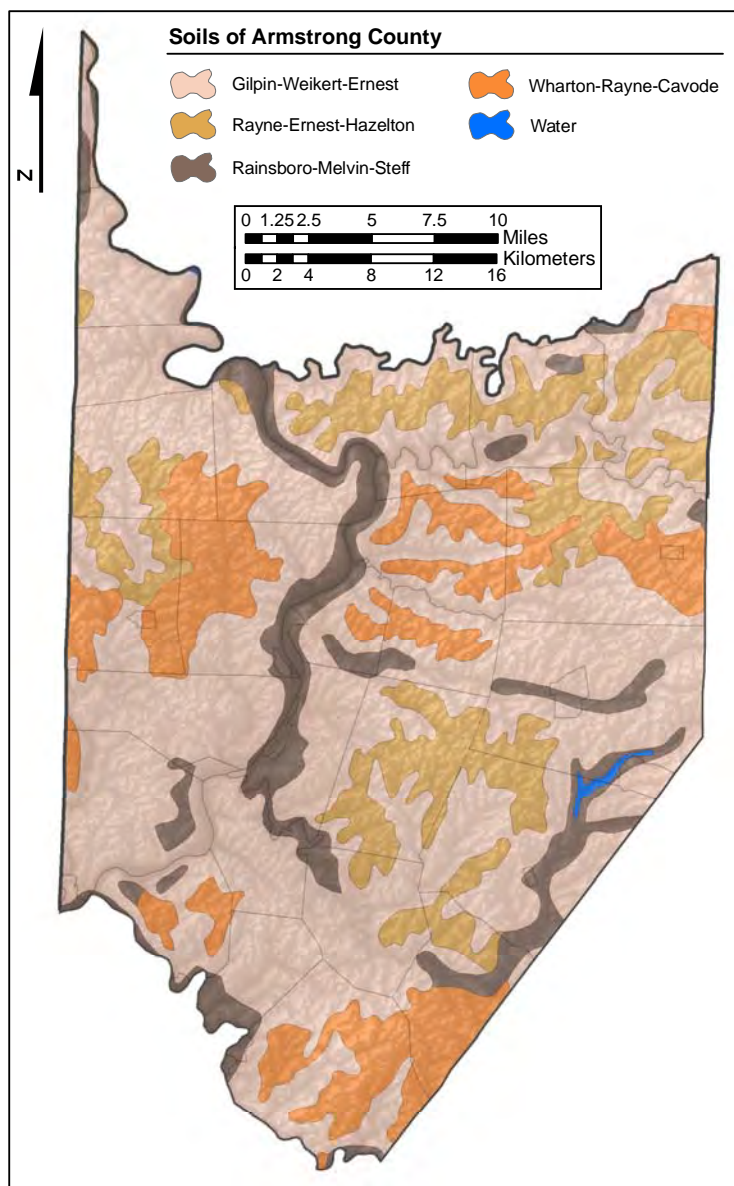


Figure 3. Generalized soil associations of Armstrong County.

Soils

Soil is the mineral or organic material on the surface of the earth that provides the substrate for the growth of plants. A soil association is a grouping of soils based on similarities in climatic or physiographic factors and soil parent materials (Canadian Soil Information System 2003). It includes a number of soil types, usually one or two major soils, and a minor soil. The soils of Armstrong County have been described in the Soil Survey of Armstrong County, Pennsylvania (USDA 1977). The four soil associations recognized within the county are named and mapped in Figure 3.

The Rayne-Ernest-Hazleton association is composed of sandstone and shale. The Gilpin-Weikert-Ernest and Wharton-Rayne-Cavode associations are composed of shale, sandstone, and siltstone. The Rainsboro-Melvin-Steff association is alluvial soil found along floodplains and terraces.

Table 3. Soil associations described for Armstrong County, adapted from The Soil Survey of Armstrong County (USDA 1977).

Soil Association	Description	Percentage of Area in County	Land Use
Rayne-Ernest-Hazleton	Gently sloping to steep, deep, well drained and moderately well drained soils on ridge tops and hillsides; formed in material weathered from sandstone and shale	19	crops and pasture including building sites with some areas in woodland and wildlife habitat
Rainsboro-Melvin-Steff	Nearly level to sloping, deep, very poorly drained to well drained soils formed in alluvial material on flood plains and terraces	9	urban development is fairly extensive with crops, pasture and hay land in remaining areas
Gilpin-Weikert-Ernest	Gently sloping to very steep, shallow to deep, well drained and moderately well drained soils on ridges and hills, formed in material weathered from shale siltstone, and sandstone	51	extensive steeper areas are wooded other areas are mainly crops and pasture
Wharton-Rayne-Cavode	Nearly level to moderately steep, deep, well drained to somewhat poorly drained soils on ridges, benches, and hillsides; formed in material weathered from clay shale and siltstone	21	mainly used for crops, pasture and hay land with some of the steep areas remaining wooded

Vegetation

The interaction of geology and climate produces the pattern of vegetation expressed on the landscape. Vegetation provides several critical functions in the landscape including the regulation of biogeochemical cycles (water, carbon, and nitrogen), soil formation, and wildlife habitat. The classification of vegetation communities typically revolves around the dominant species, habitat, and their growth form. Discussion of vegetation communities in this report is divided between terrestrial forested communities and wetland communities. Boundaries between community types in the field are generally less distinct.

The landscapes and waterways of Armstrong County have undergone considerable change over the course of human settlement, most notably from mining, agriculture, and logging. During the timber boom in the early twentieth century, much of the forest in the county underwent general clear-cutting and subsequent widespread fires. Mining began with deep mine excavation and transitioned to mostly surface mining operations as mining technology developed. Coal mining has been widespread in the county, along with some limestone mining. Agriculture has been extensive in certain parts of the county, resulting in an environmental transformation of a large proportion of the land. Throughout the county, the condition of ecological resources today closely reflects the history of human land use.

Forest Communities

Armstrong County lies within the Mixed Mesophytic Forest Region as described by Braun (1950). Prior to European settlement, the forests were dominated by a variety of species, including beech (*Fagus grandifolia*), tuliptree (*Liriodendron tulipifera*), basswood (*Tilia americana*), sugar maple (*Acer saccharum*), chestnut (*Castanea dentata*), oaks (*Quercus* sp.), and hemlock (*Tsuga canadensis*). Since there are so many species in this forest type, composition can vary greatly in each location. Chestnut trees have been lost in this area due to the chestnut blight fungus, introduced into the United States in the early 1900's, which decimated chestnuts throughout all of eastern North America. Currently chestnut tree are only seen as small sprouts, which succumb to the fungus before reaching maturity. Hemlock wooly adelgid is another invasive pest, which threatens hemlock populations and the species that they support.

Natural communities have redeveloped across large swaths of the landscape previously used for logging and agriculture. Few large forested areas remain, but those that do help to maintain water quality in streams and provide habitat for native species of plants and animals. The condition of forest communities varies across the county. While some areas have regenerated into a broad spectrum of natural forest communities, many areas remain fragmented by roads, artificial clearings, and utility rights-of-way. Additionally, over-browsing by deer is affecting biological diversity and forest regeneration in many regions of the county.

Steep ravines hold the largest contiguous blocks of forest in the county, since they are difficult to convert to other uses. Like other areas of Pennsylvania, these forests are composed largely of second and third growth stands of timber. The understory is often dominated by shrubs from the heath family—blueberries, huckleberries (*Vaccinium* spp.), rhododendron (*Rhododendron maximum*), and mountain laurel (*Kalmia latifolia*).

Connectivity between habitat patches and maintenance of natural corridors that connect forests, wetlands, and waterways is of critical importance for many species. For example, many amphibians and dragonflies use an aquatic or wetland habitat in one phase of their life, then migrate to an upland, forested habitat for their adult life. Several programs are available so that forest landowners can better manage their forestlands. The Pennsylvania Forest Stewardship Program, a voluntary program that provides information, education, and technical assistance, is one such program. See Appendix V (pg. 242) for more details on this program.

Wetland Communities

Within the matrix of forest, unique communities, such as forested seepage wetlands, headwaters shrub swamps, and vernal pools, occur in conjunction with specific topographic or geologic conditions. Although these communities occupy a comparatively small portion of the natural landscape, they are of particular value to the county's biodiversity because of the species they support. Groups of specialist species that would otherwise not be present in the county—such as amphibians that breed only in vernal ponds, or plant species that live only in acidic wetlands—inhabit these communities. One-half of Pennsylvania's wetlands have been lost or substantially degraded. Wetland and aquatic species that depend on these habitats are correspondingly declining.

Wetlands provide essential habitat for many plant and animal species, as well as valuable ecosystem services such as water filtration, groundwater recharge and flood control. Wetlands are transitional lands between terrestrial and aquatic systems. They are communities dominated by water for some part of the growing season throughout each year. Saturation by water determines the soil development, which in turn influences the type of plants and animals using that habitat. Wetlands differ regionally based on topography, geology, climate, hydrology, vegetation, and human influences (Stewart 2001). Typical plants found in wetlands include sedges, grasses, ferns, shrubs, and some trees. The ecological character of a wetland is heavily influenced by local soil type, disturbance history, bedrock composition, and hydrologic regime. Types of wetlands range from open marshes that are continuously flooded, to forested seeps where groundwater saturates the surface only when heavy precipitation raises the water table.

In Armstrong County, many of the wetlands are associated with streams and include floodplain forests, forested swamps, shrub swamps, and graminoid marshes. Wetlands resulting from excavations and impoundments are also present in the local landscape but were not included in this study because they typically do not host the rich and distinctive assemblage of native species that natural wetlands do.

Floodplain forests occur along rivers and streams in low-lying areas. These locations are periodically inundated by floodwaters resulting from spring runoff and intense storm events. Floodplain forest communities can receive severe disturbances from floodwaters including erosion, scouring by ice and debris and the deposition of considerable quantities of sediment. Only species with adaptations or tolerance for these kinds of conditions can survive here.

Graminoid marshes are wetlands dominated by plants such as cattails (*Typha latifolia*), sedges (*Carex* spp.), and grasses. These wetlands may be found in association with streams or in areas with ground water seepages. Graminoid marshes in the county are frequently formed as successional communities following the creation of beaver dams or other impoundments or can be found along the edges of reservoirs. These wetlands are frequently rich in species diversity and provide important breeding habitat for numerous amphibians, reptiles, invertebrates, and birds.

Vernal pools, also known as seasonal/ephemeral or fluctuating ponds, are wetlands that fill annually from precipitation, surface runoff, and rising groundwater (Kenney and Burne 2000). Vernal pools in Armstrong County typically occur along streams. The pools typically become completely dry, through evaporation, by late spring or early summer. Since these ponds dry up, they cannot support fish populations. During the brief window when the pools contain water, they serve as important breeding grounds for a multitude of amphibian species (e.g. salamanders and frogs), many of which breed solely in these areas due to the absence of fish (see page 23 for a discussion of these amphibian and reptile species).

Because wetlands are relatively rare through much of Pennsylvania, they are an important refuge for plants and provide important habitat for nesting and migrating birds. Many other animal groups such as amphibians, reptiles, dragonflies, damselflies, moths and butterflies also depend on specific wetland habitats for all or a portion of their life cycles.

Grassland communities

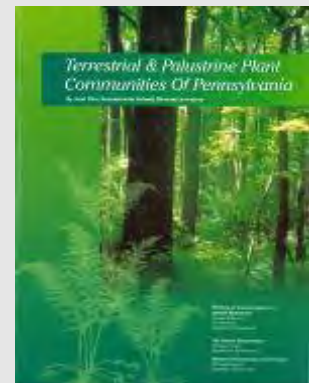
Historically, most of the Northeast was forested except for scattered openings that existed along river floodplains, wetlands, beaver meadows, and heathlands. Fires, set by lightning strikes or burning and clearing by Native Americans, also opened up forested areas. With European colonization during the 1800s, grasslands became widespread as land was cleared for pastures and hayfields and grassland species flourished. Today, as farmland reverts back to forest, and agricultural landscapes are being replaced by housing and business developments, species dependent on grasslands are declining. Grassland habitat in Armstrong County consists primarily of agricultural land such as hay fields and pastures, reclaimed surface mines and maintained areas such as utility rights-of-way.

The scour areas along the shoreline of the Allegheny River and its larger tributaries also support grassland communities. These grasslands typically occur in linear strips in areas where ice and water are able to provide the necessary disturbance needed to keep these areas dominated by grasses and herbaceous plants. In Armstrong County, these communities are mostly found above the dammed section of the Allegheny River. The lock and dam system does not allow the natural fluctuations in water level necessary for the maintenance of these grasslands, and they are often crowded out by trees, shrubs, and invasive species.

Many grassland birds and other wildlife associated with open areas are experiencing declines due to habitat loss and modern agricultural practices (Jones and Vickery 1997). In parts of western Pennsylvania where a small portion of reclaimed surface mines are maintained as grassland habitat or farmers are participating in the Conservation Reserve Enhancement Program (CREP), several grassland-dependent species have been able to maintain small strongholds. Dedicated, long-term management is needed to maintain these grassland habitats. Objectives for large-scale planning should include restricting mowing during the breeding season, managing grazing using a rotational system, conducting periodic burns, and limiting development in those areas where grassland-dependent species are known to reside.

Classification of Natural Plant Communities in Pennsylvania

Terrestrial & Palustrine Plant Communities of Pennsylvania (Fike 1999) is the most current community classification system for Pennsylvania's palustrine and terrestrial plant communities. This report was developed by the Pennsylvania Natural Heritage Program to update and refine Smith's 1991 report *Classification of Natural Communities in Pennsylvania (draft)*, the first effort dedicated specifically to the classification of natural communities in the state. Work is ongoing to improve the current classification system and therefore, future editions may define new community types or alter currently defined types. Aquatic communities (lakes, streams, and rivers), communities where vegetation is absent or not a definitive characteristic (caves, scree slopes), and communities resulting from extensive human disturbance (old agricultural fields, manmade wetlands, etc.), are not addressed in this classification. Until more extensive work can be completed to define these types of communities and incorporate them into a single statewide framework, the County Natural Heritage Inventory reports will provisionally refer to features of ecological interest that fall outside the Fike 1999 system using categories described in Smith 1991. (more information on community classification in Pennsylvania is available at <http://www.naturalheritage.state.pa.us>)



Flowing Water and Major Stream Systems

Flowing water forms aquatic systems of great diversity in Armstrong County. Flowing water systems begin as high mountain brooks which form from surface runoff, springs, and seeps. These unite to become the headwaters of stream systems lower in the watershed. These mountain waters serve as a home to numerous organisms, from tiny diatoms and algae to insects that provide food for small fish and salamanders.

As the mountain brooks coalesce into streams and creeks, they form larger aquatic systems that have a diversity of microhabitats. These support a large diversity of stream-dwelling organisms within two major stream habitats— riffles and pools. Riffles are shallow, fast-flowing, well-aerated rapids over rocky sections of the stream bottom. These riffles support a diverse animal community including insects, crustaceans, and fish. Interspersed between riffle sections are pools. These are quiet, deeper water habitats that tend to support a less diverse stream biota. The stream systems, in turn, feed into larger flowing water systems such as the Allegheny and Kiskiminetas Rivers.

Floodplains are flat, often flooded, areas along streams and rivers. They are important terrestrial habitat areas tied to the flowing water system. Floodplains are typically inundated by water during the spring runoff and then remain dry after these floodwaters recede. The effects of water on these systems determine the vegetation communities that can persist there. These forested floodplains also serve as a protective buffer against erosion, provide cooling shade to the waterway, filter pollutants and excessive nutrients from runoff, and help alleviate flood damage along many of the area’s creeks. Areas that have a history of flooding are poor choices for building sites and are best left in their natural condition.

In addition to naturally vegetated floodplains, vegetated riparian buffers (Figure 4a) along streams and other bodies of water provide vital benefits including: protection of water quality, reduced erosion, flood control and wildlife habitat. Elimination of riparian vegetation (Figure 4b) removes the capacity of this region to buffer the effects of the surrounding landscape and consequently reduces the water quality in the stream. Two major effects of the loss of riparian buffers are sedimentation and nutrient enrichment.

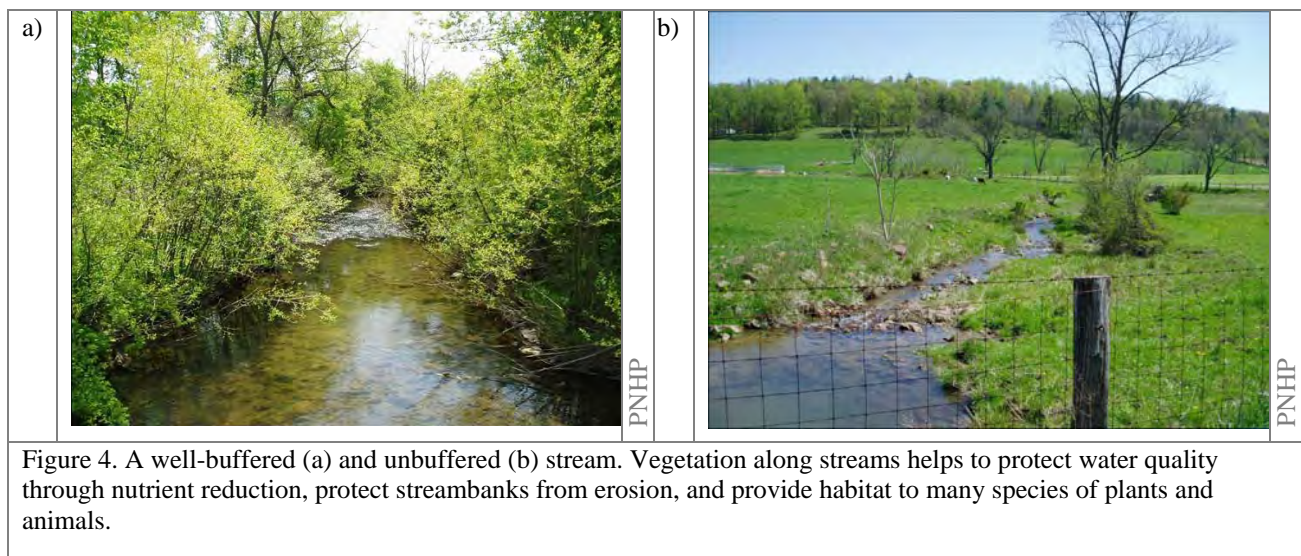


Figure 4. A well-buffered (a) and unbuffered (b) stream. Vegetation along streams helps to protect water quality through nutrient reduction, protect streambanks from erosion, and provide habitat to many species of plants and animals.

Mining, industry, agriculture, residential development, road building and maintenance as well as other activities have contributed to the degradation of water quality in many areas of the county. Protecting the quality and purity of surface and groundwater resources from degradation contributes to the future well-being of all plants and animals including human communities. The Pennsylvania State-wide Surface Waters Assessment Program can provide information on specific potential sources of water impairment within Armstrong County.

PNHP has recently completed an Aquatic Community Classification which describes predicted communities for all of the streams within Pennsylvania. Priority aquatic communities determined through this project are shown in Appendix VII (pg. 244). In addition to flowing water systems, standing water aquatic communities do exist within Armstrong County, in the form of numerous farm ponds as well as three large manmade lakes. Although natural wetland systems support a higher diversity of species, these man-made systems may have similar vegetation to some of the wetland communities around their shallow edges and support common species, including fish, reptiles, amphibians, and insects.

Classification of Aquatic Communities in Pennsylvania

A statewide project of the Pennsylvania Natural Heritage Program, the Pennsylvania Aquatic Classification Project, collected aquatic datasets from state and federal agencies, interstate basin commissions, and universities, analyzed information with standard statistical methods, and identified community types and habitat associations. The most common community type per watershed was chosen to represent typical watershed organisms and habitats. Although other community types may exist in a particular watershed, the major community type is described. Further details about the development of the Pennsylvania Aquatic Community Classification project are covered in Appendix VII along with fact sheets detailing each predicted community found within Armstrong County.

(more information on the Pennsylvania Aquatic Community Classification is available at <http://www.naturalheritage.state.pa.us>)



PNHP

PNHP staff sampling for mussels.

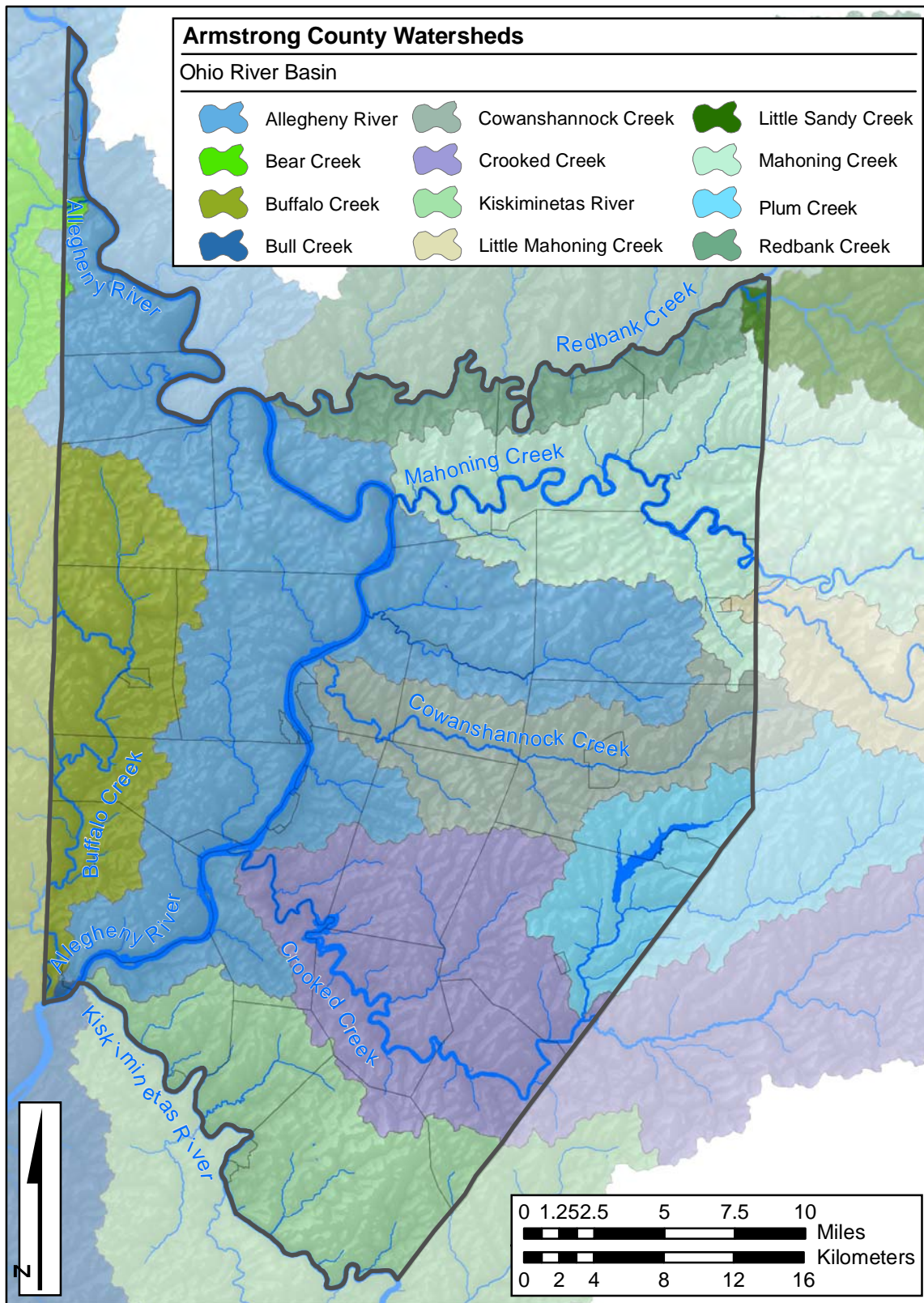


Figure 5. Major watersheds of Armstrong County.

Disturbance

Disturbances, whether natural or man-made, are pivotal in shaping many natural communities. The nature, scale, and frequency of disturbances are influential in the evolution and occurrences of natural communities and associated rare species. Examples of natural and anthropogenic disturbance events are presented in Table 4.

Table 4. Examples of natural and anthropogenic disturbances (adapted from Scott et. Al. 1999).

Natural Events	Anthropogenic Events
<i>Fire</i>	Residential development
<i>Disease epidemics</i>	Road, trail, railroad line
<i>Flood</i>	Telephone line, utility line
<i>Drought</i>	Dams and canals
<i>Hurricane/tornado/landslide</i>	Commercial development
<i>Ice storm</i>	Modern agriculture
	Mining
	Dredging
	<i>Logging</i>
	<i>Grazing</i>

*entries in italics connote reversible disturbances, while those in normal type represent long-term disturbances.

Natural Disturbances

Natural disturbances such as fire and flooding can benefit certain natural communities and species. For example, periodic fires are needed to maintain pitch pine–scrub oak barrens. Burns in such areas stimulate new growth in these species and exclude other successional species. Floodplain forests benefit from the periodic scouring and deposition of sediments that occurs when streams flood their banks. At the same time, streamside wetland communities hold excess water, thus reducing the scale of downstream flooding.

Another natural disturbance (exacerbated by human mismanagement), over-browsing by deer, can have detrimental effects on natural communities and species (Rhoads and Klein, 1993). Excessive deer browse can decrease the understory of some forests, and halt regeneration of new growth of the canopy and understory by preferential feeding. For example, forests that were once dominated by oak are now converting to red maple, due to deer pressure on the oak seedlings and saplings (Abrams 1998). Deer feeding preferences can have a direct effect on rare plants and severely decrease essential habitat for other animal species including birds, mammals, reptiles, amphibians, and insects. Over-browsing can result in a lack of forest regeneration, a reduction in the diversity and density of forest understory, a decrease in songbird diversity and a direct loss of rare plants (Yahner 1995). Private landowners can be encouraged to control deer populations by allowing hunting on their lands.

Disturbances caused by beaver can be either beneficial or detrimental to wetland habitats within the county. On one hand, thinning the canopy and flooding by beavers can eventually create open wetland meadows upon which many unique species rely. On the other hand, damming by beavers can alter habitats to a degree that renders the sites no longer suitable for some of the rare species of the county. For example, peatlands support an array of rare plants and animals, but flooding by beaver can degrade these communities until they no longer support the uniquely adapted species. Beaver activity in the long term is critical to the cyclic pattern of wetland disturbance, but in the short term, beaver activity can threaten the integrity of now rare wetland habitats and jeopardize many of the unique species that inhabit these natural communities. This creates difficulty in assessing how beavers should be managed. The long-term benefit of habitat creation must be weighed against the potential short-term threat to the existing plants and animals. In certain situations, beaver removal is preferred and implementation of management practices with regard to beaver must be considered on a case-by-case basis.

Human Disturbances

Human and natural disturbances create different habitats in different scenarios, but human disturbances often leave the most lasting effects on the environment. Some human disturbances can be beneficial, especially to species that require an early successional habitat. However, what may be beneficial to a few species is often detrimental to other species. Many rare species have become rare because they are unable to adapt to disturbance of their particular specialized habitat. Consequently, many species have declined due to human alteration of the landscape. Therefore, decisions about the type, timing, location, and extent of future disturbances are important to the natural ecological diversity that remains.

In Armstrong County, logging and mining have played major roles in altering the landscape. Repeated logging of the forests has restricted the presence of older forests to steep slopes that are nearly inaccessible. Mining, which has altered topography and vegetation, is not as active in the county as it once was. Properly reclaimed mine lands can provide valuable nesting and wintering habitat for many species of grassland birds. Furthermore, farming and urbanization have created biological “islands” where small natural areas are surrounded by agriculture or development. This isolates wildlife and plants species, inhibiting the gene flow between populations.

Additionally, many wetlands have been intentionally flooded or drained, resulting in loss of habitat for many species. In fact, in less than 25 years Pennsylvania lost 50% of its natural wetlands through draining and filling. Though increased efforts have been made to protect our remaining wetlands, these often rely on wetland mitigation, where artificial wetlands are created to replace those that are destroyed. From a biological standpoint, mitigated wetlands are typically of poor quality and do not provide the same diversity of species and functioning food webs that natural wetlands provide.

As farming remains a central industry in Armstrong County, some farm practices and abandoned farmland, along with abandoned mines, make conditions favorable for some grassland birds. Birds such as Barn Owl, Eastern Meadowlark, Bobolink, and Henslow’s Sparrow have benefited from human created and managed early successional habitats.

Pennsylvania has thousands of dams on its rivers, creeks, and streams. Large dams exist on the Allegheny River, which are used to allow navigation between Pittsburgh and East Brady. Dams placed on Mahoning Creek and Crooked Creek are used for flood control, and provide recreational areas. Other dams no longer serve their intended uses and have fallen into a state of disrepair. These unnecessary structures can be a liability to their owners, as many run-of-the-river dams create dangerous hydraulic conditions at their base, making them a threat to river users in the area. Besides acting as liabilities and maintenance headaches, dams cause numerous environmental impacts including reduced water quality, thermal pollution, disrupted sediment transport processes that increase sedimentation in impounded areas and increase streambed and streambank erosion in downstream areas, altered flow regimes, and habitat destruction and fragmentation. By removing the unused, unnecessary dams from our rivers and streams, we can re-establish natural free-flowing dynamics which support diverse ecosystems, reduce localized flooding and erosion, improve water quality, and restore habitat and access to upstream habitat for aquatic organisms. To address the impacts to resources under their management, the PA Fish & Boat Commission has authority (PA Code Chapter 57, Section 22) to request that dam owners install fish passage structures on dams to benefit migratory or resident fish species.

Dam Safety

Due to the public safety threat, owners of existing run-of-the-river dams and permittees for the construction of new run-of-the-river dams are required to mark the areas above and below the dam to warn river users of the dangerous conditions around the dam structure. This requirement went into effect on January 1, 1999 through an amendment to the Fish and Boat Code known as Act 91 of 1998 (P.L. 702, No. 91). Failure to comply with the responsibilities of Act 91 can lead to a civil penalty between \$500 and \$5,000 annually for each calendar year of noncompliance.

Pennsylvania currently leads the nation in dam removal and Governor Rendell received a National Award of Merit from the Association of State Dam Safety Officials in 2004 for his commitment to dam safety in Pennsylvania. Numerous agencies, nonprofit organizations, and engineering firms have experience with dam removal in Pennsylvania. For more information on dam safety, dam owner requirements, and dam removal, please contact the Department of Environmental Protection Division of Dam Safety, at 717-787-8568 or at <http://www.dep.state.pa.us/dep/deputate/watermgt/we/damprogram/main.htm>.

Invasive Species in Armstrong County

Natural habitats within Armstrong County are threatened by the invasion of exotic plant and animal species. These invasive species are plants, animals or other organisms that do not naturally occur in the area, and are likely to cause harm to the natural environment, the economy or to human health. Because they have no natural enemies to limit their reproduction, they usually spread rampantly. Once established, it is extremely difficult to remove them or even control their spread. Invasive species are recognized as one of the leading threats to biodiversity and impose enormous economic costs to agriculture, forestry, fisheries, and other enterprises, as well as to human health (Swearingen et al. 2002).



Christopher Tracey, PNHP

Garlic mustard (*Alliaria petiolata*), an invasive herb of forests and woodlands.

The introduction of non-native species into Pennsylvania began with the initial European settlement and continues to this day (Thompson 2002). Plants and animals have been deliberately introduced for a variety of reasons including food sources, erosion control, landscaping, and game for hunting and fishing. Other species have been accidentally introduced as ‘stowaways’ through trade and transportation. These introductions have had drastic effects on Pennsylvania’s biodiversity over time. For example, over 37 percent of the plant species now found in the Commonwealth did not occur here during the first period of European settlement (Thompson 2002).

Invasive Plants

Invasive plants are ones that reproduce rapidly, spread quickly over the landscape, and have few, if any, natural controls, such as herbivores and diseases, to keep them in check. Invasive plants share a number of characteristics that allow them to spread rapidly and make them difficult to remove or control:

- spread aggressively by runners or rhizomes
- produce large numbers of seeds that survive to germinate
- disperse seeds away from the parent plant through various means such as wind, water, wildlife, and people

Invasive plants are capable of displacing native plants from natural communities, especially those with rare, vulnerable, or limited populations. This initial impact is worsened by the tendency for native wildlife to prefer native species over invasive species for food. In some cases, a switch to the invasive plant food supply may affect the physiology of the prey species. For example, many invasive shrubs, including bush honeysuckle, provide fruits that native birds find attractive, yet these fruits do not provide the nutrition and high-fat content the birds need in their diets (Swearingen et al. 2002).

Aggressive invasive plants can also transform a diverse small-scale ecosystem, such as a wetland or meadow, into a monoculture of a single species, drastically reducing the overall plant richness of an area and limiting its ecological value. The decrease in plant biodiversity can, in turn, impact the mammals, birds and insects in an area, as the invasive plants do not provide the same food and cover value as the natural native plant species did (Swearingen et al. 2002).

Significant invasive plant species found in Armstrong County are listed in Table 5.

Table 5. Invasive plants commonly encountered in Armstrong County

Species	Description and Threat
tree-of-heaven (<i>Ailanthus altissima</i>)	Introduced to Philadelphia from China in the late 1700's, it is present along roadsides, old fields and timber cuts throughout the county. This fast growing tree is a prolific seeder and can also proliferate through vegetative means, outcompeting native vegetation.
Japanese stiltgrass (<i>Microstegium vimineum</i>)	A fast-spreading grass that is typically found along forest roads, streambanks, and other cool moist habitats. Outcompetes native vegetation and may affect animal species that use streamside microhabitats.
Japanese knotweed (<i>Falopia japonica</i>) giant knotweed (<i>Falopia sachalinense</i>)	These large fast-growing exotics displace natural vegetation and alter natural ecosystems. Typically found along stream banks and other low-lying areas, as well as old home sites and waste areas.
purple loosestrife (<i>Lythrum salicaria</i>)	An herbaceous wetland invasive that is present at scattered sites throughout the county. Once established in a wetland, this species is difficult to eradicate and will displace native species.
garlic mustard (<i>Alliaria petiolata</i>)	An increasingly common invasive biennial herb spreading through natural areas throughout the region. Recent scientific evidence has shown that this species can disrupt micorrhizal relationships that trees depend on for their growth.
Japanese honeysuckle (<i>Lonicera japonica</i>) Oriental Bittersweet (<i>Celastrus orbiculatus</i>)	These vines cover and outcompete native vegetation as well as girdle trees by twining up them.
bush honeysuckles (<i>Lonicera tatarica</i> , <i>L. morrowii</i> , and <i>L. maackii</i>)	Found in a variety of environments from wetlands to uplands. Competes with native plants for moisture, nutrients, and pollinators. Fruits do not provide high energy food for migrating birds.
Canada thistle (<i>Cirsium arvense</i>)	A Pennsylvania-listed noxious weed. Invades a variety of dry to moist habitats, displacing native plants and disrupting community processes.
autumn olive (<i>Elaeagnus umbellata</i>)	A drought-tolerant species that thrives in many soil conditions. It threatens native ecosystems through competition and alteration of natural succession patterns and nutrient cycling.
Japanese barberry (<i>Berberis thunbergii</i>)	Commonly planted ornamental that escapes and forms dense stands in a variety of habitats, including forests and wetlands, displacing native vegetation.
winged burning bush (<i>Euonymus alata</i>)	A shrub that can form dense thickets that displace native woody and herbaceous plants.
multiflora rose (<i>Rosa multiflora</i>)	Widely planted shrub that invades a variety of habitats excluding most native shrubs and herbs. May be detrimental to the nests of native birds.
privet (<i>Ligustrum</i> spp.)	These shrubs form dense thickets in floodplains, forests, wetlands, and fields that can outcompete native vegetation.

Control methods for invasive plants can range from hand pulling to mechanical methods (e.g. mowing) to herbicides. Herbicide control should be only performed by individuals with proper training and licensing through the Pennsylvania Department of Agriculture. When working in sensitive habitats such as wetlands, a 'wetland-safe' herbicide should be used to avoid indirect effects on other organisms. It should be noted that each invasive species present on a site may require a different technique or suite of techniques for effective control. Generally speaking, control efforts should be concentrated before these species disperse their seed for the year. Specific control methods for these species can be found at: <http://www.invasive.org/eastern/>.

Other invasive plants that pose less, but still significant threats to native flora and fauna have been observed in the county. For example, periwinkle (*Vinca minor*), a widely planted ornamental plant, has been observed spreading along roadsides into natural areas in the county.

Invasive Animal Species

In addition to invasive plants, Pennsylvania is now home to several exotic species of animals including mammals, birds, fish, and reptiles. These species directly threaten populations of native animals through direct competition or predation. Other invasive exotic animals can alter habitats and ecosystems by changing plant cover or diversity. Some of these invasive animals, such as the Norway rat (*Rattus norvegicus*), are all too common encounters in our homes and developed areas.

One of the most significant threats to the biodiversity of Armstrong County from an invasive animal species is the hemlock woolly adelgid (*Adelges tsugae*). This is a small aphid-like insect that feeds on the leaves of eastern hemlock trees (*Tsuga canadensis*). Infestations of the woolly adelgid appear as whitish fluffy clumps of feeding adults and eggs along the underside of the branch tips of the hemlock. This species is native to Japan and China and was introduced accidentally to North America around 1924 (McClure 2001). It is currently distributed from Maine to Georgia and can be found in over two-thirds of the counties in Pennsylvania (PA DCNR 2007).



Connecticut Agricultural Experiment
Station Archives

Hemlock Woolly Adelgid infestation along a hemlock branch. This invasive species is currently causing a severe decline (>90%) of native hemlock stands, an important habitat type in Pennsylvania.

Hemlock decline and mortality typically occurs within four to ten years of initial infestation. The adelgid can cause up to 90 percent mortality in eastern hemlocks, which are important for shading trout streams, controlling erosion of steep stream banks, and providing habitat for about 90 species of birds and mammals. This species has the potential to drastically alter the Pennsylvania landscape. Several control options are currently being tested, but a cost-effective treatment has not yet been found.

The landscape of Pennsylvania was drastically altered by Chestnut blight (*Cryphonectria parasitica*), a fungus probably introduced to North America from infected nursery stock from China in the 1890s. First detected in New York City in 1904, it had all but wiped out the American chestnut (*Castanea dentata*) from Maine to Alabama. American chestnut once comprised one-fourth to one-half of eastern U.S. forests, and was prized as a food for humans, livestock, and wildlife and for its durable wood. Today, only stump sprouts from infected trees remain and the resulting canopy gaps have been filled by the chestnut's associate species, including oaks and hickories.

The gypsy moth (*Lymantria dispar*) has caused extensive defoliation of forests in the northeast. This European moth was intentionally introduced to the U.S. in 1869 as part of a failed commercial silk production venture. Its main impact is that it defoliates trees, particularly oak species. This defoliation can result in a reduction in the tree's growth rate or even lead to the eventual death of the tree.

The European starling (*Sturnus vulgaris*) is an exotic bird species established in North America during the mid to late 1800s as part of a plan to introduce all of the birds mentioned in the works of Shakespeare to Central Park in New York City. It has since spread throughout the United States. In addition to competing with native bird species for food and space, large flocks of this species destroy fields of crops. The house sparrow (*Passer domesticus*) was introduced to several places in the United States in the late 1800's and has become widely distributed. In addition to causing crop damage, house sparrows will sometimes kill native adult cavity nesters and their young or smash their eggs. The house sparrow is partially responsible for a decline of eastern bluebirds (*Sialia sialis*) in the United States.

Feral swine (*Sus scrofa*; also called wild hogs) are potentially one of the most influential upcoming invasive species for Pennsylvania forests. Escaped or deliberately released swine now exist in relatively low numbers in Pennsylvania. Feral swine can impact livestock and cause significant ecological and property damage. This

includes rooting and destruction of native herbs and trees, and the creation of significant erosion from wallowing along river banks and streams. The potential exists for the numbers of feral swine, and their negative ecological impacts, to explode and significantly impact forest and agricultural lands over the next decade.

Several other invasive animal species are spreading throughout the streams, rivers, and lakes of Pennsylvania, but in many cases the impact of these species remains unknown. The zebra mussel (*Dreissena polymorpha*) was accidentally introduced to the Great Lakes in the 1980's and has been spreading in Pennsylvania's waters. Zebra mussels have been found in several locations in the Allegheny River. Another non-native bivalve, the Asian clam (*Corbicula fluminea*), has spread throughout most of Pennsylvania's waterways. Of greatest concern to biodiversity is the capacity of this clam to alter the ecology of an aquatic system, making it less hospitable to the native assemblage of freshwater mussels, fish, invertebrates, and plants. Another aquatic species, the rusty crayfish (*Orconectes rusticus*), has been introduced from its native range in the midwestern United States to many of Pennsylvania's watersheds. Rusty crayfish can reproduce in large numbers and reduce lake and stream vegetation, depriving native fish and their prey of cover and food. Their size and aggressive nature keeps many fish species from feeding on them. Rusty crayfish may also reduce populations of native crayfish, freshwater mussels, and amphibians by out-competing them for food and habitat or by preying on young individuals. Table 6 presents an overview of the potential invasive animal species.

Table 6. Significant invasive animal species found or with colonization potential in Armstrong County.

Species	Description and Threat
hemlock woolly adelgid (<i>Adelges tsugae</i>)	Often called simply HWA, this species is causing severe damage to eastern hemlock (<i>Tsuga canadensis</i>) killing up to 90% of infected trees, thus greatly modifying ecosystems.
gypsy moth (<i>Lymantria dispar</i>)	Feeding preferentially on oak trees (<i>Quercus</i> spp.) and their relatives, this species will eat almost any plant when forced and can cause severe environmental and economic damage.
common pine shoot beetle (<i>Tomiscus piniperda</i>)	A pest of pine trees (<i>Pinus</i> spp.) this species damages terminal shoots, stunting the growth of trees and thus weakening the trees and increasing their susceptibility to other pests.
sirex woodwasp (<i>Sirex noctilio</i>)	A recent invader, this species attacks living pines and is likely to cause great amounts of damage to pine plantations throughout the nation.
multicolored Asian ladybird beetle (<i>Harmonia axyridis</i>)	Preying on native insects and invading houses each winter, this species was likely introduced in an attempt to control non-native aphids.
zebra mussel (<i>Dreissena polymorpha</i>)	Introduced from dumped ballast water, this species is not yet known in Armstrong County, but must be watched for given its disastrous effects on ecosystems and economies.
Asian clam (<i>Corbicula fluminea</i>)	Found in extremely high densities along major tributaries and rivers, this species is directly competing with native mussels for food and habitat.
rusty crayfish (<i>Orconectes rusticus</i>)	Found in many of our streams, this recent invader is displacing native crayfish, reducing fish populations by feeding on young fish, and generally disrupting aquatic systems.
round and tubenose gobies (<i>Neogobius melanostomus</i> and <i>Proterorhinus marmoratus</i>)	These predatory fish prefer cobbly bottoms in slow moving water. Introduced from dumped ballast water, they feed on macroinvertebrates, small clams and mussels, and fish eggs and are a direct competitor with our many small native darters and minnows.
grass carp (<i>Ctenopharyngodon idella</i>)	A voracious herbivore, this species was introduced to control weeds in eutrophied lakes. However, it now causes significant damage to native wetland vegetation that is important for reducing nutrients in water-bodies.
common carp (<i>Cyprinus carpio</i>)	Introduced as a food fish, this species is now found anywhere with warm, slow-moving water. As a bottom feeder it greatly increases turbidity and mobilizes large amounts of sediment.

snakehead (<i>Channa spp.</i>)	Prized as a food species in Asia, this species was recently introduced to the East Coast and has quickly taken root. Currently not found in Armstrong County, it should be monitored for.
feral swine (<i>Sus scrofa</i>)	Wild hogs should be monitored for due to their negative impact on livestock, property, and natural areas.
house sparrow (<i>Passer domesticus</i>)	Generally found any place humans are, this species can cause crop damage, but mainly competes with small, native cavity nesting birds.
European starling (<i>Sturnus vulgaris</i>)	Competing directly with native cavity-nesting birds, this species also cause severe crop damage.
rock dove / pigeon (<i>Columba livia</i>)	Generally found around human structures, this species can cause crop damage, is a known carrier for several serious human diseases, and causes a general mess where it nests and roosts.
mute swan (<i>Cygnus olor</i>)	While considered pretty by some, this European invader causes significant damage to wetland vegetation that it “grubs” out during feeding. Additionally, it is fiercely competitive and will exclude all other native waterfowl from its nesting territory to the point of killing intruders.
house mouse (<i>Mus musculus</i>)	Ubiquitous throughout the world, this species carries many diseases, competes directly with many native species, and can cause significant damage to crops and structures.
Norway rat (<i>Rattus norvegicus</i>)	Generally a pest of human infrastructure, the Norway Rat is also found around rivers and other water systems. Known as a carrier for many diseases, this species is a threat anywhere it occurs.
house cat (<i>Felis silvestris</i>)	House cats, both domestic and feral, can each kill several small animals in a day, causing the death of many amphibians, reptiles, birds, and mammals each year.

Overall Invasive Recommendations

Although Armstrong County has many sites that are free from non-native species, invasive species are an increasing threat to the biodiversity harbored within Armstrong County. Successful control of invasive plant species is a time, labor, and resource intensive process. Prevention or control during the early stages of invasion is the best strategy. In areas where invasive plants are well established, multiple control strategies and follow-up treatments may be necessary. Specific treatment depends on the target species' biological characteristics and population size. Invasive plants can be controlled using biological, mechanical, or chemical methods.

The following are presented as ways to deal with invasive species in the region:

- Biological Diversity Areas (BDAs) identified in this report can serve as useful high conservation value “focus areas” for the priority control of invasive species.
- Many educational resources are available regarding invasive exotic species. Regional groups such as the Mid-Atlantic Exotic Pest Plant Council (MA-EPPC) can help with funding opportunities and educational outreach on invasive species.
- Pennsylvania has a Noxious Weed law that prevents the propagation, sale, or transport of thirteen weed species within the Commonwealth. Some of these thirteen species that are currently listed are agricultural weeds that rarely threaten natural areas, however, purple loosestrife (*Lythrum salicaria*), giant hogweed (*Heracleum mantegazzianum*), kudzu (*Pueraria lobata*), mile-a-minute (*Polygonum perfoliatum*), Canada thistle (*Cirsium arvense*), and multiflora rose (*Rosa multiflora*) are present on the noxious weed list. The Pennsylvania Fish and Boat Commission maintains a list of Aquatic Invasive Species (AIS)
- that are prohibited from possession, sale, barter, or distribution within the Commonwealth (PA Code 58.71.6). This list includes the zebra mussel and the rusty crayfish, among others.

- Cooperative Weed Management Areas (CWMAs), once largely confined to the western states, are increasingly forming in the east. A CWMA is a partnership of landowners, including federal, state, and local government agencies, individuals and various interested groups that work together to manage noxious weeds and invasive plants in a defined geographic area. An overview of CWMAs can be found online at: <http://www.weedcenter.org/cwmas/howCWMA.html>.

After intensive removal of invasive species, restoration of natural habitats through replanting with native species is often needed. Nurseries, landscape architects, and horticultural professionals can assist with native plant restoration. Complete eradication of invasive non-native plants from a site may not be completely achieved, but it is possible to reduce infestations within native plant communities to a level which can be routinely maintained. Control of invasive plants is critical to the long-term protection of Pennsylvania's natural areas and rare species.

Natural Resources

Humans value natural ecosystems for the resources that they provide in terms of food, energy, and materials. The use of resources can be categorized into renewable resources, where the resource will naturally replenish itself over time, and non-renewable resources, where the resource is extracted and cannot be replaced in a reasonable time scale. Some types of natural resource development may have significant effects on local and regional biodiversity.

Renewable

Sources of water in the county are drilled wells, dug wells, springs, and storage reservoirs. Small springs located at the base of mountain slopes furnish water to the more isolated farms and cabins. Groundwater is typically found 100-200 feet below the surface in most areas of the county.

Forestry resources are currently being utilized in Armstrong County. The vast majority of the forests in the county have been cut several times. Few older stands of forest still exist along the steep slopes that are difficult to log.

As of 2009, no wind power generation facilities are located within Armstrong County. Typically in the Ridge and Valley province, the areas with the highest suitability to wind power development are ridgelines. Wind power development may be in conflict with the conservation of large blocks of forests as well as migratory bird and bat corridors.

Non-renewable

Mineral extraction has been heavily conducted in Armstrong County. The Main Bituminous Coal Field lies under all of Armstrong County. This field contains high-volatile bituminous coal (DCNR 2008). Coal present in this bed is close to the surface and much has been strip mined, although there has been more deep mining in Armstrong County. Reclamation of strip mines has often been done using non-native species, and abandoned mine drainage has affected many of the waterways in the county.

Natural gas wells have also begun to dot the landscape in many parts of the county. The infrastructure and road systems needed to maintain the wells have a serious impact on the natural systems and the species that live within them.

Dredging in the Allegheny River occurs in many of the navigational pools and removes the sand and gravel substrate along the river bottom. Some of the major uses for this resource are building roads and landscaping, but the substrate also provides habitat for a diverse group of mussel species, some of which are globally rare and federally endangered. Dredging needs to be minimized in areas with high mussel populations in order to retain the remaining habitat for the mussels and other aquatic species.

A REVIEW OF THE ANIMALS OF ARMSTRONG COUNTY

Although this Natural Heritage Inventory focuses on the rare and endangered species and habitats that compose the biodiversity found within Armstrong County, this region is home to a great number of more common species. This section provides an overview of these species and makes general conservation recommendations for these taxa.

Mammals of Armstrong County

Armstrong County lies within the Pittsburgh Low Plateaus Section of the Appalachian Plateaus Province and is characterized by a broad and rolling landscape separated by narrow and moderately steep valleys. Headwater streams primarily drain into the Allegheny River within the western portion of the county. Some relatively important areas for mammals include the areas drained by the Clarion River as it empties into the Allegheny River, the stream valleys bisected by the Mahoning Creek and Crooked Creek and the adjoining forested areas. While there remains a good amount of forested habitat within much of the county, a great deal of fragmentation occurs due to the scattered nature of development and agriculture.



Kansas Department of Parks and recreation

American beaver (*Castor canadensis*)

Deer hunting remains one of the county's significant non-agricultural resources. Although difficult to estimate the number of deer harvested in Armstrong County during a single season due to the inception of the use of Wildlife Management Units, WMU 2D, which contains all of the county, displayed some of the highest harvest numbers in the state including over 18,000 antlerless deer during the 2007-08 season. Bear, another popular game species, have been harvested at between 30-90 per year between 1999 and 2007 and the future seems good for continued successful hunts. Furbearers such as beaver and mink are also popular game species and their populations appear to be stable at present.

Many of the species occurring throughout the county are quite unremarkable in that they possess abilities that ensure their survival in a wide range of habitat types and are well represented throughout Pennsylvania. These species are termed "generalists" and include the northern short-tailed shrew (*Blarina brevicauda*) and several other shrew and mole species, white-footed mouse (*Peromyscus leucopus*) and several other rodent species, as well as striped skunks (*Mephitis mephitis*), red fox (*Vulpes vulpes*), coyote (*Canis latrans*), and the ubiquitous chipmunk (*Tamias striatus*). All of these species occur throughout the diverse forests and widespread marshes and other wetland habitats within Armstrong County and are in no jeopardy of disappearing from the landscape.



Dick Cooper

White-footed mouse (*Peromyscus leucopus*)

Other species have fairly restricted habitat needs and are termed "habitat specialists". They may be restricted to grassland- and meadow-type habitats, the forest interior, upper elevation ridgelines, wetlands, and streams or, during part of their life cycle, to specific habitats such as caves and mines. Examples of these species include the meadow vole (*Microtus pennsylvanicus*) (grasslands and meadows), muskrat (*Ondatra zibethicus*) and beaver (*Castor canadensis*) (wetlands and streams) and many bat species (caves and mines).

Wetlands and streams play a major role in providing habitat for mammals as well as serving as corridors for dispersal throughout the county. Whenever biologists research mammals, one of the first environs investigated are

wetlands, such as marshes, bogs and streams, as they are often sites where the number of species of mammals, or diversity, is highest. It is not uncommon to find many species of shrews, rodents, weasels, and bats, as well as sign of various medium-sized carnivores like red fox, squirrels, bear, and deer along these habitats.



Dennis W. Donohue

Ground hog (*Marmota monax*)

Open land in the form of wet meadows and reverting grasslands are habitat types that are fairly common in Armstrong County. Normally a product of former and present agricultural practices, these habitats are also found in areas that are somewhat flood-controlled. The most well known mammal occurring in these openlands is the meadow vole. Meadow voles are so successful at dispersing throughout the state that they are sometimes found in grassy forest clearings within large tracts of forest having made their way there along the forest roads, pipelines, and power right-of-ways. Several other species of mammal are known to occur within openlands including the eastern cottontail rabbit (*Sylvilagus floridanus*), ground hog (*Marmota monax*), and red fox.

While openlands as mentioned above are familiar to many, one type that is more often than not overlooked is scrub-shrub openlands. Although commonly made up of scrub oak, blueberry and other low-growing plants, they do not have the large expanses of canopy high overhead as found in forests. The understory in these types of habitats is fairly open in that there are few very low-growing plants except in areas that may have suffered from recent burns, common along these dry sites. These habitats are extremely important to several species as either foraging areas or nesting sites, such as the black bear (*Ursus americanus*). Openlands such as these can be found along upper elevation forests in areas where soils are thin and the climate fairly dry.

Bats are a common component of the wetlands, streams, and forests of Armstrong County, most often encountered during the summer months along streams and open bodies of water. During the summer, floodplain forests along the Clarion and Allegheny Rivers may provide roost sites for many bat species as they raise their young. One rarely encountered bat species, the silver-haired bat (*Lasiurus noctivagans*) may occur within Armstrong County during the early spring or late fall months as it migrates to and from its summer habitat in the northern portion of the United States and Canada. During the winter months, hibernating bat species such as the little brown bat (*Myotis lucifugus*) and big brown bat (*Eptesicus fuscus*) find their way to several large mines in the county and form large populations ranging from 10,000 to over 90,000 bats. These large mines are known to harbor rare and endangered species, such as the eastern small-footed (*M. leibii*) and Indiana (*M. sodalis*) bats, and are extremely important to the continued existence of these species. Within the previous three years, however, hibernating bat species have been coming under a new and severe threat, White-nose Syndrome. This disease, first discovered in New York, has caused the deaths of an estimated one million bats from the New England States and Pennsylvania.



PNHP

This cluster of hibernating bats serves a vital ecological role beneficial to humans. In the warmer months of the year, these bats will forage for insects along wooded creeks and streams.

Potentially a near extinction event for hibernating bats, researchers are currently trying to determine what can be done to protect our bat populations. It is imperative that protection be afforded any large hibernating population and that the communities across the county as well as the state begin to view bats as a group of animals worth

greater conservation efforts. Several other bat species such as the hoary bat (*Lasiurus cinereus*) and red bat (*Lasiurus borealis*) don't over-winter in the state but migrate further south to states like the Carolinas and Florida. They are thought to spend their winter months in hibernation under deep patches of leaf and forest floor litter. These species have been shown to be susceptible to high mortality rates caused by improper siting of wind energy complexes. It is likely that the future does not bode well for all of the state's bat populations. Only increased conservation efforts can help this group of species that may be destined for extirpation in Pennsylvania. In Armstrong County, the potential for the creation of winter habitat for bats in the form of protected mines and caves as well as further conservation efforts for summer habitat along the major river corridors is very good.



John White

River otter (*Lontra canadensis*)

Historically, several species either disappeared from much of Pennsylvania or their populations became so low that they were thought to be gone from the state entirely. Two of these species, the fisher (*Martes pennanti*) and the river otter (*Lontra canadensis*) have recently been re-introduced or translocated by the Pennsylvania Game Commission to portions of their range in Pennsylvania where habitat necessary for their existence still occurs. Currently these two species are known to be residents of the county. The prognosis for their future remains very positive.

Armstrong County is very diverse in terms of the habitats available to the mammal fauna. In many portions of the state, habitats are fragmented and the ecosystems necessary for the survival of many species have become small, occupied blocks within a matrix of inhospitable habitat. Development of land, splitting of habitats by un-crossable barriers such as major highways, drainage of wetland areas and environmental degradation have all served to confine many mammal species to very localized populations that become limited in their ability to survive any major change in food resources, availability of nesting habitat or

increased predation. These populations may be doomed to what is termed as "localized extinction". If enough of these populations disappear from the landscape, these species existence in Pennsylvania may be in jeopardy. The potential for conservation efforts protecting mammal habitats and populations in Armstrong County is good, especially for bats and species that use riparian corridors. Efforts for protecting large, abandoned mines as habitat for bats should be expanded with the assistance of the Pennsylvania Game Commission. Large, unfragmented riparian corridors should be stressed so that species such as the river otter and fisher can continue to disperse to new localities and habitats that provide both foraging areas as well as those areas necessary for rearing young.

Armstrong County has become a popular destination for residents of Pennsylvania during the various hunting seasons. As the area continues to attract people for its present scenic beauty, it may in the future suffer from

Regulations and Protection

The Pennsylvania Game Commission (PGC) has the ownership, control, and jurisdiction of the mammals within the Commonwealth. Rules and Regulations on the taking of wildlife can be found through consultation with the PGC.

Important Mammal Areas

Important Mammal Areas (IMAs) are regions designated to recognize areas of high mammal diversity within Pennsylvania. IMAs present within Armstrong County are discussed within the results section on page 49.

continued expansion of developments and the accompanying infrastructure. Large blocks of forested wetlands and vegetated stream corridors can serve as avenues of dispersal for the diverse list of mammals noted to occur in the county. These dispersal corridors may be seriously impacted as human population densities continue to rise. Continued vigilance as well as enlightened management will ensure that the list of mammals found in Armstrong will not be shortened and may grow in the future providing opportunities to all Pennsylvanians to view the state's mammalian wildlife. This, in turn, will enhance the county's wealth as the ecotourism industry begins to flourish in Pennsylvania.

Birds of Armstrong County

Pennsylvania provides a wide range of habitats, including Great Lakes glacial wetlands and Atlantic Coast tidal marshes, southern hardwood heaths, and northern boreal forests. Approximately 400 bird species have been observed in the state; of these 186 regularly breed here (Pulcinella 1997). The state's extensive forests provide breeding habitat for many declining bird species in the Northeast and a large number of raptors and songbirds travel along its ridgetops during spring and fall migration (Brauning 1992). Even though Armstrong County contains few intact habitats such as large forest blocks and wetlands, there is still a variety of habitats available for numerous bird species, including some species of concern.

Forest Bird Communities

Few places with forest blocks large enough to support interior forest species still occur in Armstrong County. The largest forests in the county are located along the Allegheny River and its tributaries, but the largest intact patch of forest is only approximately 2600 acres in size. This is too small for some forest interior birds that require large tracts of forest for nesting. As forested landscapes are fragmented into smaller patches by development, roads, and logging, many bird populations are declining (Askins et al. 1991). These birds are considered forest interior species and require large blocks of core or contiguous interior forest (300 feet from an edge) in order to breed (Robbins, Dawson, and Dowell 1989). Forest fragmentation negatively affects their nesting success because of increased predation from animals that use edges for hunting and brood parasitism. Brown-headed Cowbirds (*Molothrus ater*) use perches along edge to prospect for nests of other species in which to lay their eggs (Robinson 1994). Forest interior species include a variety of owls, hawks, woodpeckers, thrushes, vireos, and warblers.



Bob Moul

Red-shouldered Hawk (*Buteo lineatus*)

Table 7. Examples of forest interior bird species found in Armstrong County

Common Name	Scientific Name
Acadian Flycatcher	<i>Empidonax virescens</i>
Black-throated Blue Warbler	<i>Dendroica caerulescens</i>
Cerulean Warbler	<i>Dendroica cerulea</i>
Pileated Woodpecker	<i>Dryocopus pileatus</i>
Red-shouldered Hawk	<i>Buteo lineatus</i>
Scarlet Tanager	<i>Piranga olivacea</i>
Worm-eating Warbler	<i>Helmitheros vermivorum</i>
Wood Thrush	<i>Hylocichla mustelina</i>

Of those species found in interior forest, four occupy a special niche within the interior forest. The Acadian Flycatcher, Cerulean Warbler, Louisiana Waterthrush, and Red-shouldered Hawk all specialize in riparian corridors and wetlands in interior forest. These habitats, formerly common in Pennsylvania, are being converted to other uses and habitat types at an alarming rate. In riparian areas, floodplain forests should be maintained by limiting harvesting within the riparian zone per

Pennsylvania Bureau of Forestry aquatic habitat buffer guidelines

(http://www.dcnr.state.pa.us/forestry/sfrmp/documents/Water_Aquatic_Buffer_Guidelines.pdf). These forests typically have larger, older trees that provide habitat for cavity-dependent and bark-utilizing species, provide nesting sites for raptor species and colonial waterbirds.

Whenever possible, fragmentation of large contiguous forest tracts (at least 750 acres in size) should be avoided. Naturally uneven-aged forests with a well-developed woody and herbaceous understory should be maintained. Care should be taken not to increase predation and parasitizing opportunities for cowbirds by keeping roads, trails, and other disturbance corridors narrow with the edges of opening in brush or long grass

over 6 inches tall (no mowing). Dead trees, snags, and slash-piles serve many wildlife functions including foraging sites, nesting cavities, hunting perches, and shelter and should be maintained.

Wetland Bird Communities

In Pennsylvania, 56 percent of all state bird species of concern are wetland obligate species and an even higher percentage of species of concern use wetlands at some point during their life cycle (Gross 2002). Wetlands and riparian zones are imperiled habitats across the state (Myers et al. 2000). From 1956-1979, 38% of Pennsylvania’s wetlands with emergent vegetation were drained, filled, or succumbed to succession (Tiner 1990). This combination has led to wetland habitat becoming rare, along with the species that rely on the wetlands.



Ron Austing

Sora (*Porzana carolina*)

Although few intact wetlands remain in Armstrong County today, what does remain provides an important habitat refuge for many declining species. Few natural wetlands exist in the county, but some habitat has been created through manmade ponds and areas surrounding reservoirs. Wetland areas provide breeding and foraging habitat for various raptors such as Osprey (*Pandion haliaetus*) and Bald Eagle (*Haliaeetus leucocephalus*).

Other wetland species, such as waterfowl, shorebirds, and wading birds require these habitats for nesting and foraging. Wading birds, such as Great Blue Herons (*Ardea herodias*), prefer clumps of dead, water-surrounded trees to place their rookeries.

Table 8. Examples of wetland bird species found in Armstrong County.

Common Name	Scientific Name
Alder Flycatcher	<i>Empidonax alnorum</i>
American Black Duck	<i>Anas rubripes</i>
Bald Eagle	<i>Haliaeetus leucocephalus</i>
Belted Kingfisher	<i>Ceryle alcyon</i>
Great Blue Heron	<i>Ardea herodias</i>
Green Heron	<i>Butorides striatus</i>
Willow Flycatcher	<i>Empidonax traillii</i>

Unfortunately, many of these wetland species are secretive, cryptic, and hard to flush, making these challenging habitats to survey and limiting our knowledge of the true range and status of these species.

The conservation and proper management of wetland habitat is crucial to sustaining healthy populations of these bird species in addition to maintaining general

ecosystem viability and a reliable water supply. Immediate needs include the conservation of emergent wetlands that provide nesting, feeding, and wintering habitats for both breeding and migratory species. Wetlands must be protected from hydrologic changes (draining, flooding, filling, etc.), unnatural siltation, pollution, and invasion by exotic species.

Grassland Bird Communities

Historically, most of the northeastern United States was forested except for scattered openings that existed along river floodplains, wetlands, beaver meadows, and heathlands. Fires set by lightning strikes or burning and clearing by Native Americans also opened up forested areas on a periodic basis. With European colonization during the 1800s, grasslands became widespread as forests were cleared for pastures and hayfields allowing grassland species to flourish. Today, with farmland reverting back to forest or being replaced by housing and business developments, species dependent on grasslands are declining, precipitously in some

Table 9. Examples of shrubland and grassland bird species found in Armstrong County.

Common Name	Scientific Name
American Kestrel	<i>Falco sparverius</i>
Bobolink	<i>Dolichonyx oryzivorus</i>
Eastern Meadowlark	<i>Sturnella magna</i>
Grasshopper Sparrow	<i>Ammodramus savannarum</i>
Killdeer	<i>Charadrius vociferus</i>
Savannah Sparrow	<i>Passerculus sandwichensis</i>

cases. Changes in agricultural practices in the Midwest have made early successional habitat in the Northeast important refuges for many grassland species. (Askins, 2000).



Ron Austing

Henslow's Sparrow (*Ammodramus henslowii*)

Although more grasslands have been created in this historically forested area, currently a large number of grassland birds appear to be declining throughout the East, as documented in the American Breeding Bird Survey (BBS). Grassland habitat in Armstrong County consists primarily of agricultural land such as hay fields and pastures, and maintained areas such as reclaimed mines. Most grassland birds, including common species like Eastern Meadowlark (*Sturnella magna*), show a decline of around 40 to 60 percent (Sauer et al. 2000). Their decline has resulted from changes in agricultural practices, habitat fragmentation, pesticide application, natural fire

suppression, and human development. Converting hay fields and pasture to high intensity row crops limits their use as grassland bird habitat. In parts of western Pennsylvania, however, where open areas are maintained as grassland habitat or farmers are participating in the Conservation Reserve Enhancement Program (CREP), several grassland-dependent species have been able to maintain small strongholds. Additionally, some grassland species, such as Henslow's Sparrows (*Ammodramus henslowii*), have adapted to the unique habitat found on abandoned surface mines allowing them to utilize this all too common habitat type to their advantage.

Large-scale planning efforts aimed at preserving grassland bird species should restrict mowing to outside the breeding season, manage grazing using a rotational system, include periodic managed fires to minimize woody plant regrowth, and limit development in areas where grassland-dependent species are known to reside. However, the creation of additional grassland habitats is not considered beneficial and should not be a primary activity for grassland bird conservation.

Regulations and Protection

The Pennsylvania Game Commission has the ownership, control, and jurisdiction of the birds within the Commonwealth. Rules and Regulations on the taking of wildlife can be found through consultation with the PGC.

Many bird species are also protected through international treaties and federal and state laws such as the Migratory Bird Treaty Act and the Endangered Species Act (US Fish and Wildlife Service 2007).

Pennsylvania's Breeding Bird Atlas

The 2nd Pennsylvania Breeding Bird Atlas is the most extensive survey of the state's nesting birds ever attempted. More information about the breeding bird atlas can be found at <http://www.carnegiemnh.org/atlas/>

Reptiles and Amphibians of Armstrong County

Pennsylvania's mixed landscapes create a great diversity of habitats for a wide range of reptile and amphibian species. Pennsylvania's reptile and amphibian makeup, known as the herpetofauna, is quite unique. The ranges of most Pennsylvania reptiles and amphibians are restricted to certain regions of the state, a testament to the varied topography and physiographic provinces within the region. Today, the Commonwealth is home to 77 native herptile species, including those common in the glaciated regions of the Canadian Shield, many of the southern species from the lower regions of the Appalachians, several associated with western prairies, and a few connected with the coastal plain.

Armstrong County is home to many common, generalist species, such as the Eastern Garter Snake (*Thamnophis sirtalis*), Red-spotted Newt (*Notophthalmus viridescens*), Bull and Green Frogs (*Lithobates catesbeianus*, *L. clamitans*), and Painted and Snapping Turtles (*Chrysemys picta*, *Chelydra serpentina*).

These species occur in many different habitats, exist throughout the entire state, and are the most commonly encountered reptiles and amphibians in the Commonwealth. Along with these common species, Armstrong County includes several less common species of herptiles. Many of these species have restricted ranges or are considered specialists, meaning their life histories have more specific habitat requirements.



Milk Snake (*Lampropeltis triangulum*)

Charlie Eichelberger

Salamanders

The woodland salamanders depend on canopied forests with adequate amounts of leaf litter. These salamanders are voracious predators on the forest floor. Their role in limiting the numbers of leaf decomposing invertebrates has been shown to be significant in maintaining a rich layer of organic matter on the forest floor, often an indicator of forest health. The Red-backed, Slimy, Wehrle's, and Valley and Ridge Salamanders (*Plethodon cinereus*, *P. glutinosus*, *P. wehrlei*, *P. hoffmani*) are the most common woodland species in Armstrong County's forests.



Long-tailed Salamander (*Eurycea longicauda*)

Charlie Eichelberger

The numerous waterways and streams of Armstrong County provide habitat for the brook salamanders, including the Seal, Northern and Mountain Dusky Salamanders (*Desmognathus monticola*, *D. fuscus*, *D. ochrophaeus*), the Northern Two-lined and Long-tailed Salamanders (*Eurycea bislineata*, *E. longicauda*) and the Northern Spring Salamander (*Gyrinophilus porphyriticus*). In the cold-water drainages of the county, the brilliant Northern Red Salamander (*Pseudotriton ruber*) can be found under the litter and rocks in seeps and spring heads. All of the streamside salamanders require high water quality.

The largest salamander on the continent, the Hellbender (*Cryptobranchus alleganiensis*) can be found in high quality waters of the Allegheny River drainage. Able to reach well over two feet in length, this bizarre-looking harmless salamander is rarely seen, as it spends the majority of its time under large flat rocks in swift moving waters. Hellbender populations have been declining rapidly due to decreases in water quality, introductions of aggressive non-native crayfish, and competition with non-native fish species. Another fully

aquatic salamander, the Mudpuppy (*Necturus maculosus*), often inhabits waters alongside the Hellbender but is more of a generalist and can be found in many flowing waters that have rocky bottoms. As adults, Mudpuppies have gills, the only salamander in the state with this character. Amphibians as a whole are particularly sensitive to pollution. Consequently, pollutants and heavy sediments loads can be detrimental to the Hellbenders and Mudpuppies inhabiting affected streams.

Temporary wetlands and vernal pools are critical to a group of amphibians that rely on the wet/dry annual cycle that eliminates the possibility of fish populations being established. The Spotted and Jefferson



Charlie Eichelberger

Jefferson Salamander (*Ambystoma jeffersonianum*)

Salamanders (*Ambystoma maculatum*, *A. jeffersonianum*) are vernal pool obligates, meaning they cannot reproduce without the presence of fish free ephemeral wetlands. The Four-toed Salamander (*Hemidactylium scutatum*) is not a vernal pool obligate but can be found in association with these habitats. This diminutive salamander lays its eggs in peat mosses (*Sphagnum* spp.) and can be found in the margins of seeps, springs, and streambanks where *Sphagnum* moss is found above cool, clear water. The Four-toed Salamander tends its clutch, which is laid in vertical mats of sphagnum, until the young hatch.

Frogs and Toads

The Wood Frog (*Lithobates sylvaticus*), like the Ambystomatid salamanders discussed earlier, is considered a vernal pool obligate species, however Wood Frogs are one of the more “liberal” vernal pool species and can also be found breeding in shallow marshes and ditches. The American Toad (*Anaxyrus americanus*), Spring Peeper (*Pseudacris crucifer*), and Grey Tree Frog (*Hyla versicolor*) are regular visitors to many different types of wetlands where they breed and forage.

The Pickerel Frog (*Lithobates palustris*) and Northern Leopard Frog (*L. pipiens*) require heavily vegetated streams and wet meadows. Once Pennsylvania’s most common species of frog, the Northern Leopard Frog has rapidly disappeared from much of its range for mysterious reasons and there is now concern for the future of this species. Likewise, the Western Chorus Frog (*Pseudacris triseriata*) and Mountain Chorus Frog (*P. brachyphona*) can be found using herbaceous marshes, riparian backwaters, and ephemeral wetlands where there is plenty of cover among the grasses and sedges. Both of these species have declined precipitously in the past few decades for a number of reasons, and their continued presence in Armstrong County is in question.

Turtles

The Spotted Turtle (*Clemmys guttata*) is a small semiaquatic turtle that can inhabit a range of wetlands, from vernal pools, to wet meadows, marshes, and slow moving streams. Spotted Turtles are becoming increasingly rare in the state because of habitat loss, predation, and illegal collection. The Wood Turtle (*Glyptemys insculpta*) relies on wooded creeks and rivers, and while it can be locally common in areas, the species is becoming increasingly rare across its range. The Eastern Box Turtle (*Terrapene carolina*) is an easily recognized, generalist species which may be



Charlie Eichelberger

Wood turtle (*Glyptemys insculpta*)

found throughout the county. While this species is still considered common, with a lifespan that may reach beyond a century, many biologists believe that Box Turtle populations have been in a steady decline due to road mortality and predation on nests and juveniles. The Spiny Softshell Turtle (*Apalone spinifera*) can be found throughout the Allegheny River. Female Spiny Softshells are much larger than the males, and females' shells may reach nearly 20 inches in Pennsylvania. One of only two records for the Smooth Softshell turtle (*A. mutica*) in Pennsylvania is from Armstrong County. Not seen since 1901, the Smooth Softshell is presumed extirpated due to the pollution that overtook the large rivers during the industrial revolution.

Turtle nests are laid in suitable substrates with sun exposure, frequently along waterways. These sites are used by many nesting females and are easily targeted by overpopulations of raccoons, skunks, and opossums. There is growing concern for many of Pennsylvania's turtles, because numerous populations are nearly void of juvenile turtles, indicating that there is little successful reproduction occurring.



Charlie Eichelberger

Northern Fence Lizard (*Sceloporus undulatus*)

Lizards and Snakes

The Eastern Fence Lizard (*Sceloporus undulatus*) has historically been known from Armstrong County, and while no record exists for the Five-lined Skink (*Plestiodon fasciatus*) in the county, the range of the species indicates that this species may have thus far been overlooked. These species occur in relatively small, isolated populations in dry habitats with an abundance of cover objects and basking areas. These habitats often include many sun-exposed rocks and dead woody debris. These species are particularly susceptible to localized extinction because of their populations' small sizes and isolation from other lizard populations.

The Northern Black Racer (*Coluber constrictor*) and the Eastern Rat Snake (*Pantherophis alleghaniensis*), two fairly common species in the state, can be found in many different habitats across the county. These two species prey upon small mammals including mice and squirrels. The brilliantly patterned Eastern Milk Snake (*Lampropeltis triangulum*) can be found in a variety of habitats and though it is common, this species is rather secretive and is rarely seen. A more frequently observed snake, the Northern Water Snake (*Nerodia sipedon*) is a widespread resident of Armstrong County. This species hunts along open waterways, searching for amphibians and small fish. Often overlapping habitats with the Northern Water Snake is the Queen Snake (*Regina septemvittata*). This snake is smaller than the Northern Water Snake, with an unpatterned olive-brown back, and a belly that is yellowish tan and striped with four black bands that run the length of the snake. This species is specialized to feed on crayfish, and is thought to be declining in the state because of water pollution and the introduction of invasive Rusty Crayfish (*Orconectes rusticus*).



Charlie Eichelberger

Queen Snake (*Regina septemvittata*)

The Eastern Ribbon Snake (*Thamnophis sauritus*), a slender species of garter snake, depends on the sedge and grass covered edges of wetlands and is thought to be declining due to wetland destruction. The Smooth Green Snake (*Liochlorophis vernalis*) is likely

common in grassy areas but is difficult to locate because its camouflage allows it to virtually disappear into vegetation. Though this snake is rarely seen, the species is considered vulnerable to apparently secure in the state.

Several small and secretive snake species in the county include the Northern Brown Snake (*Storeria dekayi*), Northern Redbelly Snake (*S. occipitamaculata*), and the Northern Ringneck Snake (*Diadophis punctatus*). All of these species are common residents and can be found beneath rocks and decaying wood and bark.

The Timber Rattlesnake (*Crotalus horridus*) and Northern Copperhead (*Agkistrodon contortrix*) have long been persecuted due to their venomous nature. Although these snakes may deliver a serious bite if threatened, the danger they pose has been drastically over-exaggerated. In fact, there has never been a documented human fatality in Pennsylvania from a wild venomous snake bite.

While the range of the Timber Rattlesnake encompasses Armstrong County, no documented occurrences of this species exist in the county. If this species does exist in the county, they are at the westernmost limit of their range, and likely exist in small populations. Rattlesnakes are able to use a wide range of habitats and may be encountered in the forested regions of the county. They primarily occur on rocky slopes where they can find refuge in spaces between the boulders as well as thermoregulate in the sunny openings. Copperheads are able to use a wide range of habitats and may be encountered throughout Armstrong County and can be found from mountaintops to valley floors in dry settings as well as wetland edges. They may forage in a variety of habitats, but favor forested areas with healthy small mammal populations.

Armstrong County is a significant spot in the state for the Commonwealth's reptiles and amphibians. The remaining forested tracts and numerous waterways and wetlands provide critical habitat. Of utmost importance to the conservation of the county's herpetofauna is the protection of the region's forests, streams, marshes, and especially the wet meadows. The past half century has seen a dramatic change in agricultural practices. The intense, hard, mechanized approach to agriculture has led to much habitat destruction for Armstrong's reptiles and amphibians, and efforts to restore some of these habitats should be made. The rich and diverse herpetofauna of Armstrong County is unique to Pennsylvania and should be considered in the long term plan of the region.

Pennsylvania Fish and Boat Commission Regulations

In Pennsylvania, the Fish and Boat Commission has jurisdiction over the reptiles and amphibians. Recently, regulations concerning the herptiles were reviewed and there have been considerable changes with how this group is managed. The regulations now include a list of "no-take" species that are thought to be declining. More information on the amphibian and reptile regulations can be found on the Fish and Boat Commission's website at:
http://sites.state.pa.us/PA_Exec/Fish_Boat/regs_nongame.htm.

Pennsylvania Herpetological Atlas

The Pennsylvania Herpetological Atlas, begun in 1997, serves to fill some of the gaps in our knowledge of herptile distributions in the state. The atlas is a volunteer based project and citizens are encouraged to submit records for species of conservation concern to the atlas. Submissions may be made online at:
<http://www.paherpatlas.org/>

Fish of Armstrong County

Fish are one of the most diverse and interesting animals found in streams, rivers, reservoirs, and lakes. Anglers appreciate sport fishes such as brook trout and smallmouth bass, but there are over 150 fish in the Commonwealth, many of which eat, reproduce, and occupy their habitats in unique and fascinating ways.

Fish can be voracious eaters of other fish or gentle grazers of plants. Many fish are predators of insects, while others eat mollusks, crayfish, salamanders, or frogs. Some fish eat only algae throughout their lives.

Many fish species migrate to spawn. Upstream habitats are important for spawning and the development of young fish. Access to spawning habitats is inhibited by dams along the migratory paths of fish, despite fish ladders on some large dams. Populations of the once common American shad declined greatly from historic levels after dams were constructed on the Susquehanna River.



Northern hogsucker (*Hypentelium nigricans*)

WPC

Nests are created by some fish to protect their young. River chubs (*Nocomis micropogon*) assemble piles of gravel up to 24 inches wide, while trout make nests called “redds” which are trough-like depressions in the stream bottom, oriented to supply oxygen to the developing fish. Channel catfish (*Ictalurus punctatus*) lay their eggs in undercut banks, sunken logs, or abandoned muskrat holes. Sunfish, such as bluegills (*Lepomis macrochirus*), create depressions in sand and gravel on the stream bottom. The adult fish guard the developing eggs from predators and later defend the young larvae until they are able to fend for themselves.



Banded darter (*Etheostoma zonale*)

WPC

Habitat provides food resources and shelter for fish. Bottom dwelling fish prefer to cling to the rocks and logs that line the stream beds. Sculpins and darters, adapted to the life on the stream bottom, rest their fins on the substrate and eat insects that cling to the rocks. Other fish prefer to swim the open waters or among vegetation at the shores of rivers and lakes.

The fish found in Pennsylvania’s flowing waters have distinct habitat preferences; the two most important factors of habitat are stream size and water temperature. The typical habitats of streams and rivers are stratified as:

- Headwater streams are the smallest streams, and water temperatures are often cold (<70°F). The water is fast-moving, well-oxygenated, and usually slightly acidic. These streams often hold “Coldwater Fish Community,” species such as brook trout (*Salvelinus fontinalis*) and mottled sculpin (*Cottus bairdii*).
- Mid-reach streams are slightly warmer (65-75°F) and have a mixture of stream habitat types, such as pools, riffles (fast-flowing, turbulent waters) and runs (moderately flowing, but calm waters). These streams usually have “Coolwater Stream Fish Community,” with smallmouth bass (*Micropterus dolomieu*), creek chubs, and a variety of shiner, sucker, and dace species.
- The Lower Reaches of streams often have warmer waters (>75°F) and slower flows. Pools and runs become more prominent than riffles. These streams usually have “Warmwater Fish Community,” with largemouth bass (*Micropterus salmoides*) and different species of darters.
- Large rivers, such as the Allegheny, Ohio, Susquehanna, and Delaware Rivers, usually have warmer, slower waters. When there are dams, the habitat can be similar to lake conditions. Since large rivers usually flow through well-populated areas, they often receive many pollutants and have multiple threats to water quality. Rivers may have “Large River Fish Community” with fish species like channel

catfish, sauger (*Sander canadensis*), freshwater drum (*Aplodinotus grunniens*), and river herring (*Moxostoma carinatum*).

Table 10. Common fish communities of Armstrong County determined by the PNHP Aquatic Community Classification.

Fish Community	Indicator Species
Coldwater Community*	Brook trout (<i>Salvelinus fontinalis</i>) mottled sculpin (<i>Cottus bairdii</i>), brown trout (<i>Salmo trutta</i>), rainbow trout (<i>Oncorhynchus mykiss</i>)
Coolwater Stream Community	Blacknose dace (<i>Rhinichthys atratulus</i>), creek chub (<i>Semotilus atromaculatus</i>), stocked brown trout (<i>Salmo trutta</i>), white sucker (<i>Catostomus commersoni</i>), redbreast dace (<i>Clinostomus elongatus</i>), longnose dace (<i>Rhinichthys cataractae</i>), fathead minnow (<i>Pimephales promelas</i>), pearl dace (<i>Margariscus margarita</i>), and slimy sculpin (<i>Cottus cognatus</i>)
Warmwater Community	Greenside darter (<i>Etheostoma blennioides</i>), central stoneroller (<i>Campostoma anomalum</i>), rainbow darter (<i>Etheostoma caeruleum</i>), rosyface shiner (<i>Notropis rubellus</i>), johnny darter (<i>Etheostoma nigrum</i>), fantail darter (<i>Etheostoma flabellare</i>), logperch (<i>Percina caprodes</i>), stonecat (<i>Noturus flavus</i>), silver shiner (<i>Notropis photogenis</i>), golden redbreast (<i>Moxostoma erythrurum</i>), mimic shiner (<i>Notropis volucellus</i>), pumpkinseed (<i>Lepomis gibbosus</i>), yellow perch (<i>Ameiurus natalis</i>), large-mouth bass (<i>Micropterus salmoides</i>), green sunfish (<i>Lepomis cyanellus</i>), tonguehead minnow (<i>Exoglossum laurae</i>), Ohio lamprey (<i>Ichthyomyzon bdellium</i>)
Large River Community	Channel catfish (<i>Ictalurus punctatus</i>), sauger (<i>Sander canadensis</i>), freshwater drum (<i>Aplodinotus grunniens</i>), walleye (<i>Stizostedion vitreus</i>), quillback carpsucker (<i>Carpionus cyprinus</i>), smallmouth buffalo (<i>Ictiobus bubalus</i>), river herring (<i>Moxostoma carinatum</i>), mooneye (<i>Hiodon tergisus</i>), white crappie (<i>Pomoxis annularis</i>), longnose gar (<i>Lepisosteus osseus</i>), brook silverside (<i>Labisthes sicculus</i>)

* The most common communities that are dominant in the Armstrong County watersheds are discussed in Appendix VII. Although there are Coldwater Communities in Armstrong County, no watershed was dominated by the community type.

Much of Armstrong County’s fish diversity is contained within the minnow family. These minnows and shiners are found in a variety of waterways. Some commonly encountered species include northern hogsucker, white sucker, blacknose dace, brook trout, pumpkinseed, longnose dace, bluegill, and banded darter. Additionally, trout, sculpins, catfishes, and other darters and sunfishes are common groups found in the waterways of Armstrong County. The Aquatic Community Classification has identified several fish communities (Table 10). Fact sheets detailing these communities can be found in Appendix VII.



Pumpkinseed (*Lepomis gibbosus*)

Conservation Recommendations

Preserving water quality is important to fish, particularly those sensitive to poor water quality, such as brook trout and some darters. Sensitive fish are readily lost from streams when water quality begins to decline. Additionally, many invertebrates, which serve as the food base to stream fish, are especially sensitive to water quality. The headwaters and mid-reach streams often provide important spawning habitat, even if some of the fishes live further downstream most of the time.

Preservation of water quality in rivers and streams starts in the headwaters and mid-reach streams. Well-vegetated riparian zones provide the leaves and woody debris that sustain the headwater food chain and lead to properly functioning stream ecosystems in the lower reaches. The riparian zone is also important to provide shading, keeping water temperatures cool. The most important function of the riparian buffer is to filter out sediments and other compounds that flow from the land into streams.



WPC

Log perch (*Percina caprodes*)

Mine drainage plagues the waterways in the coal mining regions of Pennsylvania, such as Armstrong County. Acidification and metal contamination from mine drainage often wipes out the fish community. While clean-up of contaminated streams is costly, programs to fund remediation projects are available through Commonwealth agencies, such as the Department of Environmental Protection.

Water quality issues are complex for large rivers because there are many sources of pollution. Degradation due to runoff from agriculture and impervious surfaces is compounded by point-source pollution (such as effluent from sewer treatment plants and industrial discharges). Riparian buffers assist in controlling non-point source pollution in larger streams and rivers. Improving water quality from sewage outfalls, stormwater, and legacy mining effluent and industrial pollution, particularly in large rivers, are challenges for water resource managers.

The most widespread causes of water quality and habitat decline in Pennsylvania are suspended sediments in the water and sedimentation of the stream habitat. Erodable sediments are transported into streams or are rapidly eroded from stream banks. Soils can erode from improperly managed agriculture, logging, and other earth disturbances. Suspended sediments cloud the waters to levels that are intolerable to some organisms. The excess sediment fills in the spaces between gravel and rocks, smothering habitat for the invertebrates on which fish feed, and spawning and nesting habitats. In addition, sediments can carry large amounts of nutrients that over-stimulate plant growth and bacteria causing alterations in the food web and eutrophication. Erosion can be controlled by establishing or maintaining buffers of native vegetation and adequate width along all streams.



WPC

Longnose dace (*Rhinichthys cataractae*)

Another human-caused alteration to fish populations includes the stocking of non-native fish such as brown trout, rainbow trout, and the stocked subspecies of muskellunge. Fishes such as these are introduced for their appeal as sport fishes, and their capability to thrive in new environments. Unfortunately, their success may be at the expense of native fishes. Stocked species are often more aggressive than native species and can out-compete the natives for food and habitat. This leads to losses in biodiversity as the native fishes are displaced or die because they cannot co-exist with the introduced species.

For more information on Pennsylvania's fish species, see:
<http://www.fish.state.pa.us/pafish/fishhtms/chapindx.htm>

For more information on Pennsylvania's fish communities and stream types, see:
Walsh, M.C., J. Deeds, and B. Nightingale. 2007. User's Manual and Data Guide to the Pennsylvania Aquatic Community Classification. Pennsylvania Natural Heritage Program, Western Pennsylvania Conservancy, Middletown, PA, and Pittsburgh, PA.

Freshwater Mussels of Armstrong County

North America has the highest diversity of freshwater mussels in the world with nearly 300 species (Williams et al. 1993). Historically, 65 species were known from Pennsylvania (PNHP 2009). Freshwater mussels are found in waterways throughout Pennsylvania, from medium-sized streams to large rivers. Freshwater mussels are an important part of aquatic ecosystems, filtering and cleaning the water, as well as making nutrients more available



PNHP

for other aquatic life (Vaughn and Hakenkamp 2001). They can be hard to find because they bury themselves in the substrate and blend in with cobble and gravel.

Many freshwater mussels, like the wavy-rayed lampmussel (*Lampsilis fasciola*) shown here, have highly evolved lures to attract host fish.

Armstrong County currently contains approximately 26 species of freshwater mussels, most of which are found in the Allegheny River. However, many of these species probably occur in much lower numbers than historic populations (Ortmann 1909). The Allegheny River is free-flowing for more than 100 miles from Kinzua Reservoir in Warren County to the navigational pools beginning near East Brady. Many freshwater mussels have lost major portions of their habitats due to the lock and dam system built on the lower and middle Allegheny River. These dams were built in order to create a minimum 9 foot pool to allow barge traffic. These dams are fixed crest and do not provide flood control (U.S. Army Corps of Engineers 2010). Prior to construction of these dams the lower Allegheny consisted primarily of shallow riffles and runs (Ortmann 1909). Although the lower sections have been dammed, and water quality has been impacted by industry, the free-flowing sections of the upper and middle Allegheny provide important habitat for aquatic species that require well-oxygenated, fast moving water, including many species of mussels and fish. Nearly 40 species of freshwater mussels were historically known from the entire Allegheny River. Since 1990 only approximately 30 species have been recorded. However, the middle and upper sections of the Allegheny River continue to provide globally important habitat for mussel species, including two federally endangered species, clubshell (*Pleurobema clava*) and northern riffleshell (*Epioblasma torulosa rangiana*).

Native freshwater mussels have a unique life cycle that is well adapted to flowing waters and aids the dispersal of these relatively immobile organisms. The larval stage of many mussels, called a glochidium, must attach to a fish, usually on the gills, to feed and grow for a couple of weeks. The glochidia are so small that no negative effect is felt by the fish. After transforming into a juvenile mussel, it falls off into the substrate and grows there by feeding on nutrients in the substrate and plankton in the water. The host fish may transport the glochidia long distances, enabling the mussels to colonize new habitats. There is an amazing range of adaptations that exist in freshwater mussels to ensure that the glochidia can successfully attach to a host fish. In some species a portion of the mussel's internal tissue has been modified to look like a minnow. The female mussel opens its shell and displays the minnow-like lure to attract predator fish and then expels the glochidia onto any fish that is attracted to the lure.

Threats to native mussels include the construction of dams, non-native invasive species such as the zebra mussel (*Dreissena polymorpha*) and the Asian clam (*Corbicula fluminea*), stream channelization, water pollution, sedimentation from poor agriculture and forestry practices, bridge and road construction, and habitat loss through dredging (Richter et al. 1997). As filter feeders, mussels are sensitive to changes in water quality, making the presence of a healthy mussel community an indicator of high water quality. Many of the streams in Armstrong County have been impacted by abandoned mine drainage, which has dramatically reduced mussel populations and also affects the health of other aquatic organisms. The impacts of abandoned mine drainage are somewhat mitigated in the Allegheny River due to the large volume of water. However, the creation of the navigational lock and dams

on the Allegheny, commercial sand and gravel dredging, and non-native invasive species are threats to mussel populations in the river.

Zebra mussels have been found in the Allegheny River in Armstrong County. They grow on hard surfaces including the shells of native mussels and compete with native mussels for food. In high enough densities, they can starve and suffocate native mussels by covering their shells completely. Zebra mussels generally do not reach high densities in flowing water, but the navigational dams create slow water habitat that zebra mussels are able to colonize more successfully.

Additionally, boat traffic made possible by the navigational pools enables the spread of zebra mussels.

Regulations and Protection

The Pennsylvania Fish and Boat Commission (PFBC) has the ownership, control, and jurisdiction of the mussels within the Commonwealth. Rules and Regulations on the taking of wildlife can be found through consultation with the PFBC.

Dredging removes sand and gravel substrate, and the deep depressions that remain often fill with silt and debris (Brown et al. 1998) unsuitable for colonization by riverine mussels. Altered substrate and flow resulting from gravel extraction can reduce or eliminate mussel populations (Hubbs et al. 2003). Dredging can alter river hydrology and increase silt in the water column. In addition to the direct effects to mussels, suspended sediments from excavation activities have led to the loss or reduction of fish and macroinvertebrate habitat (Brown et al. 1998, Cross et al. 1982). A study by the Western Pennsylvania Conservancy mapped depths in navigational pools 4-8, showing depths in parts of the Allegheny River approaching 70 feet. Approximately 37% of the river bottom was deeper than 20 feet (Long and Chapman 2008), although navigation only requires a depth of 9 feet. Certain areas of the river have dredging restrictions, including buffers along shorelines, islands, and bridges. The results of a PNHP/WPC mussel study indicate higher mussel species richness and abundance in undredged, shallow portions of the river. In this mussel study, 95% of live mussels were found in areas less than 20 feet (Smith and Meyer *in press*). The Pennsylvania Department of Environmental Protection and the U.S. Army Corps of Engineers issue permits for sand and gravel dredging in the river.

Protecting habitats where mussels currently occur is a first step to ensuring the long-term persistence of a mussel resource. Preventing major channel alteration by bridges, dams, and dredging is important for maintaining habitat. Alleviating excessive amounts of sediment, nutrient, and toxin input to streams and rivers will help maintain good water quality, and thus, support healthy mussel communities. Adopting zoning, stormwater retention, and natural resource protection ordinances will help protect mussels. Reducing the effects of urbanization through control of quantity and quality of stormwater will also help protect these habitats.

Effective conservation of mussel populations will result only from preserving aquatic systems as a whole. Targeting entire biological communities is a proactive approach to biodiversity conservation because it protects complete assemblages of species, rather than focusing on saving a single species. In the biological community approach, all species are protected: the common, the rare, and those not yet discovered (Higgins et al. 1998). Pennsylvania has several freshwater mussel species that are considered globally rare. By performing conservation work in the watersheds where these species are found, we are able to conserve the species more effectively. For these reasons, it is important to protect examples of each mussel community and the watersheds that contain them.

Table 11. Mussels found in Armstrong County (since 1990) based on available PNHP records

<i>Actinonaias ligamentina</i>	Mucket	<i>Leptodea fragilis</i>	Fragile papershell
<i>Alasmodonta marginata</i>	Elktoe	<i>Ligumia recta</i>	Black sandshell
<i>Amblema plicata</i>	Threeridge	<i>Pleurobema clava</i>	Clubshell
<i>Elliptio dilatata</i>	Spike	<i>Pleurobema sintoxia</i>	Round pigtoe
<i>Epioblasma torulosa rangiana</i>	Northern riffleshell	<i>Potamilus alatus</i>	Pink heelsplitter
<i>Epioblasma triquetra</i>	Snuffbox	<i>Ptychobranchus fasciolaris</i>	Kidneyshell
<i>Fusconaia flava</i>	Wabash pigtoe	<i>Pyganodon grandis</i>	Giant floater
<i>Fusconaia subrotunda</i>	Long solid	<i>Quadrula quadrula</i>	Mapleleaf
<i>Lampsilis cardium</i>	Plain pocketbook	<i>Simpsonaias ambigua</i>	Salamander mussel
<i>Lampsilis fasciola</i>	Wavy-rayed lampmussel	<i>Strophitus undulatus</i>	Creeper
<i>Lampsilis ovata</i>	Pocketbook	<i>Utterbackia imbecillis</i>	Paper pondshell
<i>Lampsilis siliquoidea</i>	Fatmucket	<i>Villosa fabalis</i>	Rayed bean
<i>Lasmigona costata</i>	Flutedshell	<i>Villosa iris</i>	Rainbow mussel

Insects of Armstrong County

Pennsylvania is home to over ten thousand insect species. We know very little about most of these species, but there are three groups of insects that have been studied well enough to allow the Pennsylvania Biological Survey to assign state ranks to all the species occurring in the Commonwealth: the Odonata (dragonflies and damselflies), the Lepidoptera (butterflies and moths), and the Cicindelidae (tiger beetles).

Dragonflies and Damselflies

There are approximately 350 species of dragonflies (Needham et. al. 2000) and 161 species of damselflies (Westfall and May 1996) in North America. Within Pennsylvania 121 species of dragonflies and 55 species of damselflies are known to occur (PNHP 2006).

Adult odonates can fly with exceptional maneuverability and speed, allowing them to be efficient predators. Larval odonates are also predators of aquatic insects, often eating the larvae of the same species preyed on by adults. Predators such as these can have significant effects on populations of prey such as mosquitoes.



Rick Koval

Lilypad Clubtail (*Arigomphus furcifer*)

Odonates live in a wide variety of aquatic habitats, from clear mountain streams to large rivers, small temporary forest pools to large wetlands or lakes. Declines in water quality and alteration or destruction of habitat are the greatest threats to populations of odonates (Westfall and May 1996). Many activities take place that destroy or alter odonate habitats so that they are no longer suitable for odonates or can only support a few tolerant species. Alteration of hydrology can also cause odonate mortality. Poor storm water management can cause unusually large fluctuations in water flow. Heavy water demand can lead to decreased water tables and lower

flow through the streams. Changes in natural water flow patterns can cause changes in sedimentation rates, nutrient loading, floodplain area and water depth, hydroperiod, temperature, dissolved oxygen levels and the types and amounts of aquatic vegetation in and around the aquatic habitat. All of these factors are important in proper development of odonate eggs and larvae.

Development of extensive agricultural, urban, and suburban areas creates biological islands of isolated natural areas. It can be difficult for animals to move long distances across unsuitable habitat and navigate large obstacles such as highways and developed areas, although some stronger flying odonates are able to evade these obstacles, however, other odonate species are not strong flyers or are disinclined to fly any great distance from their preferred type of habitat. For those species that can travel large distances, there is increased risk that they will not be able to find suitable habitat at the end of their journey in a fragmented landscape with diminished habitat. Just as habitat fragmentation isolates a group of animals on an island of habitat, it also isolates the gene pool collectively held by that group of animals. When animals cannot make contact with other populations, inbreeding occurs. This means there is no gene flow between populations and a loss of genetic diversity results. As genetic diversity is lost, the offspring become less healthy and the ability of that population to adapt to changes in the environment is reduced. This increases the chances that the population will go extinct.

Butterflies and Moths

There are an estimated 765 species of butterflies and 10,500 moths in the United States and Canada (Covell 1984). The varied habitats present within Pennsylvania support 154 species of butterflies and skippers (PNHP data 2006), and up to 1,200 species of moths. No state agency is directly responsible for managing butterfly



Gray Hairstreak (*Strymon melinus*)

Sally Ray (PNHP)

and moths, and scientists suspect downward population trends are occurring for many species within the Commonwealth.

Butterflies and moths are grouped together in the insect order called Lepidoptera. Inspecting the two forewings or hindwings under magnification, each wing reveals thousands of neatly arranged scales of different colors. These species are also characterized by a coiled, tubular mouthpart called the proboscis which is used to drink nectar.

These species undergo a complete metamorphosis. This type of lifecycle begins with an egg laid on a specific host plant. The egg hatches and a tiny caterpillar (larva) emerges. The caterpillar feeds and grows larger, and will shed its skin several times to allow for growth. The pupa stage emerges when a fully-grown caterpillar sheds its skin and exposes a

protective shell. Inside this shell the transformation from caterpillar to adult takes place. After a period of time that varies from species to species, the adult emerges and the moth or butterfly takes off on its maiden flight.

Butterflies and moths are closely related insects, and they share many common features. They have similar life histories and they utilize a similar suite of habitats. However, there are important differences between the two groups. Moths typically land and spread their wings open flat, while butterflies will often land and close their wings together over their back, or at 45-degree angles (the skippers). Moths are mostly active at night and butterflies fly during the day, although there are also many day-flying moths. Butterfly pupae have a smooth exterior called a chrysalis, while moth pupae form a cocoon, which is typically wrapped in silky fibers.

Many butterflies and moths depend not only on specific habitat, but also on a single species of plant within that habitat. For example, the monarch butterfly (*Danaus plexippus*) only uses milkweed (*Asclepias* spp.) as its larval food plant. Therefore, maintenance of populations of the host plants for these insects is vital for the continued success of these species.



Common Least Skipper (*Ancyloxypha numitor*)

Sally Ray (PNHP)

Tiger Beetles

Beetles make up the order Coleoptera, which is the largest order in the animal kingdom with 350,000 named species. We know very little about the distribution of most beetles in Pennsylvania, but the tiger beetle family is an exception. These colorful, active, relatively large beetles have attracted the attention of amateur naturalists, thus they are frequently collected. Consequently, we have a good understanding of their historical range, abundance, and habitat requirements. Although little survey work for tiger beetles has been conducted in Armstrong County, approximately 20 species occur in Pennsylvania (Pearson et al. 2006).

Tiger beetles range in color from brilliant green, to orange, to brown, to grayish black, and usually have white spots on the wing covers. They are approximately one-half inch (10-21 mm) long. Tiger beetles are predators, generally eating smaller insects such as flies and ants. They move swiftly over the ground, and, unlike most other beetles, take flight without a split second's hesitation when approached.

Because they hunt by running, they are usually restricted to areas with exposed substrate such as soil, sand, or small rocks, without dense vegetation. Different species have highly specific preferences for habitat, and these exposed habitats are usually created by disturbance. Some species use habitat created by human disturbance, such as quarries or the compacted soil along foot trails, but many other species live along streams and rivers in habitats created by natural disturbance. These riverine habitats, including vertical clay banks, cobble scours, and sand bars, are created and maintained by the fast-flowing water of natural flooding regimes.



Betsy Leppo (PNHP)

Six-spotted tiger beetle (*Cicindela sexguttata*)

Protection of tiger beetles revolves around the maintenance of natural flooding regimes and streamside riparian vegetation in watersheds where this species occurs. Reduction of these floods by building dams allows vegetation to grow on previously scoured areas, and prevents the formation of new sandbars. Keeping vegetated buffers along streams prevents erosion that can clog streams with silt and reduces the availability of sand and cobble habitat. Exotic invasive plants such as Japanese stiltgrass (*Microstegium vimineum*) can quickly colonize bare sand sites and thus prevent tiger beetles from using them.

The presence of a diverse assemblage of tiger beetle species along a waterway is an indicator of a healthy stream, that is, a stream with a natural disturbance regime that creates a diversity of geomorphological features. Such a stream is also likely to support diverse populations of fish, aquatic invertebrates, and other species.

While the largest and most obvious organisms in our environment are relatively easy to evaluate, a large number of organisms have received little attention, frequently due to their small size or cryptic habitats. These groups include most insects, snails, spiders, mushrooms, mosses, lichens. Though not as widely studied as the mega fauna and flora, the role of these small things within the environment is enormous. For the most part, these understudied taxonomic groups currently lack any official protection status. Early efforts to conserve large quality habitats that support significant diversity of these organisms can help avoid the necessity of protecting individual species in the future. The following account of the biology and ecology of land snails was prepared for this report as an introduction to a group of organisms that are often overlooked and undervalued for the significant role they play in the environment.

Land Snails of Pennsylvania by Timothy A. Pearce, Carnegie Museum of Natural History

Pennsylvania's often overlooked land snails and slugs play an important role in food webs where they function as scavengers and prey items for other species. By grazing on vegetation and scavenging decomposing material, snails and slugs convert plant and waste matter into concentrated energy sources available to higher predators, serving as a critical food source for small mammals, reptiles, amphibians, insects, and birds. In fact, the shells of snails are extremely important to female birds as a source of calcium during the egg laying season (Graveland et al. 1994).



Photo: Maria Coppelino

Eight species of native snails placed on a penny for scale

Land snails occur in nearly every terrestrial habitat, including relatively pristine forests, disturbed woods, meadows, agricultural areas, residential yards and gardens, and even traffic islands and waste areas. Non-native species tend to occur in more disturbed areas. Habitat requirements of individual land snail species are poorly known, however we do know that snails need moisture and that they tend to be more abundant and diverse in limestone areas where calcium is abundant. Microhabitats are likely to be important, but specific needs of individual species are mostly unknown at this time.

Of the approximately 130 species of land snails and slugs in Pennsylvania, 33 species are known in Armstrong County. All the snails and two of the slug species are native to Pennsylvania, but 4 of the slug species are non-native, introduced from Europe. While no land snails are currently recognized as, or proposed for having special status in PA, one species (*Glyphyalinia raderi*) is considered globally imperiled (G2) based on its currently known distribution in only three mid-Appalachian states. Two other uncommon species documented in Armstrong County (*Inflectarius inflectus* and *Patera pennsylvanica*) are worth noting for their limited distribution in Pennsylvania.

Land snail populations are declining across North America (Lydeard et al. 2004) with habitat destruction and change being the primary threat. Effective conservation of land snails will result from identifying where rare species or high species diversity occur and conserving those habitats.

Because land snails are strongly influenced

by moisture, changes in hydrology can alter snail populations. Activities such as long wall mining, damming, road building, and vegetation changes are just a few of those noted in causing land snail declines. Invasive plants can alter microhabitats, and exotic animals such as Norway rats and terrestrial flatworms directly prey on our native land snails. Invasive snails and slugs can compete with, and sometimes outcompete, native land snail species (Rollo 1983a, b). Other threats to land snails include acid precipitation, which can interfere with their ability to acquire calcium for their shells, and global climate change, which will alter temperatures and moisture patterns. The quintessentially slow moving snails might be unable to cope with these shifting habitats. Moving snails might be unable to keep up with their shifting habitats.

The Pennsylvania Land Snail Atlas Project, an effort begun in 2005 to map the distribution of Pennsylvania's land snails, has already documented several new state records and scores of new county records. The project continues to fill gaps in our knowledge of land snail distributions and status. Pennsylvanian residents may submit specimens to the project by sending land snails along with locality information about where they were collected to: Tim Pearce, Carnegie Museum of Natural History, 4400 Forbes Ave., Pittsburgh, PA 15217; PearceT@CarnegieMNH.org; (412)622-1916.

Methods

Sixty-one county inventories have been completed in Pennsylvania to date. The methods used in the Armstrong County Natural Heritage Inventory followed established Pennsylvania Natural Heritage Program procedures, which are based on those used by Anonymous (1985), Reese et al. (1988), and Davis et al. (1990). Natural Heritage Inventories proceed in three stages: 1) site selection based on existing data, map and aerial photo interpretation, recommendations from local experts and aerial reconnaissance; 2) ground surveys; and 3) data analysis and mapping.

Site Selection

Inventory site selection is guided by information from a variety of sources. A review of the Pennsylvania Natural Heritage Program database determined what locations were previously known for species of concern and important natural communities in Armstrong County. Local citizens knowledgeable about the flora and fauna of Armstrong County were contacted for site suggestions. Individuals from academic institutions and state and federal agencies that steward natural resources (e.g., Pennsylvania Game Commission, Pennsylvania Bureau of Forestry, Carnegie Museum of Natural History) were also contacted to obtain information about lands or resources they manage. National Wetland Inventory data, compiled by the U.S. Fish and Wildlife Service, was used to locate wetlands of potential ecological significance within the county. General information from other sources such as soil maps, geologic maps, earlier field studies, and published materials on the natural history of the area helped to provide a better understanding of the area's natural environment.

Aerial photographs were reviewed to identify sites for ground survey. An initial study of aerial photos revealed large-scale natural features (e.g., contiguous forest, wetlands), disturbances (e.g., utility line rights-of-way, surface mines, timbered areas), and a variety of other features. Once preliminary site selection was completed, a reconnaissance flight over chosen areas of the county was undertaken. Information concerning extent, quality, and context within the landscape can be gathered easily from the air. River scour shorelines, wetlands, and contiguous blocks of forest were of primary interest during fly-overs in Armstrong County. Based on aerial photo interpretation and aerial surveys, some sites were eliminated from consideration if they proved to be highly disturbed, fragmented, or lacked the targeted natural feature.



Denise Watts, PNHP

PNHP ecologists study aerial photographs as part of the site selection process, including Black Fox Island in the Allegheny River.

Ground Surveys

Areas identified as inventory sites were scheduled for ground surveys. Ecologists conducted field surveys throughout Armstrong County from 2007 through 2008. After obtaining permission from landowners, sites were examined to evaluate the condition and quality of the habitat and to classify the communities present. Field survey forms were completed for each site. Using location data collected using Global Positioning Systems (GPS), boundaries for each site were determined using USGS 1:24,000 topographic maps and PAMAP aerial photography. If a plant species of concern was recorded and the population was of sufficient size and vigor, a voucher specimen was collected to be archived in the herbarium of the

Carnegie Museum of Natural History in Pittsburgh. The flora, fauna, level of disturbance, approximate age of forest community and local threats were among the most important data recorded for each site. In cases where landowner permission for site visits could not be obtained or enough existing information was available from other sources, sites were not ground surveyed.

Data Analysis and Mapping

Data on species of concern and natural communities obtained during the field work for this inventory were combined with existing data and summarized. Plant and animal nomenclature follows that adopted by the Pennsylvania Biological Survey. Natural community descriptions primarily follow Fike (1999). All sites with rare species and/or natural communities were selected for inclusion in Biological Diversity Areas (BDA). Spatial data on the elements of concern was compiled in a Geographic Information System (GIS; ESRI ArcGIS 9.0). Boundaries defining core habitats and supporting landscapes for each BDA were delineated using PNHP conservation planning specifications for the elements of concern. These specifications are based on scientific literature and professional judgment for individual species or animal assemblages and may incorporate physical factors (e.g., slope, aspect, hydrology); ecological factors (e.g., species composition, disturbance regime); or input provided by jurisdictional government agencies. Boundaries tend to vary in size and extent depending on the physical characteristics of a given site and the ecological requirements of its unique natural elements. For instance, two wetlands of exactly the same size occurring in the same region may require very different areas to support their functions if one receives mostly ground water and the other receives mostly surface water, or if one supports riparian species of concern. The BDAs were then assigned a significance rank based on their importance to the biological diversity and ecological integrity of Armstrong County (Table 12). These ranks can be used to help prioritize future conservation efforts.

Table 12. County Natural Heritage Areas Significance Ranks

<i>Ranks</i>	<i>Description</i>
Exceptional	Sites that are of exceptional importance for the biological diversity and ecological integrity of the county or region. Sites in this category contain one or more occurrences of state or national species of concern or a rare natural community type that are of a good size and extent and are in a relatively undisturbed condition. Sites of exceptional significance merit quick, strong, and complete protection.
High	Sites that are of high importance for the biological diversity and ecological integrity of the county or region. These sites contain species of concern or natural communities that are highly ranked, and because of their size or extent, and/or relatively undisturbed setting, rate as areas with high potential for protecting ecological resources in the county. Sites of high significance merit strong protection in the future.
Notable	Sites that are important for the biological diversity and ecological integrity of the county or region. Sites in this category contain occurrences of species of concern or natural communities that are either of lower rank (G and S rank) or smaller size and extent than exceptional or high ranked areas, or are compromised in quality by activity or disturbance. Sites of notable significance merit protection within the context of their quality and degree of disturbance.
Local	Sites that have great potential for protecting biodiversity in the county but are not, as yet, known to contain species of concern or state significant natural communities. Often recognized because of their size, undisturbed character, or proximity to areas of known significance, these sites invite further survey and investigation. In some cases, these sites could be revealed as high or exceptional sites.

Results

Natural Heritage Areas & Conservation Planning Categories

To provide the information necessary to plan for conservation of biodiversity at the species, community and ecosystem levels, two types of Natural Heritage Areas, as well as designations from two other conservation programs, are included in the report.

Biological Diversity Area (BDA)

BDAs are areas containing plants or animals of concern at state or federal levels, exemplary natural communities, or exceptional native diversity. BDAs include both the immediate habitat and surrounding lands important in the support of these elements. They are mapped according to their sensitivity to human activities, with designations of Core Habitat and Supporting Landscape areas. “Core” areas delineate essential habitat that cannot absorb significant levels of activity without substantial impact to the elements of concern. “Supporting Landscape” areas maintain vital ecological processes or secondary habitat that may be able to accommodate some types of low-impact activities.

Landscape Conservation Area (LCA)

LCAs are large contiguous areas that are important because of their size, open space, habitats, and/or inclusion of one or more BDAs. Although a LCA includes a variety of land uses, it typically has not been heavily disturbed and thus retains much of its natural character. These large regions can be viewed as regional assets: they improve quality of life by providing a landscape imbued with a sense of beauty and wilderness, they provide a sustainable economic base, and their high ecological integrity offers a unique capacity to support biodiversity and human health. Planning and stewardship efforts can protect these landscape functions by limiting the overall amount of land converted to other uses, thereby minimizing fragmentation of these areas.

The preparation of this report has resulted in the identification of fifty-one Biological Diversity Areas and one Landscape Conservation Areas (LCAs). Two Important Mammal Areas (IMAs) and one Important Bird Area (IBA) have also been defined in the county. These are discussed in turn, beginning with larger, landscape level conservation areas and are followed by the discussion of Biological Diversity Areas.

Landscape-scale Conservation

Prior to European settlement, forest covered more than 90 percent of Pennsylvania (Goodrich et al. 2003). Today, 62 percent of the state is forested, comprising an area of over 17 million acres (Figure 6a; Goodrich et al. 2003; Myers et al. 2000). Figure 6b shows the fragmentation of these forests by major fragmenting features such as interstate highways and major rivers. However, much of this forest exists as relatively small islands isolated by surrounding linear features such as roads, utility rights-of-ways, all-terrain vehicle trails, snowmobile trails and railroads, as well as patches of non-forested lands. Figure 6c shows forested areas greater than one acre that remain after fragmentation by interstates and highways, state and local roads, public forest roads, utility rights-of-way and active railroads. These forest blocks represent potential contiguous habitat for animals sensitive to all scales of fragmenting features, such as amphibians and interior forest birds. The acreage size classes shown in this figure roughly correspond to area-sensitive species requirements.

A number of studies have looked at the effects of roads and other linear features on the landscape. Ecological impacts of these fragmenting features include: 1) direct mortality of wildlife from vehicles; 2) disruption of wildlife dispersal; 3) habitat fragmentation and loss; 4) imposition of edge effects; 5) spread of exotic species; and 6) alteration of the chemical environment.

Roads can be a significant cause of mortality for a variety of animals. Amphibians may be especially vulnerable to road-kill because their life histories often involve migration between wetland and upland

habitats, and can be inconspicuous and not readily seen. A study conducted in southeastern Pennsylvania documented over 100 road-killed salamanders and frogs on a single one-mile stretch of road during one rainy night in the spring breeding season (Goodrich et al. 2003). Large and mid-sized mammals are particularly susceptible to vehicle collisions on secondary roads, while birds and small mammals are most vulnerable on wider, high-speed highways (Forman and Alexander 1998). In Upper St. Clair Township, Pennsylvania, over a recent four year period, white-tailed deer mortality due to road-kills was approximately four times higher than mortality due to hunting (Upper St. Clair Township Department of Deer Management, 2005). Six hundred and thirty seven bobcats (*Lynx rufus*) were reported as road kills in Pennsylvania from 1985-2000 (Goodrich et al. 2003). A 10-year study of road mortality along a 90-mile section of highway in New Jersey recorded 250 raptors representing 12 species.

Animals may also alter their behavior in the presence of a road. One study found that small forest mammals (e.g. eastern chipmunk, eastern gray squirrel, and deer mouse) were reluctant to venture onto road surfaces where the distance between forest margins exceeded 60 feet (20 meters)(Oxley et al. 1974). The same study concluded that a four-lane divided highway might be as effective a barrier to the dispersal of small forest mammals as a body of freshwater twice as wide. A study conducted in North Carolina found that black bears shift their home ranges away from areas with high road densities (Brody and Pelton 1989). Traffic noise has been shown to interfere with songbird vocal communication, which affects their territorial behavior and their mating success (Seiler 2001). Roads, wide trails, and grass corridors can also function as barriers restricting the movements of invertebrates and amphibians. Populations of microhabitat-specific species like land snails and salamanders that generally require moist habitats, may be isolated by inhospitable, xeric corridors (Williams 1995, Blaustein et al. 1994). Some forest butterflies, such as the West Virginia white (*Pieris virginiensis*), will not cross open habitats and its current rarity may be a function of habitat fragmentation and isolation (Williams 1995). Consequences of the isolation of populations include reduced genetic diversity and low recruitment rates that can, in turn, result in local extinctions (Seiler 2001).

Fragmentation of contiguous forested landscapes into smaller, isolated tracts has an effect on plant and animal distribution and community composition. When an extensive forest tract is fragmented, the resulting forest islands may lack the full range of microhabitats that existed in the original tract or may be smaller than the minimum area required by a given species (Lynch and Whigham 1984). For example, the Louisiana Waterthrush (*Seiurus motacilla*) is rarely found in small woodlots because they require upland forest streams within their territory, and most small woodlots lack this necessary component (Robbins 1980, Robinson 1995). Area-sensitive species such as the northern goshawk (*Accipiter gentilis*), barred owl (*Strix varia*), bobcat (*Lynx rufus*), and the timber rattlesnake (*Crotalus horridus*) require interior forest areas in excess of 6,000 acres to accommodate breeding and foraging territories (Squires and Reynolds 1997, Mazur and James 2000, Ciszek 2002, NatureServe 2007).

Along with a reduction in total forested area, forest fragmentation creates a suite of 'edge effects' which can extend almost 1000 feet (300 meters) into the remaining fragment (Forman and Deblinger 2000). Edge forest is composed of a zone of altered microclimate and contrasting community structure distinct from the interior or core forest (Matlack 1993). Edges experience increased light intensity, altered plant and insect abundance, a depressed abundance and number of species in the macroinvertebrate soil fauna and a reduced depth of the leaf-litter layer (Yahner 1995, Haskell 2000, Watkins et al. 2003). The macroinvertebrate fauna of the leaf litter is significant for the pivotal role it plays in energy and nutrient cycling; these macroinvertebrates also provide prey for salamanders and ground-feeding birds. A number of studies have shown that the nesting success of forest-interior songbirds is lower near forest edges than in the interior because of increased densities of nest predators and brooding parasites (reviewed in Marcia 1995).

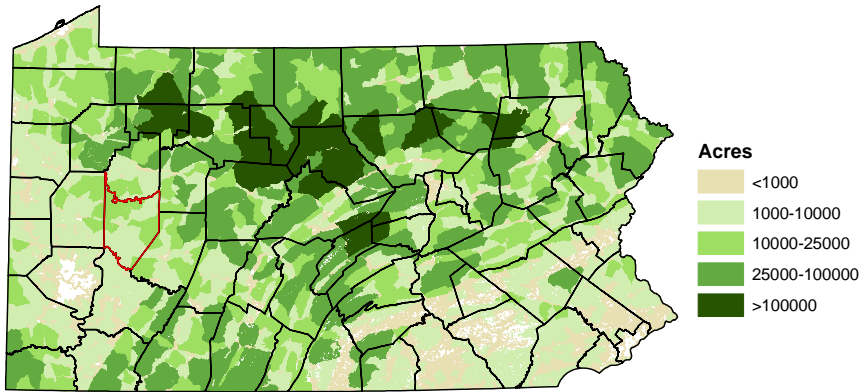
Roads can act as corridors for plant dispersal and exotic species can increase their range by spreading along roadsides (Watkins et al. 2003). Vehicles and road-fill operations transport exotic plant seeds into previously uninfested areas while road construction and maintenance operations can create sites for seed

germination and seedling establishment (Schmidt 1989, Greenberg et al. 1997, Trombulak and Frissell 2000). Road traffic and maintenance of right-of-ways contribute at least six different classes of chemicals to the environment: heavy metals, salt, organic pollutants, ozone, nutrients, and herbicides (Forman and Alexander 1998, Trombulak and Frissell 2000). Heavy metals such as lead, aluminum, and iron contaminate soils, plants, and invertebrates up to 650 feet (200 meters) from roads, as well as vertebrate fauna foraging within the affected zone (Trombulak and Frissell 2000). Deicing salts contribute ions to the soil, altering pH and soil chemical composition, which affects plant growth (Forman and Alexander 1998, Trombulak and Frissell 2000). Airborne sodium chloride from snowplowing may cause leaf injury to trees up to 400 feet (120 meters) from a road (Forman and Alexander 1998). Organic pollutants such as dioxins and polychlorinated biphenyls (PCBs) are present in higher concentrations along roads, and hydrocarbons may accumulate in aquatic ecosystems near roads. Storm runoff from roads, particularly where roads abut or cross water bodies, results in the transport of nutrients and sediments into aquatic ecosystems. Drifting or misapplied herbicides applied to roadsides and utility rights-of-way to control woody plant growth may damage forest edge and interior plant species (Williams 1995).

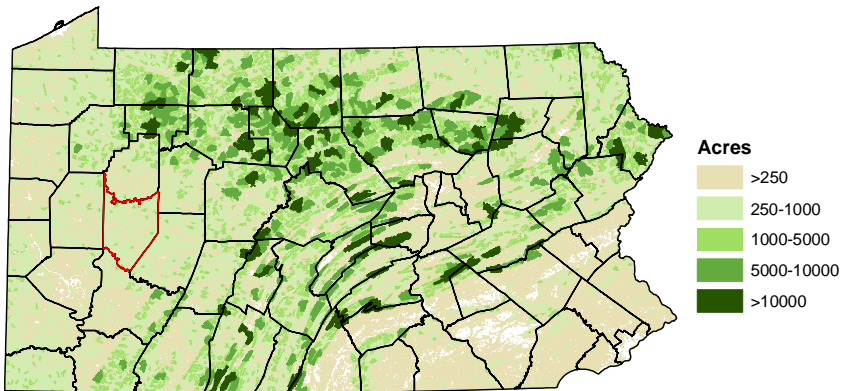
Humans are an integral part of natural history, where we function as ecosystem engineers, altering the landscape around us to suit our needs. Some species benefit from human-induced changes, such as birds that inhabit the early successional and edge habitats provided by utility corridors or disturbance-adapted plants that colonize roadsides, but as is more often the case, species with specific habitat requirements suffer declining numbers when faced with human encroachment. Given the pervasiveness of human influence throughout the northeastern United States, the ecological importance of large areas of relatively pristine habitat cannot be overestimated. Not only are they potential habitat for a number of area-sensitive species, but they are also important for the maintenance of vital ecosystem processes and services such as nutrient cycling, pollination, predator-prey interactions and natural disturbance regimes (Heilman et al. 2002). Additionally, large forested areas also serve to filter and regulate stream flow within watersheds and store large quantities of carbon as biomass.



a. Forest and wetland areas in Pennsylvania derived from the National Land Cover Data Set for Pennsylvania (USGS 2001).



b. Forest and wetland areas greater than one acre, fragmented by interstate and state highways. Roads of this magnitude function as a barrier to all animals. The forest and wetland blocks shown here represent potential contiguous habitat for megafauna relatively insensitive to smaller-scale fragmenting features, such as black bear.



c. Forest and wetland areas greater than one acre, fragmented by interstates, highways, state and local roads, public forest roads, and active railroads. The habitat blocks shown in this figure represent potential contiguous habitat for animals sensitive to all scales of fragmenting features, such as interior forest birds and amphibians.

Figure 6. Forest and wetland areas of Pennsylvania showing the effects of habitat fragmentation by human-created linear landscape features.

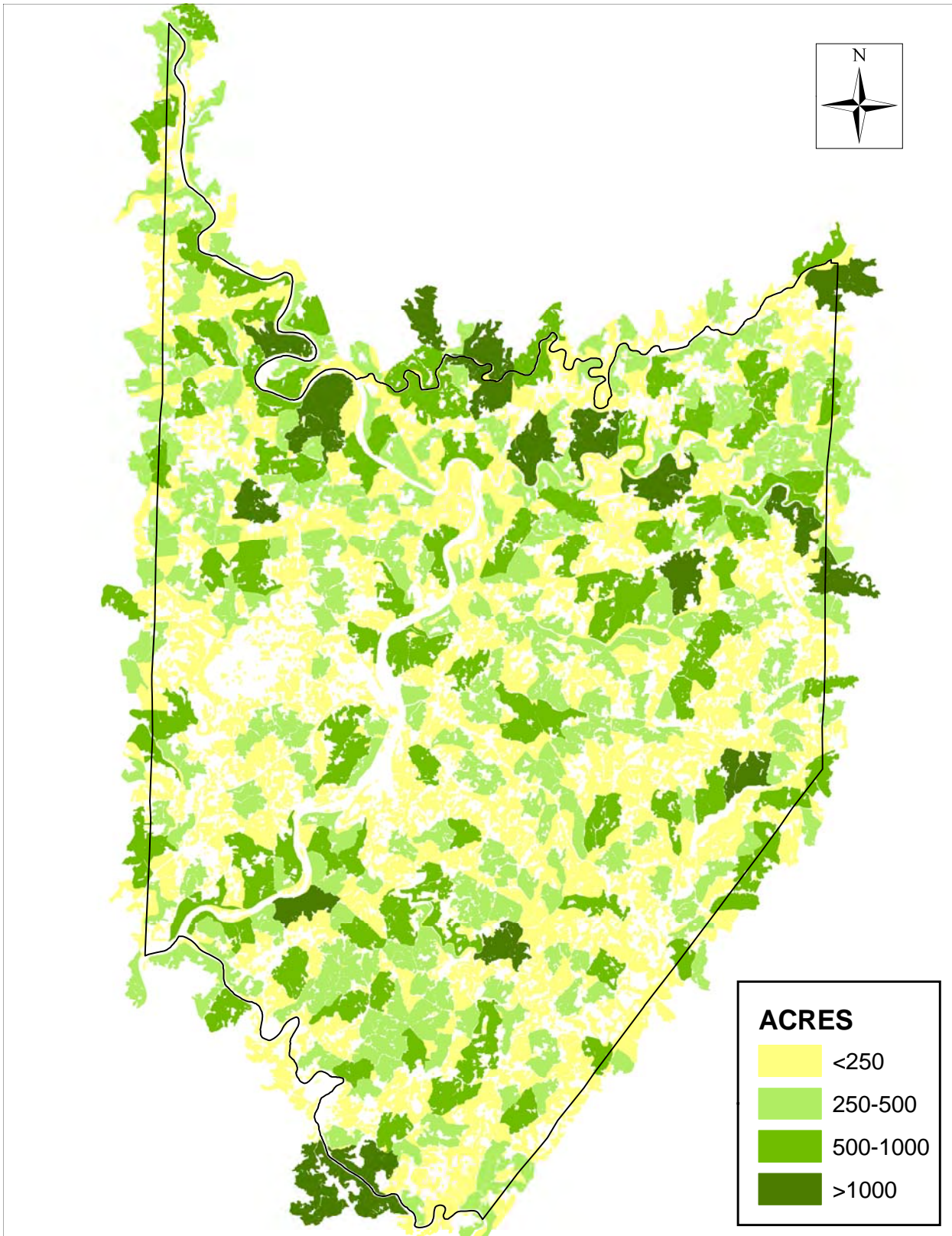


Figure 7. Forest blocks classified by size in Armstrong County.

Landscape Conservation Areas

Landscape Conservation Areas (LCAs) represent large areas of the landscape that are of higher ecological quality than other areas of similar size in the county. They may include large blocks of contiguous forest, extensive wetland complexes, and/or areas linking rare element occurrences such as those recognized as Biological Diversity Areas. One LCA containing the exceptionally diverse Allegheny River and surrounding area has been identified for Armstrong County (Figure 8). Because of its size, ownership is divided among many entities: individual, corporate, and public.

General Threats and Stresses for the Allegheny River Landscape Conservation Area

Given the large area this Landscape Conservation Area (LCA) represents, threats and stresses to these systems generally relate to the development of the land within them. Potential threats and stresses to species and natural communities identified with individual Biological Diversity Areas (BDAs) found within the (LCA) are described later in this report.

Of all ecosystems, perhaps none is as intertwined and dependent upon all parts of the landscape for its health and existence as the stream and river ecosystems. Therefore, activities that tend to affect water quality are of particular concern. River systems receive pollution from “point” and “non-point” sources. Point source pollution refers to an input of pollution that can be traced to one point within the watershed. Non-point source pollution results from runoff from land-based human activities, such as agriculture and road development and thus cannot be traced to any one point in the watershed. Loss of soil and subsequent siltation of any water courses, input of nutrients, runoff of pesticides or herbicides, changes in water temperature due to loss of shading or ponding, and alterations to hydrology would all be detrimental to the stream communities present within the watershed.

General Conservation Recommendations for the Allegheny River Landscape Conservation Area

Much of the land encompassed by the Allegheny River LCA is under private ownership, which presents challenges when attempting to manage this area. The large number of landowners may inhibit large scale projects to protect this area.

Forests – Forest fragmentation can be minimized by utilizing existing disturbed areas for new projects (e.g. wind farms) rather than clearing additional forest, by consolidating roads and rights-of-way where multiple routes exist, and by restoring unused cleared areas such as abandoned roads or railroad tracks to forest. When planning development, it is preferable to avoid complete division of the LCA. The impact of individual features such as wells, roads, rights-of-way and other clearings can also be minimized by the use of ecologically informed best management practices in construction and maintenance.

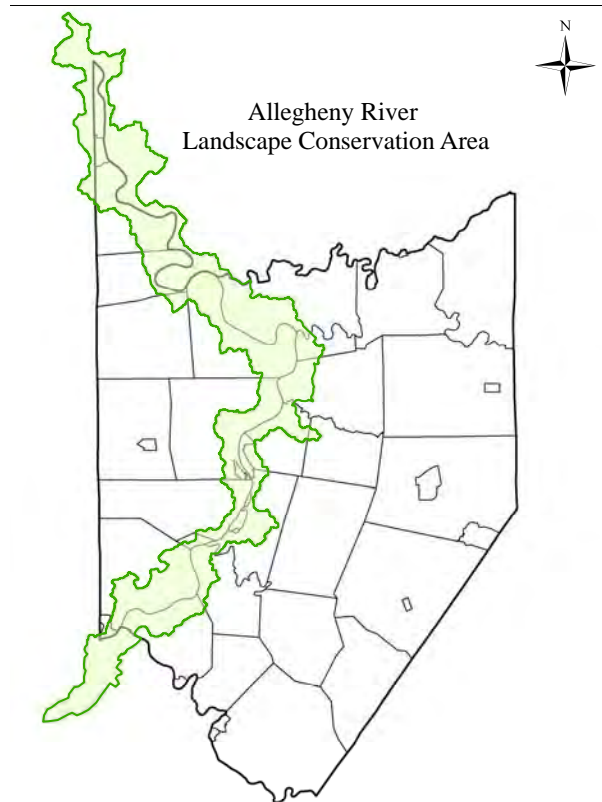


Figure 8. Landscape Conservation Area of Armstrong County.

A number of resources, listed in Appendix V, are available to private landowners interested in sustainably managing their forestlands for biodiversity conservation, forest health and forest products including timber, mushrooms, and high value medicinal herbs. A good place to start is the Forest Stewardship Program, which assists landowners in developing a forest management plan based on envisioned goals for their land. Landowners interesting in bringing deer numbers back into balance with their habitat may want to consider enrolling in the Pennsylvania Game Commission's Deer Management Assistance Program (DMAP).

Watersheds – One of the main source of water pollution in Armstrong County comes from abandoned mine drainage entering waterways from current and abandoned mines. Runoff from agricultural fields is also a large contributor to water pollution. An overall management plan for these watersheds would identify best management practices (BMPs) to reduce the effects of abandoned mine drainage and assure that the amount and frequency of fertilizer application would not exceed the ability of the land and water to process it. Incentives and educational programs to encourage all land owners to provide riparian buffers and adopt best management practices would have a striking impact in limiting the many potential inputs of nutrients into the water.

The county and its municipalities need to incorporate protection strategies into comprehensive plans and regulations. Careful monitoring and enforcement of regulations for activities on rivers and their tributary streams will be important for the recovery of stream ecosystems throughout Armstrong County. Working with residents, the County Conservation District, and the municipalities within the watershed to develop a vision and planning strategy that meets the needs of the stream as well as those of the people living within the watershed, will complement the work that individual organizations have undertaken.

Other Landscape Scale Conservation Areas

Across the state, a number of organizations have undertaken conservation planning efforts at a landscape scale. The areas identified through these efforts frequently overlap with sites identified by County Natural Heritage Inventories and serve to emphasize the importance of focusing conservation efforts in those areas. The results of three such planning efforts are included here, in order to provide information relating to the natural heritage of Armstrong County.

Important Bird Areas (IBAs) of Armstrong County

An Important Bird Area (IBA) is a region designated by the Pennsylvania Chapter of the National Audubon Society that recognizes sites vital to promote proactive avian habitat conservation in Pennsylvania. Over 80 IBA sites have been identified in the state; encompassing over two million acres of public and private lands. These areas include migratory staging areas, winter roost sites, and prime breeding areas for songbirds, wading birds, shorebirds and other species. Criteria used in determining IBAs include exceptional concentrations or diversity of birdlife, populations of Pennsylvania ‘special concern’ species, sites with representative, rare, or unique bird habitats or sites with long-term ongoing avian research. More information on the IBA program is available from the Pennsylvania Chapter of the National Audubon Society (717-213-6880; <http://pa.audubon.org/>).

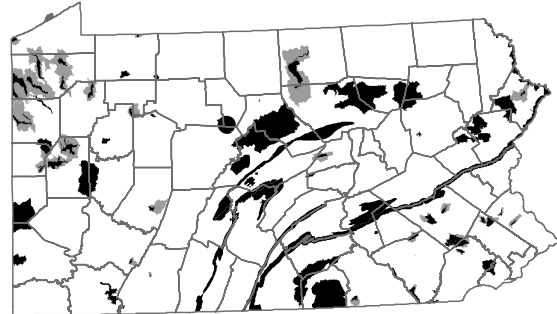


Figure 9. Important Bird Areas in Pennsylvania.

Armstrong County includes a portion of one Important Bird Area (IBA), Buffalo Creek Valley. This IBA extends beyond Armstrong County, therefore, features described below pertain to the entire IBA and are not necessarily confined to the county.



Ron Austing

Cerulean Warbler (*Dendroica cerulea*)

Note: the following information is adapted from the Audubon Pennsylvania IBA site descriptions (Audubon 2002). Additional information can be found at <http://pa.audubon.org/iba/>.

Located along the western border of Armstrong County, the steep, forested banks of Buffalo Creek and its tributaries provide habitat for a variety of woodland birds. This is one of few areas in the region that provide large, unfragmented tracts of forest required by species such as Cerulean Warblers. The watershed of Buffalo Creek has been used to delineate the IBA boundaries. Todd Sanctuary is located in the Butler County portion of this IBA and offers the public the opportunity to enjoy the large tracts of forest and the species that use it.

This area satisfies the following IBA criteria:

- Regionally significant populations of Neotropical forest interior migrants and resident forest species: warblers, flycatchers, thrushes, tanager, vireos, nuthatch, parids, etc.
- Exceptional habitat for resident forest, Neotropical forest interior, and migrant species. Includes species that are area sensitive (Cerulean Warbler), limited by habitat size (Pileated Woodpecker).

- Todd Sanctuary has been the site of several avian and ecological studies.

Conservation Recommendations - Conservation of this IBA should be focused on maintaining the habitat quality. This area represents one of the larger forests blocks in the region, which provides suitable habitat for those species that need large patches of contiguous forests. Forest pests and disease, increased development, recreation overuse, and excessive or unsustainable forestry practices could potentially affect the habitat quality and therefore the quality of the IBA.

Important Mammal Areas (IMAs) of Armstrong County

The objective of the Important Mammal Area Project is to identify a network of sites throughout Pennsylvania that are essential for sustaining populations of wildlife species of concern. This process begins with the nomination of a site that is then reviewed by the Mammal Technical Committee of the Pennsylvania Biological Survey to determine if there is a need to protect the habitat for mammals of conservation concern. Once a site is selected for designation, a qualified mammalogist conducts an assessment of the area in order to detail priority habitat types, list mammal species located at the site, describe significant flora or fauna, describe conservation issues, outline research needs, note threats that may impact the site, list stakeholders involved with the site, and suggest conservation actions that will improve habitat for priority mammals.

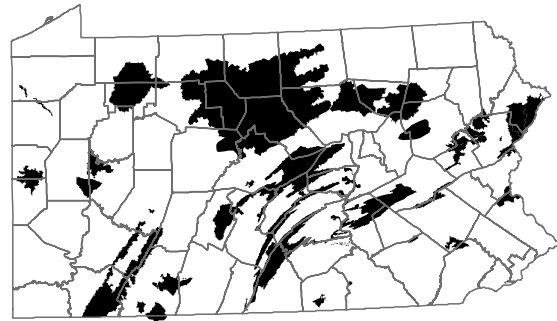


Figure 10. Important Mammal Areas in Pennsylvania.

Armstrong County contains portions of the Long Run Mine and US Steel Mine Important Mammal Areas (IMA). Both of these IMAs extend beyond the borders of Armstrong County therefore, many features described below pertain to the entire IMA and are not necessarily confined to the county.

Note: the following information is adapted from the Important Mammal Areas Assessment Reports (2005).

Long Run Mine IMA – This IMA covers approximately 50,000 acres in western Armstrong County and Butler County. The Long Run Mine IMA was selected due to the large bat colony that is located in this area. The bats also use the woodlots and farm fields for foraging habitat. The entire IMA is privately owned, which may pose conflicts with the landowners.

This area satisfies the following IMA criteria:

- There is a confirmed viable local population of a species or subspecies listed as threatened or endangered by the PA Biological Survey

Conservation Recommendations – Although the mine entrance has been gated to protect the bats, other resource extraction activities at this site may disturb the bats in this mine. Any activities on this property should be conducted at a respectful distance from the mine entrance. Maintaining the habitat surrounding the mine will continue to provide necessary foraging habitat for the bats.

US Steel Mine IMA – This IMA covers approximately 53,000 acres, most of which is located in northwestern Armstrong County, although it also extends slightly into Butler and Clarion Counties. This mine provides habitat for all six of the bat species known to hibernate in Pennsylvania. The IMA boundaries include the mine entrance and surrounding foraging habitat, including riparian

areas along the Allegheny River and tributaries. Ownership of this IMA is State Game Lands at the mine entrance, but mostly private in the supporting habitat.

This area satisfies the following IMA criteria:

- There are significant aggregations of mammals in one or more seasons
- There are important core populations or population segments
- There is a confirmed viable local population of species or subspecies listed as threatened or endangered by the PA Biological Survey
- There is a confirmed viable local population of species or subspecies that are declining or vulnerable nationally or listed as candidate species by the PA Biological Survey

Conservation Recommendations – The mine entrance has been gated to protect the bats from disturbance, but public access of the area may present opportunities for disturbance. Alterations to supporting habitat may affect quality of foraging areas. Forests should be kept intact, especially in riparian areas to maintain foraging habitat. Limit access to the mine entrance to minimize potential disturbances.



Charlie Eichelberger (PNHP)

In 2009, White-Nose-Syndrome (WNS) which was first found in New York State in 2006, showed up in several locations in Pennsylvania, causing mass mortality within infected sites, WNS has the potential to wipe out cave bats in Pennsylvania. The spread has been rapid, and so far, there is little hope that the spread of the disease can be controlled. Bats play a key role in forest ecology, and the loss of this suite of unique animals will undoubtedly cause pest insect populations to rise dramatically. Bat conservation should be considered a top priority over the coming years, with the hope that at least some of Pennsylvania's cave bats will survive. For more information, visit www.batcon.org

Biological Diversity Areas

Detailed maps and description of Armstrong County's Natural Heritage Areas follow, organized by township. For each township a map, a summary table and a full report are provided. Biological Diversity Areas, Landscape Conservation Areas, and Publicly Managed Lands are indicated. Publicly Managed Lands are public properties established and managed to a large extent for natural resources and/or those that have the potential to manage such resources in order to maintain or enhance important ecological assets in the county. Examples include State Game Lands, State Forests, and State Parks. Townships are arranged alphabetically within each region. Boroughs are discussed with the surrounding or adjoining township due to their small size.

Biological Diversity Areas (BDAs) are areas containing plants or animals of concern at state or federal levels, exemplary natural communities, or exceptional native diversity. BDAs include both the immediate habitat and surrounding lands important in the support of these elements and are mapped according to their sensitivity to human activities. Specific information about each BDA includes:

- a categorical designation of a site's relative significance listed after the site name. Table 1 (pg. 12) has a summary of sites by significance category
- state-significant natural communities and species of concern that have been documented within the area
 - Some species perceived to be highly vulnerable to intentional disturbance are not named at the request of the jurisdictional agency*.
 - The PNDI (Pennsylvania Natural Diversity Inventory) rarity ranks and current legal status (detailed in Appendix I, pg. 233) are listed for each community and species.
- the text that follows each table discusses the natural qualities of the site and includes descriptions, potential threats, and recommendations for protection

***A note about sensitive species**

As stated above, several species are considered sensitive by the jurisdictional agency overseeing their protection (i.e. Department of Conservation of Natural Resources (DCNR), Pennsylvania Game Commission (PGC), Pennsylvania Fish and Boat Commission (PFBC), or the US Fish and Wildlife Service (USFWS)). Reasons for sensitive species status include extreme rarity, collection for the pet or nursery trade, disturbance due to public observation, or deliberate poaching and killing. Therefore, these species are referred to as 'species of concern'. In certain cases, some species (e.g. timber rattlesnakes, bald eagles) are not mapped due to large home ranges and high sensitivity to disturbance. Within this county, environmental review may pick up conflicts for sites not presented in this report.

Bethel Township

	PNDI Rank ¹		Legal Status ¹	Last Seen	Quality ²
	Global	State	State (Proposed)		
NATURAL HERITAGE AREAS:					
Allegheny River Pool #5 BDA					
<i>Exceptional Significance</i>					
Goldeye (<i>Hiodon alosoides</i>) – fish	G5	S2?	PT(PT)	1986	E
Mooneye (<i>Hiodon tergisus</i>) – fish	G5	S2S3	PT(PT)	1988	E
River redhorse (<i>Moxostoma carinatum</i>) – fish	G4	S3S4	N(CU)	1997	E
Channel darter (<i>Percina copelandi</i>) – fish	G4	S2	N(PT)	1988	E
Longhead darter (<i>Percina macrocephala</i>) – fish	G3	S2S3	N(PT)	1986	E
Wabash pigtoe (<i>Fusconaia flava</i>) – mussel	G5	S2	N(PE)	2007	B
Long solid (<i>Fusconaia subrotunda</i>) – mussel	G3	S1	N(PE)	2005	D
Pocketbook (<i>Lampsilis ovata</i>) – mussel	G5	S3S4	N(N)	1985	E
Fragile papershell (<i>Leptodea fragilis</i>) – mussel	G5	S2	N(CR)	2005	D
Round pigtoe (<i>Pleurobema sintoxia</i>) – mussel	G4G5	S2	N(PE)	2007	E
Pink heelsplitter (<i>Potamilus alatus</i>) – mussel	G5	S2	N(CR)	2005	CD
Mapleleaf (<i>Quadrula quadrula</i>) – mussel	G5	S1S2	N(PT)	2002	E
Paper pondshell (<i>Utterbackia imbecillis</i>) – mussel	G5	S3S4	N(CU)	2002	E
Sensitive species of concern ³	-	-	-	1986	E
Sensitive species of concern ³	-	-	-	2007	E
Allegheny River Pool #6 BDA					
<i>Exceptional Significance</i>					
Goldeye (<i>Hiodon alosoides</i>) – fish	G5	S2?	PT(PT)	1986	E
River redhorse (<i>Moxostoma carinatum</i>) – fish	G4	S3S4	N(CU)	1997	E
Longhead darter (<i>Percina macrocephala</i>) – fish	G3	S2S3	N(PT)	1986	E
Elktoe (<i>Alasmidonta marginata</i>) – mussel	G4	S4	N(N)	2007	E
Wabash pigtoe (<i>Fusconaia flava</i>) – mussel	G5	S2	N(PE)	2007	B
Fragile papershell (<i>Leptodea fragilis</i>) – mussel	G5	S2	N(CR)	2005	D
Round pigtoe (<i>Pleurobema sintoxia</i>) – mussel	G4G5	S2	N(PE)	2007	E
Pink heelsplitter (<i>Potamilus alatus</i>) – mussel	G5	S2	N(CR)	2005	CD
Sensitive species of concern ³	-	-	-	2005	E
Sensitive species of concern ³	-	-	-	2007	E
Allegheny River shoreline at Rosston BDA					
<i>Notable Significance</i>					
Blue false-indigo (<i>Baptisia australis</i>) – plant	G5	S2	N(PT)	2008	A
Crooked Creek at Rossford BDA					
<i>High Significance</i>					
Sensitive species of concern ³	-	-	-	1984	E
Crooked Creek Outflow BDA					
<i>High Significance</i>					
Turquoise bluet (<i>Enallagma divagans</i>) – damselfly	G5	S3	N(N)	2007	E
Green-faced clubtail (<i>Gomphus viridifrons</i>) – dragonfly	G3G4	S1	N(N)	2007	E
Sensitive species of concern ³	-	-	-	2008	E
Crooked Creek Reservoir BDA					
<i>Notable Significance</i>					
Cattail sedge (<i>Carex typhina</i>) – plant	G5	S2	PE(PT)	2008	BC
Sensitive species of concern ³	-	-	-	2008	E

LANDSCAPE CONSERVATION AREAS:

Allegheny River LCA

PUBLICLY MANAGED LAND:

None

1 = Please refer to Appendix I for an explanation of PNHP ranks and legal status

2 = Please refer to Appendix II for an explanation of quality ranks

3 = This species is not named by request of the jurisdictional agency

Armstrong County Natural Heritage Inventory Bethel Township

Biological Diversity Areas

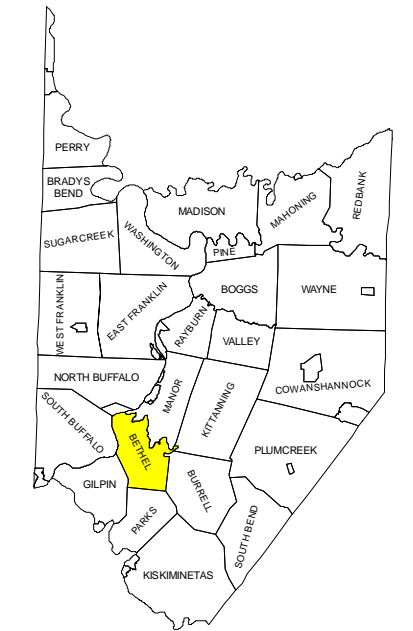
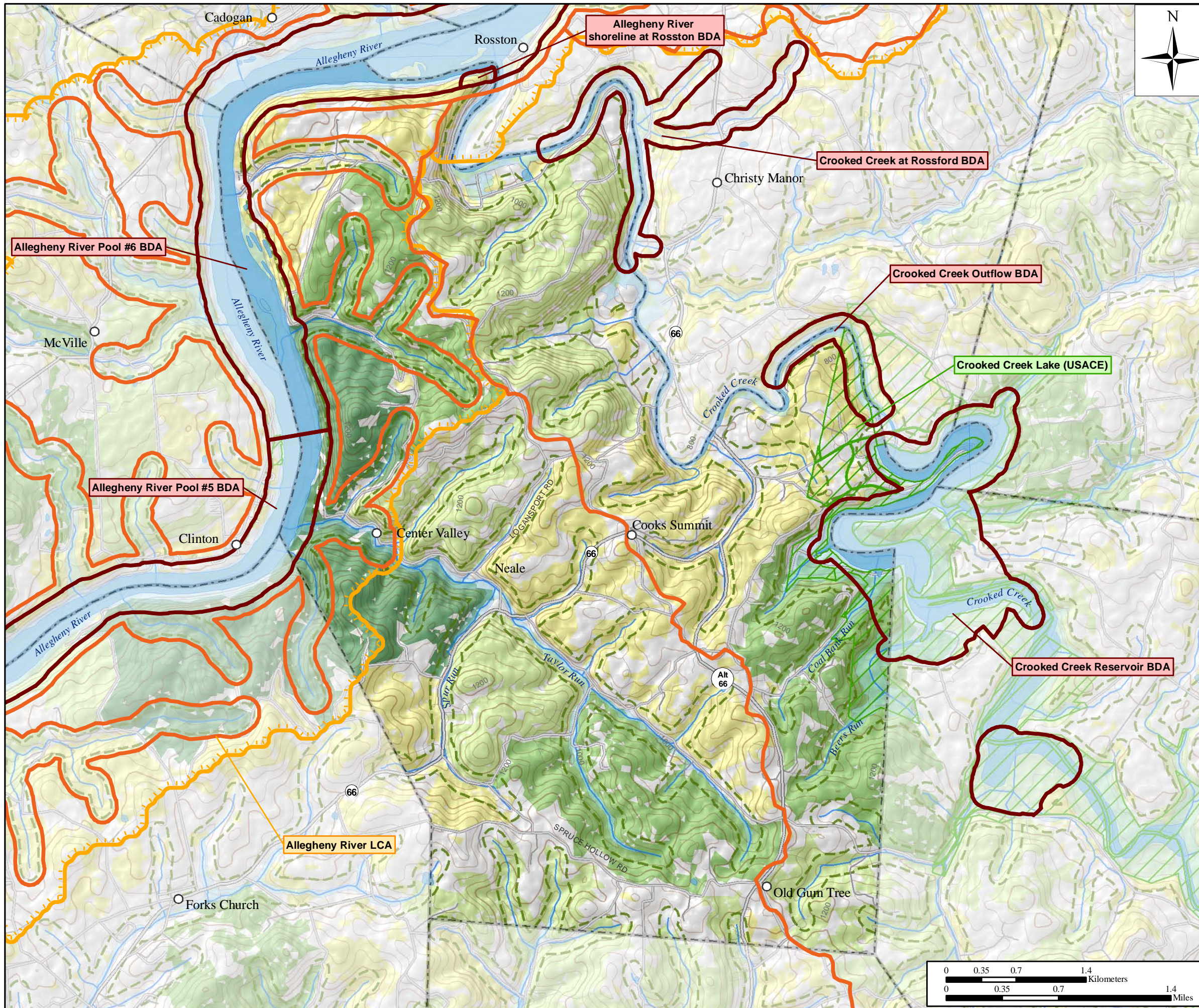
- Allegheny River Pool #5 BDA
- Allegheny River Pool #6 BDA
- Allegheny River shoreline at Rosston BDA
- Crooked Creek at Rossford BDA
- Crooked Creek Outflow BDA
- Crooked Creek Reservoir BDA

Landscape Conservation Areas

- Allegheny River LCA


Public Land

- Crooked Creek Lake (USACE)



Legend

- Landscape Conservation Area (LCA)
- Biological Diversity Area (BDA)**
 - Core
 - Supporting Landscape
- ~ Streams
- ~ National Wetland Inventory
- ~ 100-year Floodplain
- ~ Recommended Riparian Buffer



PNHP
Pennsylvania Natural Heritage Program

Forest Blocks by Acre

- < 250
- 251 - 500
- 501 - 1000
- > 1000

- Municipal Boundary
- US Army Corps of Engineers
- PA Game Commission
- ~ 40 Ft. Contour Line

0 0.35 0.7 1.4
Kilometers

0 0.35 0.7 1.4
Miles

Bethel Township

Bethel Township is located in southern Armstrong County. The Allegheny River flows along a portion of the western border, and Crooked Creek marks the northern boundary.

The township covers 15.9 square miles. Forest makes up 66% of the landscape and agriculture 23%. Only 1% of the area is developed. A forest block of over 1400 acres overlaps both Bethel and Gilpin Townships. Other parts of the township have forest blocks ranging from 300 – 900 acres. These forested areas help to maintain water quality and provide habitat for many species of plants and animals. In addition to the Allegheny River and Crooked Creek, Taylor Run is another major waterway within the township.

According to reports from the Department of Environmental Protection in 2002 and 2003, water quality is impaired in some of the waterways. Abandoned mine drainage affects Coal Bank Run, a tributary to Crooked Creek and an unnamed tributary to the Allegheny River. Conservation concerns should focus on restoring these streams so that they can support aquatic life.

Allegheny River Pool #5 BDA

Allegheny River Pool #6 BDA

The Allegheny River is one of the most ecologically significant areas in Armstrong County, including a large diversity of fish and mussel species. The Allegheny River begins in Potter County and flows north into New York. The river then turns south and flows down through Warren, Forest, and Venango Counties. As the Allegheny River enters Armstrong County it is free-flowing until it reaches Lock and Dam #9 north of Cosmus. The Allegheny River combines with the Monongahela River in Allegheny County before it enters the Ohio River. The lock and dam system was created in the 1920's and 1930's for navigation. The dams alter the natural flow of the river and create a different type of habitat than is found in the free-flowing sections upstream.

The health of the Allegheny River has been threatened by pollutants and other disturbances. Abandoned mine drainage has impacted many of the streams in Armstrong County. Few mussels were found in other waterways in the county, due to lowered pH and diminished water quality. There are also some other notable point source pollutants to the Allegheny, such as the PPG dump near Ford City that is imputing heavy metals into the river. The Allegheny River, however, seems able to maintain populations of species that are sensitive to changes in water quality.

Sand and gravel dredging is another threat facing aquatic species, especially mussels. The substrate is removed from the river bottom and is often used for road construction. Excavation of the substrate removes the mussel habitat in areas that allow dredging, including Pool #5.

Despite the dams along the Allegheny River creating habitat that is deeper and slower moving than most of the free-flowing sections of the river, there are still some areas that have the shallow, quick-moving riffle habitat that supports higher mussel populations. This habitat can especially be found below dams and near sediment deposits that have formed islands in the river.

Freshwater mussels are one group of organisms that require high water quality. While many mussel species historically known from the Allegheny River have been extirpated, certain sections of the river have some of the highest diversity of freshwater mussels in the state.

Allegheny River Pool #5 is located just above the Kiskiminetas River and continues upstream near the village of Kelly Station. Eight freshwater mussel species of concern are currently known in the Allegheny River Pool #5- **fragile papershell** (*Leptodea fragilis*), **long solid** (*Fusconaia subrotunda*), **mapleleaf** (*Quadrula quadrula*), **paper pondshell** (*Utterbackia imbecillis*), **pink heelsplitter** (*Potamilus alatus*), **pocketbook** (*Lampsilis ovata*), **round pigtoe** (*Pleurobema sintoxia*), and **wabash pigtoe** (*Fusconaia flava*). The Allegheny River is also home to a large number of fish species, including several species of concern. **Channel darter** (*Percina copelandi*), **longhead darter** (*Percina macrocephala*), **goldeye** (*Hiodon alosoides*), **mooneye** (*Hiodon tergisus*), and **river redhorse** (*Moxostoma carinatum*), five fish species of concern, have all been located along this section of the Allegheny River. Allegheny River Pool #5 also provides habitat for **two other aquatic animal species of concern**.



Tam Smith, PNHP

Long solid (*Fusconaia subrotunda*)

Allegheny River Pool #6 is located above the village of Kelly Station and continues upstream to Kittanning. Dredging in Pool #6 has been banned since 1985, protecting the habitat for aquatic species. This section of the Allegheny River flows through the more populated areas of the county, specifically Kittanning and Ford City. A large portion of Kittanning lies within the floodplain of the Allegheny River, putting much of the town in danger of flooding. Five freshwater mussel species of concern are currently known in the Allegheny River Pool #6- **elktoe** (*Alasmidonta marginata*), **fragile papershell** (*Leptodea fragilis*), **pink heelsplitter** (*Potamilus alatus*), **round pigtoe** (*Pleurobema sintoxia*), and **wabash pigtoe** (*Fusconaia flava*). The Allegheny River is also home to a large number of fish species,

including several species of concern. **Longhead darter** (*Percina macrocephala*), **goldeye** (*Hiodon alosoides*), and **river redhorse** (*Moxostoma carinatum*), three fish species of concern, have all been located along this section of the Allegheny River. Allegheny River Pool #6 also provides habitat for **two other aquatic animal species of concern**.

Threats and Stresses – The habitat of the stream-dependent species can be considerably impacted from nearby land use decisions. Many of the steep hillsides and stream valleys along the Allegheny River are forested, but there are significant agricultural and mining operations on the banks of the river and within the Allegheny River watershed. In addition, the many impervious surfaces of the surrounding urban area, such as roads, parking lots and roof tops channel rain water directly into the waterways, taking numerous non-point source pollutants with them. Storm water runoff through urban and suburban areas can be a significant source of chemical pollutants for the waterways, which can severely impact water quality and the food chain of the river. The PPG dump below Ford City a notable source of point source pollution that is leaching heavy metals and other point source pollutants directly into the Allegheny River.

River dredging directly removes the substrate that the mussels imbed themselves in for most of their adult life. Fish also use this gravel habitat for breeding and foraging for food. Once the substrate has been removed, the flow of the river can be altered, and sediment can fill in the holes left behind. The sediment makes the river bottom uninhabitable for many species.

Invasive plants, such as purple loosestrife (*Lythrum salicaria*) and Japanese knotweed (*Fallopia japonica*), can be quite common on the islands and along the banks of the river. These aggressive invasive

plants dominate portions of the floodplain, outcompeting and displacing native vegetation. The zebra mussel (*Dreissena polymorpha*), another invasive species, has been located in several pools of the Allegheny River. This small mussel can grow on top of native mussels, substrate, and infrastructure in the water, altering the natural system and causing damage to pipes and other objects in the water.

Conservation Recommendations – Conservation efforts should focus on protecting and improving the quality of the surface water for both the local human community as well as for the habitat for the sensitive species of concern. Additional steps can be taken to protect and improve the aquatic habitat, such as maintenance and restoration of the natural hydrology of the Allegheny River and the floodplain habitats along the river’s edge. These buffers serve an important role by slowing and filtering runoff before it enters the aquatic system. Improve water quality of the river by providing vegetated buffers along inflows to the creek and along the river shoreline. Stop river dredging to maintain the remaining potential habitat for the aquatic species. Control invasive species of plants by eliminating new small populations. Larger well-established populations of invasive species will require a sustained and continual suppression effort to prevent their spread. Contain zebra mussels to those areas already affected by cleaning boats and other items used in the water to control their spread into new areas.



Blue false-indigo (*Baptisia australis*).

Denise Watts, PNHP

Allegheny River shoreline at Rosston

BDA– A small population of the PA-threatened plant species of concern, **blue false-indigo (*Baptisia australis*)**, occurs along the shoreline of the Allegheny River at the confluence with Crooked Creek. Blue false-indigo, like the grasslands it is often associated with, is found scattered along the Allegheny River and its major tributaries primarily above the series of flat water pools created by the system of locks and dams. This plant is most frequently associated with sand and cobble deposits within high energy floodplains that receive periodic flooding and scour disturbance. The potential habitat for this species has been greatly diminished by the river’s habitat modification. Most of the populations of this species within the lock and dam system occur in the shallower water just below the dams or in very small scattered populations.

Threats and Stresses – The blue false-indigo at this location occurs in a small population along the shoreline of the river. It is likely that if the system of locks and dams were not in place, this rare plant would be more prevalent in sand and cobble floodplain habitats along the lower Allegheny River.

Invasive species of plants and the introduced zebra mussel impact habitat quality by competing for resources and displacing native species. Japanese knotweed, purple loosestrife, and garden loosestrife are currently present along the river shoreline.

Conservation Recommendations – Invasive plant species are frequently a problem along many riparian areas and control efforts need to be targeted and continuous. Japanese knotweed in particular poses a direct threat due to its potential to occupy the same habitat as blue false-indigo. Control invasive species

of plants by first eliminating new small pioneer populations. Larger well-established populations of invasive species will require a sustained and continual suppression effort to prevent their spread.

Crooked Creek at Rossford BDA – An occurrence of a **species of concern** was found along this stretch of Crooked Creek and its tributaries. This area is located about 1 mile from the Allegheny River. Much of this area is adjacent to agricultural fields and residential areas, which may negatively impact water quality. Relying on clean water to maintain healthy invertebrate prey populations, this species also uses bushy vegetation along the creek. Streamside vegetation along the creek is necessary for the maintenance of the water quality and to provide critical habitat for the species of concern found at this site.

Threats and Stresses – Riparian vegetation is important to this species as habitat and also as a filter for pollutants. Some portions of the riparian area have been thinned for agriculture. Removal of the remaining riparian vegetation would destroy habitat and allow runoff to enter directly into the stream. Pesticides or fertilizers used on the agricultural fields may also degrade water quality.

Conservation Recommendations – Maintain riparian vegetation to provide habitat and protect water quality for the species of concern located at this site.

Crooked Creek Outflow BDA – Recent surveys below the Crooked Creek dam outflow uncovered three species of concern, including the **green-faced clubtail (*Gomphus viridifrons*)** and the **turquoise bluet (*Enallagma divagans*)**. In the larval stage, both of these odonates live among the vegetation along the shoreline. Once they emerge as adults, they continue to use the surrounding area as foraging habitat. Another **species of concern**, not named in this report at the request of the agency overseeing its jurisdiction, is found along Crooked Creek. Relying on clean water to maintain healthy invertebrate prey populations, this species also uses bushy vegetation along the creek. Streamside vegetation along the creek is necessary for the maintenance of the water quality and to provide critical habitat for all of the species of concern found at this site.

Threats and Stresses – The dam on Crooked Creek alters the natural flow of the stream. Although Crooked Creek Lake Park is open to the public, it is owned by the Army Corps of Engineers, which should help keep this habitat intact. Maintaining good water quality and riparian vegetation is vital to the species of concern.

Recommendations – Limit access to only those areas currently used for fishing to avoid disturbance along the shoreline. Maintain a native riparian buffer to provide habitat and protect water quality for the species of concern found at this site.

Crooked Creek Reservoir BDA – Crooked Creek Reservoir was created by the damming of Crooked Creek in 1940 as a means of controlling floodwaters in the lower Allegheny and Ohio Rivers. The water level in the reservoir fluctuates widely as floodwaters alternately flood and dry the shoreline, establishing an ebb and flow. The difference between average summer water level height and full capacity at the dam breast is roughly 65 feet. Debris from past flood events such as fallen trees and assorted trash litters the shoreline in a wide band extending up the slope of the shoreline. The fluctuating water level along the shoreline helps to foster habitat at conditions favorable for a population of the PA-endangered plant species of concern, **cattail sedge (*Carex typhina*)**. The species typically grows in wet woods and bottomlands, particularly around the edges of low spots that intermittently have standing water. Another **species of concern** is also known to be breeding at this site.



Denise Watts, PNHP

Cattail sedge (*Carex typhina*)

Threats and Stresses – There are no evident threats to this species at this location and management does not seem to be necessary. The artificially induced shoreline fluctuations actually help maintain favorable habitat conditions for the cattail sedge. The cattail sedge is not currently known to be as widely dispersed along the shoreline of this reservoir as at the Mahoning Creek Reservoir, and recreational activities could more easily disturb the habitat for this population. Poorly sited infrastructure improvements such as access roads and parking lots could eliminate portions of the habitat for this species. Human disturbance in this area may also affect nesting success of the other species of concern.

Conservation Recommendations – The extremely dynamic nature of the floodplain of this reservoir will likely force any future infrastructure improvements to remain a respectful distance from the active floodplain. Disturbance in this area should be limited from January to June to prevent nest abandonment of the species of concern.

Boggs Township

	PNDI Rank ¹		Legal Status ¹	Last Seen	Quality ²
	Global	State	State (Proposed)		

NATURAL HERITAGE AREAS:

Allegheny River Pool #7 BDA		Exceptional Significance				
River redhorse (<i>Moxostoma carinatum</i>) – fish	G4	S3S4	N(CU)	1997	E	
Elktoe (<i>Alasmidonta marginata</i>) – mussel	G4	S4	N(N)	2007	E	
Wabash pigtoe (<i>Fusconaia flava</i>) – mussel	G5	S2	N(PE)	2007	B	
Fragile papershell (<i>Leptodea fragilis</i>) – mussel	G5	S2	N(CR)	2005	D	
Pink heelsplitter (<i>Potamilus alatus</i>) – mussel	G5	S2	N(CR)	2005	CD	
Paper pondshell (<i>Utterbackia imbecillis</i>) – mussel	G5	S3S4	N(CU)	2001	E	
Sensitive species of concern ³	-	-	-	2007	E	
Sensitive species of concern ³	-	-	-	2005	E	
Sensitive species of concern ³	-	-	-	2007	E	

Allegheny River Pool #8 BDA		Exceptional Significance				
River carpsucker (<i>Carpiodes carpio</i>) – fish	G5	S1	N(CU)	2000	E	
River redhorse (<i>Moxostoma carinatum</i>) – fish	G4	S3S4	N(CU)	1997	E	
Longhead darter (<i>Percina macrocephala</i>) – fish	G3	S2S3	N(PT)	2000	E	
Elktoe (<i>Alasmidonta marginata</i>) – mussel	G4	S4	N(N)	2007	E	
Wabash pigtoe (<i>Fusconaia flava</i>) – mussel	G5	S2	N(PE)	2007	B	
Wavy-rayed lampmussel (<i>Lampsilis fasciola</i>) – mussel	G5	S4	N(N)	2007	E	
Fragile papershell (<i>Leptodea fragilis</i>) – mussel	G5	S2	N(CR)	2005	D	
Round pigtoe (<i>Pleurobema sintoxia</i>) – mussel	G4G5	S2	N(PE)	2004	E	
Pink heelsplitter (<i>Potamilus alatus</i>) – mussel	G5	S2	N(CR)	2005	CD	
Red-head pondweed (<i>Potamogeton richardsonii</i>) – plant	G5	S3	PT(PR)	2002	E	
Sensitive species of concern ³	-	-	-	2007	E	
Sensitive species of concern ³	-	-	-	2007	D	
Sensitive species of concern ³	-	-	-	2005	E	
Sensitive species of concern ³	-	-	-	2007	E	

Allegheny Trail South of Templeton BDA		High Significance				
West Virginia white (<i>Pieris virginiensis</i>) – butterfly	G3G4	S2S3	N(N)	2008	E	
Shiny Gray Carpet Moth (<i>Stammnodes gibbicostata</i>) – moth	G4	SU	N(N)	2008	E	
Harbinger of spring (<i>Erigenia bulbosa</i>) – plant	G5	S4	PT(PR)	2008	E	
Stalked bulrush (<i>Scirpus pedicellatus</i>) – plant	G4	S1	PT(PT)	2007	E	

South Fork Pine Creek at Oscar BDA		Notable Significance				
Sensitive species of concern ³	-	-	-	2008	E	

Templeton Mine BDA		Notable Significance				
Sensitive species of concern ³	-	-	-	2000	E	

LANDSCAPE CONSERVATION AREAS:

Allegheny River LCA

PUBLICLY MANAGED LAND:

State Game Lands #287

1 = Please refer to Appendix I for an explanation of PNHP ranks and legal status

2 = Please refer to Appendix II for an explanation of quality ranks

3 = This species is not named by request of the jurisdictional agency

Armstrong County Natural Heritage Inventory Boggs Township

Biological Diversity Areas

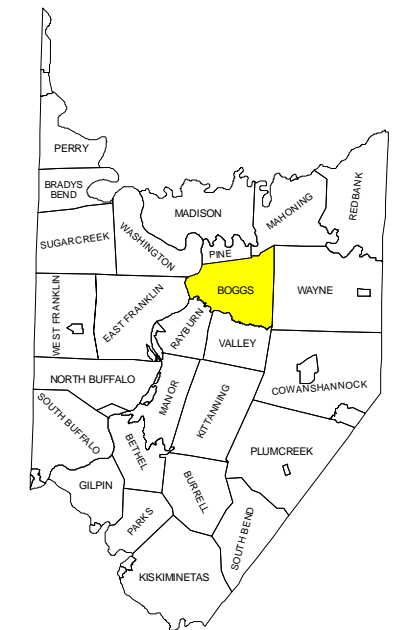
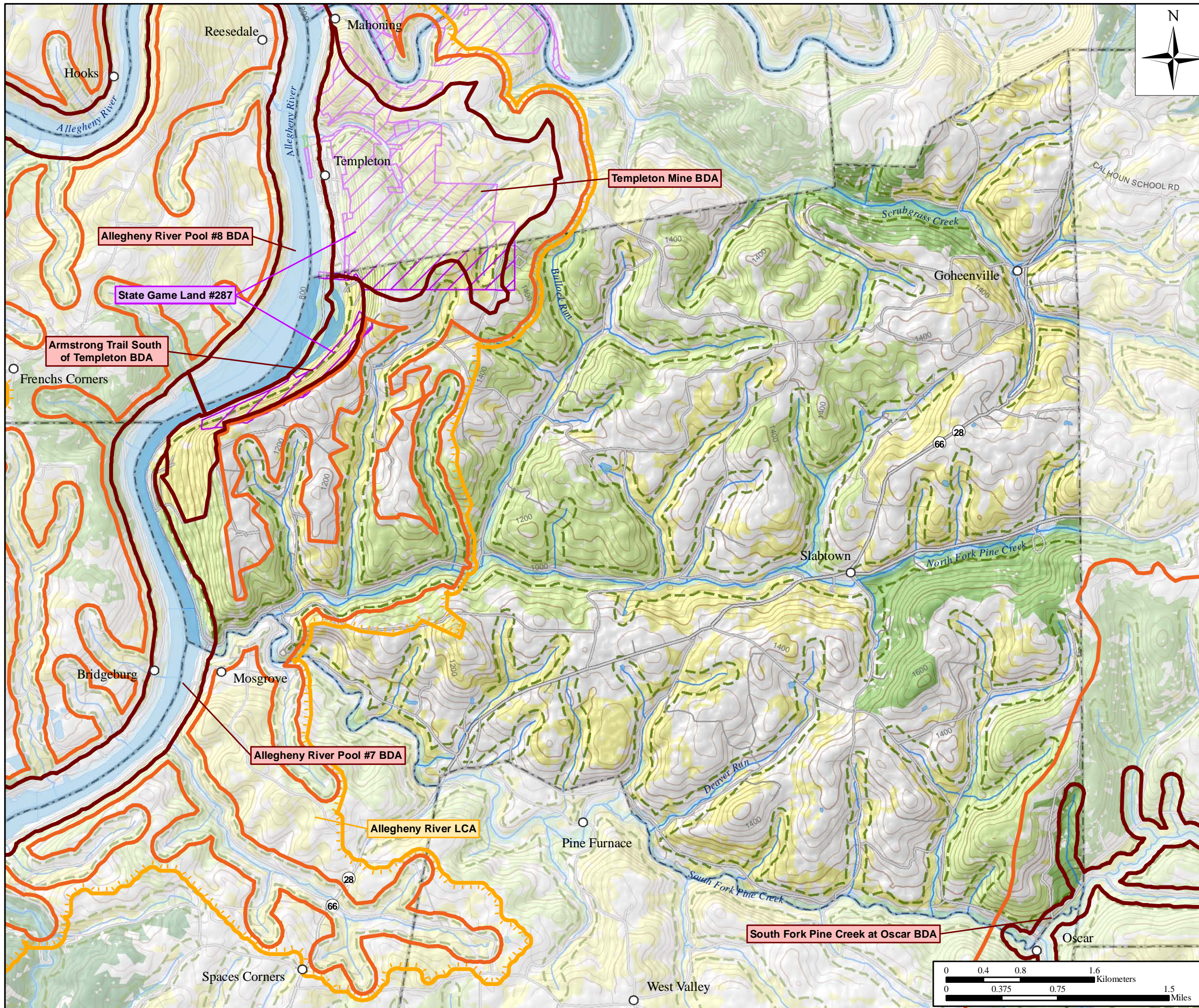
- Allegheny River Pool #7 BDA
- Allegheny River Pool #8 BDA
- Armstrong Trail South of Templeton BDA
- South Fork Pine Creek at Oscar BDA
- Templeton Mine BDA

Landscape Conservation Areas

- Allegheny River LCA

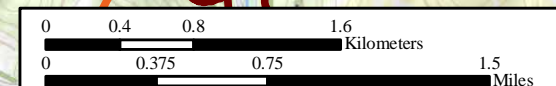
Public Land

- State Game Land #287



Legend

- Landscape Conservation Area (LCA)
- Biological Diversity Area (BDA)
 - Core
 - Supporting Landscape
- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer
- Forest Blocks by Acre
 - < 250
 - 251 - 500
 - 501 - 1000
 - > 1000
- Municipal Boundary
- US Army Corps of Engineers
- PA Game Commission
- 40 Ft. Contour Line



Boggs Township

Boggs Township is located in northern Armstrong County. The South Fork Pine Creek forms the southern boundary with Rayburn and Valley Townships, and the Allegheny River the western border with East Franklin and Washington Townships. Boggs Township was split from Pine Township in 1878. This 24 square mile township has not changed much over the past century in terms of population. The 1890 census reported a population of 1000; the 2000 census reported a population of 979. Less than 1% of the land cover is residential.

A small portion of State Game Land (SGL) #287 is located in the northwest corner of Boggs Township. Most of SGL 287 lies to the north in neighboring Pine Township. Public land accounts for 2% of the land within the township; the other 98% of township land is under private ownership. The eastern fringe of the US Steel Mine Important Mammal Area is in the northeastern part of the township. It includes sections of SGL #287.

The major waterways within the township are the South Fork Pine Creek and North Fork Pine Creek. Both streams flow westward and merge to form Pine Creek within a short distance of its confluence with the Allegheny River. Despite a history of mining in the township, the Department of Environmental Protection (DEP) classifies most streams in the township as “attaining” which means they meet water quality standards in four categories: aquatic life, fish consumption, recreational use, and potable water supply.

Land use within the township is 43% agricultural and 52% forested. Out of 28 townships, only five have a slightly higher percentage of land in agriculture. Small forest blocks make up most of the forest cover. The two largest blocks (500-600 acres) are in the southeastern portion of the township. Most of the forest blocks are highly fragmented at 300 acres or less.

Forest cover protects local streams by filtering and reducing non-point source pollution that otherwise would run off into the streams. Additionally, these buffers provide links between the smaller forest blocks and can serve as wildlife corridors connecting the fragmented forest. In areas without forest buffers along stream banks, conservation efforts should focus on establishing riparian buffers.

Allegheny River Pool #7 BDA

Allegheny River Pool #8 BDA

The Allegheny River is one of the most ecologically significant areas in Armstrong County, including a large diversity of fish and mussel species. The Allegheny River begins in Potter County and flows north into New York. The river then turns south and flows down through Warren, Forest, and Venango Counties. As the Allegheny River enters Armstrong County it is free-flowing until it reaches Lock and Dam #9 north of Cosmus. The Allegheny River combines with the Monongahela River in Allegheny County before it enters into the Ohio River. The lock and dam system was created in the 1920's and 1930's for navigation. The dams alter the natural flow of the river and create a different type of habitat than is found in the free-flowing sections.

The health of the Allegheny River has been threatened by pollutants and other disturbances. Abandoned mine drainage has impacted many of the streams in Armstrong County. Few mussels were found in other waterways, due to lowered pH and diminished water quality. There are also some other notable point source pollutants to the Allegheny, such as the PPG dump near Ford City that is imputing heavy metals into the river. The Allegheny River, however, seems able to maintain populations of species that cannot tolerate low water quality.

Sand and gravel dredging is another threat facing aquatic species, especially mussels. The substrate is removed from the river bottom and is often used to build roads. This impacts the mussel habitat in areas that allow dredging, including Pools #7 and #8.



Tamara Smith, PNHP

Elktoe (*Alasmidonta marginata*)

Despite the dams along the Allegheny River creating habitat that is deeper and slower moving than most of the free-flowing sections of the river, there are still some areas that have the shallow, quick-moving riffle habitat that supports higher mussel populations. This habitat can especially be found below dams and near sediment deposits that have formed islands in the river.

Fresh water mussels are one group of organisms that require high water quality. While many mussel species historically known from the Allegheny River have been extirpated, certain sections of the river have some of the highest diversity of freshwater mussels in the state.

Allegheny River Pool #7 is located in Kittanning and continues upstream near the town of Frenchs Corners. This section of the Allegheny River flows through the more populated areas of the county, specifically Kittanning and Ford City. A large portion of Kittanning lies within the floodplain of the Allegheny River, putting this area in danger of flooding. Five freshwater mussel species of concern are currently known in the Allegheny River Pool #7- **elktoe** (*Alasmidonta marginata*), **fragile papershell** (*Leptodea fragilis*), **paper pondshell** (*Utterbackia imbecillis*), **pink heelsplitter** (*Potamilus alatus*), and **wabash pigtoe** (*Fusconaia flava*). The Allegheny River is also home to a large number of fish species, including several species of concern. **River carpsucker** (*Carpionodes carpio*) and **river redhorse** (*Moxostoma carinatum*), two fish species of concern, have been located along this section of the Allegheny River. Allegheny River Pool #7 also provides habitat for **three other aquatic animal species of concern**.

Allegheny River Pool #8 is located just above the town of Frenchs Corners and continues upstream north of Cosmus. Six freshwater mussel species of concern are currently known in the Allegheny River Pool #8- **elktoe** (*Alasmidonta marginata*), **fragile papershell** (*Leptodea fragilis*), **pink heelsplitter** (*Potamilus alatus*), **round pigtoe** (*Pleurobema sintoxia*), **wabash pigtoe** (*Fusconaia flava*), and **wavy-rayed lampmussel** (*Lampsilis fasciola*). The Allegheny River is also home to a large diversity of fish species, including several species of concern. **Longhead darter** (*Percina macrocephala*), **river carpsucker** (*Carpionodes carpio*), and **river redhorse** (*Moxostoma carinatum*), three fish species of concern, have been located along this section of the Allegheny River. Allegheny River Pool #8 also provides habitat for **four other aquatic animal species of concern**.



PNHP

Wavy-rayed lampmussel (*Lampsilis fasciola*)

Threats and Stresses – The habitat of the stream-dependent species can be considerably impacted from nearby land use decisions. Many of the steep hillsides and stream valleys along the Allegheny River are forested, but there are significant agricultural and mining operations on the banks of the river and within the Allegheny River watershed. In addition, the many impervious surfaces of the surrounding urban area, such as roads, parking lots, and roof tops channel rain water into the waterways, taking numerous non-point source pollutants

with them. Storm water runoff through urban and suburban areas can be a significant source of chemical pollutants for the waterways, which can severely impact water quality and the food chain of the river.

River dredging directly removes the substrate that the mussels imbed themselves in for most of their adult life. Fish also use this gravel habitat. Once the substrate has been removed, the flow of the river can be altered, and sediment can fill in the holes left behind. The sediment makes the river bottom inhabitable for many species.

Invasive plants, such as purple loosestrife (*Lythrum salicaria*) and Japanese knotweed (*Polygonum cuspidatum*), can be quite common on the islands and along the banks of the river. These aggressive invasive plants dominate portions of the floodplain, outcompeting and displacing native vegetation. The zebra mussel (*Dreissena polymorpha*), another invasive species, has been located in several pools of the Allegheny River. This small mussel can grow on top of native mussels, substrate, and infrastructure in the water, altering the natural system and causing damage to pipes and other objects in the water.

Conservation Recommendations – Conservation efforts should focus on protecting and improving the quality of the surface water for both the local human community as well as for the habitat for the sensitive species of concern. Additional steps can be taken to protect and improve the aquatic habitat. Maintain and restore the natural hydrology of the Allegheny River. Restore floodplain habitats along the river’s edge to slow and filter



Denise Watts, PNHP

runoff before it enters the aquatic system.

Improve water quality of the river by providing vegetated buffers along inflows to the creek and along the river shoreline. Stop river dredging to maintain the remaining potential habitat for the aquatic species. Control invasive species of plants by eliminating new small populations. Larger well-established populations of invasive species will require a sustained and continual suppression effort to prevent their spread. Contain zebra mussels to those areas already affected by cleaning boats and other items used in the water to control their spread into new areas.

Maintaining a riparian buffer of at least 100 meters (328 feet) helps to improve water quality.

Templeton was created on a railroad bed paralleling the Allegheny River, passing between a steep wooded hillside and a large wetland complex. The trail passes through State Game Lands #287, most of which is on the uphill side of the trail. The north-facing wooded slope contains a rich plant assemblage characteristic of a sugar maple-basswood forest. The large trees and north-facing aspect of the slope provide a cool moist habitat that supports a rich spring wildflower community. Among the rich diversity of plants at this location is a large population of the PA-threatened plant species of concern, **harbinger-of-spring** (*Erigenia bulbosa*). This small, delicate plant is one of the earliest-blooming wildflowers in Pennsylvania, with the flowers generally appearing from March into early April. This plant occurs predominately in the western part of the state on wooded slopes, floodplain forests, and in rich woodlands.

Armstrong Trail south of Templeton BDA

Two uncommon insects are also associated with this habitat. The **PA butterfly species of concern, West Virginia white** (*Pieris virginiensis*), is considered a globally vulnerable species. Its preferred larval host plant is the two-leaved toothwort (*Cardamine diphylla*), a spring wildflower that is prevalent in this rich, moist woodland. The adult butterflies feed on nectar from many spring wildflowers such as violets, toothworts, bluebells, and trillium. The West Virginia White is a species of the forest and will not cross open habitats or even small roads with an open canopy. Fragmentation of the forest by roads or even logging can severely limit and degrade the habitat for this species. Garlic mustard (*Alliaria petiolata*), an invasive exotic plant, is in the

same family as the host plant for this butterfly, on which it has been known to lay its eggs. Besides directly displacing the native food plant, garlic mustard is also toxic to the West Virginia White caterpillars, killing them when they eat it. These combined habitat threats, forest fragmentation and the spread of garlic mustard, point toward a serious downward trend for this species across most of its range.



Rocky Gleason, PNHP

harbinger-of-spring (*Erigenia bulbosa*)

A PA moth species of concern, the **shiny gray carpet moth** (*Stamnodes gibbicostata*), was also documented within this habitat. The larval host plant of this forest-dwelling moth is several species of maple trees. A large wetland complex occurs primarily on the river side of the former railroad bed, with a few smaller wetland openings occurring on the uphill side as well. The large open wetland contains several zones of vegetation based on the water depth within the wetland including a silver maple floodplain forest, an extensive shrub swamp, and areas dominated by emergent aquatic vegetation. A PA-threatened wetland plant species of concern, **stalked bulrush** (*Scirpus pedicellatus*), was documented within the complex of wetlands adjacent to the rail trail. This species of plant is near the southern limit of its known range in Pennsylvania. This species may hybridize with the more common wool grass (*Scirpus cyperinus*) where the two co-occur, making determination difficult.

Conservation of the naturally vegetated wetlands and

river shoreline habitat will help maintain viable populations of this species.

Also found within this BDA is a small population of the PA-threatened plant species of concern, **blue false-indigo** (*Baptisia australis*), found growing along a narrow strip of scoured shoreline of the Allegheny River. Blue false-indigo, like the grasslands it is often associated with, is found scattered along the Allegheny River and its major tributaries, primarily above the series of flat water pools created by the system of locks and dams

This plant is frequently associated with sand and cobble deposits in high energy floodplains that receive periodic flooding and scour disturbance. The potential habitat for this species has been greatly diminished by the river's habitat modification. Most of the populations of this species within the lock and dam system occur in the shallower water just below the dams or in very small scattered populations.

Threats and Stresses – Since the West Virginia White butterfly will not cross even a small canopy opening, fragmentation of the forested hillside by additional roads, utility rights-of-way, or logging could severely diminish the habitat for this species. Once a population has been extirpated, the habitat will likely not be recolonized since adults will not cross open habitats (NatureServe 2009). Currently, there is only a light scattering of the invasive plant, garlic mustard, at this location. The spread of garlic mustard can have a significant negative impact on the population of West Virginia White and on the rich forested habitat as a whole.

Excessive deer populations can eliminate the preferred food source of the West Virginia White, two-leaved toothwort. Overbrowsing by deer is a serious threat to the overall understory plant diversity. An overabundance of deer can create the effect of park-like forests in which the understory and vertical stratification is greatly reduced. Removal of understory species eliminates habitat for some nesting songbirds and other species, as well as increases competition between deer and other wildlife due to reduced food sources. Furthermore, deer prefer higher quality food, leaving poorer, less diverse species to mature and dominant the overstory.



West Virginia white (*Pieris virginiensis*)

Dave Leppo

Spraying for gypsy moths will likely be very detrimental to this species due to its low population densities and inability to recolonize an area following eradication (NatureServe2008). Permanent and seasonal residences encroach on the river's floodplain and adjacent wetlands, though most of the riverfront vegetation remains relatively intact. The still-water pool created by Lock & Dam #8 has likely reduced the potential habitat for the blue false-indigo along the river's shoreline.

Conservation Recommendations – Conserve the forested habitat in its current undisturbed condition. Avoid fragmenting the wooded hillside with any additional infrastructure, such as roads, or utility rights-of-way. Allow the forested habitat to achieve and maintain old-growth conditions. No logging should occur on this steep forested slope.

Control invasive species, particularly garlic mustard. Garlic mustard is a biennial that is pulled easily, but must be pulled and removed from the site or burned before seed dispersal. An aggressive and continual control of this species will be necessary to keep the current small population from becoming an infestation.

Keep the deer herd small in this area. Plant species of concern are particularly susceptible to deer herbivory.

South Fork Pine Creek at Oscar BDA – An occurrence of a **species of concern** was found along South Fork Pine Creek at this location. A narrow band of forest runs along this section of Pine Creek, but roads and agricultural areas fragment the forest into small sections. Relying on clean water to maintain healthy invertebrate prey populations, this species also uses bushy vegetation along the creek. Streamside vegetation along the creek is necessary for the maintenance of the water quality and to provide critical habitat for the species of concern found at this site.

Threats and Stresses – Riparian vegetation is important to this species as habitat and also as a filter for pollutants. Roads and agricultural areas have disturbed the riparian area. Removal of the riparian vegetation would destroy habitat and allow runoff to enter directly into the stream.

Recommendations – Maintain and restore riparian vegetation to provide habitat and protect water quality for the species of concern located at this site.

Templeton Mine BDA – This site is an abandoned mine shaft that now provides habitat for one **species of concern**. These abandoned mines mimic the natural cave habitats that these species typically use. The riparian forests near the mine provide critical foraging habitat for these species, and others using the mine.

Threats and Stresses – Forest fragmentation would limit foraging and roosting habitat, and the use of insecticides could limit the prey base for these species. The entrance to the mine has been gated to prevent disturbance, but trespassing and vandalism are still potential threats to this site.

Conservation Recommendations – Maintain the existing forests and replant the cleared areas with native trees and shrubs, especially along riparian corridors. Continue to gate the mine entrance and protect this site from trespassing and vandalism.

Bradys Bend Township

	PNDI Rank ¹		Legal Status ¹		Last Seen	Quality ²
	Global	State	State (Proposed)			

NATURAL HERITAGE AREAS:

Allegheny River Pool #9 BDA		<i>Exceptional Significance</i>				
Elktoe (<i>Alasmidonta marginata</i>) – mussel	G4	S4	N(N)	2007	E	
Wavy-rayed lampmussel (<i>Lampsilis fasciola</i>) – mussel	G5	S4	N(N)	2007	E	
Pocketbook (<i>Lampsilis ovata</i>) – mussel	G5	S3S4	N(N)	1985	E	
Paper pondshell (<i>Utterbackia imbecillis</i>) – mussel	G5	S3S4	N(CU)	1997	E	
Red-head pondweed (<i>Potamogeton richardsonii</i>) – plant	G5	S3	PT(PR)	2002	E	
Sensitive species of concern ³	-	-	-	2000	E	
Sensitive species of concern ³	-	-	-	2001	E	
Sensitive species of concern ³	-	-	-	2000	E	
Sensitive species of concern ³	-	-	-	1991	E	
US Steel Mine #2 BDA		<i>Exceptional Significance</i>				
Sensitive species of concern ³	-	-	-	1987	D	
Sensitive species of concern ³	-	-	-	2001	C	
Sensitive species of concern ³	-	-	-	2002	E	
Sensitive species of concern ³	-	-	-	2001	BC	

LANDSCAPE CONSERVATION AREAS:

Allegheny River LCA

PUBLICLY MANAGED LAND:

State Game Lands #105

1 = Please refer to Appendix I for an explanation of PNHP ranks and legal status
 2 = Please refer to Appendix II for an explanation of quality ranks
 3 = This species is not named by request of the jurisdictional agency

Armstrong County Natural Heritage Inventory Bradys Bend Township

Biological Diversity Areas

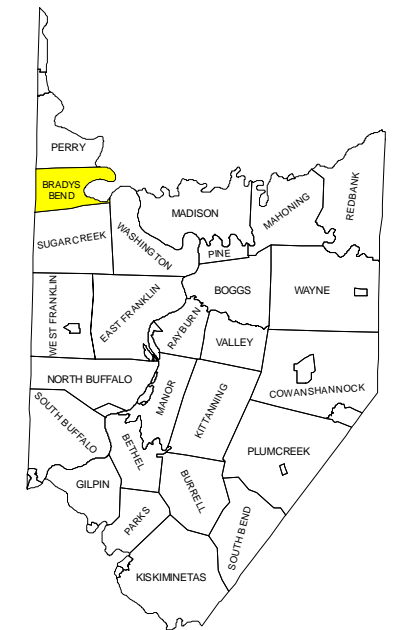
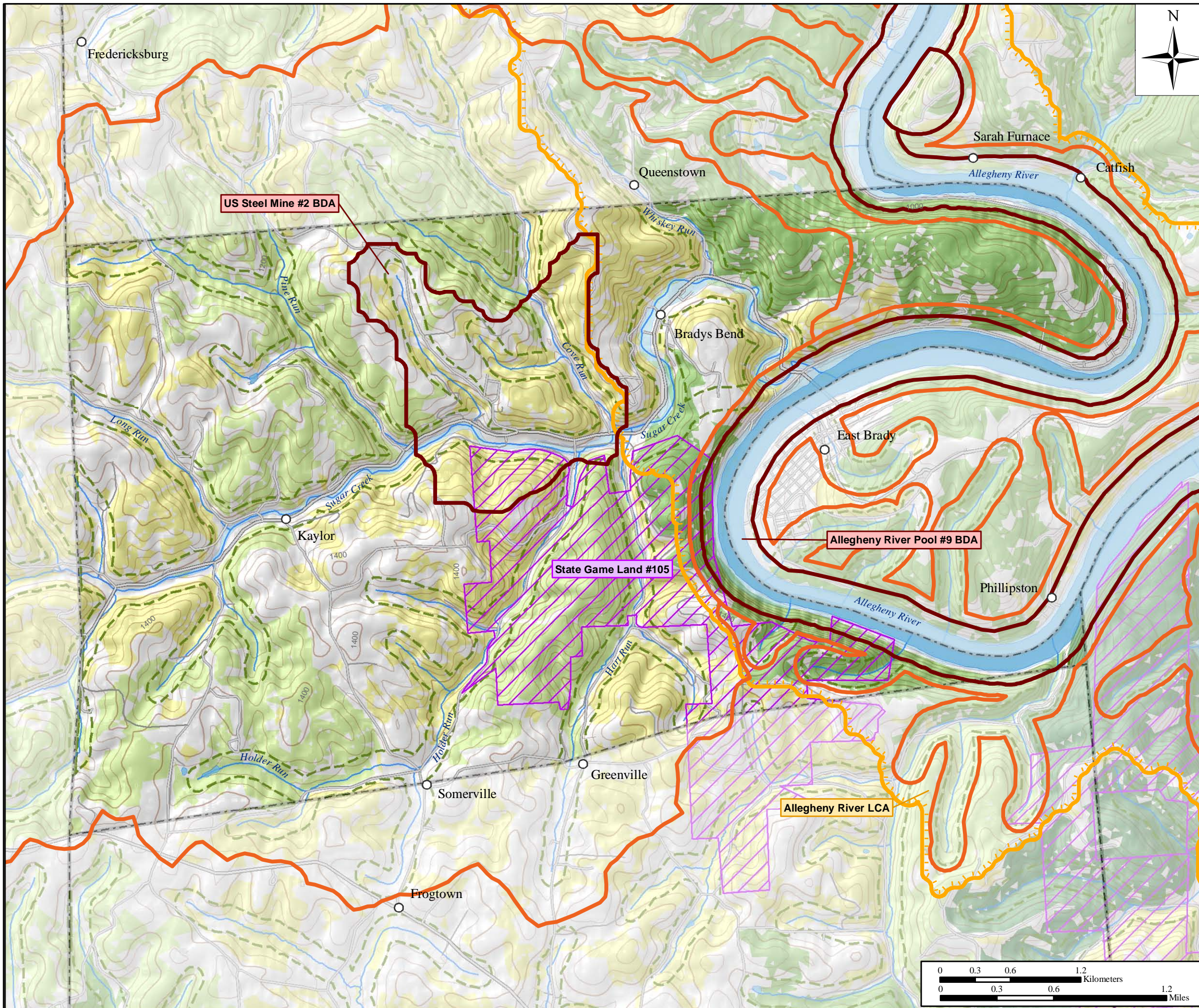
Allegheny River Pool #9 BDA
US Steel Mine #2 BDA

Landscape Conservation Areas

Allegheny River LCA

Public Land

State Game Land #105



Legend

- Landscape Conservation Area (LCA)
- Biological Diversity Area (BDA)**
- Core
- Supporting Landscape
- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer
- Forest Blocks by Acre**
- < 250
- 251 - 500
- 501 - 1000
- > 1000
- Municipal Boundary
- US Army Corps of Engineers
- PA Game Commission
- 40 Ft. Contour Line

PNHP
Pennsylvania Natural Heritage Program

Bradys Bend Township

Bradys Bend Township is in northwest Armstrong County. The 12.7 square mile township shares a border to the west with Butler County. The Allegheny River forms the eastern boundary that separates Bradys Bend from Clarion County.

Sugar Creek flows to the east through the township into the Allegheny River. The main stem of Sugar Creek and its tributary Hart Run are impaired by abandoned mine drainage (Department Environmental Protection 2009). Conservation concerns should focus on the restoration of Sugar Creek and Hart Run. Land use in the township is 30% agriculture and 56% forest. Forest blocks within the township provide important habitat for wildlife. The US Steel Mine Important Mammal Area (IMA) encompasses all of Bradys Bend Township. State Game Land (SGL) #105 occupies much of the southeast corner of the township, and extends southward into Sugarcreek Township.



Denise Watts, PNHP

Allegheny River Pool #9 BDA –

The Allegheny River is one of the most ecologically significant areas in Armstrong County, including a large diversity of fish and mussel species. The Allegheny River begins in Potter County and flows north into New York. The river then turns south and flows down through Warren, Forest, and Venango Counties. As the Allegheny River enters Armstrong County it is free-flowing until it reaches Lock and Dam #9 north of Cosmus. The Allegheny River combines with the Monongahela River in Allegheny County before it enters the Ohio River. The lock and dam system was created in the 1920's and 1930's for navigation.

Dredging removes gravel habitat from the river bottom

The dams alter the natural flow of the river and create a different type of habitat than is found in the free-flowing sections. Allegheny River Pool #9 is located north of Cosmus. This section of the river will be described upstream south of Foxburg.

The health of the Allegheny River has been threatened by pollutants and other disturbance. Abandoned mine drainage has impacted many of the streams in Armstrong County. Few mussels were found in other waterways, due to lowered pH and diminished water quality. There are also some other notable point source pollutants to the Allegheny, such as the PPG dump near Ford City that is imputing heavy metals into the river. The Allegheny River, however, seems able to maintain populations of species that cannot tolerate low water quality.

Sand and gravel dredging is another threat facing aquatic species, especially mussels. The substrate is removed from the river bottom and is often used to build roads. This impacts the mussel habitat in areas that allow dredging, including Pool #9.

Despite the dams along the Allegheny River creating habitat that is deeper and slower moving than most of the free-flowing sections of the river, there are still some areas that have the shallow quick-moving

riffle habitat that supports higher mussel populations. This habitat can especially be found below dams and near sediment deposits that have formed islands in the river.

Freshwater mussels are one group of organisms that require high water quality. While many mussel species historically known from the Allegheny River have been extirpated, certain sections of the river have some of the highest diversity of freshwater mussels in the state. Four freshwater mussel species of concern are currently known in the Allegheny River Pool #9- **elktoe** (*Alasmidonta marginata*), **paper pondshell** (*Utterbackia imbecillis*), **pocketbook** (*Lampsilis ovata*), and **wavy-rayed lampmussel** (*Lampsilis fasciola*).

The PA-threatened **red-head pondweed** (*Potamogeton richardsonii*) grows submerged in the river, rooted in the cobble covered riverbed of the Allegheny River. As with the other rare species living in this stretch of the river, the continuation of red-head pondweed at this location depends largely on maintaining the water quality of the river.

Allegheny River Pool #9 also provides habitat for **four other aquatic animal species of concern**. All of the species, both rare and common, aquatic and terrestrial, rely on the water quality of the river to maintain healthy food webs.

Threats and Stresses – The habitat of the stream-dependent species can be considerably impacted from nearby land use decisions. Many of the steep hillsides and stream valleys along the Allegheny River are forested, but there are significant agricultural and mining operations on the banks of the river and within the Allegheny River watershed. In addition, the many impervious surfaces of the surrounding urban area, such as roads, parking lots and roof tops channel rain water directly into the waterways, taking numerous non-point source pollutants with them. Storm water runoff through urban and suburban areas can be a significant source of chemical pollutants for the waterways, which can severely impact water quality and the food chain of the river.

River dredging directly removes the substrate that the mussels imbed themselves in for most of their adult life. Fish also use this gravel habitat. Once the substrate has been removed, the flow of the river can be altered, and sediment can fill in the holes left behind. The sediment makes the river bottom uninhabitable for many species.

Invasive plants, such as purple loosestrife (*Lythrum salicaria*) and Japanese knotweed (*Polygonum cuspidatum*), can be quite common on the islands and along the banks of the river. These aggressive invasive plants dominate portions of the floodplain, outcompeting and displacing native vegetation. The zebra mussel (*Dreissena polymorpha*), another invasive species, has been located in several pools of the Allegheny River. This small mussel can grow on top of native mussels, substrate, and infrastructure in the water, altering the natural system and causing damage to pipes and other objects in the water.

Conservation Recommendations – Conservation efforts should focus on protecting and improving the quality of the surface water for both the local human community as well as for the habitat for the sensitive species of concern. Additional steps can be taken to protect and improve the aquatic habitat. Maintain and restore the natural hydrology of the Allegheny River. Restore floodplain habitats along the river's edge to slow and filter runoff before it enters the aquatic system. Improve water quality of the river by providing vegetated buffers along tributaries and the river shoreline. Stop river dredging to maintain the remaining habitat for the aquatic species. Control invasive species of plants by eliminating new small populations. Larger well-established populations of invasive species will require a sustained and continual suppression effort to prevent their spread. Contain zebra mussels to those areas already affected by cleaning boats and other items used in the water to control their spread into new areas.

US Steel Mine BDA – This site is an abandoned mine shaft that now provides habitat for four species of concern. These abandoned mines mimic the natural habitats that these species typically use. The riparian forests near the mine provide critical foraging habitat for these species, and others using the mine.

Threats and Stresses – Forest fragmentation would limit foraging and roosting habitat, and the use of insecticides could limit the prey base for these species. The entrance to the mine has been gated to prevent disturbance, but trespassing and vandalism are still potential threats to this site.

Conservation Recommendations – Maintain the existing forests and replant the cleared areas with trees, especially along riparian corridors. Continue to gate the mine entrance and protect this site from trespassing and vandalism.

Burrell Township

	PNDI Rank ¹		Legal Status ¹	Last Seen	Quality ²
	Global	State	State (Proposed)		
<i>NATURAL HERITAGE AREAS:</i>					
Cherry Run at Cochrans Mills BDA <i>High Significance</i>					
West Virginia white (<i>Pieris virginiensis</i>) - butterfly	G3G4	S2S3	N(N)	2008	E
Sensitive species of concern ³	-	-	-	2008	E
Crooked Creek at Iron Bridge Road BDA <i>High Significance</i>					
Sensitive species of concern ³	-	-	-	2008	E
Crooked Creek Reservoir BDA <i>Notable Significance</i>					
Cattail sedge (<i>Carex typhina</i>) – plant	G5	S2	PE(PT)	2008	BC
Sensitive species of concern ³	-	-	-	2008	E
Crooked Creek Reservoir Floodplain BDA <i>High Significance</i>					
Stalked bulrush (<i>Scirpus pedicellatus</i>) – plant	G4	S1	PT(PT)	2007	E
Sensitive species of concern ³	-	-	-	2008	BC

LANDSCAPE CONSERVATION AREAS: None currently identified

PUBLICLY MANAGED LAND: None

1 = Please refer to Appendix I for an explanation of PNHP ranks and legal status
 2 = Please refer to Appendix II for an explanation of quality ranks
 3 = This species is not named by request of the jurisdictional agency

Armstrong County Natural Heritage Inventory Burrell Township

Biological Diversity Areas

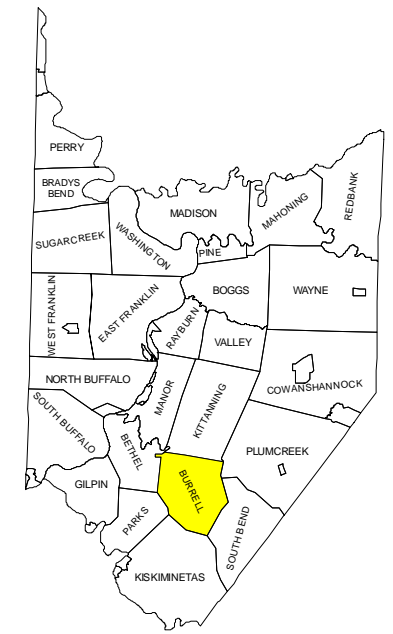
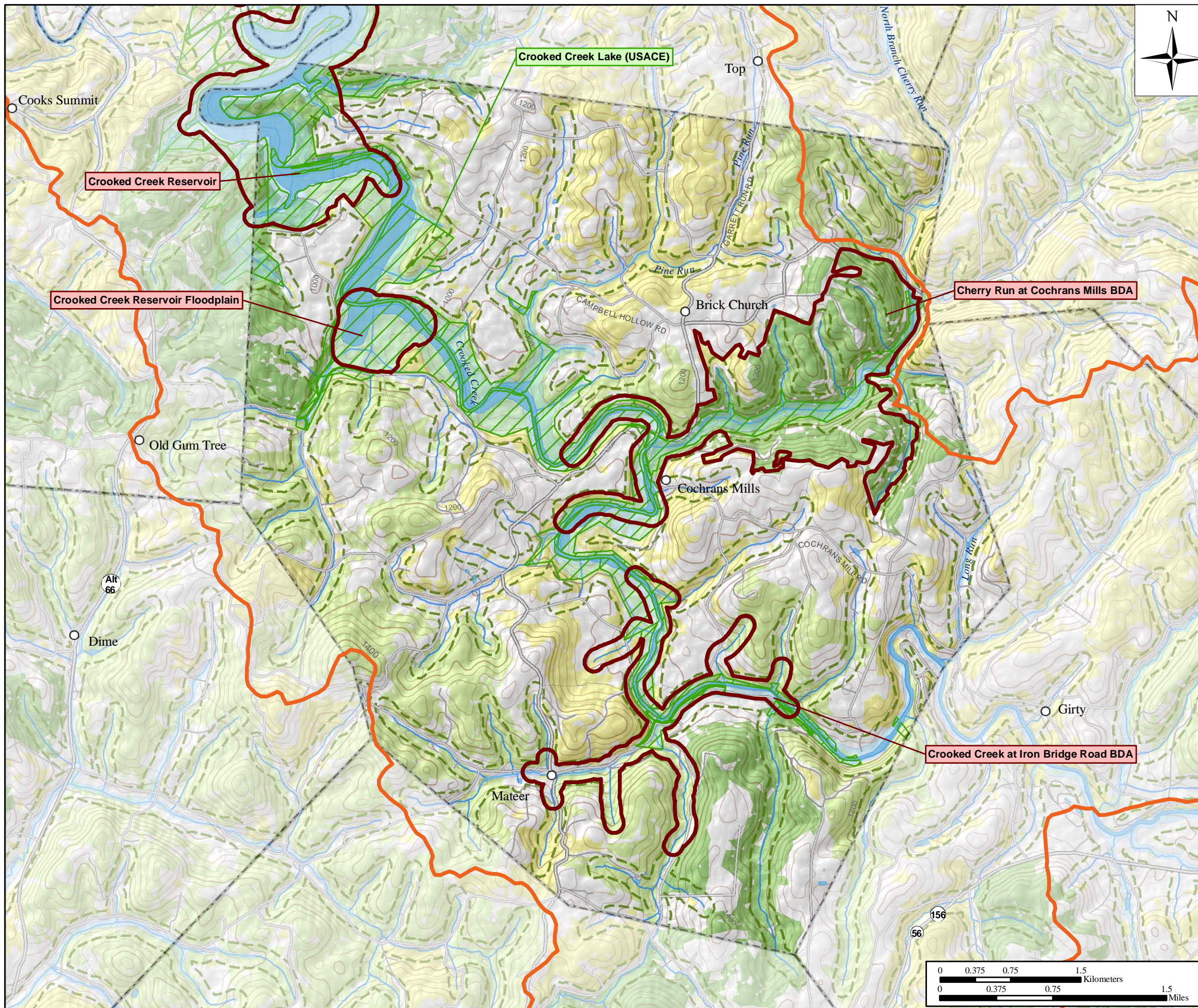
- Cherry Run at Cochrans Mills BDA
- Crooked Creek at Iron Bridge Road BDA
- Crooked Creek Reservoir BDA
- Crooked Creek Reservoir Floodplain BDA

Landscape Conservation Areas

None Currently Identified

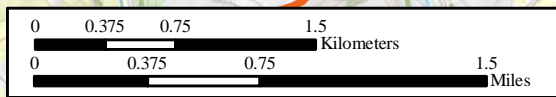
Public Land

- Crooked Creek Lake (USACE)



Legend

	Landscape Conservation Area (LCA)		
Biological Diversity Area (BDA)			
	Core		
	Supporting Landscape		
	Streams		
	National Wetland Inventory		
	100-year Floodplain		
	Recommended Riparian Buffer		
Forest Blocks by Acre			
	< 250		Municipal Boundary
	251 - 500		US Army Corps of Engineers
	501 - 1000		PA Game Commission
	> 1000		40 Ft. Contour Line



Burrell Township

Burrell Township is centrally located in southern Armstrong County and measures 21.9 square miles. Seven other townships surround Burrell: Manor, Kittanning, Plumcreek, South Bend, Kiskiminetas, Parks, and Crooked Creek. Agriculture makes up 35% of the land use and forest 56%.

Crooked Creek flows through the center of the township and Cherry Run drains the northeast sector before joining Crooked Creek. Aquatic life is impaired in several of the small tributaries to Crooked Creek due to abandoned mine drainage (Department Environmental Protection 2009). Forest blocks of 300 to nearly 900 acres occur along Cherry Run and portions of Crooked Creek. These forested stream buffers help filter surface water runoff and prevent non-point source pollution from the waterways.

Cherry Run at Cochran's Mills BDA – Cherry Run is a small stream that flows into Crooked Creek above the dam. This section of Cherry Run is mostly forested, which helps to protect the water quality of the stream. Portions of Cherry Run upstream of this site flow along roads and agricultural areas. This may affect water quality downstream, as sediments and pollutants enter directly into the water. The forested area around Cherry Run supports a population of **West Virginia whites (*Pieris virginianensis*)**, a globally vulnerable and state imperiled butterfly species of concern. This small, white butterfly requires large patches of forest and will not regularly cross roads and other breaks in the forest canopy. The larval host plant of the West Virginia white is two-leaved toothwort (*Cardamine diphylla*), while adults nectar on toothworts and other spring flowering plants. Adults are typically seen flying in May. Another **species of concern** was also observed at this site.

Threats and Stresses – This area is part of Crooked Creek Lake Park, which should help keep this habitat intact. West Virginia whites are often localized in high quality forests and are sensitive to disturbances in the forest. Overbrowsing of larval host plants and nectar plants, as well as fragmentation of the forested areas surrounding Crooked Creek and Cherry Run is detrimental to the West Virginia white population at this site. Recolonization is difficult once the population is gone, since they do not readily cross non-forested areas. Invasion by garlic mustard threatens the survival of the caterpillars and the persistence of West Virginia white population at this site. Spraying of Bt for gypsy moth control is also a threat to West Virginia white populations. The other species of concern at this location relies upon high water quality. Fragmentation of the riparian forests threatens the habitat needed for this species to survive.

Conservation Recommendations – Unfragmented forests need to be kept intact. Even relatively small breaks in the forest canopy can create a barrier to movement by the adults. Disturbance also creates openings for invasive species, such as garlic mustard. Deer populations should be managed to stay in balance with the ecosystem as a whole. Areas with known West Virginia white populations should not be sprayed with Bt or any other insecticide. Maintain the riparian forests and restore in areas 100 meters (328 feet) or less from the water edge.

Crooked Creek at Iron Bridge Road BDA – An occurrence of a **species of concern** was found along Crooked Creek at this location. The habitat is mostly forested, but some agricultural areas have disturbed the forest close to the stream. Relying on clean water to maintain healthy invertebrate prey populations, this species also uses bushy vegetation along the creek. Streamside vegetation along the creek is necessary for the maintenance of the water quality and to provide critical habitat for the species of concern found at this site.

Threats and Stresses – Riparian vegetation is important to this species as habitat and also as a filter for pollutants. Roads and agricultural areas have disturbed the riparian area. Removal of the riparian vegetation would destroy habitat and allow pollutants and sediment to enter directly into the stream.

Recommendations – Maintain and restore riparian vegetation at least 100 meters (328 feet) from the stream edge to provide habitat and protect water quality for the species of concern located at this site.

Crooked Creek Reservoir BDA – Crooked Creek Reservoir was created by the damming of Crooked Creek in 1940 as a means of controlling floodwaters in the lower Allegheny and Ohio Rivers. The water level in the reservoir fluctuates widely as floodwaters alternately flood and dry the shoreline, establishing an ebb and flow, like an irregular tide. The difference between average summer water level height and full capacity at the dam breast is roughly 65 feet. Debris from past flood events such as tree parts and assorted trash litters the shoreline in a wide band extending up the slope of the shoreline. The fluctuating water level along the shoreline helps to foster habitat conditions favorable for a population of the PA-endangered plant species of concern, **cattail sedge** (*Carex typhina*). The species typically grows in wet woods and bottomlands, particularly around the edges of low spots that intermittently have standing water.

Threats and Stresses – There are no evident threats to this species at this location and management does not seem to be necessary. The artificially induced shoreline fluctuations actually help maintain favorable habitat conditions for the cattail sedge. The cattail sedge is not currently known to be as widely dispersed along the shoreline of this reservoir as at the Mahoning Creek Reservoir, and recreational activities could more easily disturb the habitat for this population. Poorly sited infrastructure improvements such as access roads and parking lots could eliminate portions of the habitat for this species.

Conservation Recommendations – The extremely dynamic nature of the floodplain of this reservoir will likely force any future infrastructure improvements to remain a respectful distance from the active floodplain.

Crooked Creek Reservoir Floodplain BDA – A small population of an imperiled **species of concern** occurs at the site. This species was found in the moist herbaceous areas adjacent to the open wetland and along an old road leading into the area. Associated species include wild senna (*Senna hebecarpa*), sensitive fern (*Onoclea sensibilis*), deer-tongue grass (*Panicum clandestinum*), and Indianhemp (*Apocynum cannabinum*).

An additional plant species of concern, the PA-threatened **stalked bulrush** (*Scirpus pedicellatus*), occurs within a wide, marshy portion of the Crooked Creek floodplain. The stalked bulrush is near the southern limit of its known range in Pennsylvania. This species may hybridize with the more common wool grass (*Scirpus cyperinus*) where the two co-occur, making determination difficult. Conservation of the naturally vegetated floodplain / shoreline habitat will help maintain viable populations of this species.



Cattail sedge (*Carex typhina*)

Rocky Gleason, PNHP

Threats and Stresses – One of the species is threatened by unauthorized collection. The habitat surrounding this population includes forested areas and those with thick shrub cover. It is currently growing in areas with less dense vegetative cover. If succession is allowed to continue unimpeded, this species will likely be unable to compete against more aggressive species.

Recommendations – Management may be needed to maintain open areas and prevent crowding by other species. Take precautions to prevent collection of this species.



Denise Watts, PNHP

The early successional wetlands along Crooked Creek reservoir provide habitat for many species, including two species of concern.

Cadogan Township

	PNDI Rank ¹		Legal Status ¹	Last Seen	Quality ²
	Global	State	State (Proposed)		

NATURAL HERITAGE AREAS:

Allegheny River Pool #6 BDA	<i>Exceptional Significance</i>				
Goldeye (<i>Hiodon alosoides</i>) – fish	G5	S2?	PT(PT)	1986	E
River redhorse (<i>Moxostoma carinatum</i>) – fish	G4	S3S4	N(CU)	1997	E
Longhead darter (<i>Percina macrocephala</i>) – fish	G3	S2S3	N(PT)	1986	E
Elktoe (<i>Alasmidonta marginata</i>) – mussel	G4	S4	N(N)	2007	E
Wabash pigtoe (<i>Fusconaia flava</i>) – mussel	G5	S2	N(PE)	2007	B
Fragile papershell (<i>Leptodea fragilis</i>) – mussel	G5	S2	N(CR)	2005	D
Pink heelsplitter (<i>Potamilus alatus</i>) – mussel	G5	S2	N(CR)	2005	CD
Round pigtoe (<i>Pleurobema sintoxia</i>) – mussel	G4G5	S2	N(PE)	2007	E
Sensitive species of concern ³	-	-	-	2005	E
Sensitive species of concern ³	-	-	-	2007	E

LANDSCAPE CONSERVATION AREAS: Allegheny River LCA

PUBLICLY MANAGED LAND: None

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2 = Please refer to Appendix II for an explanation of quality ranks

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Armstrong County Natural Heritage Inventory

Cadogan Township & North Buffalo Township

Biological Diversity Areas

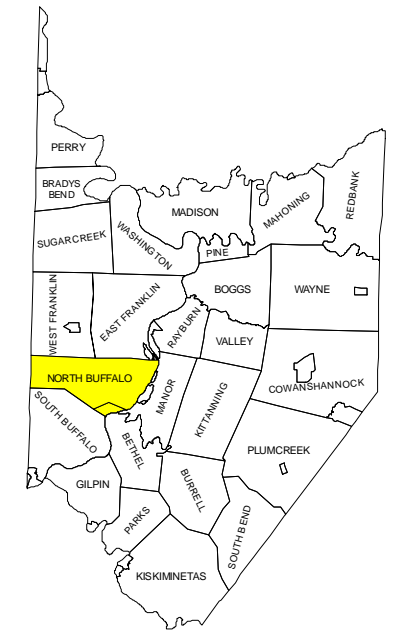
- Allegheny River Pool #6 BDA
- Long Run Mine BDA
- Rough Run BDA

Landscape Conservation Areas

- Allegheny River LCA

Public Land

- State Game Land #247



Legend

Landscape Conservation Area (LCA)

Biological Diversity Area (BDA)

Core

Supporting Landscape

Streams

National Wetland Inventory

100-year Floodplain

Recommended Riparian Buffer

Forest Blocks by Acre

- < 250
- 251 - 500
- 501 - 1000
- > 1000

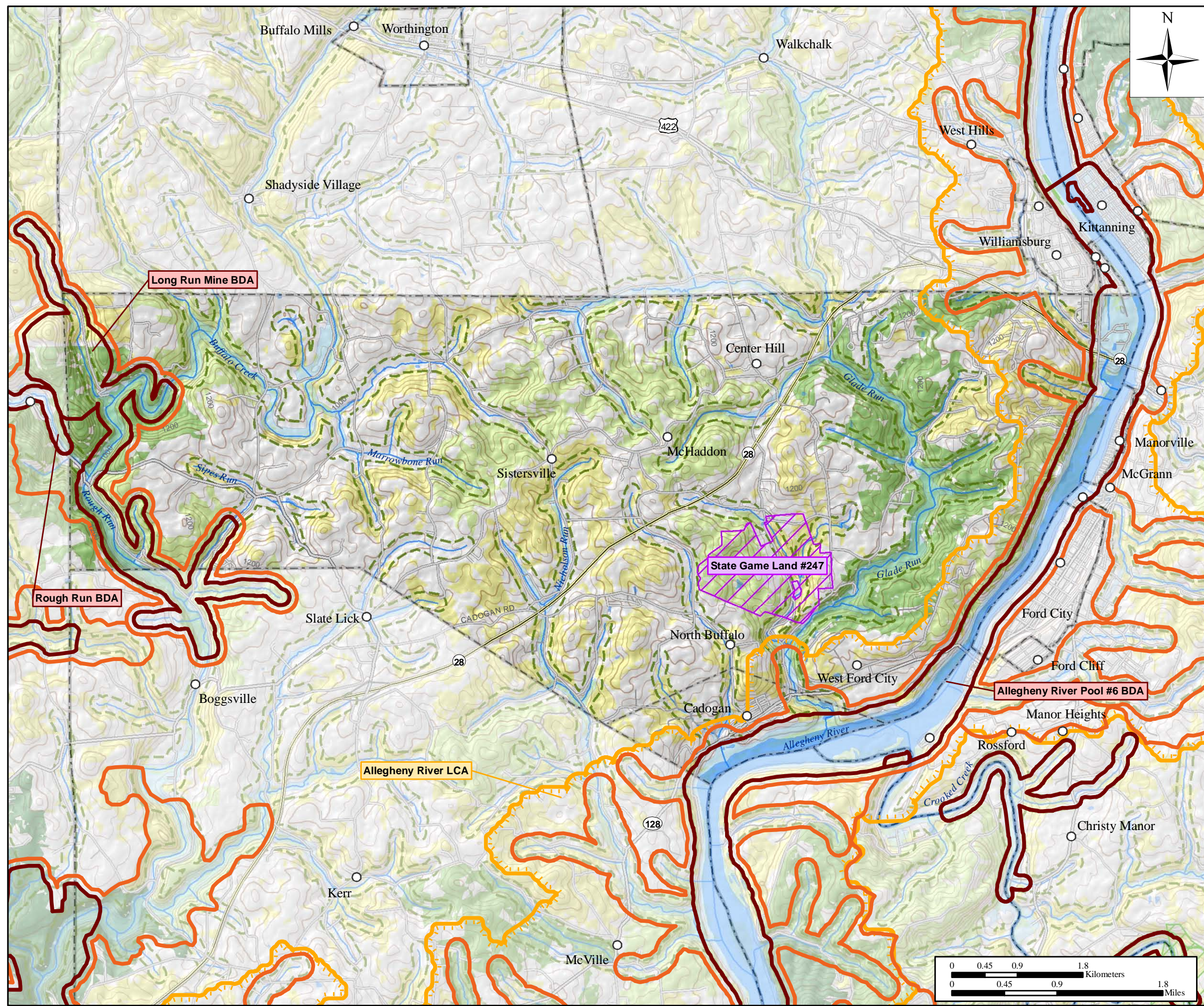
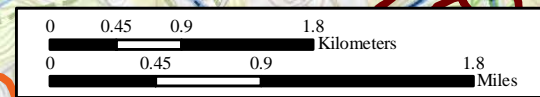
Municipal Boundary

US Army Corps of Engineers

PA Game Commission

40 Ft. Contour Line

PNHP
Pennsylvania Natural Heritage Program



Cadogan Township

Cadogan was incorporated in 1922 from part of North Buffalo Township. It was the last township incorporated within the county. Cadogan also holds the distinction of being the smallest township in Armstrong County. It occupies just 1.1 square miles.

The Allegheny River forms the southeastern border of Cadogan Township. A tributary to the Allegheny River runs through the center of the township. Unfortunately that tributary is affected by abandoned mine drainage and other habitat alterations (Department Environmental Protection 2009) While restoration on the upper reaches of the stream needs to occur in North Buffalo Township, the two branches that are within the township would benefit from the creation of a forested buffer along its banks to reduce non-point source pollution. Land use within the township is 17% agriculture and 34% forest.



Denise Watts, PNHP

Abandoned mine drainage has impacted many of the streams in Armstrong County.

Allegheny River Pool #6 BDA – The Allegheny River is one of the most ecologically significant areas in Armstrong County, including a large diversity of fish and mussel species. The Allegheny River begins in Potter County and flows north into New York. The river then turns south and flows down through Warren, Forest, and Venango Counties. As the Allegheny River enters Armstrong County it is free-flowing until it reaches Lock and Dam #9 north of Cosmus. The Allegheny River combines with the Monongahela River in Allegheny County before it enters the Ohio River. The lock and dam system was created in the 1920's and 1930's for navigation. The dams alter the natural flow of the river and create a different type of habitat than is found in the free-flowing sections. Allegheny River Pool #6 is located above the village of Kelly Station and continues upstream to Kittanning.

The health of the Allegheny River has been threatened by pollutants and other disturbances. Abandoned mine drainage has impacted many of the streams in Armstrong County. Few mussels were found in other waterways in the county, due to lowered pH and diminished water quality. There are also some other notable point source pollutants to the Allegheny, such as the PPG dump near Ford City that is imputing heavy metals into the river. The Allegheny River, however, seems able to maintain populations of species that cannot tolerate low water quality.

Sand and gravel dredging is another threat facing aquatic species, especially mussels. The substrate is removed from the river bottom and is often used to build roads. Dredging in Pool #6 has been banned since 1985, protecting the habitat for aquatic species.

Despite the dams along the Allegheny River creating habitat that is deeper and slower moving than most of the free-flowing sections of the river, there are still some areas that have the shallow, quick-moving riffle habitat that supports higher mussel populations. This habitat can especially be found below dams and near sediment deposits that have formed islands in the river.



PNHP

Mussel surveys are conducted by searching the river bottom for exposed portions of mussels, like that in the center of the picture.

Freshwater mussels are one group of organisms that require high water quality. While many mussel species historically known from the Allegheny River have been extirpated, certain sections of the river still contain some of the highest diversity of freshwater mussels in the state. Five freshwater mussel species of concern are currently known in the Allegheny River Pool #6-**elktoe (*Alasmidonta marginata*)**, **fragile papershell (*Leptodea fragilis*)**, **pink heelsplitter (*Potamilus alatus*)**, **round pigtoe (*Pleurobema sintoxia*)**, and **wabash pigtoe (*Fusconaia flava*)**. The Allegheny River is also home to a large number of fish species, including several species of concern. **Longhead darter (*Percina macrocephala*)**, **goldeye (*Hiodon alosoides*)**, and **river redhorse (*Moxostoma carinatum*)**, three fish species of concern, have all been located along this section of the Allegheny River. Allegheny River Pool

#6 also provides habitat for **two other aquatic animal species of concern**.

Threats and Stresses – The habitat of the river-dependent species can be considerably impacted from nearby land use decisions. Many of the steep hillsides and stream valleys along the Allegheny River are forested, but there are significant agricultural and mining operations on the banks of the river and within the Allegheny River watershed. This section of the Allegheny River flows through the more populated areas of the county, specifically Kittanning and Ford City. A large portion of Kittanning lies within the floodplain of the Allegheny River, putting this area in danger of flooding. In addition, the many impervious surfaces of the surrounding urban area, such as roads, parking lots, and roof tops channel rain water directly into the waterways, taking numerous non-point source pollutants with them. Storm water runoff through urban and suburban areas can be a significant source of chemical pollutants for the waterways, which can severely impact water quality and the food chain of the river. The PPG dump below Ford City a notable source of point source pollution that is leaching heavy metals and other point source pollutants directly into the Allegheny River.

Invasive plants, such as purple loosestrife (*Lythrum salicaria*) and Japanese knotweed (*Polygonum cuspidatum*), can be quite common on the islands and along the banks of the river. These aggressive invasive plants dominate portions of the floodplain, outcompeting and displacing native vegetation. The zebra mussel (*Dreissena polymorpha*), another invasive species, has been located in several pools of the Allegheny River. This small mussel can grow on top of native mussels, substrate, and infrastructure in the water, altering the natural system and causing damage to pipes and other objects in the water.

Conservation Recommendations – Conservation efforts should focus on protecting and improving the quality of the surface water for both the local human community as well as for the habitat for the sensitive



Rocky Gleason, PNHP

River shoreline development impacts the quality of the river's aquatic and riparian habitats by removing and converting floodplain vegetation to lawn. Future development should remain a respectful distance away from the river, relegating the floodplain and a buffer zone to the natural processes of the river.

species of concern. Additional steps can be taken to protect and improve the aquatic habitat. Maintain and restore the natural hydrology of the Allegheny River. Restore floodplain habitats along the river's edge to slow and filter runoff before it enters the aquatic system. Improve water quality of the river by providing vegetated buffers along inflows to the creek and along the river shoreline. Control invasive species of plants by eliminating new small populations. Larger well-established populations of invasive species will require a sustained and continual suppression effort to prevent their spread. Contain zebra mussels to those areas already affected by cleaning boats and other items used in the water to control their spread into new areas.

Cowanshannock Township, Atwood & Rural Valley Boroughs

	PNDI Rank ¹		Legal Status ¹	Last Seen	Quality ²
	Global	State	State (Proposed)		

NATURAL HERITAGE AREAS:

Keystone Lake BDA	<i>High Significance</i>				
Sora (<i>Porzana carolina</i>) – bird	G5	S3B	N(CR)	2008	E
Virginia Rail (<i>Rallus limicola</i>) – bird	G5	S3B	N(N)	2008	E
Paper pondshell (<i>Utterbackia imbecillis</i>) – mussel	G5	S3S4	N(TU)	2007	E
Sensitive species of concern ³	-	-	-	2008	B

LANDSCAPE CONSERVATION AREAS: None currently identified

PUBLICALLY MANAGED LAND: None

1 = Please refer to Appendix I for an explanation of PNHP ranks and legal status

2 = Please refer to Appendix II for an explanation of quality ranks

3 = This species is not named by request of the jurisdictional agency



Charlie Eichelberger, PNHP

Virginia Rail (*Rallus limicola*)

Armstrong County Natural Heritage Inventory Cowanshannock Township & Atwood Borough, & Rural Valey Borough

Biological Diversity Areas

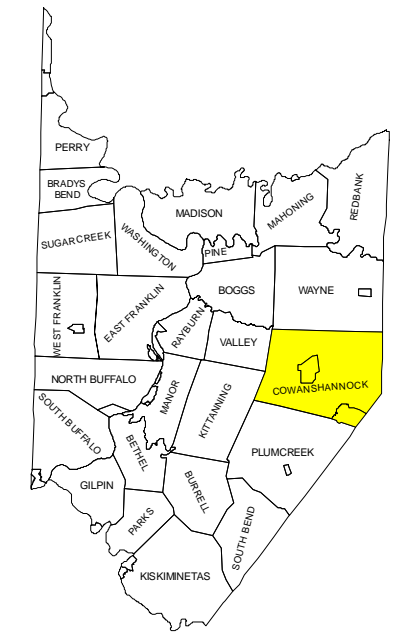
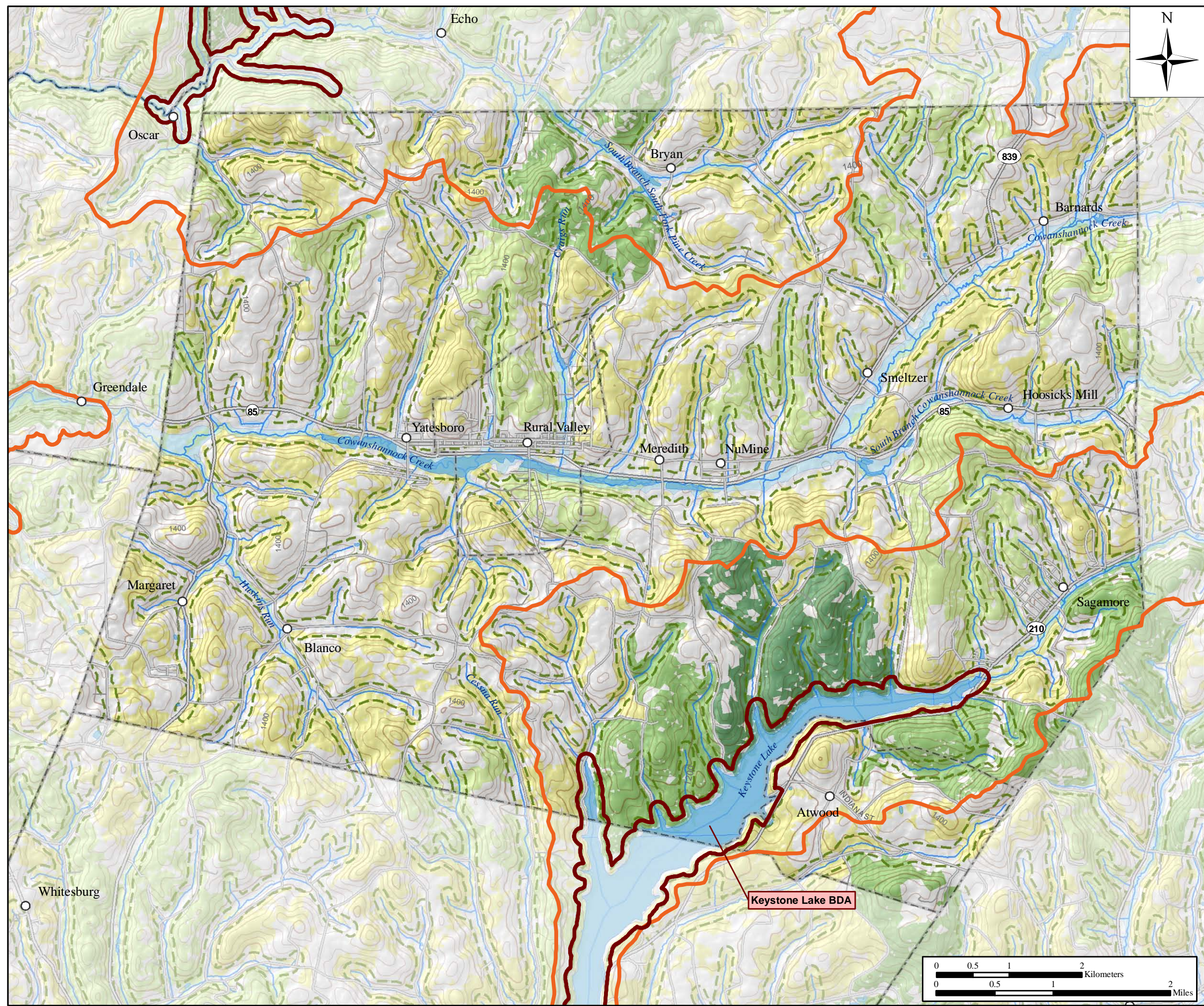
Keystone Lake BDA

Landscape Conservation Areas

None Currently Identified

Public Land

None



Legend

Landscape Conservation Area (LCA)

Biological Diversity Area (BDA)

- Core
- Supporting Landscape

Streams

National Wetland Inventory

100-year Floodplain

Recommended Riparian Buffer

Forest Blocks by Acre

- < 250
- 251 - 500
- 501 - 1000
- > 1000

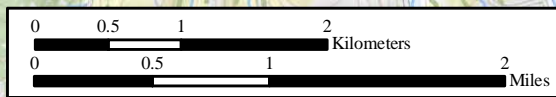
Municipal Boundary

US Army Corps of Engineers

PA Game Commission

40 Ft. Contour Line

PNHP
Pennsylvania Natural Heritage Program



Cowanshannock Township, Atwood & Rural Valley Boroughs

Cowanshannock is the largest township in Armstrong County occupying 46.3 square miles. Jefferson and Indiana Counties lie along the eastern township border. The Cowanshannock Creek flows across the township and drains much of the mid-section. In the southeast, the North Branch Plum Creek crosses the township just north of Atwood Borough.

Abandoned mine drainage impairs aquatic life in one tributary to the Cowanshannock, east of Rural Valley Borough. Nutrients from wastewater affect several tributaries to the Cowanshannock and the North Branch Plum Creek. In other areas where riparian buffers are absent, some waterways are impaired due to non-point pollution from agriculture (Department Environmental Protection 2009). Land use in the township is evenly split between forest (46%) and agriculture (45%). Some of the largest forest blocks in Cowanshannock are along the North Branch Plum Creek. Efforts to be made to maintain the large forest blocks and create forested buffers along the tributaries to the South Branch South Fork Pine Creek and the Cowanshannock where they are lacking. Forested stream buffers help filter surface water runoff from many non-point sources of pollution that would otherwise enter the waterways.

Atwood Borough

Atwood Borough is adjacent to the southeast corner of Cowanshannock Township. North Branch Plum Creek flows to its north and west. Atwood and Rural Valley are the largest boroughs in Armstrong County in terms of area. Atwood is also the smallest borough in Armstrong County in terms of population.

Rural Valley Borough

Rural Valley Borough is located in the mid section of the township. Cowanshannock Creek flows through the borough. Craigs Run, a tributary that flows into Cowanshannock Creek within the borough, is impaired due to both abandoned mine drainage and organic enrichment (Department Environmental Protection 2009). Native trees should be planted along the stream banks to protect the habitat and improve water quality.

Keystone Lake BDA – Keystone Lake was created by damming North Branch Plum Creek. The approximately 850 acre lake is used to supply water to the Keystone Power Plant (www.armstrongcounty.com). A population of **paper pondshell** (*Utterbackia imbecillis*), a state vulnerable mussel species of concern, was located at this site. This species prefers the muddy bottoms of lakes and ponds and can also be found in slow-moving, muddy bottomed sections of streams and rivers. Like other mussel species, paper pondshells need good water quality to survive.

The northern end of the lake has emergent vegetation that provides suitable breeding habitat for two state vulnerable wetland bird species of concern, **Sora** (*Porzana carolina*), and **Virginia Rail** (*Rallus limicola*). Both of these secretive species return in the spring to use wetlands with cattails and other emergent vegetation for breeding. Virginia Rails and Soras build nests over the water supported by wetland vegetation, while the shallow areas are used for foraging for seeds and invertebrates. Another **species of concern** was also located at this site.

Threats and Stresses – Destruction of wetland habitat is the primary threat to Sora, Virginia Rails, and other wetland species. The water quality must also be protected to maintain the integrity of the wetland and ensure that there are enough aquatic invertebrates to provide a food base. Maintaining high water quality is also vital to the survival of paper pondshells in the reservoir. Unauthorized collection is a threat for the other species of concern at this site, as well as hunting of the wetland bird species. This site is also used as a boat launch, and this area may be disturbed by people using this area. Horses are often tied in the area where the species of concern is located. Grazing or trampling by horses and deer are threats to this population.

Conservation Recommendations – The wetland habitat must be protected to prevent filling or destruction. A native vegetative buffer of at least 100 meters (328 feet) should be maintained around the wetland to protect the water quality. Disturbance to the wetland area should be limited, especially during the breeding season from May through July.

East Franklin Township, Applewold & West Kittanning Boroughs

	PNDI Rank ¹		Legal Status ¹	Last Seen	Quality ²
	Global	State	State (Proposed)		

NATURAL HERITAGE AREAS:

Allegheny River Island at Kittanning BDA *Notable Significance*

Blue false-indigo (<i>Baptisia australis</i>) – plant	G5	S2	PT	2008	A
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Allegheny River Pool #6 BDA *Exceptional Significance*

Goldeye (<i>Hiodon alosoides</i>) – fish	G5	S2?	PT	1986	E
River redhorse (<i>Moxostoma carinatum</i>) – fish	G4	S3S4	PC	1997	E
Longhead darter (<i>Percina macrocephala</i>) – fish	G3	S2S3	PT	1986	E
Elktoe (<i>Alasmidonta marginata</i>) – mussel	G4	S4	-	2007	E
Wabash pigtoe (<i>Fusconaia flava</i>) – mussel	G5	S2	PE	2007	B
Fragile papershell (<i>Leptodea fragilis</i>) – mussel	G5	S2	CR	2005	D
Round pigtoe (<i>Pleurobema sintoxia</i>) – mussel	G4G5	S2	PE	2007	E
Pink heelsplitter (<i>Potamilus alatus</i>) – mussel	G5	S2	CR	2005	CD
Sensitive species of concern ³	-	-	-	2005	E
Sensitive species of concern ³	-	-	-	2007	E

Allegheny River Pool #7 BDA *Exceptional Significance*

River redhorse (<i>Moxostoma carinatum</i>) – fish	G4	S3S4	PC	1997	E
Elktoe (<i>Alasmidonta marginata</i>) – mussel	G4	S4	-	2007	E
Wabash pigtoe (<i>Fusconaia flava</i>) – mussel	G5	S2	PE	2007	B
Fragile papershell (<i>Leptodea fragilis</i>) – mussel	G5	S2	CR	2005	D
Pink heelsplitter (<i>Potamilus alatus</i>) – mussel	G5	S2	CR	2005	CD
Paper pondshell (<i>Utterbackia imbecillis</i>) – mussel	G5	S3S4	CU	2001	E
Sensitive species of concern ³	-	-	-	2007	E
Sensitive species of concern ³	-	-	-	2005	E
Sensitive species of concern ³	-	-	-	2007	E

LANDSCAPE CONSERVATION AREAS: Allegheny River LCA

PUBLICALLY MANAGED LAND: None

1 = Please refer to Appendix I for an explanation of PNHP ranks and legal status

2 = Please refer to Appendix II for an explanation of quality ranks

3 = This species is not named by request of the jurisdictional agency

Armstrong County Natural Heritage Inventory East Franklin Township & West Kittanning Borough

Biological Diversity Areas

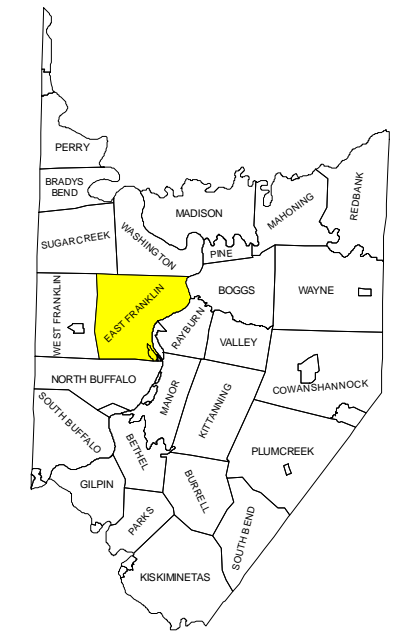
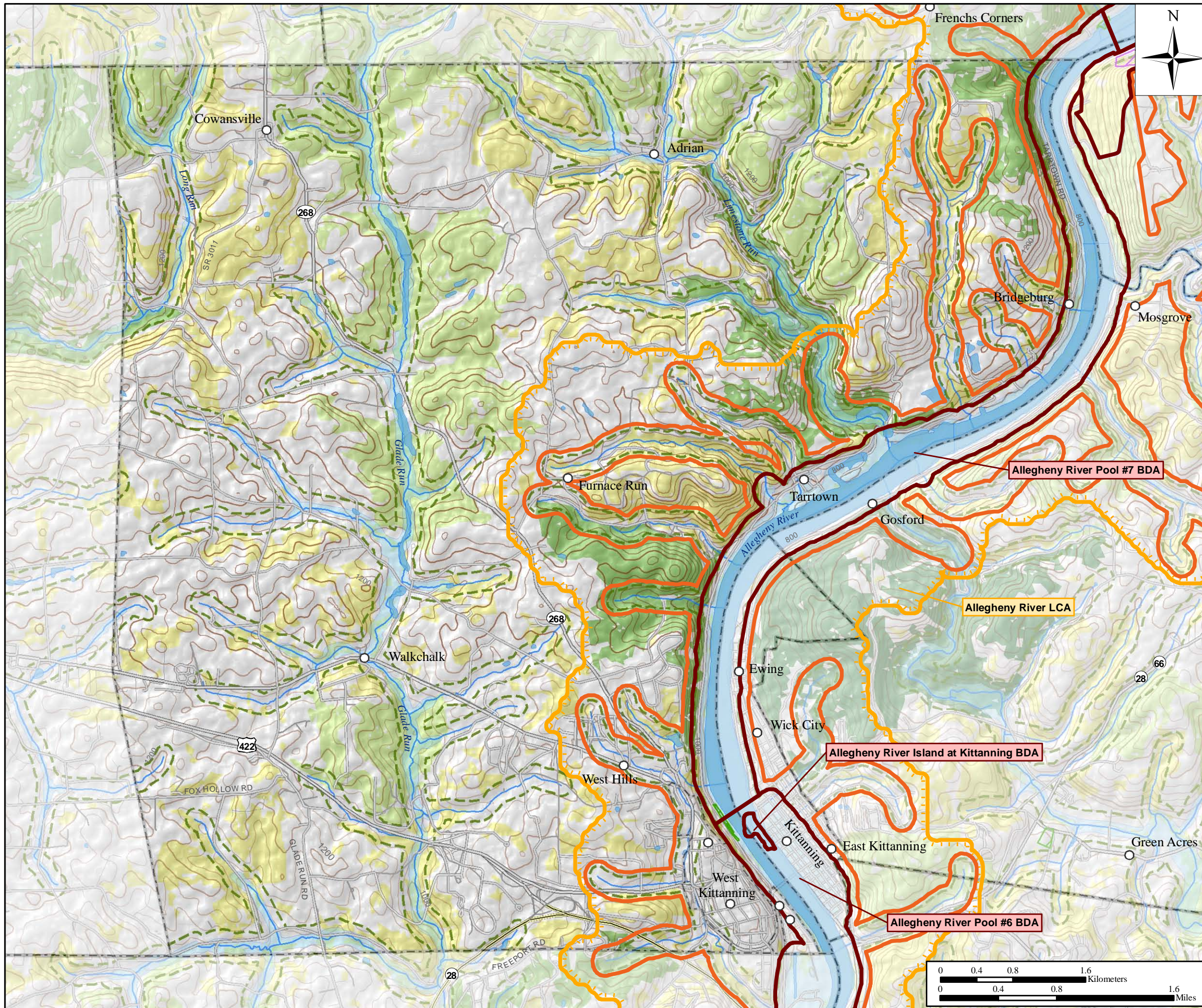
- Allegheny River Island at Kittanning BDA
- Allegheny River Pool #6 BDA
- Allegheny River Pool #7 BDA

Landscape Conservation Areas

- Allegheny River LCA

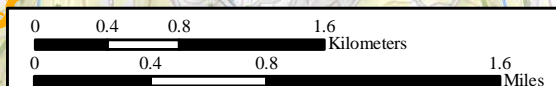
Public Land

None



Legend

- Landscape Conservation Area (LCA)
- Biological Diversity Area (BDA)**
 - Core
 - Supporting Landscape
- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer
- Forest Blocks by Acre**
 - < 250
 - 251 - 500
 - 501 - 1000
 - > 1000
- Municipal Boundary
- US Army Corps of Engineers
- PA Game Commission
- 40 Ft. Contour Line



East Franklin Township, Applewold & West Kittanning Boroughs

East Franklin Township covers over 31.5 square miles along the west bank of the Allegheny River. Glade Run makes a north to south run through the western part of East Franklin. Limestone Run drains much of the township to the northeast. Abandoned mine drainage affects this watershed and impairs aquatic life in Limestone Run and its tributaries (Department Environmental Protection 2009).

Forest covers 42% of the township and agriculture 39%. The largest forest blocks in the township are 300 – 500 acres in size; however, most forest blocks are much smaller. Efforts should be made to create riparian buffers by planting native trees along the reaches of streams where they are lacking in order to reduce non-point source pollution, especially in areas affected by abandoned mine drainage. Streamside forest corridors also provide wildlife corridors between fragmented patches of forest.

Two areas of importance to wildlife occur in East Franklin Township. A portion of the Long Run Mine Important Mammal Area (IMA) occupies the southwest corner and the eastern end of the Buffalo Creek Valley Important Bird Area (IBA) extends into East Franklin.

Applewold Borough

Applewold is the smallest borough in Armstrong County, covering just 0.1 square mile. Applewold sits between the southeast corner of East Franklin Township and the Allegheny River. North Buffalo Township is to its south.

West Kittanning Borough

West Kittanning Borough is in the southeast corner of East Franklin Township. West Kittanning Borough covers 0.4 square miles of land.

Allegheny River Island at Kittanning BDA – A good-quality population of the PA-threatened plant species of concern, **blue false-indigo** (*Baptisia australis*), occurs on the island and along the shoreline of the Allegheny River at Kittanning and at the confluence with Crooked Creek. Blue false-indigo, like the grasslands it is often associated with, is found scattered along the Allegheny River and its major tributaries, primarily above the series of flat water pools created by the system of locks and dams. This plant is most frequently associated with sand and cobble deposits in high energy floodplains that receive periodic flooding and scour disturbance. The potential habitat for this species has been greatly diminished by the river's habitat modification. Most of the populations of this species within the lock and dam system occur in the shallower water just below the dams, as is the case with this population just below Lock & Dam #7.



Rocky Gleason, PNHP

Japanese knotweed can colonize stream banks in thick stands if not controlled.

Threats and Stresses – The blue false-indigo at this location occurs along the shoreline of the river and the adjacent island just below the dam. It is likely that if the system of locks and dams were not in place, this rare plant would be more prevalent in sand and cobble floodplain habitats along the lower Allegheny River.

Invasive species of plants and the introduced zebra mussel impact habitat quality by competing for resources and displacing native species. Japanese knotweed, purple loosestrife, and garden loosestrife are currently present along the river shoreline.

Conservation Recommendations – Conservation efforts should focus on protecting and improving the quality of the surface water for both the local human community as well as for the habitat for the various species of concern associated with the river. Install or upgrade abandoned mine drainage mitigation systems to help correct this source of aquatic pollution. Reclaim former open strip mine areas by restoring natural contours and replanting in a variety of native vegetation suitable to the

location. Maintain and restore floodplain habitats along the river's edge to slow and filter runoff before it enters the aquatic system. Improve water quality of the river by providing vegetated buffers along inflows to the river and along the river shoreline. Monitor and regulate land use in the watershed to prevent siltation. Closely monitor construction, mining and agricultural activities to minimize siltation and acid runoff.

Any future riverfront development should be set back a minimum of 100 meters (328 feet) from the river's floodplain. As older buildings within the floodplain become unusable, the area they occupy should be converted to riverfront riparian buffer. In essence, buildings and infrastructure should retreat from the river's edge to protect and improve the quality of the water and habitat for all species including human communities.

Invasive species of plants are frequently a problem along many riparian areas and control efforts need to be targeted and continuous. Currently, the most common and aggressive invasive species of plants encountered on the floodplain are Japanese knotweed, purple loosestrife and garden loosestrife. Japanese knotweed in particular poses a direct threat due to its potential to occupy the same habitat as blue false-indigo. Control invasive species of plants by first eliminating new small pioneer populations. Larger well-established populations of invasive species will require a sustained and continual suppression effort to prevent their spread.

Allegheny River Pool #6 BDA

Allegheny River Pool #7 BDA

The Allegheny River is one of the most ecologically significant areas in Armstrong County, including a large diversity of fish and mussel species. The Allegheny River begins in Potter County and flows north into New York. The river then turns south and flows down through Warren, Forest, and Venango Counties. As the Allegheny River enters Armstrong County it is free-flowing until it reaches Lock and Dam #9 north of Cosmus. The Allegheny River combines with the Monongahela River in Allegheny County before it enters the Ohio River. The lock and dam system was created in the 1920's and 1930's for navigation. The dams alter the natural flow of the river and create a different type of habitat than is found in the free-flowing sections.

The health of the Allegheny River has been threatened by pollutants and other disturbances. Abandoned mine drainage has impacted many of the streams in Armstrong County. There are also some other notable point source pollutants to the Allegheny, such as the PPG dump near Ford City that is imputing heavy metals into the river. The Allegheny River, however, seems able to maintain populations of species that are sensitive to changes in water quality.

Sand and gravel dredging is another threat facing aquatic species, especially mussels. The substrate is removed from the river bottom and is often used to build roads. Dredging in Pool #6 has been banned since 1985, protecting the habitat for aquatic species, but dredging is permitted in Pool #7.

Despite the dams along the Allegheny River creating habitat that is deeper and slower moving than most of the free-flowing sections of the river, there are still some areas that have the shallow, quick-moving riffle habitat that supports higher mussel populations. This habitat can especially be found below dams and near sediment deposits that have formed islands in the river.

Freshwater mussels are one group of organisms that require high water quality. While many mussel species historically known from the Allegheny River have been extirpated, certain sections of the river have some of the highest diversity of freshwater mussels in the state.

Allegheny River Pool #6 is located above the village of Kelly Station and continues upstream to Kittanning. Five freshwater mussel species of concern are currently known in the Allegheny River Pool #6- **elktoe** (*Alasmidonta marginata*), **fragile papershell** (*Leptodea fragilis*), **pink heelsplitter** (*Potamilus alatus*), **round pigtoe** (*Pleurobema sintoxia*), and **wabash pigtoe** (*Fusconaia flava*). The Allegheny River is also home to a large number of fish species, including several species of concern. **Longhead darter** (*Percina microcephalus*), **goldeye** (*Hiodon alosoides*) and **river redhorse** (*Moxostoma carinatum*), three fish species of

concern, have all been located along this section of the Allegheny River. Allegheny River Pool #6 also provides habitat for **two other aquatic animal species of concern**.



PNHP

Mussels use specialized lures to attract host fish.

Allegheny River Pool #7 is located in Kittanning and continues upstream near the town of Frenchs Corners. Five freshwater mussel species of concern are currently known in the Allegheny River Pool #7- **elktoe** (*Alasmidonta marginata*), **fragile papershell** (*Leptodea fragilis*), **paper pondshell** (*Utterbackia imbecillis*), **pink heelsplitter** (*Potamilus alatus*), and **wabash pigtoe** (*Fusconaia flava*). The Allegheny River is also home to a large number of fish species, including two species of concern – **river carpsucker** (*Carpionodes carpio*) and **river redhorse** (*Moxostoma carinatum*) Allegheny River Pool #7 also provides habitat for **three other aquatic animal species of concern**.

Threats and Stresses – The habitat of the stream-dependent species can be considerably impacted from nearby land use decisions. Many of the steep hillsides and stream valleys along the Allegheny River are forested, but there are significant agricultural and mining operations on the banks of the river and within the Allegheny River watershed. This section of the Allegheny River flows through the more populated areas of the county, specifically Kittanning and Ford City. Much of the southern half of Kittanning lies within the 100-year FEMA designated floodplain. The northern portion of the city is buffered from flood by the floodwall built in 1940. While most of the area's effluent is treated before release, some industrial, commercial, and residential effluent from the adjacent urban and suburban areas may make its way directly into the waterways during storm events. In addition, the many impervious surfaces of the surrounding urban area, such as roads, parking lots and roof tops channel rain water into the waterways, taking numerous non-point source pollutants with them. Storm water runoff through urban and suburban areas can be a significant source of chemical pollutants for the waterways, which can severely impact water quality and the food chain of the river. The PPG dump below Ford City a notable source of point source pollution that is leaching heavy metals and other point source pollutants directly into the Allegheny River.

River dredging directly removes the substrate that the mussels imbed themselves in for most of their adult life. Fish also use this gravel habitat. Once the substrate has been removed, the flow of the river can be altered, and sediment can fill in the holes left behind. The sediment makes the river bottom uninhabitable for many species.

Invasive plants, such as purple loosestrife (*Lythrum salicaria*) and Japanese knotweed (*Fallopia japonica*), can be quite common on the islands and along the banks of the river. These aggressive invasive plants dominate portions of the floodplain, outcompeting and displacing native vegetation. The zebra mussel (*Dreissena polymorpha*), another invasive species, has been located in several pools of the Allegheny River. This small mussel can grow on top of native mussels, substrate, and infrastructure in the water, altering the natural system and causing damage to pipes and other objects in the water.

Conservation Recommendations – Conservation efforts should focus on protecting and improving the quality of the surface water for both the local human community as well as for the habitat for the sensitive species of concern. Additional steps can be taken to protect and improve the aquatic habitat. Maintain and restore the natural hydrology of the Allegheny River. Restore floodplain habitats along the river's edge to slow and filter runoff before it enters the aquatic system. Improve water quality of the river by providing vegetated buffers along inflows to the creek and along the river shoreline. Stop river dredging to maintain the remaining potential habitat for the aquatic species. Control invasive species of plants by eliminating new small populations. Larger well-established populations of invasive species will require a sustained and continual suppression effort to prevent their spread. Contain zebra mussels to those areas already affected by cleaning boats and other items used in the water to control their spread into new areas.

Gilpin Township & Leechburg Borough

	PNDI Rank ¹		Legal Status ¹	Last Seen	Quality ²
	Global	State	State (Proposed)		

NATURAL HERITAGE AREAS:

Allegheny River Pool #4 BDA	Exceptional Significance				
Mooneye (<i>Hiodon tergisus</i>) – fish	G5	S2S3	PT(PT)	1988	E
River redhorse (<i>Moxostoma carinatum</i>) – fish	G4	S3S4	N(CU)	1997	E
Channel darter (<i>Percina copelandi</i>) – fish	G4	S2	N(PT)	1988	E
Wabash pigtoe (<i>Fusconaia flava</i>) – mussel	G5	S2	N(PE)	2007	B
Long solid (<i>Fusconaia subrotunda</i>) – mussel	G3	S1	N(PE)	2005	D
Fragile papershell (<i>Leptodea fragilis</i>) – mussel	G5	S2	N(CR)	2005	D
Pink heelsplitter (<i>Potamilus alatus</i>) – mussel	G5	S2	N(CR)	2005	CD
Sensitive species of concern ³	-	-	-	1986	E

Allegheny River Pool #5 BDA	Exceptional Significance				
Goldeye (<i>Hiodon alosoides</i>) – fish	G5	S2?	PT(PT)	1986	E
Mooneye (<i>Hiodon tergisus</i>) – fish	G5	S2S3	PT(PT)	1988	E
River redhorse (<i>Moxostoma carinatum</i>) – fish	G4	S3S4	N(CU)	1997	E
Channel darter (<i>Percina copelandi</i>) – fish	G4	S2	N(PT)	1988	E
Longhead darter (<i>Percina macrocephala</i>) – fish	G3	S2S3	N(PT)	1986	E
Wabash pigtoe (<i>Fusconaia flava</i>) – mussel	G5	S2	N(PE)	2007	B
Long solid (<i>Fusconaia subrotunda</i>) – mussel	G3	S1	N(PE)	2005	D
Pocketbook (<i>Lampsilis ovata</i>) – mussel	G5	S3S4	N(N)	1985	E
Fragile papershell (<i>Leptodea fragilis</i>) – mussel	G5	S2	N(CR)	2005	D
Round pigtoe (<i>Pleurobema sintoxia</i>) – mussel	G4G5	S2	N(PE)	2007	E
Pink heelsplitter (<i>Potamilus alatus</i>) – mussel	G5	S2	N(CR)	2005	CD
Mapleleaf (<i>Quadrula quadrula</i>) – mussel	G5	S1S2	N(PT)	2002	E
Paper pondshell (<i>Utterbackia imbecillis</i>) – mussel	G5	S3S4	N(CU)	2002	E
Sensitive species of concern ³	-	-	-	2007	E
Sensitive species of concern ³	-	-	-	1986	E

Allegheny River Slope at Godfrey BDA	High Significance				
Sensitive species of concern ³	-	-	-	2008	AB

LANDSCAPE CONSERVATION AREAS:

Allegheny River LCA

PUBLICLY MANAGED LAND:

None

1 = Please refer to Appendix I for an explanation of PNHP ranks and legal status

2 = Please refer to Appendix II for an explanation of quality ranks

3 = This species is not named by request of the jurisdictional agency

Armstrong County Natural Heritage Inventory Gilpin Township

Biological Diversity Areas

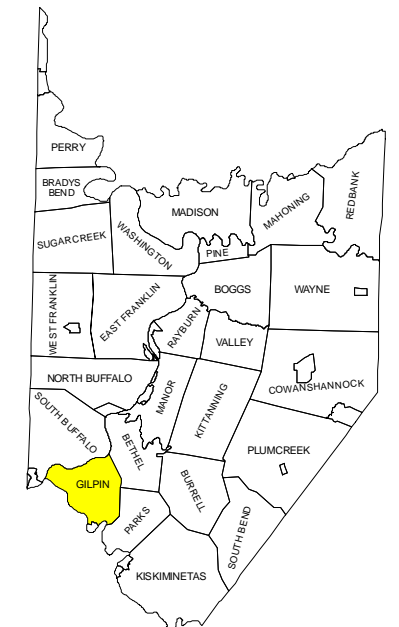
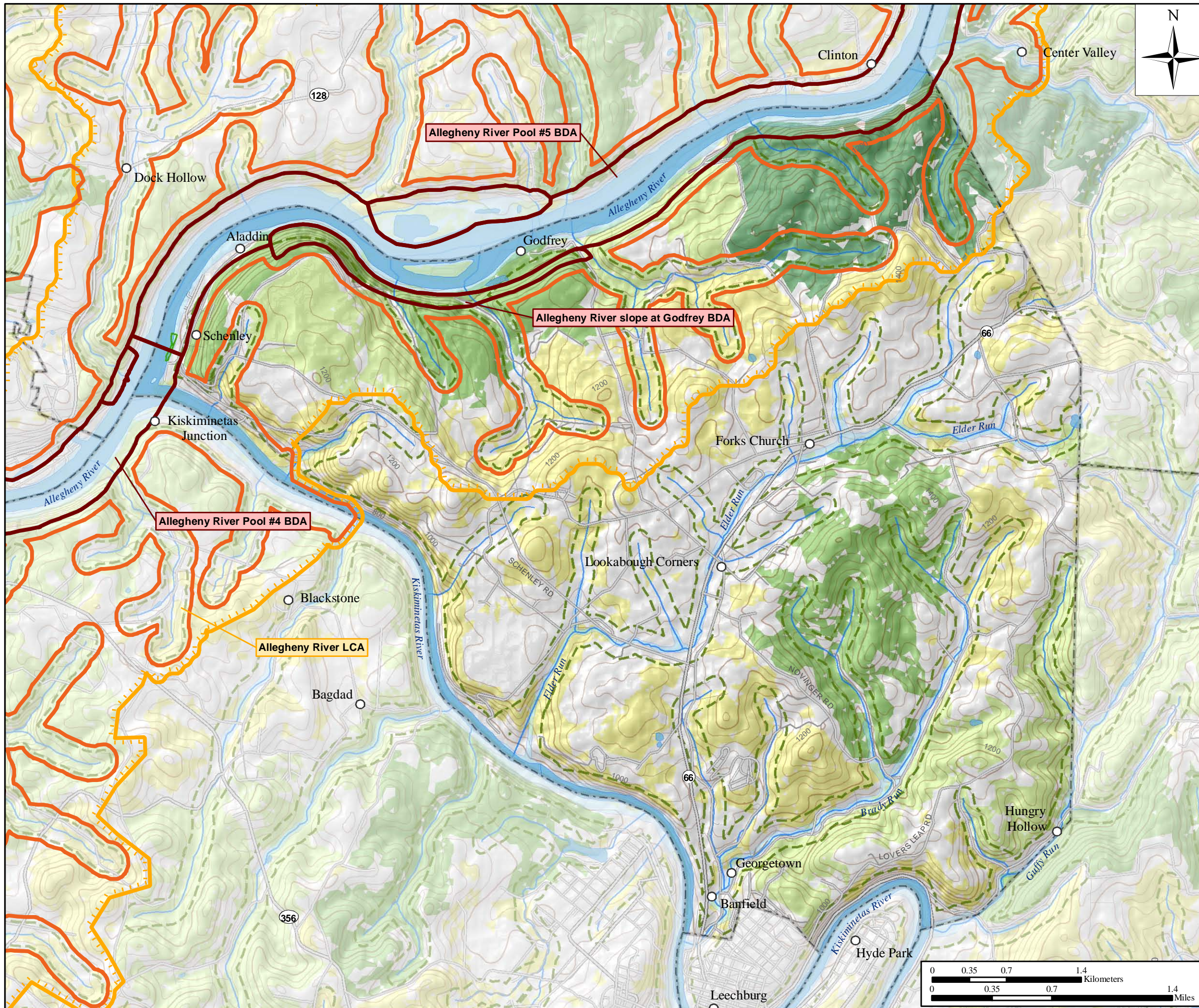
- Allegheny River Pool #4 BDA
- Allegheny River Pool #5 BDA
- Allegheny River slope at Godfrey BDA

Landscape Conservation Areas

- Allegheny River LCA

Public Land

None



Legend

Landscape Conservation Area (LCA)

Biological Diversity Area (BDA)

- Core
- Supporting Landscape

Streams

National Wetland Inventory

100-year Floodplain

Recommended Riparian Buffer

Forest Blocks by Acre

- < 250
- 251 - 500
- 501 - 1000
- > 1000

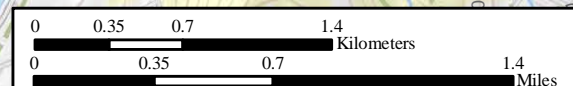
Municipal Boundary

US Army Corps of Engineers

PA Game Commission

40 Ft. Contour Line

PNHP
Pennsylvania Natural Heritage Program



Gilpin Township & Leechburg Borough

Gilpin is located in southern Armstrong County and covers 17.1 square miles. The Kiskiminetas River separates Gilpin Township from Westmoreland County. The Borough of Leechburg sits along this boundary with the river. The Allegheny River forms the northwest border with South Buffalo Township.

Streams in the southern two-thirds of the township drain into the Kiskiminetas River. Nutrients from residential runoff impair aquatic life in Brady Run and two of its tributaries. Siltation also impairs another tributary to the Kiskiminetas near the confluence with the Allegheny. Erosion and siltation affect three other unnamed tributaries to the Allegheny. Abandoned mine drainage degrades the Kiskiminetas before it reaches Gilpin Township (Department Environmental Protection (DEP) 2009). Abandoned mine drainage should be addressed where it occurs. Native trees and shrubs should be planted to create riparian buffers that will help filter surface water runoff and prevent many non-point sources of pollution from entering the waterways of the township.

Elder Run flows across the center of the township before entering the Kiskiminetas River. While this stream is listed as supporting aquatic life (DEP 2009), water quality would be enhanced with forested streamside buffers throughout the agricultural areas. Agriculture covers 34% of the township.

Forest makes up 52% of the land use in the township. A forest block of over 1400 acres extends from the northeast part of the township across the township line into Bethel Township. A few other forest blocks of 300 – 700 acres occur, but within the central region of the township, the forest blocks are small and highly fragmented. The restoration of streamside buffers can link isolated forest blocks and serve as natural wildlife corridors.

Leechburg Borough

Leechburg Borough is located along the north bank of Kiskiminetas River across the river from Westmoreland County. It is 0.45 square miles in size. At the time of the 2000 U.S. Census, 2,386 people lived in Leechburg. Eighty-six percent of the borough is developed.

Allegheny River Pool #4 BDA Allegheny River Pool #5 BDA

The Allegheny River is one of the most ecologically significant areas in Armstrong County, including a large diversity of fish and mussel species. The Allegheny River begins in Potter County and flows north into New York. The river then turns south and flows down through Warren, Forest, and Venango Counties. As the Allegheny River enters Armstrong County it is free-flowing until it reaches Lock and Dam #9 north of Cosmus. The Allegheny River combines with the Monongahela River in Allegheny County before it enters the Ohio River. The lock and dam system was created in the 1920's and 1930's for navigation. The dams alter the natural flow of the river and create a different type of habitat than is found in the free-flowing sections.

The health of the Allegheny River has been threatened by pollutants and other disturbances. Abandoned mine drainage has impacted many of the streams in Armstrong County. Few mussels were found in other waterways, due to lowered pH and diminished water quality. There are also some other notable point source pollutants to the Allegheny, such as the PPG dump near Ford City that is imputing heavy metals into the river. The Allegheny River, however, seems able to maintain populations of species that cannot tolerate low water quality.

Sand and gravel dredging is another threat facing aquatic species, especially mussels. The substrate is removed from the river bottom and is often used to build roads. This impacts the mussel habitat in areas that allow dredging, including Pools #4 and 5.

Despite the dams along the Allegheny River creating habitat that is deeper and slower moving than most of the free-flowing sections of the river, there are still some areas that have the shallow, quick-moving riffle habitat that supports higher mussel populations. This habitat can especially be found below dams and near sediment deposits that have formed islands in the river.

Freshwater mussels are one group of organisms that require high water quality. While many mussel species historically known from the Allegheny River have been extirpated, certain sections of the river have some of the highest diversity of freshwater mussels in the state.

Allegheny River Pool #4 is located below Jacks Island in Allegheny County and continues upstream north of Freeport. Four freshwater mussel species of concern are currently known in the Allegheny River Pool #4- **fragile papershell** (*Leptodea fragilis*), **long solid** (*Fusconaia subrotunda*), **pink heelsplitter** (*Potamilus alatus*), and **wabash pigtoe** (*Fusconaia flava*). The Allegheny River is also home to a large diversity of fish species, including several species of concern. **Channel darter** (*Percina copelandi*), **mooneye** (*Hiodon tergisus*), and **river redhorse** (*Moxostoma carinatum*), three fish species of concern, have all been located along this section of the Allegheny River. Allegheny River Pool #4 also provides habitat for **one other aquatic species of concern**.

Allegheny River Pool #5 is located just above the Kiskiminetas River and continues upstream near the village of Kelly Station. Eight freshwater mussel species of concern are currently known in the Allegheny River Pool #5- **fragile papershell** (*Leptodea fragilis*), **long solid** (*Fusconaia subrotunda*), **mapleleaf** (*Quadrula quadrula*), **paper pondshell** (*Utterbackia imbecillis*), **pink heelsplitter** (*Potamilus alatus*), **pocketbook** (*Lampsilis ovata*), **round pigtoe** (*Pleurobema sintoxia*), and **wabash pigtoe** (*Fusconaia flava*). The Allegheny River is also home to a large number of fish species, including several species of concern. **Channel darter** (*Percina copelandi*), **goldeye** (*Hiodon alosoides*), **longhead darter** (*Percina macrocephala*), **mooneye** (*Hiodon tergisus*), and **river redhorse** (*Moxostoma carinatum*), five fish species of concern, have all been located along this section of the Allegheny River. Allegheny River Pool #5 also provides habitat for **one other aquatic animal species of concern**.

Threats and Stresses – The habitat of the stream-dependent species can be considerably impacted from nearby land use decisions. Many of the steep hillsides and stream valleys along the Allegheny River are forested, but there are significant agricultural and mining operations on the banks of the river and within the Allegheny River watershed. In addition, the many impervious surfaces of the surrounding urban area, such as roads, parking lots and roof tops channel rain water directly into the waterways, taking numerous non-point source pollutants with them. Storm water runoff through urban and suburban areas can be a significant source of chemical pollutants for the waterways, which can severely impact water quality and the food chain of the river.

River dredging directly removes the substrate that the mussels imbed themselves in for most of their adult life. Fish also use this gravel habitat. Once the substrate has been removed, the flow of the river can be altered, and sediment can fill in the holes left behind. The sediment makes the river bottom uninhabitable for many species.

Invasive plants, such as purple loosestrife (*Lythrum salicaria*) and Japanese knotweed (*Polygonum cuspidatum*), can be quite common on the islands and along the banks of the river. These aggressive invasive plants dominate portions of the floodplain, outcompeting and displacing native vegetation. The zebra mussel (*Dreissena polymorpha*), another invasive species, has been located in several pools of the

Allegheny River. This small mussel can grow on top of native mussels, substrate, and infrastructure in the water, altering the natural system and causing damage to pipes and other objects in the water.

Conservation Recommendations – Conservation efforts should focus on protecting and improving the quality of the surface water for both the local human community as well as for the habitat for the sensitive species of concern. Additional steps can be taken to protect and improve the aquatic habitat. Maintain and restore the natural hydrology of the Allegheny River. Restore floodplain habitats along the river’s edge to slow and filter runoff before it enters the aquatic system. Improve water quality of the river by providing vegetated buffers along inflows to the creek and along the river shoreline. Stop river dredging to maintain the remaining potential habitat for the aquatic species. Control invasive species of plants by eliminating new small populations. Larger well-established populations of invasive species will require a sustained and continual suppression effort to prevent their spread. Contain zebra mussels to those areas already affected by cleaning boats and other items used in the water to control their spread into new areas.



Rocky Gleason, PNHP

The common white trillium (*Trillium grandiflorum*) is a typical spring wildflower of wooded hillsides in Armstrong County.

Allegheny River Hillside at

Godfrey BDA – A healthy population of a **species of concern** is located along the steep hillside of the Allegheny River at this location. The steep forested slopes along the river have remained relatively intact compared to forests in the rest of the county due to the difficulty of logging. This has created a refuge for species that prefer mature forests and little disturbance.

Threats and Stresses – Logging and other large disturbances along the rail line that runs near this site may destroy habitat for the species of concern. This species may also hybridize with other related species,

threatening the integrity of the population. The rail line that runs below the slope may provide an access point for invasive species that could potentially alter the species composition. Overbrowsing by deer could also reduce or eliminate the population of the species of concern.

Recommendations – This site would best be managed by not altering it from its current state. Monitor the area for invasive species, and begin removal of new populations as they occur. More aggressive treatment will be needed for established populations of non-native species. Regulate the deer herd in this area to keep it at a size that is in balance with the other species at this site.

Hovey Township

	PNDI Rank		Legal Status	Last Seen	Quality
	Global	State	State (Proposed)		

NATURAL HERITAGE AREAS:

Allegheny River shoreline at Parker BDA	Notable Significance				
Blue false-indigo (<i>Baptisia australis</i>) – plant	G5	S2	N(PT)	2008	A

Allegheny River stretch through Emlenton and Foxburg BDA	Exceptional Significance				
Elktoe (<i>Alasmidonta marginata</i>) – mussel	G5	S3	N(N)	2007	E
Wavy-rayed lampmussel (<i>Lampsilis fasciola</i>) – mussel	G5	S4	N(N)	2007	E
Round pigtoe (<i>Pleurobema sintoxia</i>) – mussel	G4G5	S2	N(PE)	1998	E
Sensitive species of concern ³	-	-	-	1998	E
Sensitive species of concern ³	-	-	-	2007	D
Sensitive species of concern ³	-	-	-	1991	E
Sensitive species of concern ³	-	-	-	2000	E

Allegheny River stretch through Parker and Hillville BDA	Exceptional Significance				
Streamline chub (<i>Erimystax dissimilis</i>) – fish	G4	S3	N(N)	1999	E
Longhead darter (<i>Percina macrocephala</i>) – fish	G3	S2S3	N(PT)	1986	E
Elktoe (<i>Alasmidonta marginata</i>) – mussel	G5	S3	N(N)	2007	E
Wabash pigtoe (<i>Fusconaia flava</i>) – mussel	G5	S2	N(PE)	1987	E
Wavy-rayed lampmussel (<i>Lampsilis fasciola</i>) – mussel	G5	S4	N(N)	2007	E
Pocketbook (<i>Lampsilis ovata</i>) – mussel	G5	S3S4	N(N)	1997	E
Paper pondshell (<i>Utterbackia imbecillis</i>) – mussel	G5	S3S4	N(CU)	1991	E
Red-head pondweed (<i>Potamogeton richardsonii</i>) – plant	G5	S3	PT(PR)	2001	E
Sensitive species of concern ³	-	-	-	1998	E
Sensitive species of concern ³	-	-	-	2007	D
Sensitive species of concern ³	-	-	-	1991	E
Sensitive species of concern ³	-	-	-	2000	E

County Line Ravine BDA	Local Significance				
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LANDSCAPE CONSERVATION AREAS:

Allegheny River LCA

PUBLICLY MANAGED LAND:

None

- 1 = Please refer to Appendix I for an explanation of PNHP ranks and legal status
 2 = Please refer to Appendix II for an explanation of quality ranks
 3 = This species is not named by request of the jurisdictional agency

Armstrong County Natural Heritage Inventory Hovey Township

Biological Diversity Areas

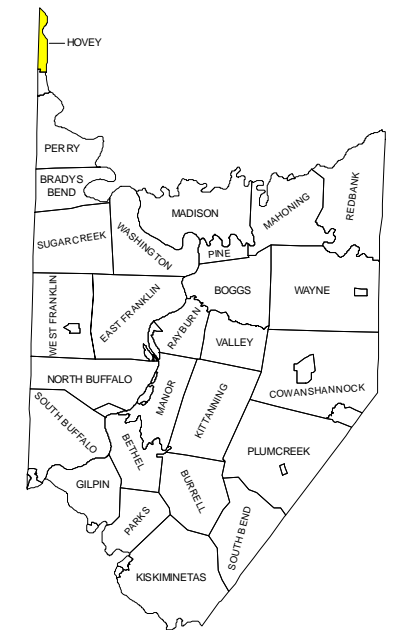
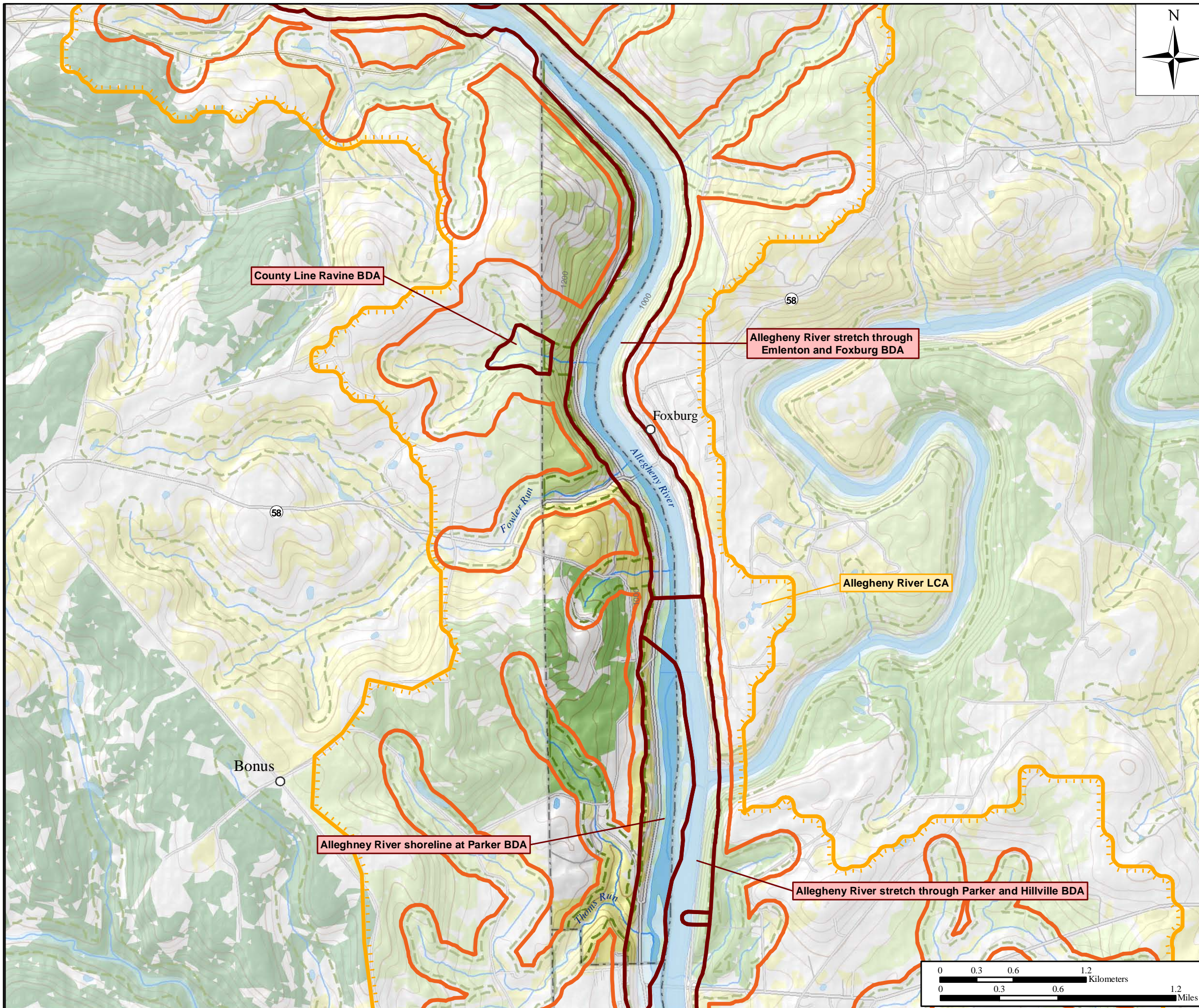
- Allegheny River shoreline at Parker BDA
- Allegheny River stretch through Emlenton and Foxburg BDA
- Allegheny River stretch through Parker and Hillville BDA
- County Line Ravine BDA

Landscape Conservation Areas

- Allegheny River LCA

Public Land

None



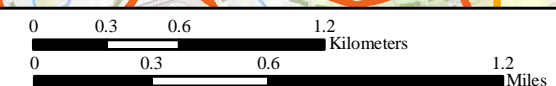
Legend

- Landscape Conservation Area (LCA)
- Biological Diversity Area (BDA)**
- Core
- Supporting Landscape
- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Pennsylvania Natural Heritage Program

Forest Blocks by Acre

< 250	Municipal Boundary
251 - 500	US Army Corps of Engineers
501 - 1000	PA Game Commission
> 1000	40 Ft. Contour Line



Hovey Township

Hovey Township occupies the northwest tip of Armstrong County and is the second smallest township (2.0 square miles). It is situated between Butler County and Clarion Counties. The Allegheny River forms the eastern border with Clarion County. Fowler Run and several other small streams flow eastward across the township into the Allegheny River. Abandoned mine drainage impairs these streams. Efforts to restore these streams must take place at the source of contamination which may be outside of the municipal boundaries. Forested areas comprise 63 % of the township and agriculture 16%. The U.S. Census in 2000 recorded a population of 93 persons in Hovey Township.



Denise Watts, PNHP

Blue false indigo (*Baptisia australis*) grows along the scoured shorelines of the Allegheny River.

Allegheny River shoreline at Parker BDA – Fluctuations in the water level of the Allegheny River create cobbly scoured areas along the shoreline. This continual disturbance creates habitat that is primarily suitable for herbaceous plant species. A species of concern at this site, **blue false-indigo (*Baptisia australis*)**, is adapted to these conditions and cannot compete once woody species colonize an area. Suitable habitat for this species is located along the scoured shoreline of the river and on islands beginning at Parker and continuing several miles upstream.

Threats and Stresses – Modification of the natural flow of the river can alter the disturbance regime that is necessary to maintain this habitat. Invasive species, such as reed canary grass and Japanese knotweed pose a threat to this species by choking out the blue false-indigo.

Conservation Recommendations – Alterations to the flow of the Allegheny River should be avoided in order to keep the habitat intact. Monitor known populations for invasive species and remove existing invasive species as soon as they are discovered, to prevent successful colonization.

Allegheny River stretch through Emlenton and Foxburg BDA – This stretch of the river is one of the last stretches of the Allegheny River that is relatively uninhibited by the downstream dams. Thus, the water level fluctuates dramatically with the spring rains, scouring some cobbly shoals along the river side, creating some interesting riparian habitat. Likewise, the river through this stretch has some great aquatic habitats, and houses a number of species of concern, including the **Elktoe (*Alasmidonta marginata*)**, **wavy-rayed lampmussel (*Lampsilis fasciola*)**, **round pigtoe (*Pleurobema sintoxia*)**, and **four other species of concern**.

Threats and Disturbances – Though the water quality is suitable for a number of species of concern, many of the tributaries that flow into this section of the river are classified by DEP as “impaired”, primarily from abandoned mine drainage pollution.

Conservation Recommendations – Improvement of the water quality of those tributaries flowing into this portion of the river will increase the ecological integrity of the river, and allow the species living in this

stretch, both common and rare, to flourish. Abandoned oil and gas wells leaking acidic waters into these tributaries should be treated appropriately.

Allegheny River stretch through Parker and Hillville BDA – This stretch of the Allegheny River is the last free flowing section before entering the dammed portion that flows through the rest of Armstrong County. Water levels in this stretch have greater fluctuations that help to maintain the scoured cobbly shorelines more typical of the natural habitat. Freshwater mussels thrive in the natural cobbly riffles of the free flowing sections of the Allegheny River. Five mussel species of concern, **elktoe** (*Alasmidonta marginata*), **paper pondshell** (*Utterbackia imbecillis*), **pocketbook** (*Lampsilis ovata*), **wabash pigtoe** (*Fusconaia flava*), and **wavy-rayed lampmussel** (*Lampsilis fasciola*) were found in this stretch of the river. Two fish species of concern, **longhead darter** (*Percina macrocephala*) and **streamline chub** (*Erimystax dissimilis*) were identified in this area, and a plant species of concern, **red-head pondweed** (*Potamogeton richardsonii*), was found growing attached to the cobbly bottom of the river. **Four other species of concern** were also found in this stretch of the Allegheny River.



The floating aquatic plant, red-head pondweed (*Potamogeton richardsonii*), was found in several areas along the Allegheny River.

Rocky Gleason, PNHP

Threats and Stresses

Though the water quality is suitable for a number of species of concern, many of the tributaries that flow into this section of the river have been impaired from abandoned mine drainage pollution and other runoff.

Invasive species, such as Japanese knotweed (*Fallopia japonica*) and purple loosestrife (*Lythrum salicaria*) are common along some sections of the shoreline and can displace native vegetation

Conservation Recommendations

Planting native vegetation along the Allegheny River and its tributaries will improve the water quality and allow the species living in this stretch, both common and rare, to flourish.

Abandoned oil and gas wells leaking acidic waters into these tributaries should be treated appropriately. Monitor and treat invasive species to control their spread and lessen their impact. Maintain the natural flow in this stretch of the river.

County Line Ravine BDA

This site is a deep ravine above the Allegheny River on the Butler-Armstrong county line. Although no species of concern are currently known from this site, the steep walls of the ravine support a very old stand of eastern hemlock (*Tsuga canadensis*), and the upper slopes support mature oaks (*Quercus* spp.). Unfragmented habitat is important for a variety of rare and common species.

Threats and Stresses – Abandoned mine drainage from the old strip mines that surround the ravine have damaged the water quality of the stream. All of the streams within the ravine are considered impaired by the DEP.

Hemlock wooly adelgids are expected to reach this area in coming years, with devastating effects on hemlock populations. Because hemlock is one of the dominant canopy trees at site, especially along the stream, the loss of the deep shade provided by hemlocks here may lead to an increase in stream temperature. This would reduce habitat quality for the northern pygmy clubtail, which needs cool water.

Excessive logging in the ravine would destroy the qualities of the natural communities that exist here.

At the time this site was surveyed, erosion on heavily used ATV trails was noted at the head of the valley. It is not known whether erosion is still a problem at this site.

Conservation Recommendations – Any logging operations here should be carefully evaluated for their effect of the forest community. Fragmentation of the habitat should be avoided. Treatment options for the abandoned mine drainage should be considered.

Kiskiminetas Township, Apollo & North Apollo Boroughs

	PNDI Rank ¹		Legal Status ¹	Last Seen	Quality ²
	Global	State	State (Proposed)		

NATURAL HERITAGE AREAS:

Roaring Run BDA	<i>Notable Significance</i>				
West Virginia white (<i>Pieris virginiensis</i>) – butterfly	G3G4	S2S3	N(N)	2008	E

LANDSCAPE CONSERVATION AREAS: None currently identified

PUBLICLY MANAGED LAND: None

1 = Please refer to Appendix I for an explanation of PNHP ranks and legal status

2 = Please refer to Appendix II for an explanation of quality ranks

Armstrong County Natural Heritage Inventory

Kiskiminetas Township & Apollo Borough & North Apollo Borough

Biological Diversity Areas

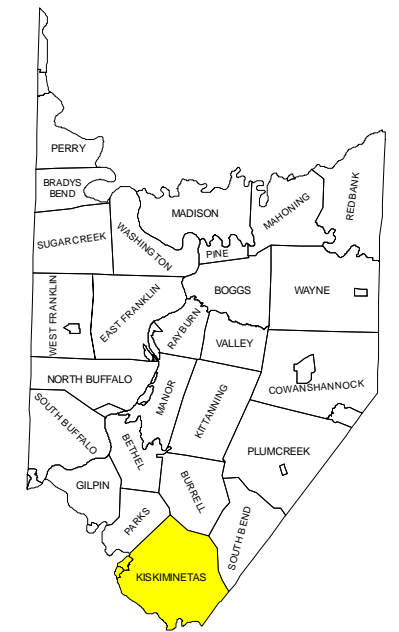
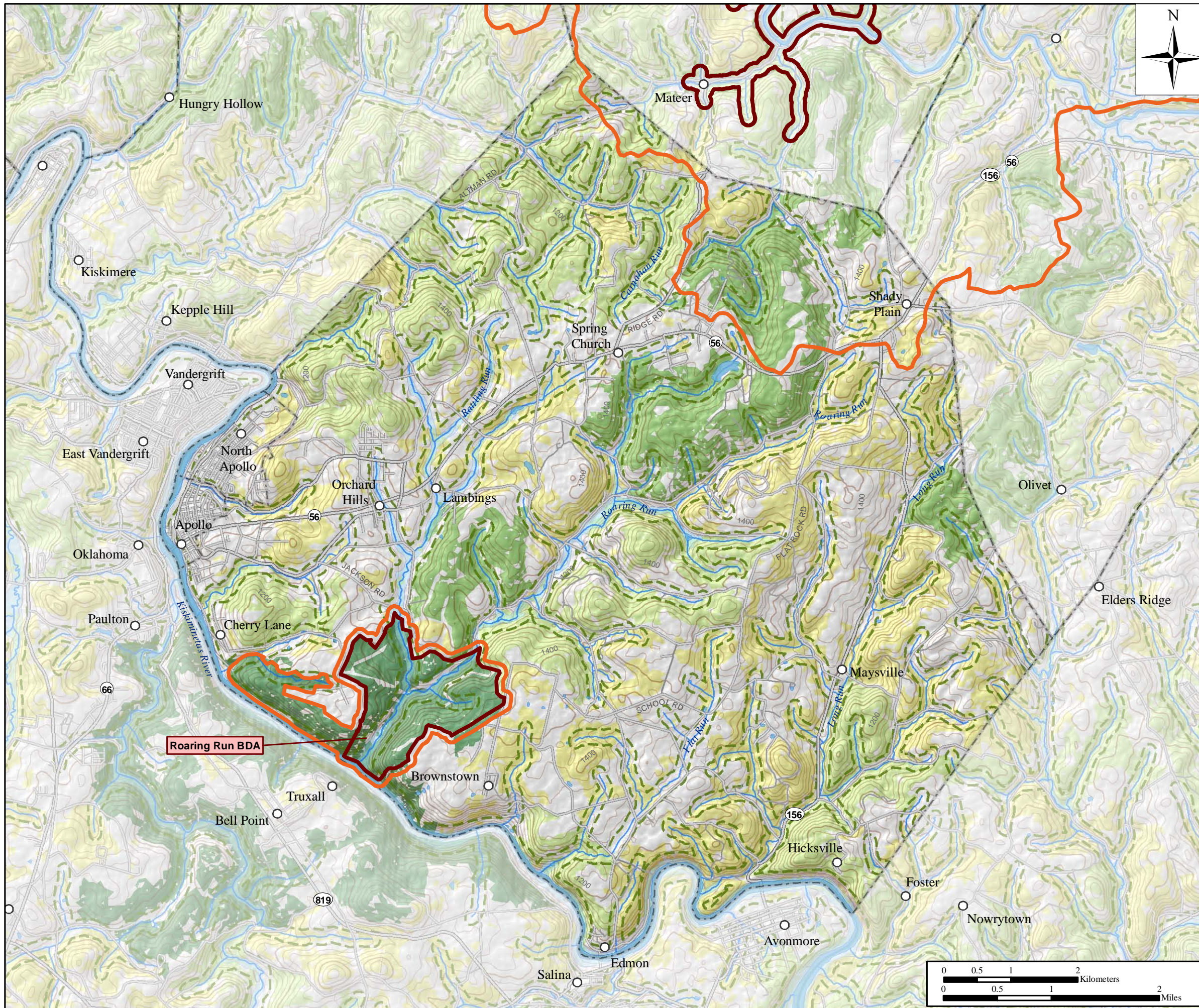
Roaring Run BDA

Landscape Conservation Areas

None Currently Identified

Public Land

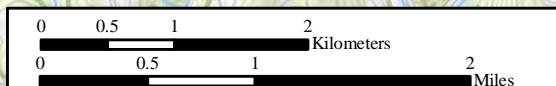
None



Legend

- Landscape Conservation Area (LCA)
- Biological Diversity Area (BDA)**
 - Core
 - Supporting Landscape
- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer
- Forest Blocks by Acre**
 - < 250
 - 251 - 500
 - 501 - 1000
 - > 1000
- Municipal Boundary
- PA Game Commission
- 40 Ft. Contour Line

Pennsylvania Natural Heritage Program



Kiskiminetas Township, Apollo & North Apollo Boroughs

Kiskiminetas Township was one of the original six townships in Armstrong County, and today it covers 41 square miles. Kiskiminetas is the southernmost township in the county. Forest makes up 56% of the land cover and agriculture comprises 33%. Streams flowing through agricultural areas should be restored by planting native trees and shrubs along the banks to protect habitat and improve water quality.

Long Run and Roaring Run are the major waterways within Kiskiminetas Township. Both streams flow south into the Kiskiminetas River that serves as the boundary between Kiskiminetas Township and Westmoreland County. Long Run and the lower reaches of Roaring Run are impacted by abandoned mine drainage as well as the Kiskiminetas River. The upper reaches of Roaring Run and Rattling Run, a tributary to Roaring Run are not impacted. Efforts should be made to restore the affected reaches of Roaring Run and Long Run. This would be a step towards improving the health of the Kiskiminetas River (Department Environmental Protection 2009).



Denise Watts, PNHP

Forests along Roaring Run support a population of West Virginia whites (*Pieris virginiensis*)

hills that provide a buffer to filter sediment and other pollutants. The limestone in this area creates soils that support a variety of spring wildflowers. **West Virginia white (*Pieris virginiensis*)**, a globally vulnerable and state imperiled butterfly species of concern, was located at this site. This small, white butterfly requires large patches of forest and will not regularly cross roads and other breaks in the forest canopy. The larval host plant of the West Virginia white is two-leaved toothwort (*Cardamine diphylla*), while adults nectar on toothworts and other spring flowering plants. The limestone in this area creates calcium rich soils that support a large diversity of spring wildflowers. Adults are typically seen flying in April and May.

Threats and Stresses – West Virginia whites are often localized in high quality forests and are sensitive to disturbances in the forest. Overbrowsing of larval host plants and nectar plants, as well as fragmentation of the forested areas surrounding Roaring Run is detrimental to the West Virginia white population at this site. Recolonization is difficult once the population is gone, since they do not readily cross non-forested areas. Invasion by garlic mustard threatens the survival of the caterpillars and the persistence of West Virginia whites at this site. Other invasive species, such as Japanese knotweed, have become established along Roaring Run. Spraying of Bt for gypsy moth control is also a threat to West Virginia white populations. Water quality issues due to abandoned mine drainage and other sources threaten the quality of this site.

Conservation Recommendations – Unfragmented forests should be kept intact to maintain habitat for the West Virginia whites. Even relatively small breaks in the forest canopy can create a barrier to movement by the adults. Disturbance also creates openings for invasive species, such as garlic mustard, a culprit in the decline of West Virginia whites. Efforts to control Japanese knotweed are already being done by the Roaring Run Watershed Association and should continue, as well as efforts to remove garlic mustard and other invasive plants. Deer populations should be managed to stay in balance with the ecosystem as a whole to prevent overbrowsing of host and nectar plants. Areas with known West Virginia white populations should not be sprayed with Bt or any other insecticide.

Kittanning Township

	<u>PNDI Rank</u> ¹		<u>Legal Status</u> ¹	Last Seen	Quality ²
	Global	State	State (Proposed)		

NATURAL HERITAGE AREAS:

Cowanshannock Creek at Stone House BDA	<i>Notable Significance</i>				
West Virginia white (<i>Pieris virginiensis</i>) – butterfly	G3G4	S2S3	N(N)	2008	E

Crooked Creek Reservoir BDA	<i>Notable Significance</i>				
Cattail sedge (<i>Carex typhina</i>) – plant	G5	S2	PE(PT)	2008	BC
Stalked bulrush (<i>Scirpus pedicellatus</i>) – plant	G4	S1	PT(PT)	2007	E
Sensitive species of concern ³	-	-	-	2008	E

LANDSCAPE CONSERVATION AREAS: None currently identified

PUBLICLY MANAGED LAND: None

1 = Please refer to Appendix I for an explanation of PNHP ranks and legal status
 2 = Please refer to Appendix II for an explanation of quality ranks
 3 = This species is not named by request of the jurisdictional agency

Armstrong County Natural Heritage Inventory Kittanning Township

Biological Diversity Areas

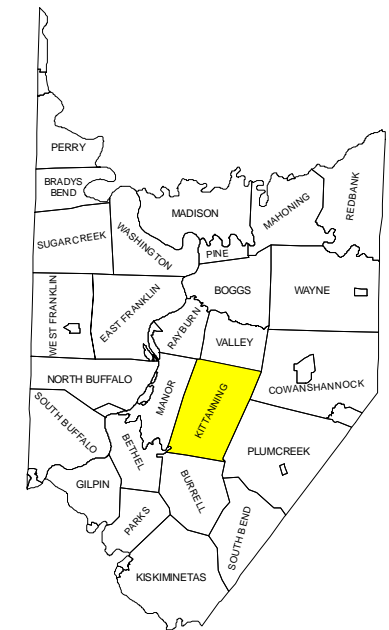
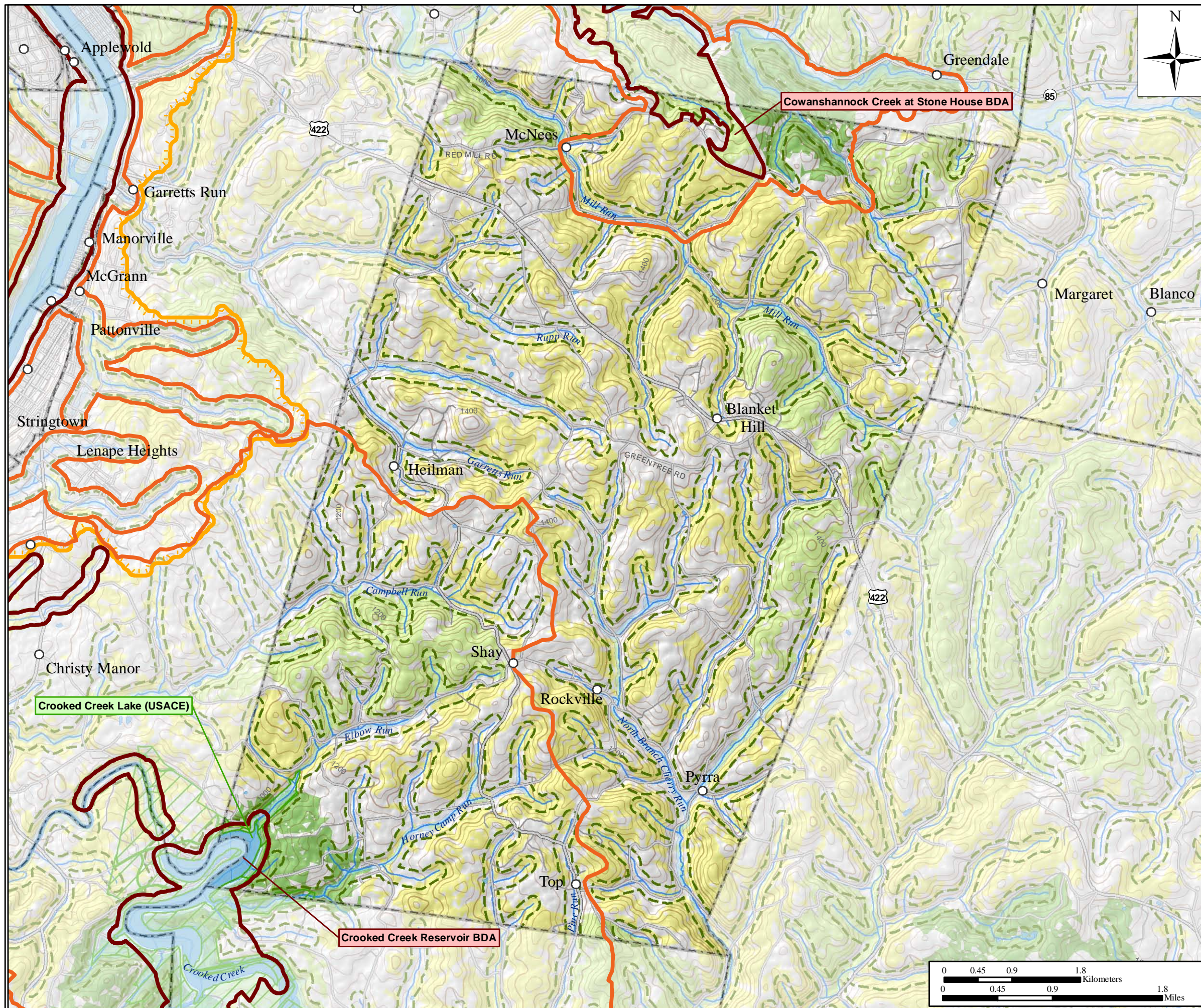
- Cowanshannock Creek at Stone House BDA
- Crooked Creek Reservoir BDA

Landscape Conservation Areas

None Currently Identified

Public Land

- Crooked Creek Lake (USACE)



Legend

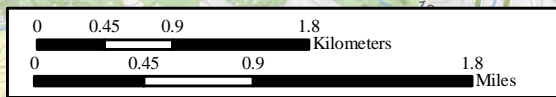
- Landscape Conservation Area (LCA)
- Biological Diversity Area (BDA)**
 - Core
 - Supporting Landscape
- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre

- < 250
- 251 - 500
- 501 - 1000
- > 1000

- Municipal Boundary
- US Army Corps of Engineers
- PA Game Commission
- 40 Ft. Contour Line

Pennsylvania Natural Heritage Program



Kittanning Township

Kittanning Township is located in central Armstrong County. It was incorporated in 1807 and was one of the six original townships formed in the county. Today it covers 30.8 square miles.

Mill Run, Garretts Run, Campbell Run, Elbow Run, and Horney Camp Run flow through the township and are part of the Allegheny River drainage basin. These streams are all listed as attaining by the Department of Environmental Resources (2009), indicating that they support aquatic life.

Forest covers 48% of the township and agriculture 43%. The largest forest blocks are all less than 500 acres. Much of the forest within Kittanning Township is highly fragmented. Reforestation of stream banks can help link smaller forest blocks together and create wildlife corridors. Planting native trees and shrubs alongside streams would also enhance water quality by preventing many non-point sources of pollution from entering the waterways.

Cowanshannock Creek at Stone House BDA – Although much of the forest in this part of the county has been fragmented, the large patches of forest along Cowanshannock Creek provide habitat for the **West Virginia white** (*Pieris virginiensis*), a globally vulnerable and state imperiled butterfly species of concern. This small, white butterfly requires large patches of forest and will not regularly cross roads and other breaks in the forest canopy. The larval host plant of the West Virginia white is toothwort (*Cardamine diphylla*), while adults nectar on toothworts and other spring flowering plants. Adults are typically seen flying in April and May.

Threats and Stresses – West Virginia whites are often localized in high quality forests and are sensitive to disturbances in the forest. Recolonization is difficult once the population is gone, since they do not readily cross non-forested areas. Forest fragmentation, overbrowsing of larval host plants and nectar plants by deer, and invasion by garlic mustard are major threats to West Virginia white populations. Garlic mustard is a common invasive species in Pennsylvania. Garlic mustard is related to the larval host plant, and adults may lay their eggs on this plant, but this species is toxic to the caterpillars if eaten. Spraying of Bt for gypsy moth control is also a threat to West Virginia white populations.

Conservation Recommendations – Unfragmented forests should be kept intact to maintain habitat for the West Virginia whites. Even relatively small breaks in the forest canopy can create a barrier to movement by the adults. Disturbance also creates openings for invasive species, such as garlic mustard. Deer populations should be managed to stay in balance with the ecosystem as a whole. Areas with known West Virginia white populations should not be sprayed with Bt or any other insecticide.

Crooked Creek Reservoir BDA – Crooked Creek Reservoir was created by the damming of Crooked Creek in 1940 as a means of controlling floodwaters in the lower Allegheny and Ohio Rivers. The water level in the reservoir fluctuates widely as floodwaters alternately flood and dry the shoreline, establishing an ebb and flow, like an irregular tide. The difference between average summer water level height and full capacity at the dam breast is roughly 65 feet. Debris from past flood events, such as tree parts and assorted trash, litters the shoreline of the reservoir in a wide band extending up the slope of the shoreline. The fluctuating water level along the shoreline helps to foster habitat conditions favorable for a population of the PA-endangered plant species of concern, **cattail sedge** (*Carex typhina*). The species typically grows in wet woods and bottomlands, particularly around the edges of low spots that intermittently have standing water.

An additional plant species of concern, the PA-threatened, **stalked bulrush** (*Scirpus pedicellatus*) occurs within a wide, marshy portion of the Crooked Creek floodplain. The stalked bulrush is near the southern limit of its known range in Pennsylvania. This species may hybridize with the more common wool grass (*Scirpus*

cyperinus) where the two co-occur, making determination difficult. Conservation of the naturally vegetated floodplain / shoreline habitat will help maintain viable populations of this species. Another **species of concern** is also known to be breeding at this site.



Stalked bulrush (*Scirpus pedicellatus*)

Rocky Gleason, PNHP

Threats and Stresses – There are no evident threats to these species at this location and management does not seem to be necessary. The artificially induced shoreline fluctuations actually help maintain favorable habitat conditions for the cattail sedge. The cattail sedge is not currently known to be as widely dispersed along the shoreline of this reservoir as at the Mahoning Creek Reservoir, and recreational activities could more easily disturb the habitat for this population. Poorly sited infrastructure improvements such as access roads and parking lots could eliminate portions of the habitat for this species. Human disturbance in this area may also affect nesting success of the species of concern.

Conservation Recommendations – The extremely dynamic nature of the floodplain of this reservoir will likely force any future infrastructure improvements to remain a respectful distance from the active floodplain. Disturbance in this area should be limited from January to June to prevent nest abandonment of the species of concern.



Pete Woods, PNHP

The West Virginia white (*Pieris virginiensis*) is a globally vulnerable butterfly species found in several locations in Armstrong County.

Madison Township

	PNDI Rank ¹		Legal Status ¹		Last Seen	Quality ²
	Global	State	State (Proposed)			

NATURAL HERITAGE AREAS:

Allegheny River Pool #8 BDA		<i>Exceptional Significance</i>				
River carpsucker (<i>Carpododes carpio</i>) – fish	G5	S1	N(CU)	2000	E	
River redhorse (<i>Moxostoma carinatum</i>) – fish	G4	S3S4	N(CU)	1997	E	
Longhead darter (<i>Percina macrocephala</i>) – fish	G3	S2S3	N(PT)	2000	E	
Elktoe (<i>Alasmidonta marginata</i>) – mussel	G4	S4	N(N)	2007	E	
Wabash pigtoe (<i>Fusconaia flava</i>) – mussel	G5	S2	N(PE)	2007	B	
Wavy-rayed lampmussel (<i>Lampsilis fasciola</i>) – mussel	G5	S4	N(N)	2007	E	
Fragile papershell (<i>Leptodea fragilis</i>) – mussel	G5	S2	N(CR)	2005	D	
Round pigtoe (<i>Pleurobema sintoxia</i>) – mussel	G4G5	S2	N(PE)	2004	E	
Pink heelsplitter (<i>Potamilus alatus</i>) – mussel	G5	S2	N(CR)	2005	CD	
Red-head pondweed (<i>Potamogeton richardsonii</i>) – plant	G5	S3	PT(PR)	2002	E	
Sensitive species of concern ³	-	-	-	2007	E	
Sensitive species of concern ³	-	-	-	2007	D	
Sensitive species of concern ³	-	-	-	2005	E	
Sensitive species of concern ³	-	-	-	2007	E	

Allegheny River Pool #9 BDA		<i>Exceptional Significance</i>				
Elktoe (<i>Alasmidonta marginata</i>) – mussel	G4	S4	N(N)	2007	E	
Wavy-rayed lampmussel (<i>Lampsilis fasciola</i>) – mussel	G5	S4	N(N)	2007	E	
Pocketbook (<i>Lampsilis ovata</i>) – mussel	G5	S3S4	N(N)	1985	E	
Paper pondshell (<i>Utterbackia imbecillis</i>) – mussel	G5	S3S4	N(CU)	1997	E	
Red-head pondweed (<i>Potamogeton richardsonii</i>) – plant	G5	S3	PT(PR)	2002	E	
Sensitive species of concern ³	-	-	-	1991	E	
Sensitive species of concern ³	-	-	-	2000	E	
Sensitive species of concern ³	-	-	-	2001	E	
Sensitive species of concern ³	-	-	-	2000	E	

Allegheny River shoreline at Hooks BDA		<i>Notable Significance</i>				
Wild bean (<i>Phaseolus polystachios</i>) – plant	G5	S1S2	N(PE)	2008	BC	

Redbank Creek at Lawsonham		<i>High Significance</i>				
Streamline Chub (<i>Erimystax dissimilis</i>) – fish	G4	S3	N(N)	2005	E	
Blue false-indigo (<i>Baptisia australis</i>) – plant	G5	S2	N(PT)	2008	A	
Big bluestem – Indiangrass river grassland – natural community	GNR	S3	N(N)	2008	E	
Sensitive species of concern ³	-	-	-	2005	E	

Redbank Creek west of St. Charles		<i>Notable Significance</i>				
Big bluestem – Indiangrass river grassland – natural community	GNR	S3	N(N)	2008	E	

LANDSCAPE CONSERVATION AREAS:

Allegheny River LCA

PUBLICLY MANAGED LAND:

State Game Land #287

1 = Please refer to Appendix I for an explanation of PNHP ranks and legal status

2 = Please refer to Appendix II for an explanation of quality ranks

3 = This species is not named by request of the jurisdictional agency

Armstrong County Natural Heritage Inventory

Madison Township

Biological Diversity Areas

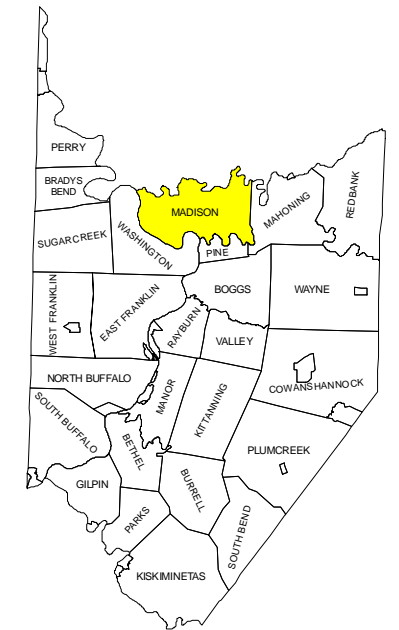
- Allegheny River Pool #8 BDA
- Allegheny River Pool #9 BDA
- Allegheny River Shoreline at Hooks BDA
- Redbank Creek at Lawsonham BDA
- Redbank Creek west of St. Charles BDA

Landscape Conservation Areas


- Allegheny River LCA

Public Land








- State Game Land #287










Legend

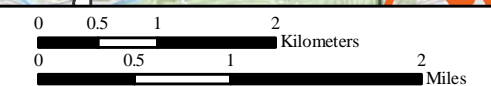


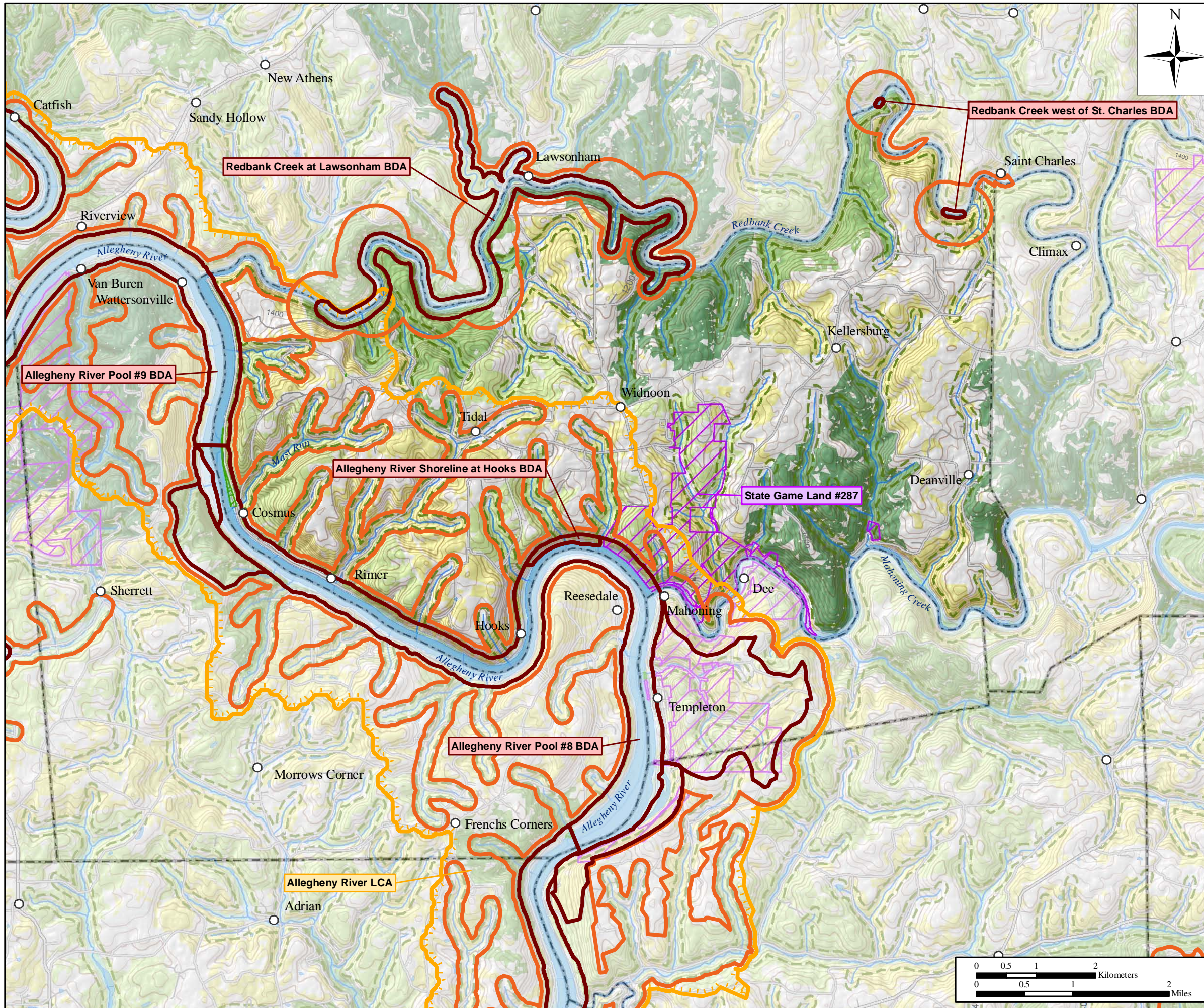
Pennsylvania Natural Heritage Program

-  Landscape Conservation Area (LCA)
- Biological Diversity Area (BDA)**
 -  Core
 -  Supporting Landscape
-  Streams
-  National Wetland Inventory
-  100-year Floodplain
-  Recommended Riparian Buffer

Forest Blocks by Acre

-  < 250
-  Municipal Boundary
-  251 - 500
-  PA Game Commission
-  501 - 1000
-  40 Ft. Contour Line
-  > 1000





Madison Township

Waterways define much of Madison Township. The Redbank Creek forms the northern boundary between Madison Township and Clarion County. The Allegheny River separates Madison Township from Washington Township and the Mahoning Creek forms the dividing line between Madison and Pine Township. Abandoned mine drainage impairs the Redbank Creek and many of its tributaries. In the center of the township, abandoned mine drainage and siltation have degraded the tributaries that flow into the Allegheny River and Mahoning Creek. The Mahoning Creek supports aquatic life despite the fact that several tributaries impaired by abandoned mine drainage empty into it (Department of Environmental Protection 2009). Efforts should be made to restore these streams so that they can support aquatic life.

The township is 32.1 square miles in size. Forest makes up 57% of the land use and agriculture makes up 33%. A portion of State Game Land #287 occurs in southern Madison Township. The US Steel Mine Important Mammal Area (IMA) covers the western and southwestern parts of the township along the Allegheny River.

Allegheny River Pool #8 BDA

Allegheny River Pool #9 BDA

The Allegheny River is one of the most ecologically significant areas in Armstrong County, including a large diversity of fish and mussel species. The Allegheny River begins in Potter County and flows north into New York. The river then turns south and flows down through Warren, Forest, and Venango Counties. As the Allegheny River enters Armstrong County it is free-flowing until it reaches Lock and Dam #9 north of Cosmus. The Allegheny River combines with the Monongahela River in Allegheny County, before it enters into the Ohio River. The lock and dam system was created in the 1920's and 1930's for navigation. The dams alter the natural flow of the river and create a different type of habitat than is found in the free-flowing sections.

The health of the Allegheny River has been threatened by pollutants and other disturbance. Abandoned mine drainage has impacted many of the streams in Armstrong County. Few mussels were found in other waterways, due to lowered pH and diminished water quality. There are also some other notable point source pollutants to the Allegheny, such as the PPG dump near Ford City that is imputing heavy metals into the river. The Allegheny River, however, seems able to maintain populations of species that cannot tolerate low water quality.

Sand and gravel dredging is another threat facing aquatic species, especially mussels. The substrate is removed from the river bottom and is often used to build roads. This impacts the mussel habitat in areas that allow dredging, including Pools #8 and #9.

Despite the dams along the Allegheny River creating habitat that is deeper and slower moving than most of the free-flowing sections of the river, there are still some areas that have the shallow quick-moving riffle habitat that supports higher mussel populations. This habitat can especially be found below dams and near sediment deposits that have formed islands in the river.

Freshwater mussels are one group of organisms that require high water quality. While many mussel species historically known from the Allegheny River have been extirpated, certain sections of the river have some of the highest diversity of freshwater mussels in the state.

Allegheny River Pool #8 is located just above the town of Frenchs Corners and continues upstream north of Cosmus. Six freshwater mussel species of concern are currently known in the Allegheny River Pool

#8- **elktoe** (*Alasmidonta marginata*), **fragile papershell** (*Leptodea fragilis*), **pink heelsplitter** (*Potamilus alatus*), **round pigtoe** (*Pleurobema sintoxia*), **wabash pigtoe** (*Fusconaia flava*), and **wavy-rayed lampmussel** (*Lampsilis fasciola*). The Allegheny River is also home to a large number of fish species, including several species of concern. **Longhead darter** (*Percina microcephalus*), **river carpsucker** (*Carpionodes carpio*), and **river redhorse** (*Moxostoma carinatum*), two fish species of concern, have been located along this section of the Allegheny River. Allegheny River Pool #8 also provides habitat for **four other aquatic animal species of concern**.

Allegheny River Pool #9 is located north of Cosmus. This section of the river is described upstream south of Foxburg. Four freshwater mussel species of concern are currently known in the Allegheny River Pool #9- **elktoe** (*Alasmidonta marginata*), **paper pondshell** (*Utterbackia imbecillis*), **pocketbook** (*Lampsilis ovata*), and **wavy-rayed lampmussel** (*Lampsilis fasciola*). The **PA-threatened red-head pondweed** (*Potamogeton richardsonii*) grows submerged in the river, rooted in the cobble covered riverbed of the Allegheny River. As with the other rare species living in this stretch of the river, the continuation of red-head pondweed at this location depends largely on maintaining the water quality of the river. Allegheny River Pool #9 also provides habitat for **three other aquatic animal species of concern**.

Threats and Stresses – The habitat of the stream-dependent species can be considerably impacted from nearby land use decisions. Many of the steep hillsides and stream valleys along the Allegheny River are forested, but there are significant agricultural and mining operations on the banks of the river and within the Allegheny River watershed. In addition, the many impervious surfaces of the surrounding urban area, such as roads, parking lots and roof tops channel rain water directly into the waterways, taking numerous non-point source pollutants with them. Storm water runoff through urban and suburban areas can be a significant source of chemical pollutants for the waterways, which can severely impact water quality and the food chain of the river.

River dredging directly removes the substrate that the mussels imbed themselves in for most of their adult life. Fish also use this gravel habitat. Once the substrate has been removed, the flow of the river can be altered, and sediment can fill in the holes left behind. The sediment makes the river bottom uninhabitable for many species.

Invasive plants, such as purple loosestrife (*Lythrum salicaria*) and Japanese knotweed (*Fallopia japonica*), can be quite common on the islands and along the banks of the river. These aggressive invasive plants dominate portions of the floodplain, outcompeting and displacing native vegetation. The zebra mussel (*Dreissena polymorpha*), another invasive species, has been located in several pools of the Allegheny River. This small mussel can grow on top of native mussels, substrate, and infrastructure in the water, altering the natural system and causing damage to pipes and other objects in the water.

Conservation Recommendations – Conservation efforts should focus on protecting and improving the quality of the surface water for both the local human community as well as for the habitat for the sensitive species of concern. Additional steps can be taken to protect and improve the aquatic habitat. Maintain and restore the natural hydrology of the Allegheny River. Restore floodplain habitats along the river's edge to slow and filter runoff before it enters the aquatic system. Improve water quality of the river by providing vegetated buffers along inflows to the creek and along the river shoreline. Stop river dredging to maintain the remaining potential habitat for the aquatic species. Control invasive species of plants by eliminating new small populations. Larger well-established populations of invasive species will require a sustained and continual suppression effort to prevent their spread. Contain zebra mussels to those areas already affected by cleaning boats and other items used in the water to control their spread into new areas.

Allegheny River shoreline at Hooks BDA – The Allegheny Valley Land Trust owns the railroad bed that is now publicly accessible trail along the steep forested slopes adjacent to the Allegheny River. A population of a PA plant species of concern, **wild bean (*Phaseolus polystachios*)** occurs scattered along the trail between Mahoning and Hooks at the edge of the forest opening created by the railroad bed. Wild bean grows as an herbaceous vine, twining around other vegetation including trees and shrubs and is considered critically imperiled in Pennsylvania due to the limited number of populations known to occur in the state. The forest edge along the trail is typical of many locations where an opening and a forest meet. This transition zone is dominated by many trees, shrubs, and herbaceous plants that are frequently considered “weedy” and are more adapted to open canopy conditions. The same weedy habitat supports the wild bean population, which also prefers the partially open conditions found here.



Rocky Gleason, PNHP

Wild bean (*Phaseolus polystachios*)

Threats and Stresses – The narrow band of weediness created by the construction of the railroad bed actually helped to expand the habitat conditions favorable for the wild bean. The wild bean prefers the partially open habitat that typifies the edges of the rail-trail, and may disappear from the site in the absence of some form of disturbance. Vegetation maintenance activities along the trail may help to maintain the conditions preferred by this species, but indiscriminate herbicide use or over aggressive vegetation clearing could diminish or destroy this population.

Conservation Recommendations – Educate the Armstrong Trail maintenance personnel and volunteers on the location and identifying features of the plant so that maintenance activities can avoid unintentional destruction of this wild bean population. Trail-side vegetation maintenance can also help to improve habitat conditions for this species and perhaps expand the population of wild bean by removing invasive species of plants along the trail. High priority for invasive species control at this site should be targeted towards removing small populations of newly established invasive plants in the mostly invasive-

free areas along the trail. In particular, Chinese wisteria, Japanese knotweed, bush honeysuckles, autumn olive, common privet, multiflora rose, Asiatic bittersweet, Bradford pear, and tree-of-heaven should all be priority targets for eradication efforts. Invasive species control efforts should try to maintain weed-free areas first, and then concentrate on removing invasive species in lightly infested areas, continually pushing back the line of invasion. Invasive species control will need to be a continuous process of monitoring and control efforts.

Redbank Creek at Lawsonham BDA

Redbank Creek west of St. Charles BDA

Redbank Creek forms the boundary between Armstrong and Clarion Counties. Between the towns of Bethlehem / New Bethlehem and the mouth of the creek at the Allegheny River, the creek forms a series of tight bends, winding through steep forested hillsides. The slopes and banks adjacent to this stretch of the creek, despite periodic logging, are remarkably undisturbed. The numerous small streams that tumble down from the steep forested slopes adjacent to the creek carry eroded particles of sand and cobble. When the streams reach the larger, slower moving Redbank Creek the sediments are transported a short distance

until deposited along the shoreline. Along the floodplain of the creek the deposits accumulate to form sand and cobble bars that extend into the creek.

This loose substrate in the creek floodplain is seasonally scoured by flood and ice, limiting the potential for colonization by woody species. In the absence of woody competition, many of the streamside cobble bars support characteristic prairie-like grasslands called a **big bluestem –Indian grass river grassland natural community**. This natural community type is currently considered rare in the state, although it may have been more prevalent on the lower Allegheny River prior to the construction of the nine navigational dams between Kittanning and Pittsburgh (Zimmerman & Podniesinski 2008). These occurrences scattered along the banks of the Redbank Creek are typically narrower and smaller in size than those found along the Allegheny River, but are still considered quality representations of this uncommon community type. Throughout most of its length in Armstrong County, the creek is free flowing, without dams to reduce the natural seasonal dynamics of flood and ice scour. These natural disturbances help to maintain the open character of the floodplain and scour zones.

In addition to the floodplain grasslands communities, several good quality populations of the PA-threatened plant species of concern, **blue false-indigo, (*Baptisia australis*)** occur scattered along the creek's floodplain. Blue false-indigo, like the grasslands it is often associated with, is found scattered along the Allegheny River, Redbank Creek and other major tributaries in areas that receive periodic flooding and scour disturbance. The dynamic activity of the creek likely causes these disturbance dependant populations to shift up and down the creek's edge over time with the fluctuation of sand and cobble deposition.

In addition to the grassland communities, an occurrence of **streamline chub (*Erimystax dissimilis*)**, a fish species of concern, and another **species of concern** were also located in Redbank Creek at Lawsonham. Both of these species are dependent on high water quality.

Threats and Stresses – Most of the Redbank Creek shoreline west of New Bethlehem is currently well vegetated, with very few buildings or infrastructure interrupting the forested hillsides or floodplain of the creek. The railroad tracks paralleling the Clarion County side of the creek are currently being dismantled, providing an excellent opportunity for use as a recreational trail. The flatter uplands on either side of the Redbank Creek have numerous strip mines in various states of activity. Some mines are still active, while others have been reclaimed and planted in various forms of vegetation. Most of the tributary streams and the Redbank Creek itself are considered impaired by DEP water quality designations due to abandoned mine drainage. Abandoned mine drainage from these former mines heavily impacts the water quality which in turn, limits the aquatic life that the creek can support.

Japanese knotweed, an aggressive invasive plant, dominates portions of the Redbank Creek floodplain, outcompeting and displacing native vegetation. This species competes directly with blue false-indigo and the native grasses for the same floodplain habitat. Once it becomes established in an area it can be very difficult to remove or control.

Dam construction or residential development along the creek or adjacent slopes would negatively impact the long term viability of the creek's aquatic systems, the adjacent riparian communities, and the species they support.

Conservation Recommendations – Maintain and improve water quality of the creek by maintaining wide vegetated buffers along inflows to the creek and along the creek shoreline. Protect and restore floodplain habitats along the creek's edge to slow and filter runoff before it enters the aquatic system. Install or upgrade abandoned mine drainage mitigation systems to help correct this source of aquatic pollution.

Reclaim former open strip mine areas by restoring natural contours and replanting in a variety of native vegetation suitable to the location.

Long term viability of the blue false-indigo and the big bluestem– Indian grass river grassland natural communities will require maintaining the natural hydrology of the creek, with the seasonal flood and ice scouring events, as well as retaining the natural conditions of the shorelines, riverbed outcrops, and islands. Avoid the construction of dams, dredging activities or any other landscape modifications that would alter the creek’s natural hydrologic regime.

Any future development along the Redbank Creek should be located a minimum of 100 meters (328 feet) away from the creek’s floodplain to maintain the natural conditions of the floodplain and riparian buffer. In essence, buildings and infrastructure should maintain a respectful distance from the creek’s edge to protect and improve the quality of the water and habitat for all species including human communities.

Control efforts should focus on eradicating Japanese knotweed in areas that support blue false-indigo and the associated big bluestem– Indian grass river grassland natural communities. Control invasive species of plants by first eliminating new small pioneer populations. Larger, well-established populations of invasive species will require a sustained and continual suppression effort to prevent their spread.

Mahoning Township & South Bethlehem Borough

	<u>PNDI Rank</u> ¹		<u>Legal Status</u> ¹	Last Seen	Quality ²
	Global	State	State (Proposed)		

NATURAL HERITAGE AREAS:

Mahoning Creek at Putneyville BDA	<i>High Significance</i>				
Sensitive species of concern ³	-	-	-	2008	E
Mahoning Creek Dam outflow BDA	<i>High Significance</i>				
Sensitive species of concern ³	-	-	-	2008	E

LANDSCAPE CONSERVATION AREAS: None currently identified

PUBLICLY MANAGED LAND: State Game Land #137

1 = Please refer to Appendix I for an explanation of PNHP ranks and legal status

2 = Please refer to Appendix II for an explanation of quality ranks

3 = This species is not named by request of the jurisdictional agency

Armstrong County Natural Heritage Inventory

Mahoning Township & South Bethlehem Borough

Biological Diversity Areas

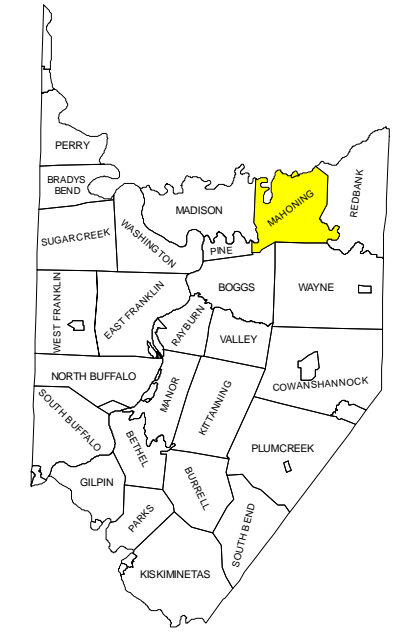
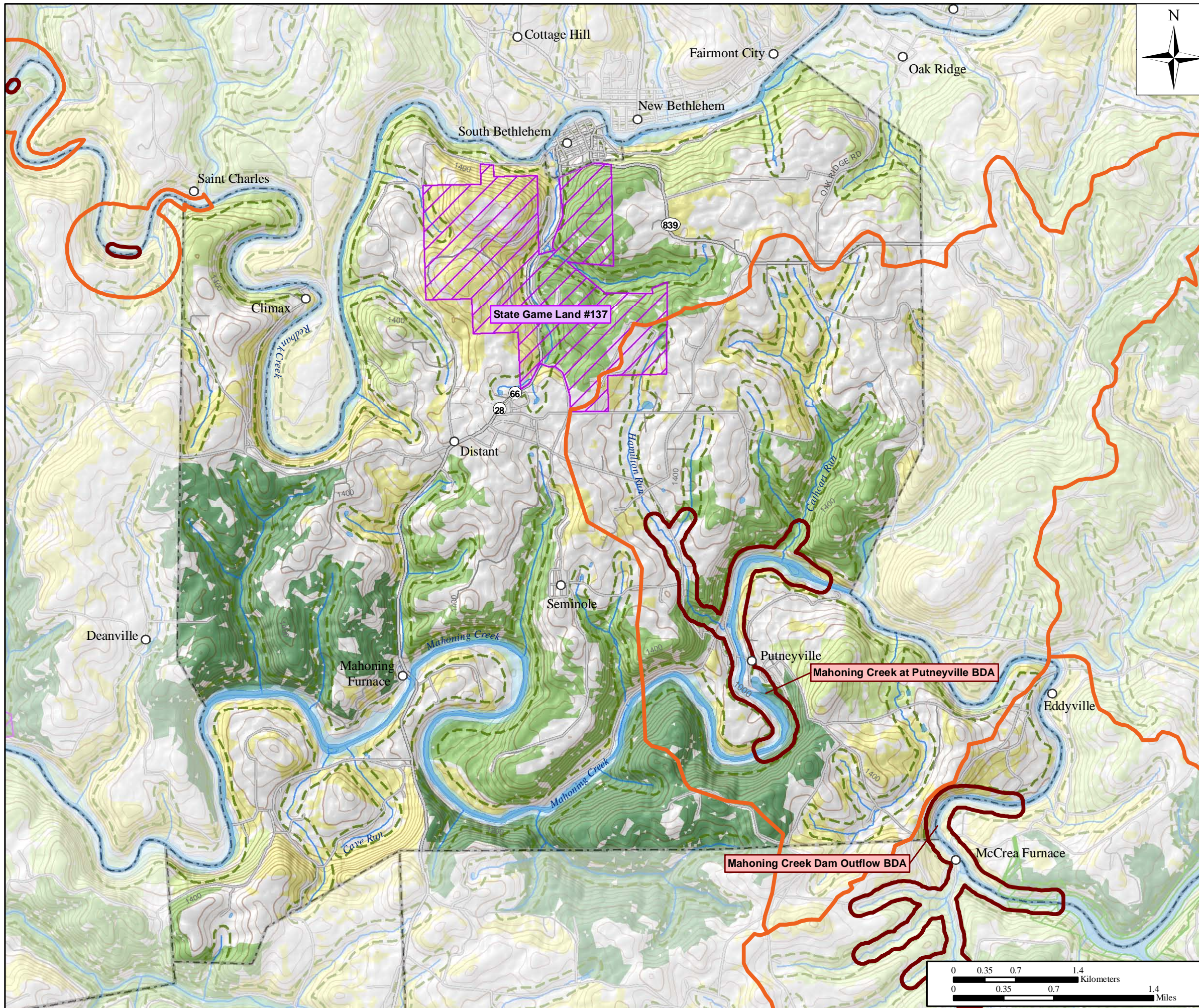
Mahoning Creek at Putneyville BDA
Mahoning Creek Dam Outflow BDA

Landscape Conservation Areas

None Currently Identified

Public Land

State Game Land #137

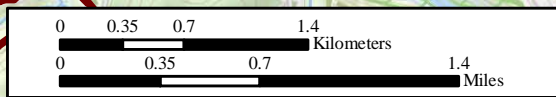


Legend

- Landscape Conservation Area (LCA)
- Biological Diversity Area (BDA)**
- Core
- Supporting Landscape
- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer
- Forest Blocks by Acre**
- < 250
- 251 - 500
- 501 - 1000
- > 1000

- Municipal Boundary
- PA Game Commission
- 40 Ft. Contour Line

Pennsylvania Natural Heritage Program



Mahoning Township & South Bethlehem Borough

Mahoning Township is in northern Armstrong County and covers 25.3 square miles. The Redbank Creek forms the northern boundary between Mahoning Township and Clarion County. The Borough of South Bethlehem sits along this line.

The Mahoning Creek flows across the southern third of the township. Both the Mahoning and Redbank Creeks eventually feed into the Allegheny River. Abandoned mine drainage impairs aquatic life in Cathcart Run, a tributary to the Mahoning (Department of Environmental Protection 2009).

Agricultural land use covers 39% of the landscape and forest 51%. Several forest blocks of over 1000 acres occur in the southern and western parts of the township, but little forest is found through the central region. Riparian buffers are needed along streams where they are absent, to reduce the effects of non-point source pollution from agriculture. State Game Lands (SGL) #137 is in the north central part of the township and protects some of the forest blocks along the Redbank Creek.

South Bethlehem Borough

South Bethlehem is the second smallest borough in the county with a total area of 0.2 square miles. Only Applegrove is smaller at 0.1 square miles. It sits across the Redbank Creek from Clarion County. Sixty-four percent of the borough is developed.



Denise Watts, PNHP

Runoff from mining threatens the aquatic habitat of Armstrong County.

of this section of Mahoning Creek has a forested buffer of at least 100 meters (328 feet), which will help to keep the water quality high. Relying on clean water to maintain healthy invertebrate prey populations, this species also uses bushy vegetation along the creek. Streamside vegetation along the creek is necessary for the maintenance of the water quality and to provide critical habitat for the species of concern found at this site.

Threats and Stresses – Riparian vegetation is important to this species as habitat and to filter pollutants before they enter the creek. Some portions of the riparian area have been thinned for agriculture. Removal of the remaining riparian vegetation would destroy habitat and allow runoff to enter directly into the stream. Pesticides or fertilizers used on the agricultural fields may also degrade water quality. Changes in the water flow below the dam may limit habitat for the species of concern.

Recommendations – Maintain riparian vegetation to provide habitat and protect water quality for the species of concern located at this site.

Mahoning Creek at Putneyville BDA Mahoning Creek Dam outflow BDA

An occurrence of a **species of concern** was found along Mahoning Creek at Putneyville. Some areas along this stretch of Mahoning Creek are forested, but much of this area is adjacent to agricultural fields and residential areas, which may negatively impact water quality. Relying on clean water to maintain healthy invertebrate prey populations, this species also uses bushy vegetation along the creek. Streamside vegetation along the creek is necessary for the maintenance of the water quality and to provide critical habitat for the species of concern found at this site.

An occurrence of a **species of concern** was found below the dam on Mahoning Creek. Most

Manor Township, Ford City, Ford Cliff & Manorville Boroughs

	PNDI Rank ¹		Legal Status ¹		Last Seen	Quality ²
	Global	State	State (Proposed)			

NATURAL HERITAGE AREAS:

Allegheny River Pool #6 BDA		<i>Exceptional Significance</i>				
Goldeye (<i>Hiodon alosoides</i>) – fish	G5	S2?	PT(PT)	1986	E	
River redhorse (<i>Moxostoma carinatum</i>) – fish	G4	S3S4	N(CU)	1997	E	
Longhead darter (<i>Percina macrocephala</i>) – fish	G3	S2S3	N(PT)	1986	E	
Elktoe (<i>Alasmidonta marginata</i>) – mussel	G4	S4	N(N)	2007	E	
Wabash pigtoe (<i>Fusconaia flava</i>) – mussel	G5	S2	N(PE)	2007	B	
Fragile papershell (<i>Leptodea fragilis</i>) – mussel	G5	S2	N(CR)	2005	D	
Round pigtoe (<i>Pleurobema sintoxia</i>) – mussel	G4G5	S2	N(PE)	2007	E	
Pink heelsplitter (<i>Potamilus alatus</i>) – mussel	G5	S2	N(CR)	2005	CD	
Sensitive species of concern ³	-	-	-	2007	E	
Sensitive species of concern ³	-	-	-	2005	E	
Crooked Creek at Rossford BDA		<i>High Significance</i>				
Sensitive species of concern ³	-	-	-	1984	E	
Crooked Creek Outflow BDA		<i>High Significance</i>				
Green-faced clubtail (<i>Gomphus viridifrons</i>) – dragonfly	G3G4	S1	N(N)	2007	E	
Turquoise bluet (<i>Enallagma divagans</i>) – damselfly	G5	S3	N(N)	2007	E	
Sensitive species of concern ³	-	-	-	2008	E	
Crooked Creek Reservoir BDA		<i>Notable Significance</i>				
Cattail sedge (<i>Carex typhina</i>) – plant	G5	S2	PE(PT)	2008	BC	
Stalked bulrush (<i>Scirpus pedicellatus</i>) – plant	G4	S1	PT(PT)	2007	E	
Sensitive species of concern ³	-	-	-	2008	E	

LANDSCAPE CONSERVATION AREAS: Allegheny River LCA

PUBLICLY MANAGED LAND: None

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Armstrong County Natural Heritage Inventory

Manor Township & Ford City Borough & Ford Cliff Borough & Manorville Borough

Biological Diversity Areas

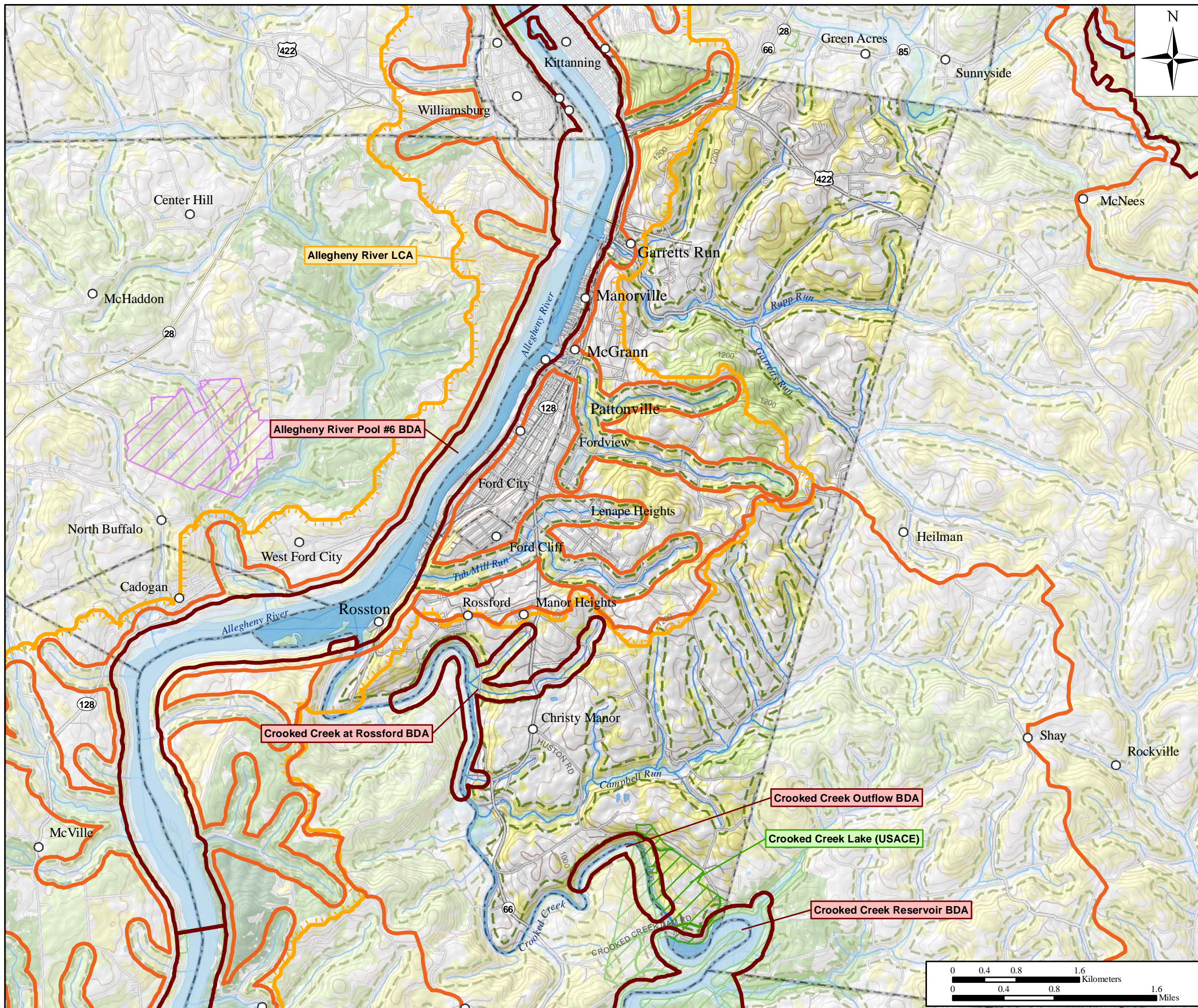
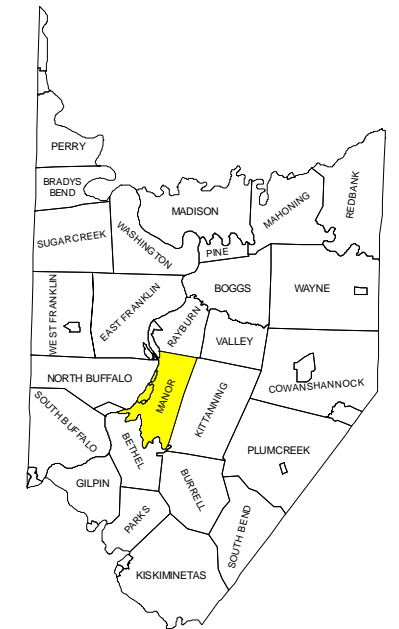
- Allegheny River Pool #6 BDA
- Crooked Creek at Rossford BDA
- Crooked Creek Outflow BDA
- Crooked Creek Reservoir BDA

Landscape Conservation Areas

- Allegheny River LCA

Public Land

- Crooked Creek Lake (USACE)



Legend

- Landscape Conservation Area (LCA)
- Biological Diversity Area (BDA)**
- Core
- Supporting Landscape
- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer
- Forest Blocks by Acre**
- < 250
- 251 - 500
- 501 - 1000
- > 1000
- Municipal Boundary
- US Army Corps of Engineers
- PA Game Commission
- 40 Ft. Contour Line

Pennsylvania Natural Heritage Program

Manor Township, Ford City, Ford Cliff & Manorville Boroughs

Manor Township sits along the east side of the Allegheny River in the central region of Armstrong County. Crooked Creek Lake is a part of this section of the river. The Boroughs of Ford City, Ford Cliff, and Manorville separate the township from the Allegheny River for a portion of this border. Crooked Creek forms the southern border with Bethel Township. The township covers 17.2 square miles.

Forest makes up 34% of the land use. The largest block of forest is in the center of the township east of Manorville. Garretts Run, Limestone Hollow, Tub Mill Run, and Crooked Creek flow westward through the township and empty into the Allegheny River along the township line. Portions of Garretts Run and its tributaries have problems with excess nutrients and siltation due to urban runoff (Department of Environmental Protection 2009). Agriculture land use covers 45% of the township. Because many streams within the township lack streamside buffers, reforestation of stream banks should be encouraged to help contain non-point sources of pollution.

Ford City

Ford City sits along the east bank of the Allegheny River and occupies 0.8 square miles. Next to Kittanning Borough, Ford City is the second largest population center in Armstrong County. Seventy-nine percent of the borough is developed. Ford Cliff Borough lies to its southeast and Manorville Borough to the north.

Ford Cliff Borough

Ford Cliff is a small borough with an area of 0.1 square miles adjacent to Ford City. Ninety-three percent of the borough is developed.

Manorville Borough

Manorville Borough is 0.1 square miles in size. It is to the north of Ford City along the east bank of the Allegheny River, which makes up half of Manorville Borough. Forty one percent of the borough is developed.

Allegheny River Pool #6 BDA – The Allegheny River is one of the most ecologically significant areas in Armstrong County, including a large diversity of fish and mussel species. The Allegheny River begins in Potter County and flows north into New York. The river then turns south and flows down through Warren, Forest, and Venango Counties. As the Allegheny River enters Armstrong County it is free-flowing until it reaches Lock and Dam #9 north of Cosmus. The Allegheny River combines with the Monongahela River in Allegheny County, before it enters into the Ohio River. The lock and dam system was created in the 1920's and 1930's for navigation. The dams alter the natural flow of the river and create a different type of habitat than is found in the free-flowing sections upstream. Allegheny River Pool #6 begins above the village of Kelly Station and continues upstream to Kittanning.

The health of the Allegheny River has been threatened by pollutants and other disturbance. Abandoned mine drainage has impacted many of the streams in Armstrong County. Few mussels were found in other waterways in the county due to lowered pH and diminished water quality. There are some other notable point source pollutants to the Allegheny, such as the PPG dump near Ford City that is imputing heavy metals into the river. The Allegheny River, however, seems able to maintain populations of species that are sensitive to changes in water quality.

Sand and gravel dredging is another threat facing aquatic species, especially mussels. The substrate is removed from the river bottom and is often used for road construction. Dredging in Pool #6 has been banned since 1985, protecting the habitat for aquatic species.

Despite the dams along the Allegheny River creating habitat that is deeper and slower moving than the free-flowing sections of the river, there are still some areas that have the shallow, quick-moving riffle habitat that supports higher mussel populations. This habitat can especially be found below dams and near sediment deposits that have formed islands in the river.

Freshwater mussels are one group of organisms that require high water quality. While many mussel species historically known from the Allegheny River have been extirpated, certain sections of the river have some of the highest diversity of freshwater mussels in the state. Five freshwater mussel species of concern are currently known in the Allegheny River Pool #6- **elktoe** (*Alasmidonta marginata*), **fragile papershell** (*Leptodea fragilis*), **pink heelsplitter** (*Potamilus alatus*), **round pigtoe** (*Pleurobema sintoxia*), and **wabash pigtoe** (*Fusconaia flava*). The Allegheny River is also home to a large number of fish species, including several species of concern. Three fish species of concern, **longhead darter** (*Percina microcephalus*), **goldeye** (*Hiodon alosoides*) and **river redhorse** (*Moxostoma carinatum*), have all been located along this section of the Allegheny River. Allegheny River Pool #6 also provides habitat for **two other aquatic animal species of concern**.



Rocky Gleason, PNHP

Shoreline residences have replaced native riparian vegetation.

Threats and Stresses – The habitat of the stream-dependent species can be considerably impacted from nearby land use decisions. Many of the steep hillsides and stream valleys along the Allegheny River are forested, but there are significant agricultural and mining operations on the banks of the river and within the Allegheny River watershed. This section of the Allegheny River flows through the more populated areas of the county, specifically Kittanning and Ford City. A large portion of Kittanning lies within the floodplain of the Allegheny River, putting much of the town in danger of flooding. In addition, the many impervious surfaces of the surrounding urban area, such as roads, parking lots, and roof tops channel rain water directly into the waterways, taking numerous non-point

source pollutants with them. Storm water runoff through urban and suburban areas can be a significant source of chemical pollutants for the waterways, which can severely impact water quality and the food chain of the river. The PPG dump below Ford City a notable source of point source pollution that is leaching heavy metals and other point source pollutants directly into the Allegheny River.

Invasive plants, such as purple loosestrife (*Lythrum salicaria*) and Japanese knotweed (*Fallopia japonica*), can be quite common on the islands and along the banks of the river. These aggressive invasive plants dominate portions of the floodplain, outcompeting and displacing native vegetation. The zebra mussel (*Dreissena polymorpha*), another invasive species, has been located in several pools of the Allegheny River. This small mussel can grow on top of native mussels, substrate, and infrastructure in the water, altering the natural system and causing damage to pipes and other objects in the water.

Conservation Recommendations – Conservation efforts should focus on protecting and improving the quality of the surface water for both the local human community as well as for the habitat of the species of concern. Additional steps can be taken to protect and improve the aquatic habitat, such as maintenance and restoration of the natural hydrology of the Allegheny River and the floodplain habitats along the river’s edge. These buffers serve an important role by slowing and filtering runoff before it enters the aquatic system. Control invasive species of plants by eliminating new small populations. Larger well-established populations of invasive species will require a sustained and continual suppression effort to prevent their spread. Contain zebra mussels to those areas already affected by cleaning boats and other items used in the water to control their spread into new areas.

Crooked Creek at Rossford BDA – An occurrence of a **species of concern** was found along this stretch of Crooked Creek and its tributaries. This area is located about 1 mile from the Allegheny River. Much of this area is adjacent to agricultural fields and residential areas, which may negatively impact water quality. Relying on clean water to maintain healthy invertebrate prey populations, this species also uses bushy vegetation along the creek. Streamside vegetation along the creek is necessary for the maintenance of the water quality and to provide critical habitat for the species of concern found at this site.

Threats and Stresses – Riparian vegetation is important to this species as habitat and also as a filter for pollutants. Some portions of the riparian area have been thinned for agriculture. Removal of the remaining riparian vegetation would destroy habitat and allow runoff to enter directly into the stream. Pesticides or fertilizers used on the agricultural fields may also degrade water quality.

Recommendations – Maintain riparian vegetation to provide habitat and protect water quality for the species of concern located at this site.

Crooked Creek Outflow BDA – Recent surveys below the Crooked Creek dam outflow uncovered three species of concern, including the **green-faced clubtail** dragonfly (*Gomphus viridifrons*) and the **turquoise bluet** damselfly (*Enallagma divagans*). In the larval stage, both of these odonates live among the vegetation along the shoreline. Once they emerge as adults, they continue to use the surrounding area as foraging habitat. Another **species of concern**, not named in this report at the request of the agency overseeing its jurisdiction, is found along Crooked Creek. Relying on clean water to maintain healthy invertebrate prey populations, this species also uses bushy vegetation along the creek. Streamside vegetation along the creek is necessary for the maintenance of the water quality and to provide critical habitat for all of the species of concern found at this site.

Threats and Stresses – Although this area is often heavily used by fisherman, there are currently no known threats to the species of concern at this site. This area is part of Crooked Creek Park, which should help keep this habitat intact. Maintaining good water quality and riparian vegetation is vital to the species of concern.

Recommendations – Limit access to only those areas currently used for fishing to avoid disturbance along the shoreline. Maintain a native riparian buffer to provide habitat and protect water quality for the species of concern found at this site.

Crooked Creek Reservoir BDA – Crooked Creek Reservoir was created by the damming of Crooked Creek in 1940 as a means of controlling floodwaters in the lower Allegheny and Ohio Rivers. The water level in the reservoir fluctuates widely as floodwaters alternately flood and dry the shoreline. The difference between average summer water level height and full capacity at the dam breast is roughly 65 feet. Debris from past flood events such as trees and assorted trash litters the shoreline in a wide band extending up the slope of the shoreline. The fluctuating water level along the shoreline helps to foster habitat conditions favorable for a population of the PA-endangered plant species of concern, **cattail sedge** (*Carex typhina*). The species typically grows in wet woods and bottomlands, particularly around the edges of low spots that intermittently have standing water.

An additional plant species of concern, the PA-threatened, **stalked bulrush** (*Scirpus pedicellatus*) occurs within a wide, marshy portion of the Crooked Creek floodplain. The stalked bulrush is near the southern limit of its known range in Pennsylvania. This species may hybridize with the more common wool grass (*Scirpus cyperinus*) where the two co-occur, making determination difficult. Conservation of the naturally vegetated floodplain / shoreline habitat will help maintain viable populations of this species. Another **species of concern** is also known to be breeding at this site.

Threats and Stresses – There are no evident threats to this species at this location and management does not seem to be necessary. The artificially induced shoreline fluctuations actually help maintain favorable habitat conditions for the cattail sedge. The cattail sedge is not currently known to be as widely dispersed along the shoreline of this reservoir as at the Mahoning Creek Reservoir, and recreational activities could more easily disturb the habitat for this population. Poorly sited infrastructure improvements such as access roads and parking lots could eliminate portions of the habitat for this species. Human disturbance in this area may also affect nesting success of the species of concern.

Conservation Recommendations – The dynamic nature of the floodplain of this reservoir will likely force any future infrastructure improvements to remain a respectful distance from the active floodplain. Disturbance in this area should be limited from January to June to prevent nest abandonment of the species of concern.

North Buffalo Township

	PNDI Rank ¹		Legal Status ¹	Last Seen	Quality ²
	Global	State	State (Proposed)		

NATURAL HERITAGE AREAS:

Allegheny River Pool #6 BDA		<i>Exceptional Significance</i>			
Goldeye (<i>Hiodon alosoides</i>) – fish	G5	S2?	PT(PT)	1986	E
River redhorse (<i>Moxostoma carinatum</i>) – fish	G4	S3S4	N(CU)	1997	E
Longhead darter (<i>Percina macrocephala</i>) – fish	G3	S2S3	N(PT)	1986	E
Elktoe (<i>Alasmidonta marginata</i>) – mussel	G4	S4	N(N)	2007	E
Wabash pigtoe (<i>Fusconaia flava</i>) – mussel	G5	S2	N(PE)	2007	B
Fragile papershell (<i>Leptodea fragilis</i>) – mussel	G5	S2	N(CR)	2005	D
Round pigtoe (<i>Pleurobema sintoxia</i>) – mussel	G4G5	S2	N(PE)	2007	E
Pink heelsplitter (<i>Potamilus alatus</i>) – mussel	G5	S2	N(CR)	2005	CD
Sensitive species of concern ³	-	-	-	2005	E
Sensitive species of concern ³	-	-	-	2007	E
Long Run Mine BDA		<i>Exceptional Significance</i>			
Sensitive species of concern ³	-	-	-	2006	D
Sensitive species of concern ³	-	-	-	2006	E
Rough Run BDA		<i>Notable Significance</i>			
Sensitive species of concern ³	-	-	-	2008	E

LANDSCAPE CONSERVATION AREAS: Allegheny River LCA

PUBLICLY MANAGED LAND: State Game Land #247

1 = Please refer to Appendix I for an explanation of PNHP ranks and legal status

2 = Please refer to Appendix II for an explanation of quality ranks

3 = This species is not named by request of the jurisdictional agency

Armstrong County Natural Heritage Inventory

North Buffalo Township & Cadogan Township

Biological Diversity Areas

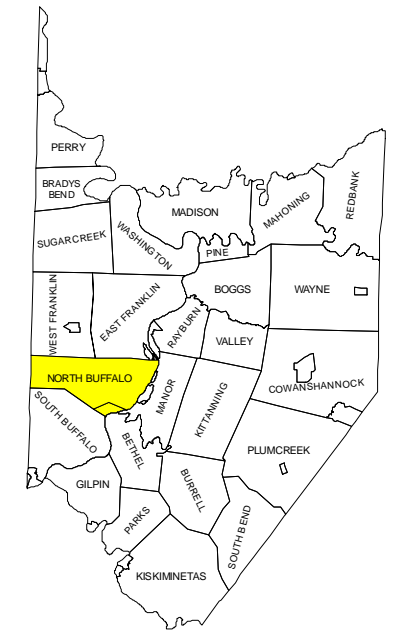
- Allegheny River Pool #6 BDA
- Long Run Mine BDA
- Rough Run BDA

Landscape Conservation Areas

- Allegheny River LCA

Public Land

- State Game Land #247



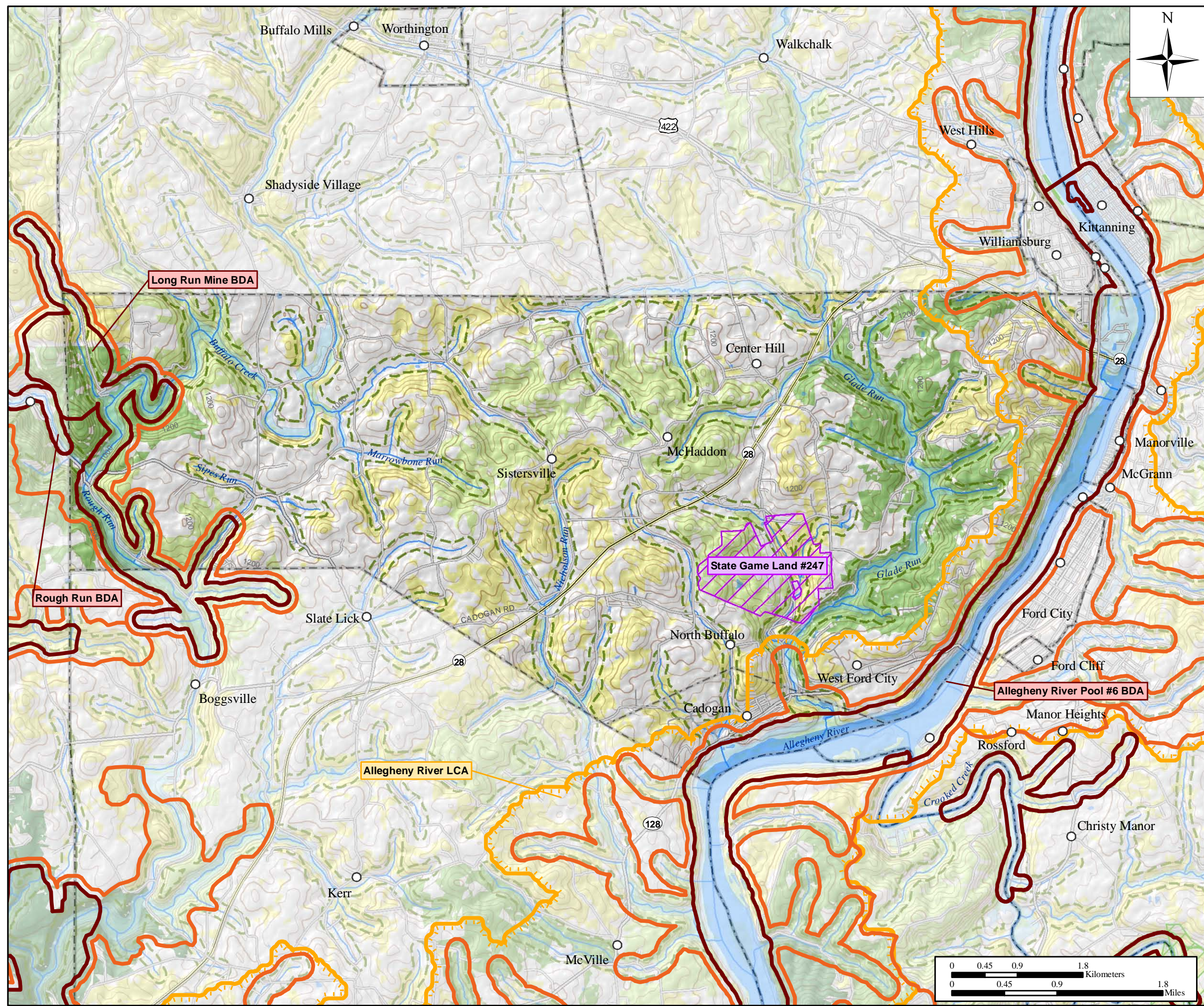
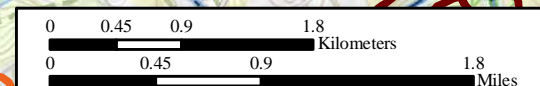
Legend

- Landscape Conservation Area (LCA)
- Biological Diversity Area (BDA)
 - Core
 - Supporting Landscape
- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre

- < 250
- 251 - 500
- 501 - 1000
- > 1000

- Municipal Boundary
- PA Game Commission
- 40 Ft. Contour Line



North Buffalo Township

The western edge of North Buffalo Township is along the border with Butler County. The township is long and narrow and extends from the Butler County line east to the Allegheny River. The township covers 25.2 miles. Forest makes up 48% of the land cover and agriculture 42%.

Glade Run forms the major drainage for the eastern half of the township and flows south into the Allegheny River in Cadogan Township. In the western half of the township, Buffalo Creek and its tributaries are the major waterways. Non-point source pollution in the form of siltation and wastewater is a problem in this area. PCB levels result in fish consumption advisories in the Allegheny River (Department of Environmental Protection 2009). Restoration and conservation efforts should be made to increase forest buffers along Buffalo Creek and other streams within the township that lack them. Riparian buffers could help filter and reduce agricultural inputs and siltation.

Two areas are designated as being important to wildlife. The Long Run Mine Important Mammal Area (IMA) includes over half of the township to the west and the Buffalo Creek Valley Important Bird Area (IBA) overlaps much of the same area. Both the Long Run Mine IMA and the Buffalo Creek Valley IBA spread across portions of several townships and extend into Butler County. State Game Lands #247 is to the east of these areas.

Allegheny River Pool #6 BDA – The Allegheny River is one of the most ecologically significant areas in Armstrong County, including a large diversity of fish and mussel species. The Allegheny River begins in Potter County and flows north into New York. The river then turns south and flows down through Warren, Forest, and Venango Counties. As the Allegheny River enters Armstrong County it is free-flowing until it reaches Lock and Dam #9 north of Cosmus. The Allegheny River combines with the Monongahela River in Allegheny County, before it enters into the Ohio River. The lock and dam system was created in the 1920's and 1930's for navigation. The dams alter the natural flow of the river and create a different type of habitat than is found in the free-flowing sections. Allegheny River Pool #6 is located above the village of Kelly Station and continues upstream to Kittanning.

The health of the Allegheny River has been threatened by pollutants and other disturbance. Abandoned mine drainage has impacted many of the streams in Armstrong County. Few mussels were found in other waterways in the county, due to lowered pH and diminished water quality. There are also some other notable point source pollutants to the Allegheny, such as the PPG dump near Ford City that is imputing heavy metals into the river. The Allegheny River, however, seems able to maintain populations of species that cannot tolerate low water quality.

Sand and gravel dredging is another threat facing aquatic species, especially mussels. The substrate is removed from the river bottom and is often used to build roads. Dredging in Pool #6 has been banned since 1985, protecting the habitat for aquatic species.

Despite the dams along the Allegheny River creating habitat that is deeper and slower moving than most of the free-flowing sections of the river, there are still some areas that have the shallow, quick-moving riffle habitat that supports higher mussel populations. This habitat can especially be found below dams and near sediment deposits that have formed islands in the river.

Freshwater mussels are one group of organisms that require high water quality. While many mussel species historically known from the Allegheny River have been extirpated, certain sections of the river have some of the highest diversity of freshwater mussels in the state. Five freshwater mussel species of concern are currently known in the Allegheny River Pool #6- **elktoe (*Alasmidonta marginata*)**, **fragile**

papershell (*Leptodea fragilis*), pink heelsplitter (*Potamilus alatus*), round pigtoe (*Pleurobema sintoxia*), and wabash pigtoe (*Fusconaia flava*). The Allegheny River is also home to a large number of fish species, including several species of concern. **Longhead darter (*Percina macrocephala*), goldeye (*Hiodon alosoides*), and river redhorse (*Moxostoma carinatum*),** three fish species of concern, have all been located along this section of the Allegheny River. Allegheny River Pool #6 also provides habitat for **two other aquatic animal species of concern.**



Rocky Gleason, PNHP

In addition to the species of concern associated with the river and its floodplain, this important habitat also supports a high diversity of common species of native plants that support native insects, which in turn help to feed the food chain of native birds and mammals.

Threats and Stresses – The habitat of the stream-dependent species can be considerably impacted from nearby land use decisions. Many of the steep hillsides and stream valleys along the Allegheny River are forested, but there are significant agricultural and mining operations on the banks of the river and within the Allegheny River watershed. This section of the Allegheny River flows through the more populated areas of

the county, specifically Kittanning and Ford City. A large portion of Kittanning lies within the floodplain of the Allegheny River, putting this area in danger of flooding. In addition, the many impervious surfaces of the surrounding urban area, such as roads, parking lots, and roof tops channel rain water directly into the waterways, taking numerous non-point source pollutants with them. Storm water runoff through urban and suburban areas can be a significant source of chemical pollutants for the waterways, which can severely impact water quality and the food chain of the river. The PPG dump below Ford City a notable source of point source pollution that is leaching heavy metals and other point source pollutants directly into the Allegheny River.

Invasive plants, such as purple loosestrife (*Lythrum salicaria*) and Japanese knotweed (*Polygonum cuspidatum*), can be quite common on the islands and along the banks of the river. These aggressive invasive plants dominate portions of the floodplain, outcompeting and displacing native vegetation. The zebra mussel (*Dreissena polymorpha*), another invasive species, has been located in several pools of the Allegheny River. This small mussel can grow on top of native mussels, substrate, and infrastructure in the water, altering the natural system and causing damage to pipes and other objects in the water.

Conservation Recommendations – Conservation efforts should focus on protecting and improving the quality of the surface water for both the local human community as well as for the habitat for the sensitive species of concern. Additional steps can be taken to protect and improve the aquatic habitat. Maintain and restore the natural hydrology of the Allegheny River. Restore floodplain habitats along the river’s edge to slow and filter runoff before it enters the aquatic system. Improve water quality of the river by providing vegetated buffers along inflows to the creek and along the river shoreline. Control invasive species of plants by eliminating new small populations. Larger well-established populations of invasive species will require a sustained and continual suppression effort to prevent their spread. Contain zebra mussels to those areas already affected by cleaning boats and other items used in the water to control their spread into new areas.

Long Run Mine BDA – This site is an abandoned mine shaft that now provides habitat for **two species of concern**. Abandoned mines mimic the natural cave habitats that the species typically use. The riparian forests near the mine provide critical foraging habitat for these species, and others using the mine.

Threats and Stresses – Forest fragmentation would limit foraging and roosting habitat, and the use of insecticides could limit the prey base for these species of concern. The entrance to the mine has been gated to prevent disturbance, but trespassing and vandalism are still potential threats to this site.

Conservation Recommendations – Maintain the existing forests and replant the cleared areas with trees, especially along riparian corridors. Continue to gate the mine entrance and protect this site from trespassing and vandalism.

Rough Run BDA – Rough Run provides habitat for a **species of concern** not named in this report at the request of the agency overseeing its jurisdiction. Relying on clean water to maintain healthy invertebrate prey populations, this species also uses bushy vegetation along the creek. Streamside vegetation along the creek is necessary for the maintenance of the water quality and to provide critical habitat for all of the species of concern found at this site.

Threats and Stresses – This population lives in very close proximity to industrial and residential developments, and roads run close to the stream throughout the core habitat. These land uses pose risks to the water quality, the quality of the habitat along the stream, and the quality of the habitat where the species hibernates.

This species is dependent on water quality because it preys on aquatic animals that are sensitive to water pollution. Runoff from dirt and gravel roads in close proximity to waterways can contribute to physical degradation of their channels and erosion and sediment pollution in streams and rivers.

Some of the streamside habitat has been converted to pavement and lawns, which expose this species of concern to direct impacts of vehicle traffic and yard maintenance. Further development of residential areas, industrial areas, or roads within the core habitat would threaten this species.

Conservation Recommendations – Maintaining suitable aquatic and riparian habitat is key to the continued success of this species. In residential areas within the core habitat, vegetated buffers should be established between lawns and the stream. Shrubs should be allowed to grow in this buffer, but dense tree cover does not provide optimal habitat. Expansion of industrial habitat, increased residential development, or widening of roads within the core habitat should be avoided.

In the upstream watershed, logging, road development, gas drilling, or other construction activities should be kept well away from riparian corridors in order to avoid degrading the water quality of Rough Run.

Parks Township

	<u>PNDI Rank</u> ¹		<u>Legal Status</u> ¹	Last Seen	Quality ²
	Global	State	State (Proposed)		

NATURAL HERITAGE AREAS:

none currently identified

LANDSCAPE CONSERVATION AREAS:

None currently identified

PUBLICLY MANAGED LAND:

None

1 = Please refer to Appendix I for an explanation of PNHP ranks and legal status

2 = Please refer to Appendix II for an explanation of quality ranks

Parks Township

Parks Township is one of the southernmost townships in Armstrong County and covers 14.2 square miles. It sits along the border with Westmoreland County. The Kiskiminetas River forms the southern border.

Carnahan Run is the major waterway flowing through Parks Township and flows into the Kiskiminetas River. The Kiskiminetas is impaired due to the effects of abandoned mine drainage, but Carnahan Run and its tributaries support aquatic life and will be a source of aquatic organisms for the Kiskiminetas after it is restored.

Forest makes up 56% of the land cover, with the largest blocks of forest in the northern and western portions of the township ranging from 300 – 600 acres in size. These forests provide buffers along the streams and protect them from direct inputs of pollutants and sediment in runoff. Agriculture covers 33% of the landscape. Efforts should be made to maintain and increase forest buffers where needed in order to reduce non-point source pollution into streams.

Armstrong County Natural Heritage Inventory Parks Township

Biological Diversity Areas

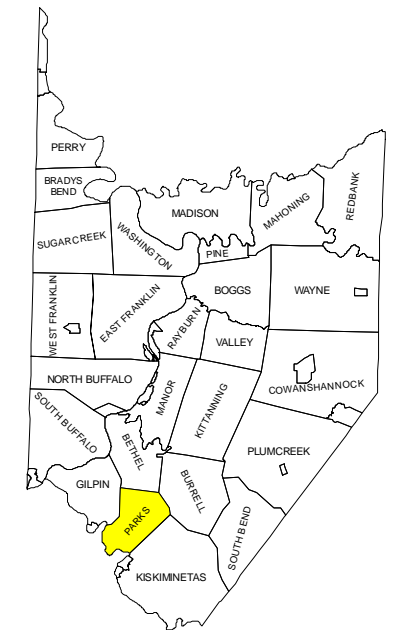
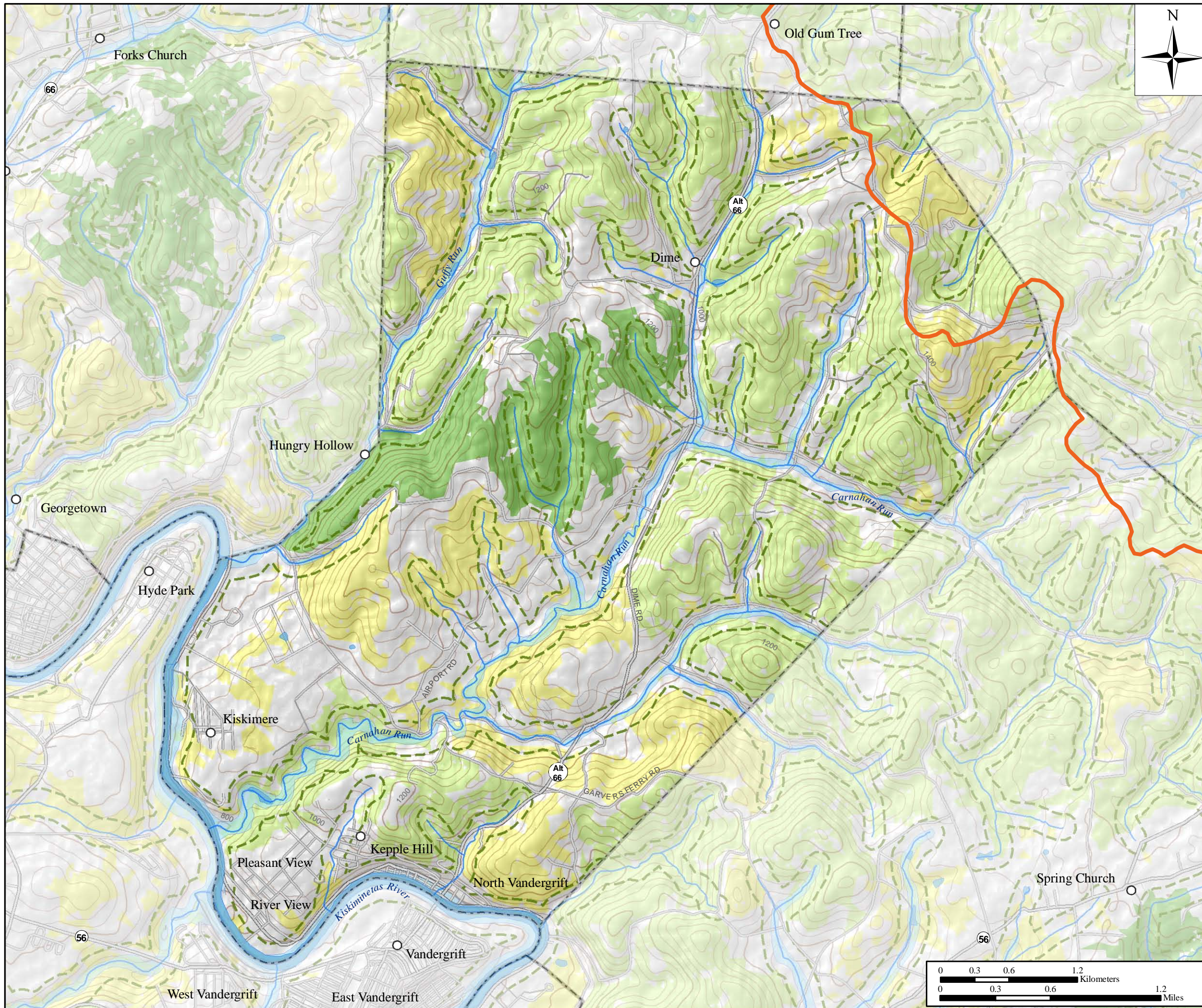
None Currently Identified

Landscape Conservation Areas

None Currently Identified

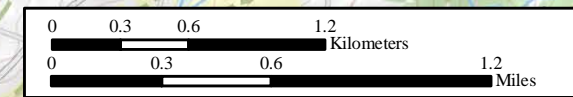
Public Land

None



Legend

- Landscape Conservation Area (LCA)
- Biological Diversity Area (BDA)
 - Core
 - Supporting Landscape
- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer
- Forest Blocks by Acre**
 - < 250
 - 251 - 500
 - 501 - 1000
 - > 1000
- Municipal Boundary
- PA Game Commission
- 40 Ft. Contour Line





Rocky Gleason, PNHP

The Kiskiminetas River has been impaired by abandoned mine drainage, limiting habitat for fish, mussels, and other aquatic species.

Perry Township & Parker City

	PNDI Rank ¹		Legal Status ¹		Last Seen	Quality ²
	Global	State	State (Proposed)			
NATURAL HERITAGE AREAS:						
Allegheny River hillside at Hillville BDA <i>Notable Significance</i>						
Sensitive species of concern ³	-	-	-		2002	E
Allegheny River Pool #9 BDA <i>Exceptional Significance</i>						
Elktoe (<i>Alasmidonta marginata</i>) – mussel	G4	S4	N(N)		2007	E
Wavy-rayed lampmussel (<i>Lampsilis fasciola</i>) – mussel	G5	S4	N(N)		2007	E
Pocketbook (<i>Lampsilis ovata</i>) – mussel	G5	S3S4	N(N)		1985	E
Paper pondshell (<i>Utterbackia imbecillis</i>) – mussel	G5	S3S4	N(CU)		1997	E
Red-head pondweed (<i>Potamogeton richardsonii</i>) – plant	G5	S3	PT(PR)		2002	E
Sensitive species of concern ³	-	-	-		1991	E
Sensitive species of concern ³	-	-	-		2000	E
Sensitive species of concern ³	-	-	-		2001	E
Sensitive species of concern ³	-	-	-		2000	E
Allegheny River shoreline at Dutch Hill BDA <i>High Significance</i>						
Blue false-indigo (<i>Baptisia australis</i>) – plant	G5	S2	N(PT)		2008	A
Big bluestem - Indian grass river grassland – natural community	GNR	S3	N(N)		2008	E
Allegheny River shoreline at Parker BDA <i>Notable Significance</i>						
Blue false-indigo (<i>Baptisia australis</i>) – plant	G5	S2	N(PT)		2008	A
Allegheny River shoreline at Upper Hillville BDA <i>Notable Significance</i>						
Blue false-indigo (<i>Baptisia australis</i>) – plant	G5	S2	N(PT)		2008	A
Big bluestem - Indian grass river grassland – natural community	GNR	S3	N(N)		2008	E
Allegheny River stretch through Parker and Hillville BDA <i>Exceptional Significance</i>						
Streamline chub (<i>Erimystax dissimilis</i>) – fish	G4	S3	N(N)		1999	E
Longhead darter (<i>Percina macrocephala</i>) – fish	G3	S2S3	N(PT)		1986	E
Elktoe (<i>Alasmidonta marginata</i>) – mussel	G5	S3	N(N)		2007	E
Wabash pigtoe (<i>Fusconaia flava</i>) – mussel	G5	S2	N(PE)		1987	E
Wavy-rayed lampmussel (<i>Lampsilis fasciola</i>) – mussel	G5	S4	N(N)		2007	E
Pocketbook (<i>Lampsilis ovata</i>) – mussel	G5	S3S4	N(N)		1997	E
Paper pondshell (<i>Utterbackia imbecillis</i>) – mussel	G5	S3S4	N(CU)		1991	E
Red-head pondweed (<i>Potamogeton richardsonii</i>) – plant	G5	S3	PT(PR)		2001	E
Sensitive species of concern ³	-	-	-		1998	E
Sensitive species of concern ³	-	-	-		2007	D
Sensitive species of concern ³	-	-	-		1991	E
Sensitive species of concern ³	-	-	-		2000	E
Bear Creek and North Branch Valleys BDA <i>Notable Significance</i>						
Northern pygmy clubtail (<i>Lanthes parvulus</i>) – dragonfly	G4	S3S4	N(N)		2007	E

LANDSCAPE CONSERVATION AREAS:

Allegheny River LCA

PUBLICLY MANAGED LAND:

None

1 = Please refer to Appendix I for an explanation of PNHP ranks and legal status

2 = Please refer to Appendix II for an explanation of quality

3 = This species is not named by request of the jurisdictional agency

Armstrong County Natural Heritage Inventory

Perry Township & Parker City

Biological Diversity Areas

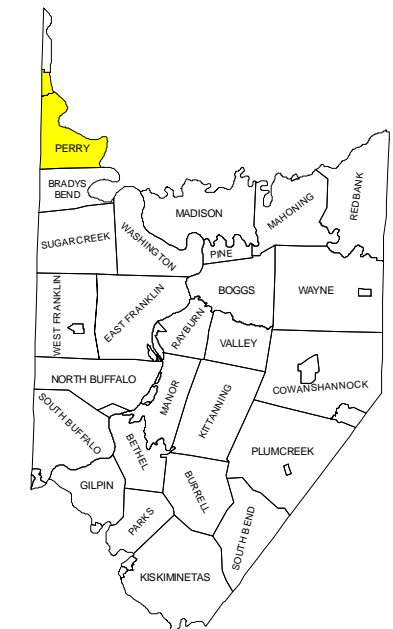
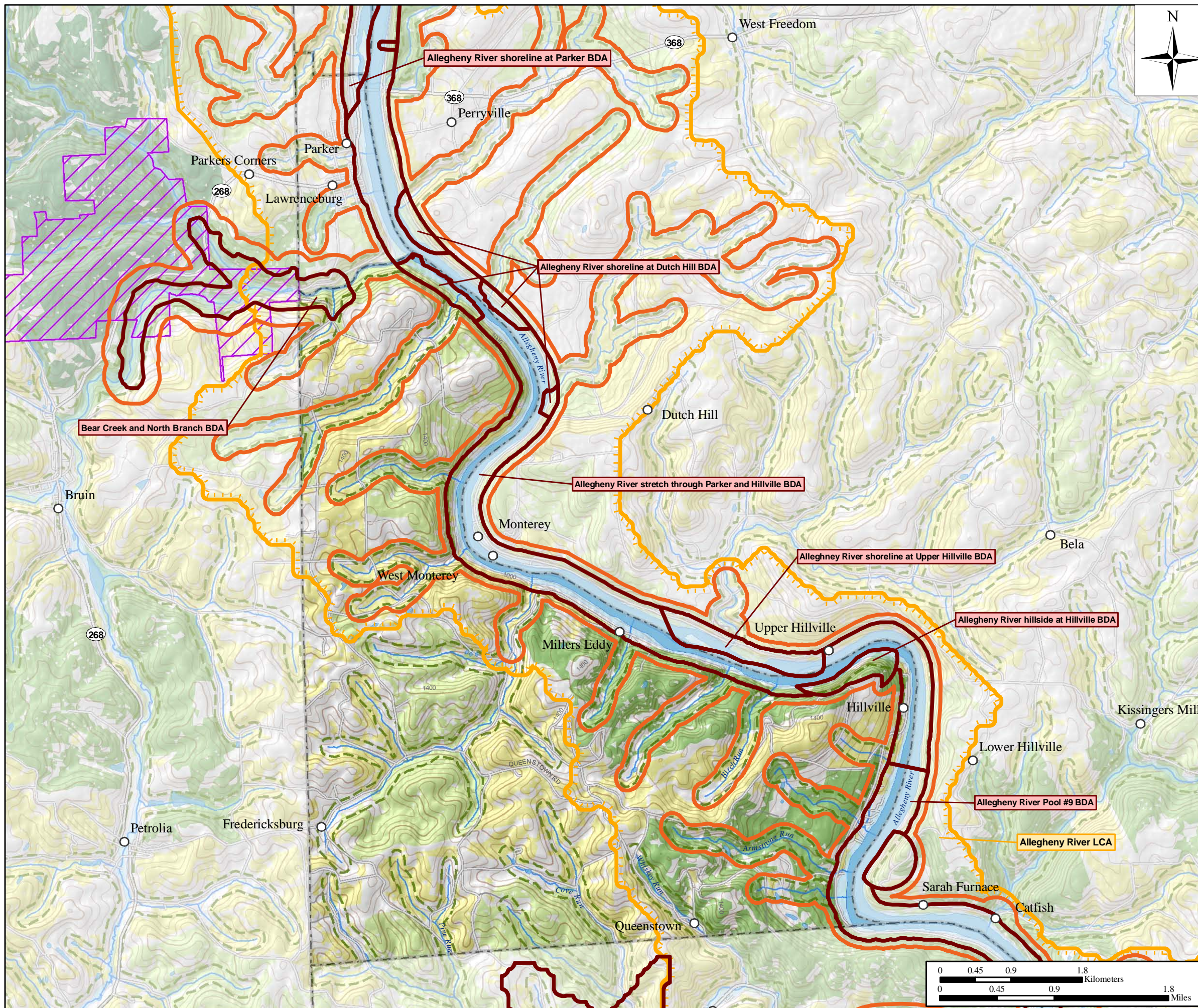
- Allegheny River hillside at Hillville BDA
- Allegheny River shoreline at Dutch Hill BDA
- Allegheny River Pool #9 BDA
- Allegheny River shoreline at Parker BDA
- Allegheny River shoreline at Upper Hillville BDA
- Allegheny River stretch through Parker and Hillville BDA
- Bear Creek and North Branch BDA

Landscape Conservation Areas

- Allegheny River LCA

Public Land

None



Legend

- Landscape Conservation Area (LCA)
- Biological Diversity Area (BDA)**
- Core
- Supporting Landscape
- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre

- < 250
- 251 - 500
- 501 - 1000
- > 1000

- Municipal Boundary
- PA Game Commission
- 40 Ft. Contour Line

PNHP
Pennsylvania Natural Heritage Program

0 0.45 0.9 1.8 Kilometers
0 0.45 0.9 1.8 Miles

Perry Township & Parker City

Perry Township is one of the northernmost townships in Armstrong County and shares a border with Butler County. The Allegheny River forms the eastern border of the township with Clarion County. The township covers 15.0 square miles in.

Tributaries along the southern edge of the township flow southward to Sugar Creek in Bradys Bend Township, but most of the township is drained by small tributaries to the Allegheny River. Land cover in the township is 25% agricultural and 61% forest. Management concerns should focus on maintaining this forest cover along streams and reestablishing vegetative buffers along waterways where it is lacking. Nearly all of Perry Township is in the area designated as The US Steel Mine Important Mammal Area (IMA).

Parker City

Parker City was settled in 1797 and incorporated in 1873. It occupies an area 1.1 square miles in size and has a population of 799 according to the 2000 U.S. census. The statistics have helped to earn it the title of the “Smallest City in the U.S.A.”. Land use in Parker City is 36% forest, 29% agriculture and 22% developed. Bear Creek forms the border between Perry Township and Parker City. This stream is impaired due to abandoned mine drainage. Efforts to restore this stream need to be addressed by all municipalities within the drainage basin.



Denise Watts, PNHP

Steep slopes along the Allegheny River have some of the largest forest blocks in the county.

Allegheny River hillside at Hillville BDA

– The steep, forested hillside along the Allegheny River at this location supports a breeding population of a **species of concern**. This species relies on high water quality for prey and undisturbed breeding habitat.

Threats and Stresses – This species is sensitive to disturbance during the breeding season. Even casual visitation may cause abandonment of the breeding site. Logging is a direct threat due to habitat loss.

Conservation Recommendations – Disturbance of the species of concern should be avoided, especially during the

breeding season from January – August. Avoid logging in this area.

Allegheny River Pool #9 BDA – The Allegheny River is one of the most ecologically significant areas in Armstrong County, including a large diversity of fish and mussel species. The Allegheny River begins in Potter County and flows north into New York. The river then turns south and flows down through Warren, Forest, and Venango Counties. As the Allegheny River enters Armstrong County it is free-flowing until it reaches Lock and Dam #9 north of Cosmus. The Allegheny River combines with the Monongahela River in Allegheny County, before it enters into the Ohio River. The lock and dam system was created in the 1920’s and 1930’s for navigation. The dams alter the natural flow of the river and create a different type of habitat than is found in the free-flowing sections upstream. Allegheny River Pool #9 is located north of Cosmus. This section of the river will be described upstream south of Hillville.

The health of the Allegheny River has been threatened by pollutants and other disturbance. Abandoned mine drainage has impacted many of the streams in Armstrong County. Few mussels were found in other waterways, due to lowered pH and diminished water quality. There are some other notable point source pollutants to the Allegheny, such as the PPG dump near Ford City that is imputing heavy metals into the river. The Allegheny River, however, seems able to maintain populations of species that are sensitive to changes in water quality.

Sand and gravel dredging is another threat facing aquatic species, especially mussels. The substrate is removed from the river bottom and is often used for road construction. Excavation of the substrate removes mussel habitat in areas that allow dredging, including Pool #9.

Despite the dams along the Allegheny River creating habitat that is deeper and slower moving than the free-flowing sections of the river, there are still some areas that have the shallow quick-moving riffle habitat that supports higher mussel populations. This habitat can especially be found below dams and near sediment deposits that have formed islands in the river.



Due to the depth in the Allegheny River pools, mussel surveys must be done using scuba gear.

Freshwater mussels are one group of organisms that require high water quality. While many mussel species historically known from the Allegheny River have been extirpated, certain sections of the river have some of the highest diversity of freshwater mussels in the state. Four freshwater mussel species of concern are currently known in the Allegheny River Pool #9- **elktoe** (*Alasmidonta marginata*), **paper pondshell** (*Utterbackia imbecillis*), **pocketbook** (*Lampsilis ovata*), and **wavy-rayed lampmussel** (*Lampsilis fasciola*). The PA-threatened **red-head pondweed** (*Potamogeton richardsonii*) grows submerged in the river, rooted in the cobble covered riverbed of the Allegheny River. As with the other rare species living in this stretch of the river, the continuation of red-head pondweed at this location depends largely on maintaining the water quality of the river. Allegheny River Pool #9 also provides habitat for **four other aquatic species of concern**.

Threats and Stresses – The habitat of the stream-dependent species can be considerably impacted from nearby land use decisions. Many of the steep hillsides and stream valleys along the Allegheny River are forested, but there are significant agricultural and mining operations on the banks of the river and within the Allegheny River watershed. In addition, the many impervious surfaces of the surrounding urban area, such as roads, parking lots and roof tops channel rain water directly into the waterways, taking numerous non-point source pollutants with them. Storm water runoff through urban and suburban areas can be a significant source of chemical pollutants for the waterways, which can severely impact water quality and the food chain of the river.

River dredging directly removes the substrate that the mussels imbed themselves in for most of their adult life. Fish also use this gravel habitat. Once the substrate has been removed, the flow of the river can be

altered, and sediment can fill in the holes left behind. The sediment makes the river bottom uninhabitable for many species.

Invasive plants, such as purple loosestrife (*Lythrum salicaria*) and Japanese knotweed (*Fallopia japonica*), can be quite common on the islands and along the banks of the river. These aggressive invasive plants dominate portions of the floodplain, outcompeting and displacing native vegetation. The zebra mussel (*Dreissena polymorpha*), another invasive species, has been located in several pools of the Allegheny River. This small mussel can grow on top of native mussels, substrate, and infrastructure in the water, altering the natural system and causing damage to pipes and other objects in the water.

Conservation Recommendations – Conservation efforts should focus on protecting and improving the quality of the surface water for both the local human community as well as for the habitat for the sensitive species of concern. Additional steps can be taken to protect and improve the aquatic habitat. Maintain and restore the natural hydrology of the Allegheny River. Restore floodplain habitats along the river’s edge to slow and filter runoff before it enters the aquatic system. Improve water quality of the river by providing vegetated buffers along inflows to the creek and along the river shoreline. Stop river dredging to maintain the remaining potential habitat for the aquatic species. Control invasive species of plants by eliminating new small populations. Larger well-established populations of invasive species will require a sustained and continual suppression effort to prevent their spread. Contain zebra mussels to those areas already affected by cleaning boats and other items used in the water to control their spread into new areas.

Allegheny River shoreline at Dutch Hill BDA

Allegheny River shoreline at Parker BDA

Allegheny River shoreline at Upper Hillville BDA



Rocky Gleason, PNHP

The rare big bluestem – Indian grass river grassland is often associated with blue false indigo (*Baptisia australis*) populations.

Fluctuations in the water level of the Allegheny River create cobbly scoured areas along the shoreline. This continual disturbance creates habitat that is suitable for herbaceous species. A **species of concern, blue false-indigo (*Baptisia australis*)**, is adapted to these conditions and cannot compete once woody species colonize an area from lack of disturbance. The **big bluestem - Indian grass river grassland** is a natural community of concern also found along river shorelines and islands in the Allegheny River. Changes in the flow of the river caused by the dams may eliminate the disturbance

necessary to maintain the scour habitat.

Threats and Stresses – Lack of disturbance causing succession to floodplain forests is one of the major threats to blue false-indigo and the natural community at this location. Modification of the natural flow of the river can alter the disturbance regime that is necessary to maintain this habitat. Invasive species, such

as reed canary grass and Japanese knotweed pose a threat to this species by choking out the blue false-indigo.

Conservation Recommendations – Alterations to the flow of the Allegheny River should be avoided in order to keep the habitat intact. Monitor known populations for invasive species and remove existing invasive species as soon as they are discovered to prevent successful colonization.

Allegheny River stretch through Parker and Hillville BDA – This stretch of the Allegheny River is the last free flowing section before entering the dammed portion that flows through the rest of Armstrong County. Water levels in this stretch have greater fluctuations that help to maintain the scoured cobbly shorelines more typical of the natural habitat. Freshwater mussels thrive in the natural cobbly riffles of the free flowing sections of the Allegheny River. Five mussel species of concern, **elktoe** (*Alasmidonta marginata*), **paper pondshell** (*Utterbackia imbecillis*), **pocketbook** (*Lampsilis ovata*), **wabash pigtoe** (*Fusconaia flava*), and **wavy-rayed lampmussel** (*Lampsilis fasciola*) were found in this stretch of the river. Two fish species of concern, **longhead darter** (*Percina macrocephala*) and **streamline chub** (*Erimystax dissimilis*) were identified in this area, and a plant species of concern, **red-head pondweed** (*Potamogeton richardsonii*), was found growing attached to the cobbly bottom of the river. **Four other species of concern** were also found in this stretch of the Allegheny River.

Threats and Stresses

Though the water quality is suitable for a number of species of concern, many of the tributaries that flow into this section of the river have been impaired from abandoned mine drainage pollution and other runoff.

Invasive species, such as Japanese knotweed (*Polygonum cuspidatum*) and purple loosestrife (*Lythrum salicaria*) are common along some sections of the shoreline and can displace native vegetation.

Conservation Recommendations

Planting native vegetation along the Allegheny River and its tributaries will improve the water quality and allow the species living in this stretch, both common and rare, to flourish. Abandoned oil and gas wells leaking acidic waters into these tributaries should be treated appropriately. Monitor and treat invasive species to control their spread and lessen their impact. Maintain the natural flow in this stretch of the river.



Northern pygmy clubtail (*Lanthus parvulus*)

Blair Nikula

Bear Creek and North Branch Valleys BDA

– This section of Bear Creek and the North Branch of Bear Creek provides habitat for **northern pygmy clubtail** (*Lanthus parvulus*), a dragonfly that is globally uncommon and vulnerable within Pennsylvania. More than the other species of dragonflies and damselflies observed here, the aquatic larvae of this species are dependent on clean, cool water. Much of Bear Creek, particularly the north branch, is bordered by eastern hemlock (*Tsuga canadensis*), which shade the water

and keep it cool, which helps the northern pygmy clubtail persist here.

The streamside forest is dominated by hemlock, sugar maple (*Acer saccharum*), and white oak (*Quercus alba*). The soils at this site are richly organic and support a diverse flora, including species such as green violet (*Hybanthus concolor*). Sandstone rock outcrops and large boulders are found throughout the valley. Much of this site is contained within SGL #95 in Butler County, but other portions are on private land.

Threats and Stresses – Many years ago Bear Creek was polluted from petroleum production and processing. Although this is no longer a source of pollution here, a newer problem throughout the watershed is abandoned mine drainage from the many strip mines on the slopes above the creek. Throughout this BDA, the stream is considered impaired by the Department of Environmental Protection.

Hemlock wooly adelgid is expected to reach this area in coming years, with devastating effects on hemlock populations. Because hemlock is one of the dominant canopy trees at site, especially along the stream, the loss of the deep shade provided by hemlocks may lead to an increase in stream temperature. This would reduce habitat quality for the northern pygmy clubtail, which needs cool water.

Northern pygmy clubtail larvae are vulnerable to siltation. Runoff from dirt and gravel roads in close proximity to streams can contribute to physical degradation of stream channels and erosion and pollution of the streams. Removal of forest cover on steep slopes is especially problematic because of the potential for increased runoff and erosion following storm events.

Conservation Recommendations – Forested stream corridors are key to maintaining high water quality. Logging, road development, strip mining, gas drilling, and other construction activities should be kept well outside of this riparian corridor in order to avoid degrading important aquatic and streamside habitat.

Pine Township

	PNDI Rank ¹		Legal Status ¹	Last Seen	Quality ²
	Global	State	State (Proposed)		

NATURAL HERITAGE AREAS:

Allegheny River Pool #8 BDA		<i>Exceptional Significance</i>			
River carpsucker (<i>Carpiodes carpio</i>) – fish	G5	S1	N(CU)	2000	E
River redhorse (<i>Moxostoma carinatum</i>) – fish	G4	S3S4	N(CU)	1997	E
Longhead darter (<i>Percina macrocephala</i>) – fish	G3	S2S3	N(PT)	2000	E
Elktoe (<i>Alasmidonta marginata</i>) – mussel	G4	S4	N(N)	2007	E
Wabash pigtoe (<i>Fusconaia flava</i>) – mussel	G5	S2	N(PE)	2007	B
Wavy-rayed lampmussel (<i>Lampsilis fasciola</i>) – mussel	G5	S4	N(N)	2007	E
Fragile papershell (<i>Leptodea fragilis</i>) – mussel	G5	S2	N(CR)	2005	D
Round pigtoe (<i>Pleurobema sintoxia</i>) – mussel	G4G5	S2	N(PE)	2004	E
Pink heelsplitter (<i>Potamilus alatus</i>) – mussel	G5	S2	N(CR)	2005	CD
Red-head pondweed (<i>Potamogeton richardsonii</i>) – plant	G5	S3	PT(PR)	2002	E
Sensitive species of concern ³	-	-	-	2007	E
Sensitive species of concern ³	-	-	-	2007	D
Sensitive species of concern ³	-	-	-	2005	E
Sensitive species of concern ³	-	-	-	2007	E

Templeton Mine BDA		<i>Notable Significance</i>			
Sensitive species of concern ³	-	-	-	2000	E

LANDSCAPE CONSERVATION AREAS: Allegheny River LCA

PUBLICLY MANAGED LAND: State Game Land #287

1 = Please refer to Appendix I for an explanation of PNHP ranks and legal status

2 = Please refer to Appendix II for an explanation of quality ranks

3 = This species is not named by request of the jurisdictional agency

Armstrong County Natural Heritage Inventory Pine Township

Biological Diversity Areas

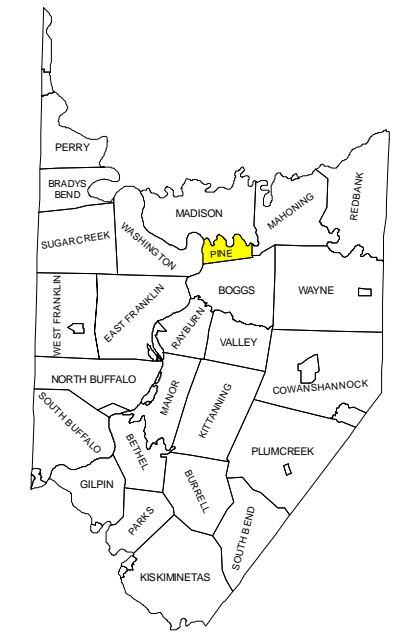
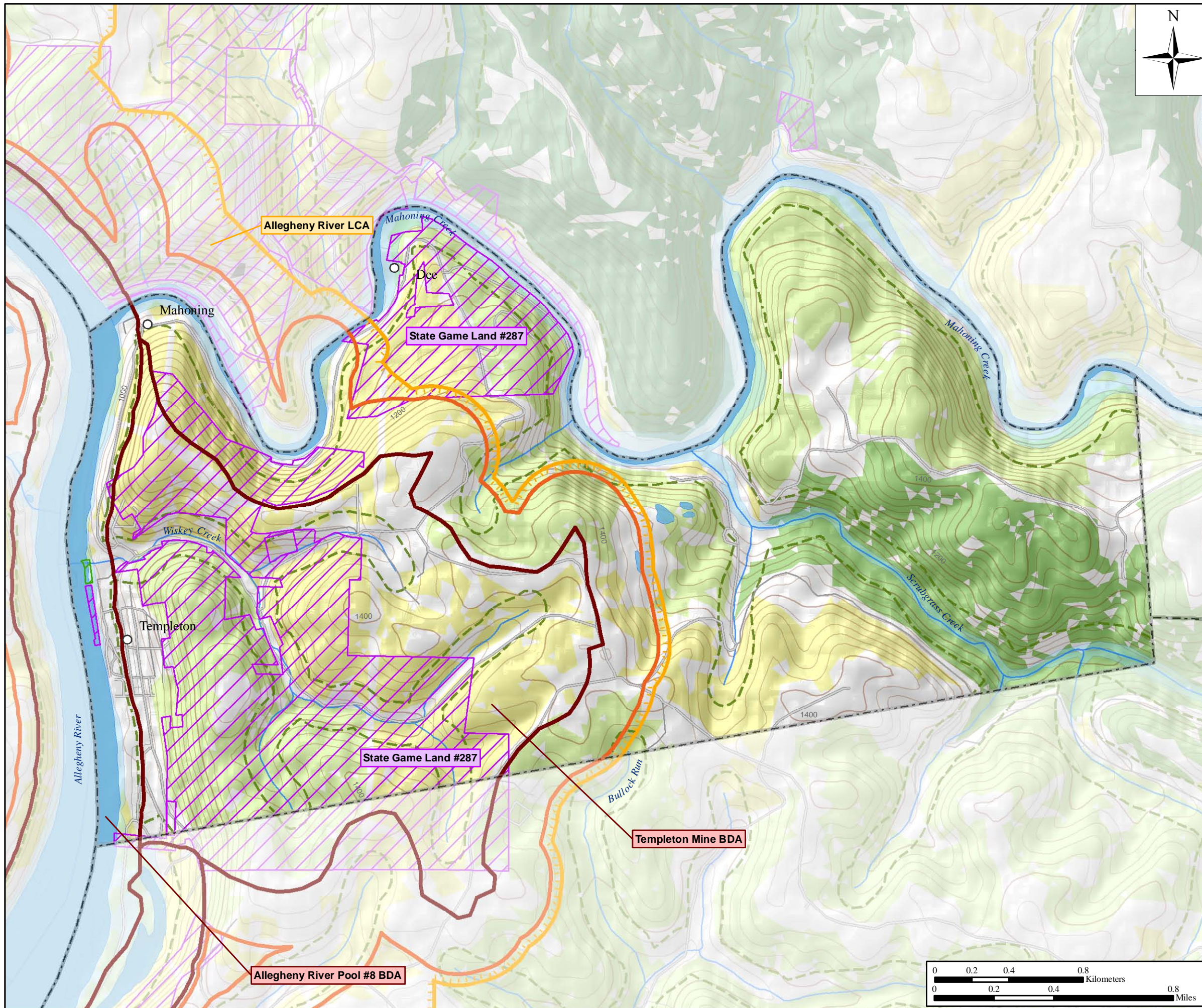
Allegheny River Pool #8 BDA
Templeton Mine BDA

Landscape Conservation Areas

Allegheny River LCA

Public Land

State Game Land #287



Legend

Landscape Conservation Area (LCA)

Biological Diversity Area (BDA)

Core

Supporting Landscape

Streams

National Wetland Inventory

100-year Floodplain

Recommended Riparian Buffer

Forest Blocks by Acre

- < 250
- 251 - 500
- 501 - 1000
- > 1000

Municipal Boundary

PA Game Commission

40 Ft. Contour Line

Pine Township

Pine Township is the third smallest township in Armstrong County, covering an area of just 5.4 square miles. Mahoning Creek forms the northern border of Pine Township while the Allegheny River forms its western border. Scrubgrass Creek drains the eastern half of the township and joins the Mahoning Creek at the township line. Whiskey Creek drains the southwest portion of the township and flows into the Allegheny River. Abandoned mine drainage impairs Whiskey Creek (Department of Environmental Protection 2009). Restoration of Whiskey Creek should be a priority for improving the waterway to the point that it can support aquatic life.

The western third of Pine Township is a part of the US Steel Mine Important Mammal Area (IMA). Much of this same area is also a part of State Game Lands (SGL) #287.

Agriculture accounts for 15% of land use and forest covers 69%. Forest blocks are found along the length of the Mahoning Creek and are critical in maintaining water quality.

Allegheny River Pool #8 BDA – The Allegheny River is one of the most ecologically significant areas in Armstrong County, including a large diversity of fish and mussel species. The Allegheny River begins in Potter County and flows north into New York. The river then turns south and flows down through Warren, Forest, and Venango Counties. As the Allegheny River enters Armstrong County it is free-flowing until it reaches Lock and Dam #9 north of Cosmus. The Allegheny River combines with the Monongahela River in Allegheny County, before it enters into the Ohio River. The lock and dam system was created in the 1920's and 1930's for navigation. The dams alter the natural flow of the river and create a different type of habitat than is found in the free-flowing sections. Allegheny River Pool #8 is located just above the town of Frenchs Corners and continues upstream north of Cosmus.

The health of the Allegheny River has been threatened by pollutants and other disturbance. Abandoned mine drainage has impacted many of the streams in Armstrong County. Few mussels were found in other waterways, due to lowered pH and diminished water quality. There are also some other notable point source pollutants to the Allegheny, such as the PPG dump near Ford City that is imputing heavy metals into the river. The Allegheny River, however, seems able to maintain populations of species that cannot tolerate low water quality.

Sand and gravel dredging is another threat facing aquatic species, especially mussels. The substrate is removed from the river bottom and is often used to build roads. This impacts the mussel habitat in areas that allow dredging, including portions of Pool #8.

Despite the dams along the Allegheny River creating habitat that is deeper and slower moving than most of the free-flowing sections of the river, there are still some areas that have the shallow quick-moving riffle habitat that supports higher mussel populations. This habitat can especially be found below dams and near sediment deposits that have formed islands in the river.

Freshwater mussels are one group of organisms that require high water quality. While many mussel species historically known from the Allegheny River have been extirpated, certain sections of the river have some of the highest diversity of freshwater mussels in the state. Six freshwater mussel species of concern are currently known in the Allegheny River Pool #8- **elktoe** (*Alasmidonta marginata*), **fragile papershell** (*Leptodea fragilis*), **pink heelsplitter** (*Potamilus alatus*), **round pigtoe** (*Pleurobema sintoxia*), **wabash pigtoe** (*Fusconaia flava*), and **wavy-rayed lampmussel** (*Lampsilis fasciola*). The Allegheny River is also home to a large number of fish species, including several species of concern. **Longhead darter** (*Percina macrocephala*), **river carpsucker** (*Carpionodes carpio*), and **river redhorse**

(*Moxostoma carinatum*), three fish species of concern, have been located along this section of the Allegheny River. Allegheny River Pool #8 also provides habitat for **four other aquatic animal species of concern**.

Threats and Stresses – The habitat of the stream-dependent species can be considerably impacted from nearby land use decisions. Many of the steep hillsides and stream valleys along the Allegheny River are forested, but there are significant agricultural and mining operations on the banks of the river and within the Allegheny River watershed. In addition, the many impervious surfaces of the surrounding urban area, such as roads, parking lots and roof tops channel rain water directly into the waterways, taking numerous non-point source pollutants with them. Storm water runoff through urban and suburban areas can be a significant source of chemical pollutants for the waterways, which can severely impact water quality and the food chain of the river.

River dredging directly removes the substrate that the mussels imbed themselves in for most of their adult life. Fish also use this gravel habitat. Once the substrate has been removed, the flow of the river can be altered, and sediment can fill in the holes left behind. The sediment makes the river bottom uninhabitable for many species.

Invasive plants, such as purple loosestrife (*Lythrum salicaria*) and Japanese knotweed (*Polygonum cuspidatum*), can be quite common on the islands and along the banks of the river. These aggressive invasive plants dominate portions of the floodplain, outcompeting and displacing native vegetation. The zebra mussel (*Dreissena polymorpha*), another invasive species, has been located in several pools of the Allegheny River. This small mussel can grow on top of native mussels, substrate, and infrastructure in the water, altering the natural system and causing damage to pipes and other objects in the water.

Conservation Recommendations – Conservation efforts should focus on protecting and improving the quality of the surface water for both the local human community as well as for the habitat for the sensitive species of concern. Additional steps can be taken to protect and improve the aquatic habitat. Maintain and restore the natural hydrology of the Allegheny River. Restore floodplain habitats along the river's edge to slow and filter runoff before it enters the aquatic system. Improve water quality of the river by providing vegetated buffers along inflows to the creek and along the river shoreline. Stop river dredging to maintain the remaining potential habitat for the aquatic species. Control invasive species of plants by eliminating new small populations. Larger well-established populations of invasive species will require a sustained and continual suppression effort to prevent their spread. Contain zebra mussels to those areas already affected by cleaning boats and other items used in the water to control their spread into new areas.

Templeton Mine BDA – This site is an abandoned mine shaft that now provides habitat for one **species of concern**. These abandoned mines mimic the natural cave habitats that these species typically use. The riparian forests near the mine provide critical foraging habitat for these species, and others using the mine.

Threats and Stresses – Forest fragmentation would limit foraging and roosting habitat, and the use of insecticides could limit the prey base for these species. The entrance to the mine has been gated to prevent disturbance, but trespassing and vandalism are still potential threats to this site.

Conservation Recommendations – Maintain the existing forests and replant the cleared areas with native trees and shrubs, especially along riparian corridors. Continue to gate the mine entrance and protect this site from trespassing and vandalism.



Denise Watts, PNHP

The large blocks of forested habitat remaining in Armstrong County should be preserved.

Plum Creek Township & Elderton Borough

	<u>PNDI Rank</u> ¹		<u>Legal Status</u> ¹	Last Seen	Quality ²
	Global	State	State (Proposed)		

NATURAL HERITAGE AREAS:

Keystone Lake BDA	<i>High Significance</i>				
Sora (<i>Porzana carolina</i>) – bird	G5	S3B	N(CR)	2008	E
Virginia Rail (<i>Rallus limicola</i>) – bird	G5	S3B	N(N)	2008	E
Paper pondshell (<i>Utterbackia imbecillis</i>) – mussel	G5	S3S4	N(TU)	2007	E
Sensitive species of concern ³	-	-	-	2008	B

LANDSCAPE CONSERVATION AREAS: None currently identified

PUBLICLY MANAGED LAND: None

1 = Please refer to Appendix I for an explanation of PNHP ranks and legal status

2 = Please refer to Appendix II for an explanation of quality ranks

3 = This species is not named by request of the jurisdictional agency

Armstrong County Natural Heritage Inventory

Plumcreek Township & Elderton Borough

Biological Diversity Areas

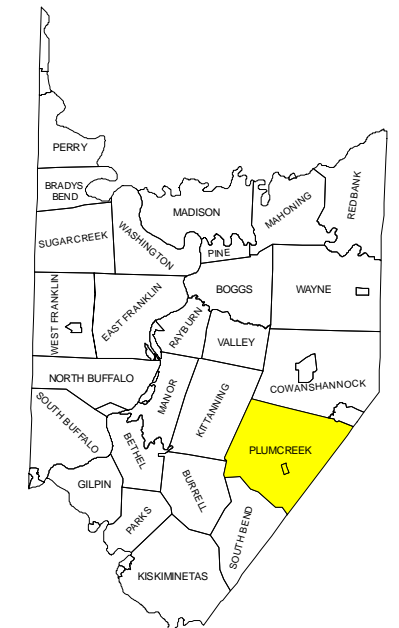
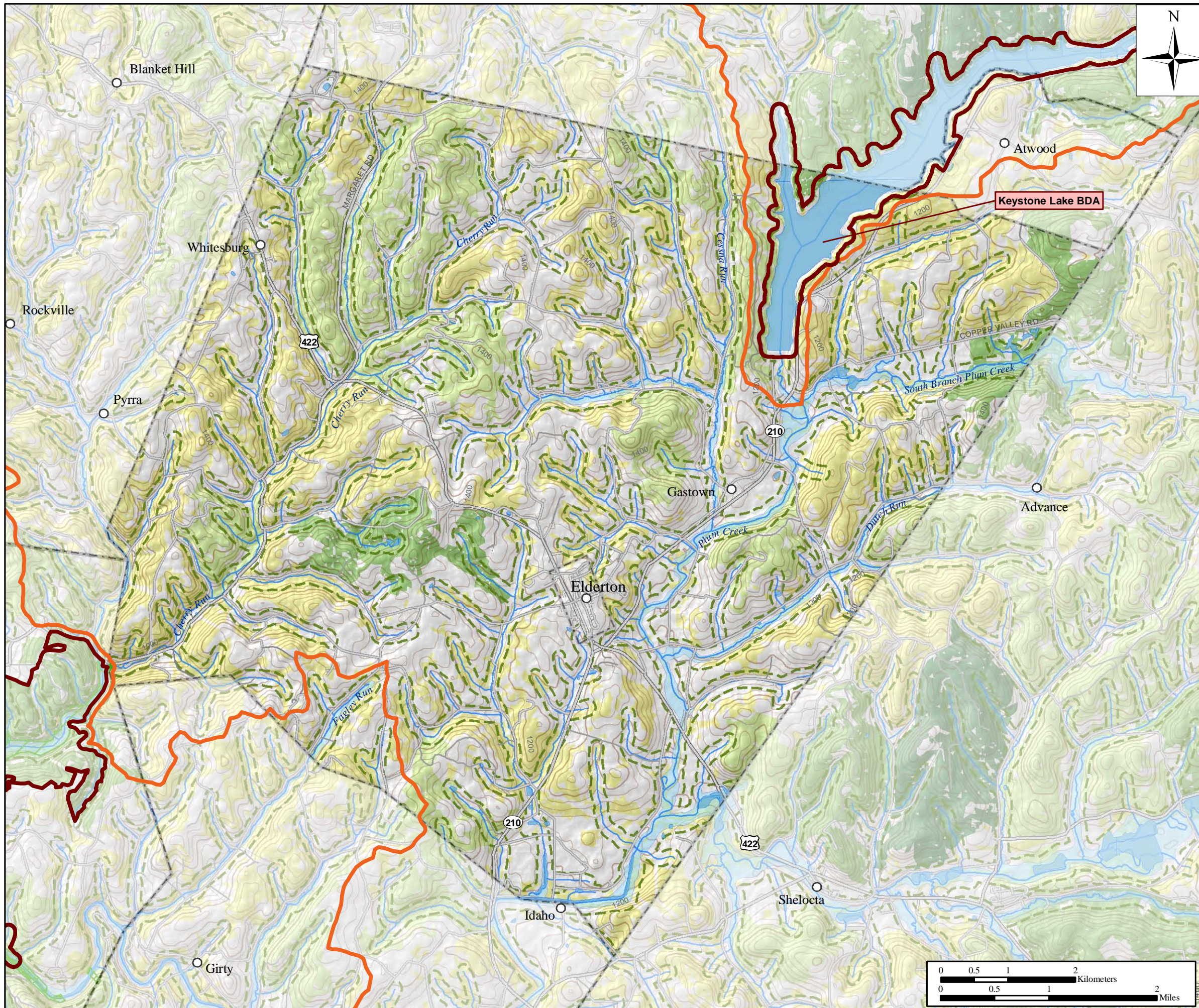
Keystone Lake BDA

Landscape Conservation Areas

None Currently Identified

Public Land

None



Legend

- Landscape Conservation Area (LCA)
- Biological Diversity Area (BDA)**
- Core
- Supporting Landscape
- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

PNHP
Pennsylvania Natural Heritage Program

Forest Blocks by Acre

- < 250
- 251 - 500
- 501 - 1000
- > 1000
- Municipal Boundary
- PA Game Commission
- 40 Ft. Contour Line

Plum Creek Township & Elderton Borough

Plum Creek was settled in 1788 and was one of six original townships formed in Armstrong County, along with Kittanning, Red Bank, Sugar Creek, Allegheny, and Buffalo Townships (the later two no longer exist). Plumcreek covers 42.3 square miles and is the third largest township in Armstrong County.

Plumcreek Township sits along the border with Indiana County in the southeast of Armstrong County. Plum Creek and Cherry Run and their tributaries carry water through the township and drain south into Crooked Creek. Most of the waterways in the township support aquatic life but abandoned mine drainage impairs one of the tributaries to Crooked Creek (Department of Environmental Protection 2009).

Land cover in the township is 31% agriculture and 44% forest. Much of the forest within the township is fragmented. Forest blocks within the township range from just a few acres to one just over 500 acres. An effort should be made to create forested buffers and corridors that would connect the small forest blocks. Vegetated buffers along streams would benefit wildlife by providing corridors between small forest blocks. The streamside buffers would also reduce non-point source pollution to the streams.

Elderton Borough

Elderton Borough is situated within Plumcreek Township. It occupies 0.28 square miles. Fourteen percent of the borough is forest, 31% is agriculture, and 52% is developed.

Keystone Lake – Keystone Lake was created by damming North Branch Plum Creek. The approximately 850 acre lake that was created is used to supply water to the Keystone Power Plant (www.armstrongcounty.com). A population of **paper pondshell** (*Utterbackia imbecillis*), a state imperiled mussel species of concern, was located at this site. This species prefers the muddy bottoms of lakes and ponds and can also be found in slow-moving, muddy bottomed sections of streams and rivers. Like other mussel species, paper pondshells need good water quality to survive.



Denise Watts, PNHP

The graminoid wetland at the northern end of Keystone Lake provides breeding habitat for several species of marsh birds.

The northern end of the lake has emergent vegetation that provides suitable breeding habitat for two state vulnerable wetland bird species of concern, **Sora** (*Porzana carolina*), and **Virginia Rail** (*Rallus limicola*). Both of these secretive species return in the spring to use wetlands with cattails and other emergent vegetation for breeding. Virginia Rails and Soras build nests over the water supported by wetland vegetation, while the shallow areas are used for foraging for seeds and invertebrates. Another **species of concern** was also located at this site.

Threats and Stresses – Destruction of wetland habitat is the primary threat to Sora, Virginia Rail, and other wetland species. The water quality must also be protected to maintain the integrity of the wetland and

ensure that there are enough aquatic invertebrates to provide a food base. Maintaining high water quality is also vital to the survival of paper pondshells in the reservoir. Unauthorized collection is a threat for the other species of concern at this site, as well as hunting of the wetland bird species. This site is also used as a boat launch, and this area may be disturbed by people using this area. Horses are often tied in the area where the species of concern is located. Grazing or trampling by horses and deer are threats to this population.

Conservation Recommendations – The wetland habitat must be protected to prevent filling, draining, or permanent flooding. A native vegetative buffer of at least 100 meters (328 feet) should be maintained around the wetland to protect the water quality. Disturbance to the wetland area should be limited, especially during the breeding season from May through July.

Rayburn Township & Kittanning Borough

	PNDI Rank ¹		Legal Status ¹	Last Seen	Quality ²
	Global	State	State (Proposed)		

NATURAL HERITAGE AREAS:

Allegheny River Island at Kittanning BDA		<i>Notable Significance</i>			
Blue false-indigo (<i>Baptisia australis</i>)	G5	S2	N(PT)	2008	A

Allegheny River Pool #6 BDA		<i>Exceptional Significance</i>			
Goldeye (<i>Hiodon alosoides</i>) – fish	G5	S2?	PT(PT)	1986	E
River redhorse (<i>Moxostoma carinatum</i>) – fish	G4	S3S4	N(CU)	1997	E
Longhead darter (<i>Percina macrocephala</i>) – fish	G3	S2S3	N(PT)	1986	E
Elktoe (<i>Alasmidonta marginata</i>) – mussel	G4	S4	N(N)	2007	E
Wabash pigtoe (<i>Fusconaia flava</i>) – mussel	G5	S2	N(PE)	2007	B
Fragile papershell (<i>Leptodea fragilis</i>) – mussel	G5	S2	N(CR)	2005	D
Round pigtoe (<i>Pleurobema sintoxia</i>) – mussel	G4G5	S2	N(PE)	2007	E
Pink heelsplitter (<i>Potamilus alatus</i>) – mussel	G5	S2	N(CR)	2005	CD
Sensitive species of concern ³	-	-	-	2005	E
Sensitive species of concern ³	-	-	-	2007	E

Allegheny River Pool #7 BDA		<i>Exceptional Significance</i>			
River redhorse (<i>Moxostoma carinatum</i>) – fish	G4	S3S4	N(CU)	1997	E
Elktoe (<i>Alasmidonta marginata</i>) – mussel	G4	S4	N(N)	2007	E
Wabash pigtoe (<i>Fusconaia flava</i>) – mussel	G5	S2	N(PE)	2007	B
Fragile papershell (<i>Leptodea fragilis</i>) – mussel	G5	S2	N(CR)	2005	D
Pink heelsplitter (<i>Potamilus alatus</i>) – mussel	G5	S2	N(CR)	2005	CD
Paper pondshell (<i>Utterbackia imbecillis</i>) – mussel	G5	S3S4	N(CU)	2001	E
Sensitive species of concern ³	-	-	-	2007	E
Sensitive species of concern ³	-	-	-	2005	E
Sensitive species of concern ³	-	-	-	2007	E

LANDSCAPE CONSERVATION AREAS: Allegheny River LCA

PUBLICLY MANAGED LAND: None

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Armstrong County Natural Heritage Inventory

Rayburn Township & Kittanning Borough

Biological Diversity Areas

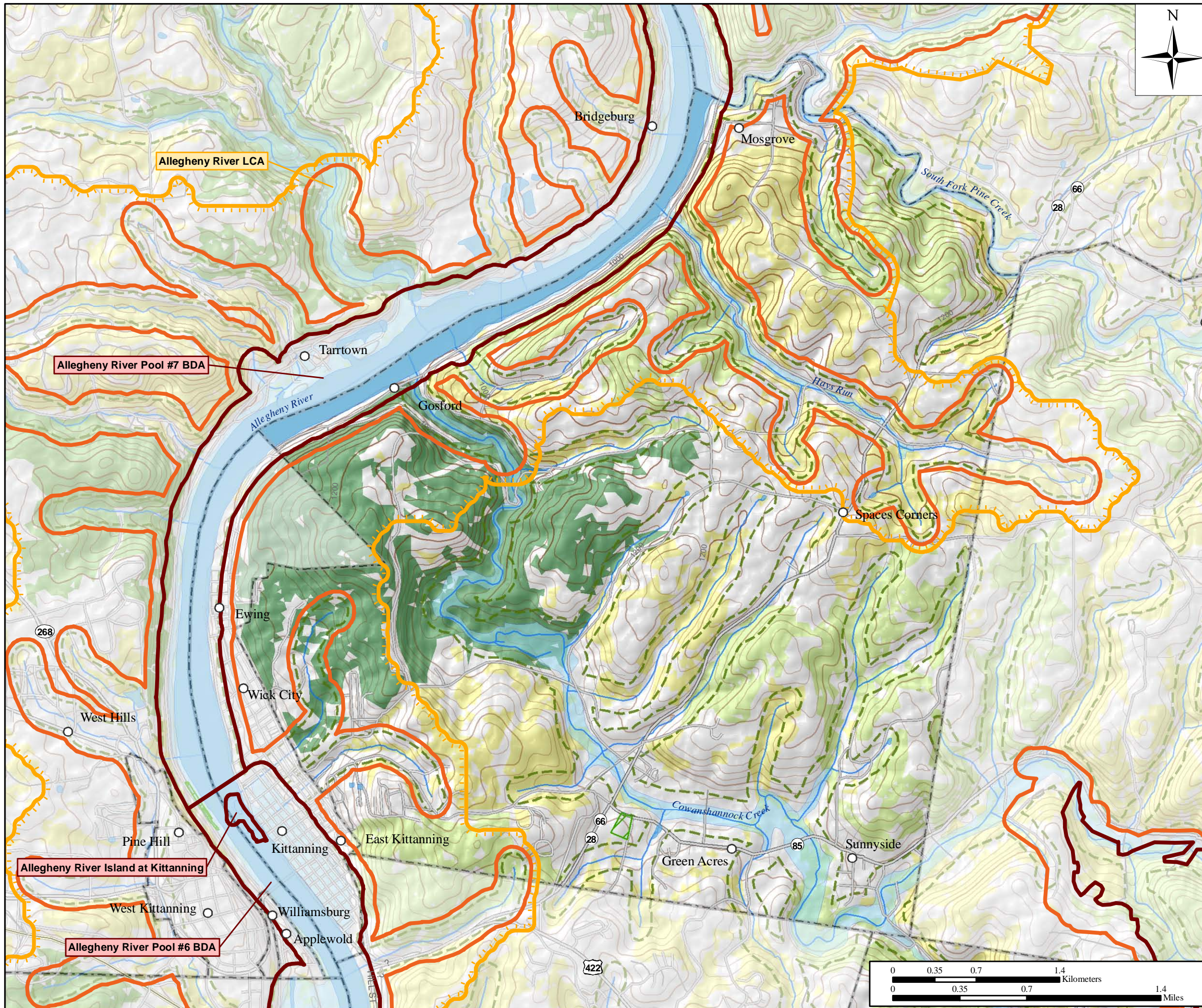
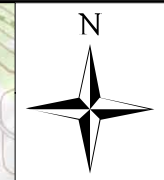
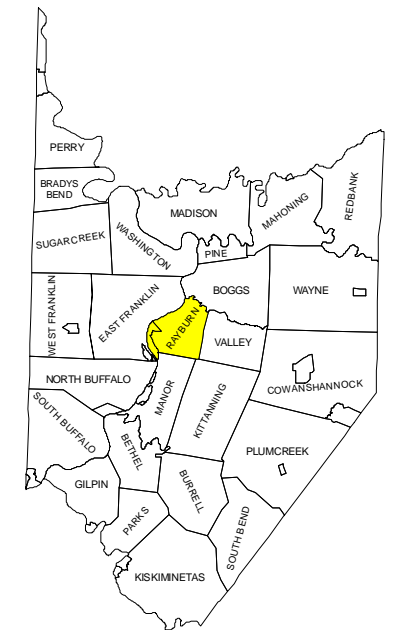
- Allegheny River Island at Kittanning
- Allegheny River Pool #6 BDA
- Allegheny River Pool #7 BDA

Landscape Conservation Areas

- Allegheny River LCA

Public Land

- None



Legend

Landscape Conservation Area (LCA)

Biological Diversity Area (BDA)

- Core
- Supporting Landscape

Streams

National Wetland Inventory

100-year Floodplain

Recommended Riparian Buffer

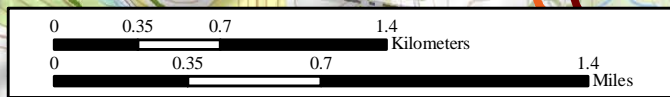
Forest Blocks by Acre

- < 250
- 251 - 500
- 501 - 1000
- > 1000

Municipal Boundary

PA Game Commission

40 Ft. Contour Line



Rayburn Township & Kittanning Borough

Rayburn Township sits along the east side of the Allegheny River in the central region of Armstrong County and covers an area of 12.4 sq miles. The Cowanshannock Creek and Hays Run drain much of the township and flow westward to the Allegheny River, which forms the western township boundary. The South Fork Pine Creek establishes most of the northern township line to the point of its confluence with North Fork Pine Creek. Pine Creek then forms the remainder of the northern border.

Abandoned mine drainage affects a number of tributaries that feed into Cowanshannock Creek (Department of Environmental Protection 2009). Restoring these streams to health should be a priority. Land cover in the township is 32% agriculture and 51% forest. A large forest block of over 1200 acres is found in the southwestern part of the township along the Allegheny River. An effort should be made to protect the forest that currently exists in the township and to create forest buffers along the Cowanshannock Creek and Hays Run where they are absent in order to reduce non-point source pollution into these waterways.

Kittanning Borough

Kittanning Borough was settled in 1724 at the site of a former Native American village named Kit-Han-Ne. According to the 2000 U.S. Census, Kittanning has the largest population of any borough in Armstrong County (pop. 4787) and serves as the county seat of Armstrong County. The borough occupies 1.0 square miles of land of which 28% is forest, 50% is developed and 20% is water. The borough sits along the eastern bank of the Allegheny River at the southwest edge of Rayburn Township.

Allegheny River Island at Kittanning BDA – A good-quality population of the PA-threatened plant species of concern, **blue false-indigo** (*Baptisia australis*), occurs on the island and along the shoreline of the Allegheny River at Kittanning. An additional small population of this plant species occurs at Crooked Creek's confluence with the Allegheny. Blue false-indigo, like the grasslands it is often associated with, is found scattered along the Allegheny River and its major tributaries primarily above the series of flat water pools created by the system of locks and dams. This plant is most frequently associated with sand and cobble deposits within high energy floodplains that receive periodic flooding and scour disturbance. The potential habitat for this species has been greatly diminished by the river's habitat modification. Most of the populations of this species within the lock and dam system occur in the shallower water just below the dams or in very small scattered populations. At this location, the relatively shallow water just below Lock & Dam #7 provides suitable sand and cobble substrate habitat along the shoreline and the adjacent island.

Threats and Stresses – The blue false-indigo at this location occurs along the shoreline of the river and the adjacent island just below the dam. It is likely that if the system of locks and dams were not in place, this rare plant would be more prevalent in sand and cobble floodplain habitats along the lower Allegheny River.

Invasive species of plants and the introduced zebra mussel impact habitat quality by competing for resources and displacing native species. Japanese knotweed, purple loosestrife, and garden loosestrife are currently present along the river shoreline.

Conservation Recommendations – Conservation efforts should focus on protecting and improving the quality of the surface water for both the local human community as well as for the habitat for the various species of concern associated with the river. Install or upgrade abandoned mine drainage mitigation systems to help correct this source of aquatic pollution. Reclaim former open strip mine areas by restoring natural contours and replanting in a variety of native vegetation suitable to the location. Maintain and restore floodplain habitats along the river's edge to slow and filter runoff before it enters the aquatic system. Improve water quality of the river by providing vegetated buffers along inflows to the river and along the river shoreline.

Monitor and regulate land use in the watershed to prevent siltation. Closely monitor construction, mining and agricultural activities to minimize siltation and acid runoff.

Any future riverfront development should be set back a minimum of 100 feet from the river's floodplain. As older buildings within the floodplain become unusable, the area they occupy should be converted to riverfront riparian buffer. In essence, human buildings and infrastructure should retreat from the river's edge to protect and improve the quality of the water and habitat for all species including human communities.

Invasive species of plants are frequently a problem along many riparian areas and control efforts need to be targeted and continuous. Currently, the most common and aggressive invasive species of plants encountered on the floodplain are Japanese knotweed, purple loosestrife and garden loosestrife. Japanese knotweed in particular poses a direct threat due to its potential to occupy the same habitat as blue false-indigo. Control invasive species of plants by first eliminating new small pioneer populations. Larger well-established populations of invasive species will require a sustained and continual suppression effort to prevent their spread.

Allegheny River Pool #6 BDA

Allegheny River Pool #7 BDA

The Allegheny River is one of the most ecologically significant areas in Armstrong County, including a large diversity of fish and mussel species. The Allegheny River begins in Potter County and flows north into New York. The river then turns south and flows down through Warren, Forest, and Venango Counties. As the Allegheny River enters Armstrong County it is free-flowing until it reaches Lock and Dam #9 north of Cosmus. The Allegheny River combines with the Monongahela River in Allegheny County, before it enters into the Ohio River. The lock and dam system was created in the 1920's and 1930's for navigation. The dams alter the natural flow of the river and create a different type of habitat than is found in the free-flowing sections.

The health of the Allegheny River has been threatened by pollutants and other disturbance. Abandoned mine drainage has impacted many of the streams in Armstrong County. Few mussels were found in other waterways, due to lowered pH and diminished water quality. There are also some other notable point source pollutants to the Allegheny, such as the PPG dump near Ford City that is imputing heavy metals into the river. The Allegheny River, however, seems able to maintain populations of species that cannot tolerate low water quality.

Sand and gravel dredging is another threat facing aquatic species, especially mussels. The substrate is removed from the river bottom and is often used to build roads. This impacts the mussel habitat in areas that allow dredging, including Pool #7.

Despite the dams along the Allegheny River creating habitat that is deeper and slower moving than most of the free-flowing sections of the river, there are still some areas that have the shallow, quick-moving riffle habitat that supports higher mussel populations. This habitat can especially be found below dams and near sediment deposits that have formed islands in the river.

Freshwater mussels are one group of organisms that require high water quality. While many mussel species historically known from the Allegheny River have been extirpated, certain sections of the river have some of the highest diversity of freshwater mussels in the state.

Allegheny River Pool #6 is located above the village of Kelly Station and continues upstream to Kittanning. Dredging in Pool #6 has been banned since 1985, protecting the habitat for aquatic species. Five freshwater mussel species of concern are currently known in the Allegheny River Pool #6- **elktoe** (*Alasmidonta marginata*), **fragile papershell** (*Leptodea fragilis*), **pink heelsplitter** (*Potamilus alatus*), **round pigtoe** (*Pleurobema sintoxia*), and **wabash pigtoe** (*Fusconaia flava*). The Allegheny River is also home to a large

number of fish species, including several species of concern. **Longhead darter** (*Percina microcephalus*), **goldeye** (*Hiodon alosoides*) and **river redhorse** (*Moxostoma carinatum*), three fish species of concern, have all been located along this section of the Allegheny River. Allegheny River Pool #6 also provides habitat for **two other aquatic animal species of concern**.

Allegheny River Pool #7 is located in Kittanning and continues upstream near the town of Frenchs Corners. Five freshwater mussel species of concern are currently known in the Allegheny River Pool #7- **elktoe** (*Alasmidonta marginata*), **fragile papershell** (*Leptodea fragilis*), **paper pondshell** (*Utterbackia imbecillis*), **pink heelsplitter** (*Potamilus alatus*), and **wabash pigtoe** (*Fusconaia flava*). The Allegheny River is also home to a large number of fish species, including several species of concern. **River carpsucker** (*Carpionodes carpio*) and **river redhorse** (*Moxostoma carinatum*), two fish species of concern, have been located along this section of the Allegheny River. Allegheny River Pool #7 also provides habitat for **three other aquatic animal species of concern**.

Threats and Stresses – The habitat of the stream-dependent species can be considerably impacted from nearby land use decisions. Many of the steep hillsides and stream valleys along the Allegheny River are forested, but there are significant agricultural and mining operations on the banks of the river and within the Allegheny River watershed. This section of the Allegheny River flows through the more populated areas of the county, specifically Kittanning and Ford City. A large portion of Kittanning lies within the floodplain of the Allegheny River, putting this area in danger of flooding. In addition, the many impervious surfaces of the surrounding urban area, such as roads, parking lots, and roof tops channel rain water directly into the waterways, taking numerous non-point source pollutants with them. Storm water runoff through urban and suburban areas can be a significant source of chemical pollutants for the waterways, which can severely impact water quality and the food chain of the river. The PPG dump below Ford City a notable source of point source pollution that is leaching heavy metals and other point source pollutants directly into the Allegheny River.

River dredging directly removes the substrate that the mussels imbed themselves in for most of their adult life. Fish also use this gravel habitat. Once the substrate has been removed, the flow of the river can be altered, and sediment can fill in the holes left behind. The sediment makes the river bottom uninhabitable for many species.

Invasive plants, such as purple loosestrife (*Lythrum salicaria*) and Japanese knotweed (*Polygonum cuspidatum*), can be quite common on the islands and along the banks of the river. These aggressive invasive plants dominate portions of the floodplain, outcompeting and displacing native vegetation. The zebra mussel (*Dreissena polymorpha*), another invasive species, has been located in several pools of the Allegheny River. This small mussel can grow on top of native mussels, substrate, and infrastructure in the water, altering the natural system and causing damage to pipes and other objects in the water.

Conservation Recommendations – Conservation efforts should focus on protecting and improving the quality of the surface water for both the local human community as well as for the habitat for the sensitive species of concern. Additional steps can be taken to protect and improve the aquatic habitat. Maintain and restore the natural hydrology of the Allegheny River. Restore floodplain habitats along the river's edge to slow and filter runoff before it enters the aquatic system. Improve water quality of the river by providing vegetated buffers along inflows to the creek and along the river shoreline. Stop river dredging to maintain the remaining potential habitat for the aquatic species. Control invasive species of plants by eliminating new small populations. Larger well-established populations of invasive species will require a sustained and continual suppression effort to prevent their spread. Contain zebra mussels to those areas already affected by cleaning boats and other items used in the water to control their spread into new areas.

Redbank Township

	PNDI Rank ¹		Legal Status ¹	Last Seen	Quality ²
	Global	State	State (Proposed)		

NATURAL HERITAGE AREAS:

Mahoning Creek Dam Outflow BDA			<i>High Significance</i>		
Sensitive species of concern ³	-	-	-	2008	E
Mahoning Creek Reservoir Shoreline BDA			<i>Notable Significance</i>		
Cattail sedge (<i>Carex typhina</i>) – plant	G5	S2	PE(PT)	2008	AB
Sensitive species of concern ³	-	-	-	2008	E
Redbank Creek at Mayport BDA			<i>Notable Significance</i>		
Sensitive species of concern ³	-	-	-	2008	E

LANDSCAPE CONSERVATION AREAS: None currently identified

PUBLICLY MANAGED LAND: None

1 = Please refer to Appendix I for an explanation of PNHP ranks and legal status

2 = Please refer to Appendix II for an explanation of quality ranks

3 = This species is not named by request of the jurisdictional agency

Armstrong County Natural Heritage Inventory Redbank Township

Biological Diversity Areas

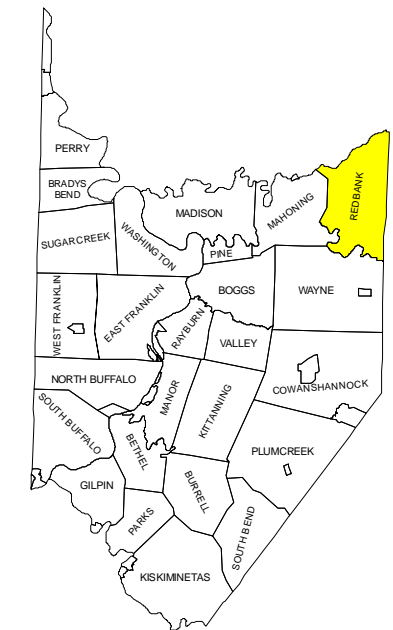
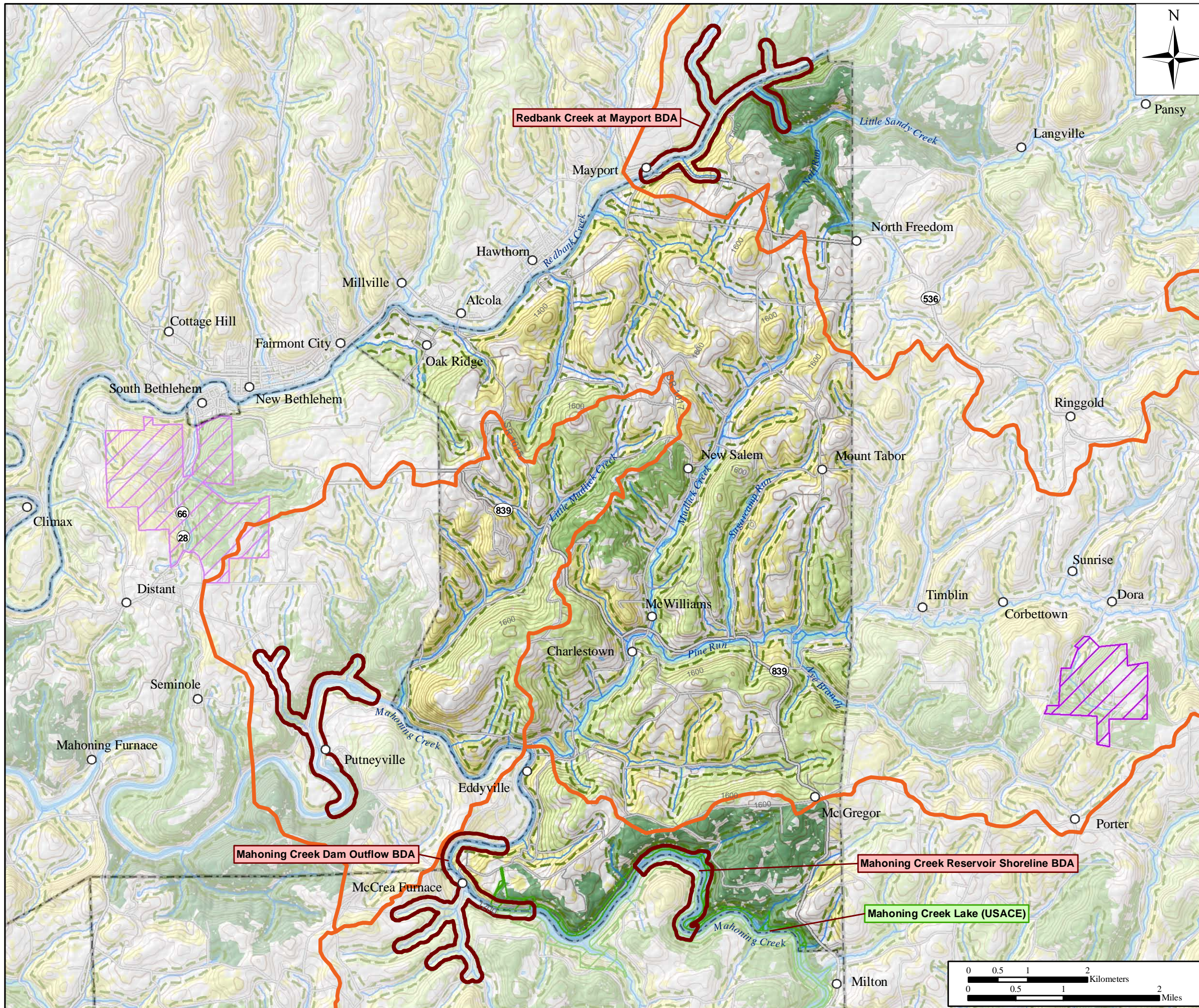
- Mahoning Creek Dam Outflow BDA
- Mahoning Creek Reservoir Shoreline BDA
- Redbank Creek at Mayport BDA

Landscape Conservation Areas

None Currently Identified

Public Land

- Mahoning Creek Lake (USACE)



Legend

- Landscape Conservation Area (LCA)
- Biological Diversity Area (BDA)**
 - Core
 - Supporting Landscape
- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Pennsylvania Natural Heritage Program

- Forest Blocks by Acre**
 - < 250
 - 251 - 500
 - 501 - 1000
 - > 1000
- Municipal Boundary
- US Army Corps of Engineers
- PA Game Commission
- 40 Ft. Contour Line

Redbank Township

Redbank is one of the six original townships formed in Armstrong County in 1806. The township anchors the northeast corner of the county sharing borders with Jefferson County to the east and Clarion County to the north. The township is 32.6 square miles in size.

The Redbank Creek, which flows between Redbank Township and Clarion County, drains the northern third of the township. The Mahoning Creek marks the southern border with Wayne Township and part of the western border with Mahoning Township. Within the township the Little Mudlick Creek and Pine Run flow westward to the Mahoning Creek. Metals and siltation from abandoned mine drainage impair Pine Run and its tributaries (Department of Environmental Protection 2009). Efforts to restore these streams should be a priority along with similar efforts upstream along Pine Run in Jefferson County.

Over half of the township is forested (55%) and 34% is in agriculture. Several large forest blocks exist along the Mahoning Creek and others in the central area of the township and the far northeastern corner. Riparian buffers should be created in the northern half of the county to create connecting corridors for wildlife between the smaller fragmented forest blocks and to reduce the effects of non-point source pollution along unprotected stream banks.

Mahoning Creek Dam outflow BDA – An occurrence of a **species of concern** was found below the dam on Mahoning Creek. Most of this section of Mahoning Creek has a forested buffer of at least 100 meters (328 feet), which will help to keep the water quality high. Relying on clean water to maintain healthy invertebrate prey populations, this species also uses bushy vegetation along the creek. Streamside vegetation along the creek is necessary for the maintenance of the water quality and to provide critical habitat for the species of concern found at this site.

Threats and Stresses – Riparian vegetation is important to this species as habitat and also as a filter for pollutants. Some portions of the riparian area have been thinned for agriculture. Removal of the riparian vegetation would destroy habitat and allow runoff to enter directly into the stream.

Recommendations – Maintain riparian vegetation to provide habitat and protect water quality for the species of concern located at this site.

Mahoning Creek Reservoir shoreline BDA – Mahoning Creek Reservoir was created by the damming of Mahoning Creek in 1941 as a means of controlling floodwaters in the lower Allegheny and Ohio Rivers. The water level in the reservoir fluctuates widely as floodwaters alternately fill and are released, establishing an ebb and flow, like an irregular tide. The difference between average summer water level height and full capacity at the dam breast is roughly 65 feet. Debris from past flood events such as tree parts as well as assorted trash litters the shoreline in a wide band extending up the slope of the shoreline.

The fluctuating water level along the shoreline helps to foster habitat conditions favorable for an unusually large and healthy population of the PA-endangered plant species of concern, **cattail sedge** (*Carex typhina*). The species typically grows in wet woods and bottomlands, particularly around the edges of low spots that intermittently have standing water. Another **species of concern** was also located breeding at this site.

Threats and Stresses – There are no evident threats to these species at this location and management does not seem to be necessary. The artificially induced shoreline fluctuations actually help maintain favorable habitat conditions for the cattail sedge. The plants are dispersed widely along the reservoir shoreline and are unlikely to be impacted by park recreational activities. Poorly sited infrastructure improvements such

as access roads and parking lots could eliminate portions of the habitat for this species. Disturbance to the other species of concern at this site could affect nesting success.

Conservation Recommendations – Any future infrastructure improvements should remain a respectful distance from the active floodplain of the reservoir. Limit accessibility to nesting location of the species of concern, especially during the nesting period from January to June.

Redbank Creek at Mayport BDA – An occurrence of a **species of concern** was found along this stretch of Redbank Creek. This is one of the more heavily forested sections of Redbank Creek, which provides a vegetative buffer necessary to maintain high water quality. Relying on clean water to maintain healthy invertebrate prey populations, this species also uses bushy vegetation along the creek. Streamside vegetation along the creek is necessary for the maintenance of the water quality and to provide critical habitat for the species of concern found at this site.

Threats and Stresses – Riparian vegetation is important to this species as habitat and also as a filter for pollutants. Some portions of the riparian area have been thinned for agriculture. Removal of the remaining riparian vegetation would destroy habitat and allow runoff to enter directly into the stream. Pesticides or fertilizers used on the agricultural fields may also degrade water quality.

Recommendations – Maintain riparian vegetation to provide habitat and protect water quality for the species of concern located at this site.



Rocky Gleason, PNHP

Debris from flooding events is scattered along the shoreline of Mahoning Lake.

South Bend Township

	<u>PNDI Rank</u> ¹		<u>Legal Status</u> ¹	Last Seen	Quality ²
	Global	State	State (Proposed)		

NATURAL HERITAGE AREAS:

none currently identified

LANDSCAPE CONSERVATION AREAS:

None currently identified

PUBLICLY MANAGED LAND:

None

1 = Please refer to Appendix I for an explanation of PNHP ranks and legal status

2 = Please refer to Appendix II for an explanation of quality ranks

South Bend Township

South Bend Township sits along the southeastern edge of Armstrong County and shares a border with Indiana County. Crooked Creek and its tributaries drain much of the township. Whiskey Run, Craig Run, and Big Run have their start in the southeastern part of the township and flow into Indiana County carrying water degraded by abandoned mine drainage (Department of Environmental Protection 2009).

The township covers 22.8 square miles. Land use is evenly split between forest (46%) and agriculture (45%). The largest forest blocks are between 300 – 600 acres in size. Many of the waterways within the township flow through areas without the benefit of streamside buffers. Efforts should be made to create riparian buffers where they are lacking to filter non-source pollutants that will help maintain aquatic life found in the streams. Water quality issues due to abandoned mine drainage need to be addressed.

Armstrong County Natural Heritage Inventory South Bend Township

Biological Diversity Areas

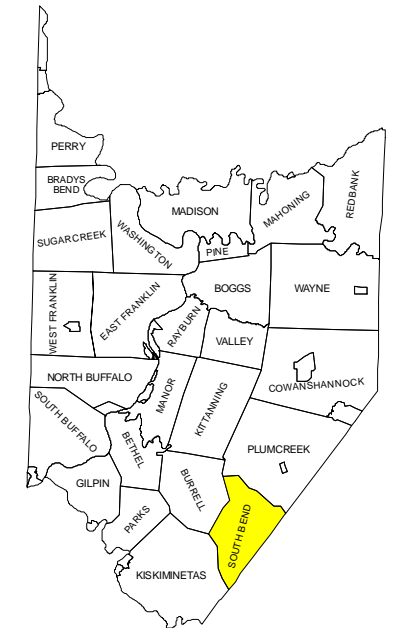
None Currently Identified

Landscape Conservation Areas

None Currently Identified

Public Land

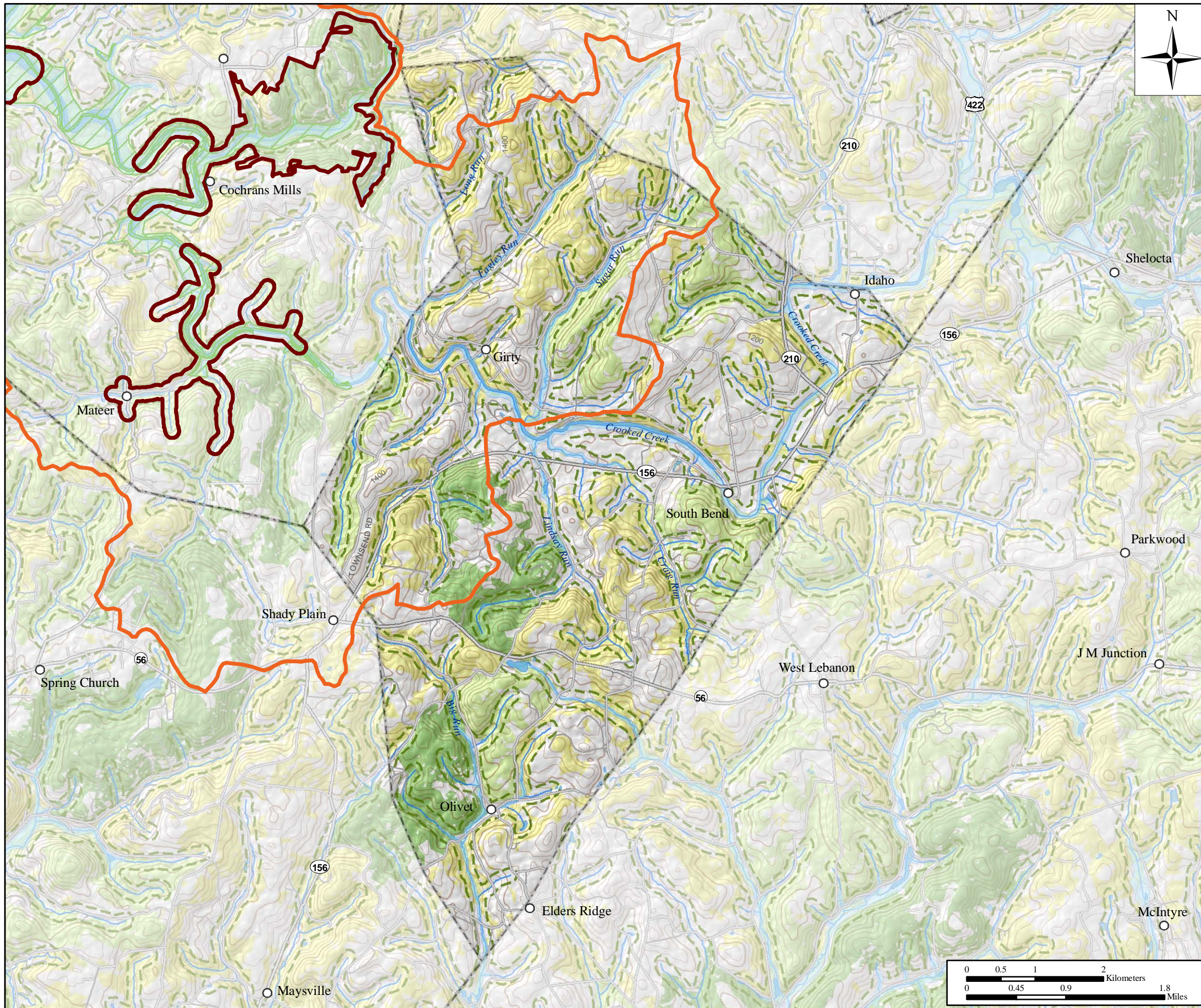
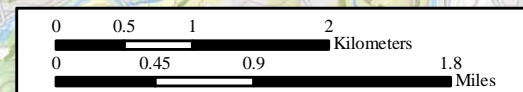
None



Legend

- Landscape Conservation Area (LCA)
- Biological Diversity Area (BDA)**
- Core
- Supporting Landscape
- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer
- Forest Blocks by Acre**
- < 250
- 251 - 500
- 501 - 1000
- > 1000
- Municipal Boundary
- US Army Corps of Engineers
- PA Game Commission
- 40 Ft. Contour Line

PNHP
Pennsylvania Natural Heritage Program



South Buffalo Township & Freeport Borough

	PNDI Rank ¹		Legal Status ¹		Last Seen	Quality ²
	Global	State	State (Proposed)			

NATURAL HERITAGE AREAS:

Allegheny River Pool #4 BDA		Exceptional Significance				
Mooneye (<i>Hiodon tergisus</i>) – fish	G5	S2S3	PT(PT)	1988	E	
River redhorse (<i>Moxostoma carinatum</i>) – fish	G4	S3S4	N(CU)	1997	E	
Channel darter (<i>Percina copelandi</i>) – fish	G4	S2	N(PT)	1988	E	
Wabash pigtoe (<i>Fusconaia flava</i>) – mussel	G5	S2	N(PE)	2007	B	
Long solid (<i>Fusconaia subrotunda</i>) – mussel	G3	S1	N(PE)	2005	D	
Fragile papershell (<i>Leptodea fragilis</i>) – mussel	G5	S2	N(CR)	2005	D	
Pink heelsplitter (<i>Potamilus alatus</i>) – mussel	G5	S2	N(CR)	2005	CD	
Sensitive species of concern ³	-	-	-	1986	E	

Allegheny River Pool #5 BDA		Exceptional Significance				
Goldeye (<i>Hiodon alosoides</i>) – fish	G5	S2?	PT(PT)	1986	E	
Mooneye (<i>Hiodon tergisus</i>) – fish	G5	S2S3	PT(PT)	1988	E	
River redhorse (<i>Moxostoma carinatum</i>) – fish	G4	S3S4	N(CU)	1997	E	
Channel darter (<i>Percina copelandi</i>) – fish	G4	S2	N(PT)	1988	E	
Longhead darter (<i>Percina macrocephala</i>) – fish	G3	S2S3	N(PT)	1986	E	
Wabash pigtoe (<i>Fusconaia flava</i>) – mussel	G5	S2	N(PE)	2007	B	
Long solid (<i>Fusconaia subrotunda</i>) – mussel	G3	S1	N(PE)	2005	D	
Pocketbook (<i>Lampsilis ovata</i>) – mussel	G5	S3S4	N(N)	1985	E	
Fragile papershell (<i>Leptodea fragilis</i>) – mussel	G5	S2	N(CR)	2005	D	
Round pigtoe (<i>Pleurobema sintoxia</i>) – mussel	G4G5	S2	N(PE)	2007	E	
Pink heelsplitter (<i>Potamilus alatus</i>) – mussel	G5	S2	N(CR)	2005	CD	
Mapleleaf (<i>Quadrula quadrula</i>) – mussel	G5	S1S2	N(PT)	2002	E	
Paper pondshell (<i>Utterbackia imbecillis</i>) – mussel	G5	S3S4	N(CU)	2002	E	
Sensitive species of concern ³	-	-	-	1986	E	
Sensitive species of concern ³	-	-	-	2007	E	

Allegheny River Pool #6 BDA		Exceptional Significance				
Goldeye (<i>Hiodon alosoides</i>) – fish	G5	S2?	PT(PT)	1986	E	
Longhead darter (<i>Percina macrocephala</i>) – fish	G3	S2S3	N(PT)	1986	E	
River redhorse (<i>Moxostoma carinatum</i>) – fish	G4	S3S4	N(CU)	1997	E	
Elktoe (<i>Alasmidonta marginata</i>) – mussel	G4	S4	N(N)	2007	E	
Wabash pigtoe (<i>Fusconaia flava</i>) – mussel	G5	S2	N(PE)	2007	B	
Fragile papershell (<i>Leptodea fragilis</i>) – mussel	G5	S2	N(CR)	2005	D	
Round pigtoe (<i>Pleurobema sintoxia</i>) – mussel	G4G5	S2	N(PE)	2007	E	
Pink heelsplitter (<i>Potamilus alatus</i>) – mussel	G5	S2	N(CR)	2005	CD	
Sensitive species of concern ³	-	-	-	2005	E	
Sensitive species of concern ³	-	-	-	2007	E	

Allegheny River shoreline at Freeport BDA		Notable Significance				
Blue false-indigo (<i>Baptisia australis</i>) - plant	G5	S2	N(PT)	2008	E	

Buffalo Creek Valley BDA		Notable Significance				
West Virginia white (<i>Pieris virginiensis</i>) - butterfly	G3G4	S2S3	N(N)	2008	E	

Fragile papershell (<i>Leptodea fragilis</i>) – mussel	G5	S2	N(CR)	2008	E
Rainbow mussel (<i>Villosa iris</i>) – mussel	G5Q	S1	N(PE)	1991	C
Sensitive species of concern ³	-	-	-	2008	E

Cornplanter Run BDA	<i>Notable Significance</i>				
Least brook lamprey (<i>Lampetra aepyptera</i>) – fish	G5	S3	PC(CR)	2003	E

Long Run Mine	<i>Exceptional Significance</i>				
Sensitive species of concern ³	-	-	-	2006	D
Sensitive species of concern ³	-	-	-	2006	E

Murphy’s Bottom BDA	<i>Local Significance</i>				
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LANDSCAPE CONSERVATION AREAS: Allegheny River LCA

PUBLICLY MANAGED LAND: None

1 = Please refer to Appendix I for an explanation of PNHP ranks and legal status
 2 = Please refer to Appendix II for an explanation of quality ranks
 3 = This species is not named by request of the jurisdictional agency

Armstrong County Natural Heritage Inventory South Buffalo Township & Freeport Borough

Biological Diversity Areas

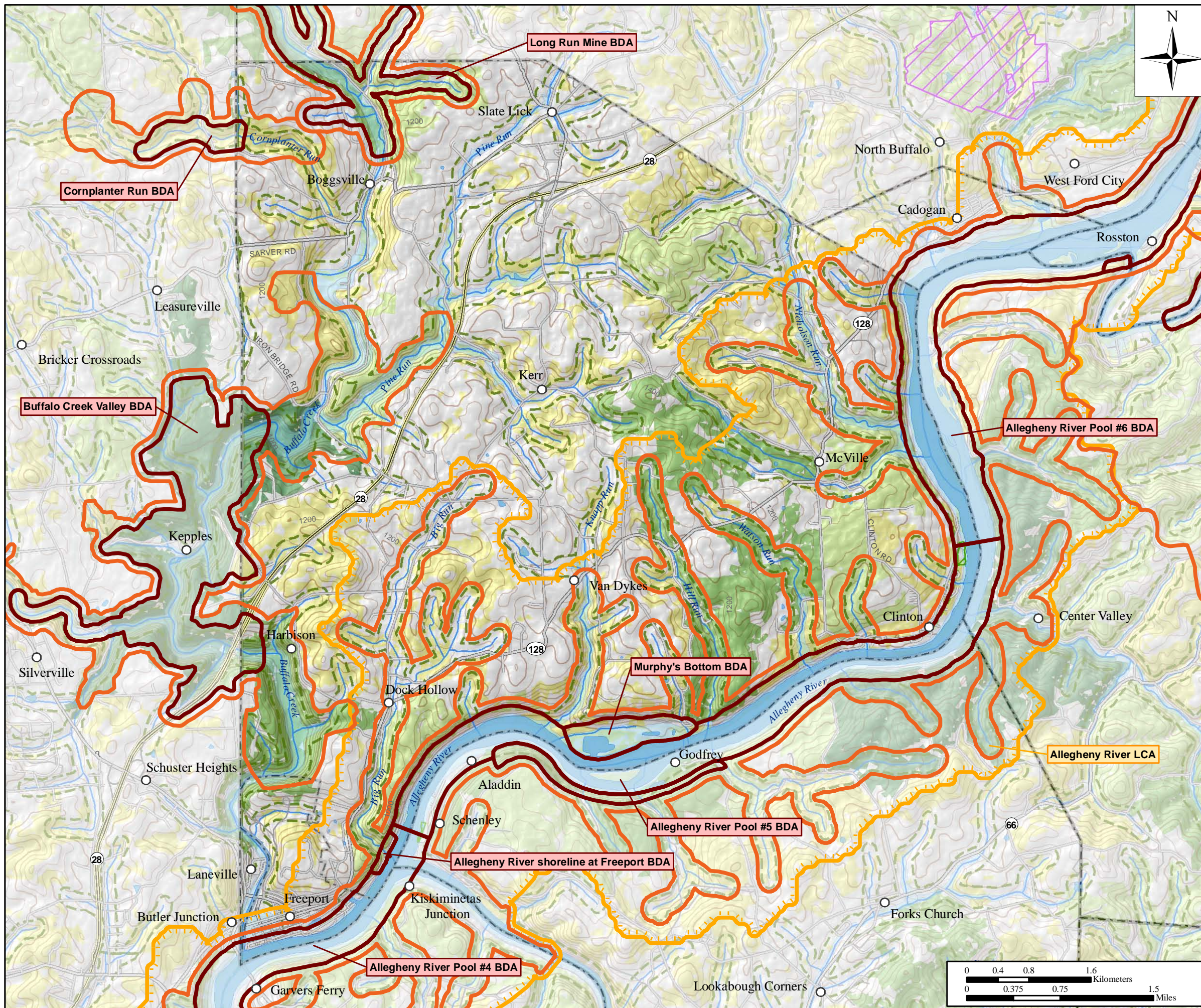
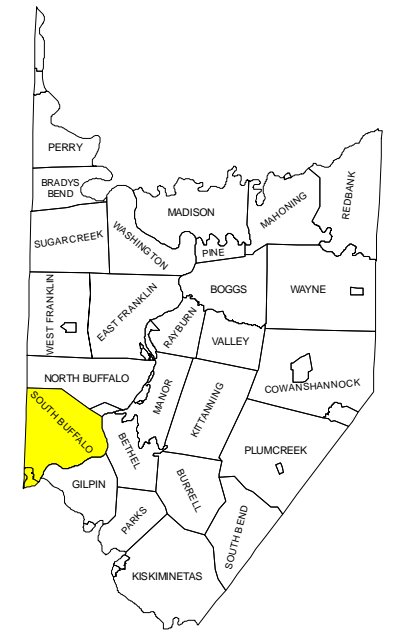
- Allegheny River Pool #4 BDA
- Allegheny River Pool #5 BDA
- Allegheny River Pool #6 BDA
- Allegheny River shoreline at Freeport BDA
- Buffalo Creek Valley BDA
- Cornplanter Run BDA
- Long Run Mine BDA
- Murphy's Bottom BDA

Landscape Conservation Areas

- Allegheny River LCA

Public Land

None



Legend

Landscape Conservation Area (LCA)

Biological Diversity Area (BDA)

- Core
- Supporting Landscape
- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

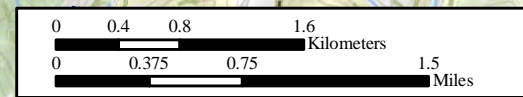
Forest Blocks by Acre

- < 250
- 251 - 500
- 501 - 1000
- > 1000

Municipal Boundary

PA Game Commission

40 Ft. Contour Line



South Buffalo Township & Freeport Borough

South Buffalo Township occupies 28.0 square miles along the southwest edge of Armstrong County. Freeport Borough sits in the southwest corner next to the Allegheny River. Land use in the township is split somewhat evenly between forest (46%) and agriculture (43%).

The Allegheny River and its tributaries drain much of the township. Nicholson Run and Watson Run drain eastern areas of the township. The Pine Run drainage covers the northwestern third of the township. Non-point pollution due to siltation impairs Pine Run, as well as several tributaries to the Allegheny River - Big Run, Knapp Run, and Hill Run (Department Environmental Protection 2009). Planting forested stream buffers would filter and help reduce the non-point pollution that degrades these waterways within the township. The Long Run Mine Important Mammal Area (IMA) covers the northwestern third of the township.

Freeport Borough

Freeport Borough is located along the Allegheny River, 28 miles northeast of Pittsburgh. It is one of the largest boroughs in Armstrong County, covering 1.2 square miles. Atwood and Rural Valley Boroughs are the largest boroughs at 2.1 square miles each. Land use in this borough is 30% forest and 40% development.

Allegheny River Pool #4 BDA

Allegheny River Pool #5 BDA

Allegheny River Pool #6 BDA

The Allegheny River is one of the most ecologically significant areas in Armstrong County, including a large diversity of fish and mussel species. The Allegheny River begins in Potter County and flows north into New York. The river then turns south and flows down through Warren, Forest, and Venango Counties. As the Allegheny River enters Armstrong County it is free-flowing until it reaches Lock and Dam #9 north of Cosmus. The Allegheny River combines with the Monongahela River in Allegheny County, before it enters into the Ohio River. The lock and dam system was created in the 1920's and 1930's for navigation. The dams alter the natural flow of the river and create a different type of habitat than is found in the free-flowing sections upstream.

The health of the Allegheny River has been threatened by pollutants and other disturbance. Abandoned mine drainage has impacted many of the streams in Armstrong County. Few mussels were found in other waterways, due to lowered pH and diminished water quality. There are also some other notable point source pollutants to the Allegheny, such as the PPG dump near Ford City that is imputing heavy metals into the river. The Allegheny River, however, seems able to maintain populations of species that are sensitive to changes in water quality.

Sand and gravel dredging is another threat facing aquatic species, especially mussels. The substrate is removed from the river bottom and is often used for road construction. Excavation of the substrate removes the mussel habitat in areas that allow dredging, including Pools #4, 5, and 6.

Despite the dams along the Allegheny River creating habitat that is deeper and slower moving than the free-flowing sections of the river, there are still some areas that have the shallow, quick-moving riffle habitat that supports higher mussel populations. This habitat can especially be found below dams and near sediment deposits that have formed islands in the river.

Freshwater mussels are one group of organisms that require high water quality. While many mussel species historically known from the Allegheny River have been extirpated, certain sections of the river have some of the highest diversity of freshwater mussels in the state.

Allegheny River Pool #4 –Allegheny River Pool #4 is located below Jacks Island in Allegheny County and continues upstream north of Freeport. Four freshwater mussel species of concern are currently known in the Allegheny River Pool #4- **fragile papershell** (*Leptodea fragilis*), **long solid** (*Fusconaia subrotunda*), **pink**

heelsplitter (*Potamilus alatus*), and **wabash pigtoe** (*Fusconaia flava*). The Allegheny River is also home to a large number of fish species, including three species of concern. **Channel darter** (*Percina copelandi*), **mooneye** (*Hiodon tergisus*) and **river redhorse** (*Moxostoma carinatum*) have all been located along this section of the Allegheny River. Allegheny River Pool #4 also provides habitat for **one other aquatic species of concern**.

Allegheny River Pool #5 –Allegheny River Pool #5 is located just above the Kiskiminetas River and continues upstream near the village of Kelly Station. Eight freshwater mussel species of concern are currently known in the Allegheny River Pool #5- **fragile papershell** (*Leptodea fragilis*), **long solid** (*Fusconaia subrotunda*), **mapleleaf** (*Quadrula quadrula*), **paper pondshell** (*Utterbackia imbecillis*), **pink heelsplitter** (*Potamilus alatus*), **pocketbook** (*Lampsilis ovata*), **round pigtoe** (*Pleurobema sintoxia*), and **wabash pigtoe** (*Fusconaia flava*). The Allegheny River is also home to a large number of fish species, including five species of concern. **Channel darter** (*Percina copelandi*), **longhead darter** (*Percina macrocephala*), **goldeye** (*Hiodon alosoides*), **mooneye** (*Hiodon tergisus*), and **river redhorse** (*Moxostoma carinatum*) have all been located along this section of the Allegheny River. Allegheny River Pool #5 also provides habitat for **two other aquatic species of concern**.

Allegheny River Pool #6 –Allegheny River Pool #6 is located above the village of Kelly Station and continues upstream to Kittanning. This section of the Allegheny River flows through the more populated areas of the county, specifically Kittanning and Ford City. A large portion of Kittanning lies within the floodplain of the Allegheny River, putting much of the town in danger of flooding. Five freshwater mussel species of concern are currently known in the Allegheny River Pool #6- **elktoe** (*Alasmidonta marginata*), **fragile papershell** (*Leptodea fragilis*), **pink heelsplitter** (*Potamilus alatus*), **round pigtoe** (*Pleurobema sintoxia*), and **wabash pigtoe** (*Fusconaia flava*). The Allegheny River is also home to a large number of fish species, including three species of concern. **Longhead darter** (*Percina macrocephala*), **goldeye** (*Hiodon alosoides*), and **river redhorse** (*Moxostoma carinatum*), have all been located along this section of the Allegheny River. Allegheny River Pool #6 also provides habitat for **two other aquatic species of concern**.

Threats and Stresses – The habitat of the stream-dependent species can be considerably impacted from nearby land use decisions. Many of the steep hillsides and stream valleys along the Allegheny River are forested, but there are significant agricultural and mining operations on the banks of the river and within the Allegheny River watershed. In addition, the many impervious surfaces of the surrounding urban area, such as roads, parking lots and roof tops channel rain water directly into the waterways, taking numerous non-point source pollutants with them. Storm water runoff through urban and suburban areas can be a significant source of chemical pollutants for the waterways, which can severely impact water quality and the food chain of the river. The PPG dump below Ford City a notable source of point source pollution that is leaching heavy metals and other point source pollutants directly into the Allegheny River.

River dredging directly removes the substrate that the mussels imbed themselves in for most of their adult life. Fish also use this gravel habitat for breeding and foraging for food. Once the substrate has been removed, the flow of the river is altered, and sediment can fill in the holes left behind. The sediment makes the river bottom uninhabitable for many species.

Invasive plants, such as purple loosestrife (*Lythrum salicaria*) and Japanese knotweed (*Fallopia japonica*), can be quite common on the islands and along the banks of the river. These aggressive invasive plants dominate portions of the floodplain, outcompeting and displacing native vegetation. The zebra mussel (*Dreissena polymorpha*), another invasive species, has been located in several pools of the Allegheny River. This small mussel can grow on top of native mussels, substrate, and infrastructure in the water, altering the natural system and causing damage to pipes and other objects in the water.

Conservation Recommendations – Conservation efforts should focus on protecting and improving the quality of the surface water for the local human community as well as for the habitat for the sensitive species of concern. Additional steps can be taken to protect and improve the aquatic habitat, such as maintenance and restoration of the natural hydrology of the Allegheny River and the floodplain habitats along the river's edge. These buffers

serve an important role by slowing and filtering runoff before it enters the aquatic system. Improve water quality of the river by providing vegetated buffers along inflows to the creek and along the river shoreline. Stop river dredging to maintain the remaining potential habitat for the aquatic species. Control invasive species of plants by eliminating new small populations. Larger well-established populations of invasive species will require a sustained and continual suppression effort to prevent their spread. Contain zebra mussels to those areas already affected by cleaning boats and other items used in the water to control their spread into new areas.

Allegheny River shoreline at Freeport BDA – A small population of the PA-threatened plant species of concern, **blue false-indigo** (*Baptisia australis*), occurs along the cobbly shoreline of the Allegheny River. Blue false-indigo, like the grasslands it is often associated with, is found scattered along the Allegheny River and its major tributaries in areas that receive periodic flooding and scour disturbance. There is little habitat for



Denise Watts, PNHP

Blue false indigo (*Baptisia australis*)

blue false-indigo at this location, likely due in part to its location below Lock and Dam #5, which restricts flooding and scour disturbance necessary to maintain habitat.

Threats and Stresses – It is likely that if the system of locks and dams were not in place, this rare plant would be more prevalent along the lower Allegheny River. The lock and dam system alters the fluctuations in the river that are needed to maintain the early successional habitat.

Succession to floodplain forests caused by a lack of flooding and scour disturbance is another major threat to blue false-indigo, which is beginning to happen at this location.

Modification of the natural flow of the river can alter the disturbance regime that is necessary to maintain this habitat.

Invasive species of plants can displace native plant communities. Japanese knotweed, purple loosestrife, and garden loosestrife are currently present along the river shoreline.

Conservation Recommendations – Maintain river flow that is as close to natural conditions as possible. Any future riverfront development should be set back a minimum of 100 meters (328 feet) from the river’s floodplain. Restore floodplain habitats along the river’s edge to slow and filter runoff before it enters the aquatic system to improve the quality of water and habitat for all species, including human communities.

Invasive species of plants are frequently a problem along many riparian areas and control efforts need to be targeted and continuous.

Buffalo Creek Valley BDA – The calcareous sandstone cliffs along the Buffalo Creek Valley are home to calcium-loving plants such as walking fern (*Asplenium rhizophyllum*), wild hydrangea (*Hydrangea arborescens*), sharp-lobed hepatica (*Hepatica nobilis* var. *acuta*), wild ginger (*Asarum canadense*), maidenhair fern (*Adiantum pedatum*), and bloodroot (*Sanguinaria canadensis*). These cliffs also support a population of **American yew** (*Taxus canadensis*), a watchlist species that is uncommon in the region. A favored food plant of white-tailed deer, American yew is usually restricted to cliffs that deer cannot reach.

The calcareous sandstone influences the soil chemistry and vegetation of the valley’s forest. The forests at this site, particularly the lower, moister parts, support **West Virginia whites** (*Pieris virginiensis*), a butterfly species of concern. The caterpillars of this species eat toothworts (*Cardamine* spp.), and adults nectar on a variety of spring wildflowers. This species ranged throughout the northern and central Appalachians, but has been declining and is now considered globally vulnerable. In Pennsylvania it occurs in the northern and western counties.

The riverside areas of this site are home to **species of concern**, which cannot be named here at the request of the agency overseeing its protection. This species requires somewhat open habitat along shores, with shrubs that

overhang the water for, and flat, fractured rocks in sunny places along the shore, which provide shelter. This species is dependent on water quality because it preys on aquatic animals that are sensitive to water pollution.

This section of Buffalo Creek is home to at least 2 freshwater mussel species of concern, **rainbow mussel** (*Villosa iris*) and **fragile papershell** (*Leptodea fragilis*). Freshwater mussels are filter feeders that spend their adult lives in the substrate of streams. Movement is accomplished either by means of a muscular foot, flood currents, or dispersal of larva on host fish. Mussels obtain oxygen and food from the water column by continuously siphoning water through their bodies. They feed on suspended organic matter, including detritus and plankton. Because mussels are dependent upon good water quality as well as an environment that will support populations of host fish, they are considered good indicators of the health of aquatic ecosystems.

Threats and Stresses – Sedimentation is a main cause of the freshwater mussel declines throughout North America, because it renders stream bottoms unsuitable as mussel habitat. Erosion, whether caused by deforestation, poor agricultural practices, or the destruction of riparian zones, leads to increased silt loads and shifting, unstable stream bottoms. Siltation and contaminants, such as heavy metals, pesticides, and abandoned mine drainage, have long been recognized as threats to mussels (Ortmann 1909; Ellis 1931; cited in Williams et al. 1993). Increases in siltation can also indirectly impact freshwater mussel communities by interfering with host fish – mussel interactions. Increased sedimentation can reduce the abundance, diversity, and reproduction of fish, including host fish that are necessary for protection and dispersal of virtually all freshwater mussels during their larval stage. The increased turbidity associated with suspended sediment loads also interferes with the visual cues used by both adult mussels and host fish in the transfer of the glochidia, or mussel larvae (Box and Mossa 1999).

Forest fragmentation is a serious threat to the West Virginia white, because these butterflies do not typically cross roads or other non-forested areas. The result is that populations become genetically isolated, and if a population is extirpated the chances are low that remaining populations will be able to recolonize the habitat. Development pressure in this corner of Butler County is resulting in continued fragmentation of the remaining forest.

An even greater threat to the West Virginia white is the spread of garlic mustard (*Alliaria petiolata*). This invasive plant is in the same family (the mustard family) as toothworts, and the chemical signatures of the plants are similar enough that female butterflies will lay their eggs on garlic mustard. The caterpillars, however, cannot survive on garlic mustard, and these butterflies have disappeared from areas where garlic mustard is dominant.

High densities of white-tailed deer pose another threat to West Virginia whites, because deer browsing greatly reduces the abundance of many of the wildflowers that are crucial nectar sources for the butterflies. Although their flight period is short, adults rely on several successive waves of spring wildflowers to produce a steady supply of nectar.

Japanese knotweed (*Fallopia japonica*) is a serious threat to biodiversity along the creek, where in many places it grows in dense monocultures, displacing all native plants. This species grows most thickly along the creek where frequent disturbance allows it to become established, but it is also a problem in upland areas, where it has begun to spread across forested and unforested slopes.

Conservation Recommendations – In the upstream watershed, logging, road development, gas drilling, or other construction activities should be kept well away from riparian corridors in order to avoid degrading important aquatic and streamside habitat within the tributaries flowing into the Buffalo and Little Buffalo Creeks. Land use within the watershed has so far been compatible with maintaining the high-quality conditions within this site, but the anticipated upswing in gas development could pose a challenge to maintaining water quality. Any planning of future development within the watershed should seek to avoid potential impacts to both the physical character and water quality of Buffalo and Little Buffalo Creeks.

Japanese knotweed, garlic mustard, and other invasive species must be controlled in this area to avoid serious losses of biodiversity.

Fragmentation of the remaining forest should be avoided. New development such as housing, roads, and powerlines should be concentrated in areas that have already been disturbed.

White-tailed deer should be kept to a low density to avoid degradation of the forest's diversity.

Cornplanter Run BDA – Cornplanter Run provides habitat for **least brook lamprey** (*Lampetra aepyptera*), a fish species considered vulnerable in Pennsylvania. The least brook lamprey requires clear, clean water and inhabits large creeks and small rivers (NatureServe 2007). Eggs of this species are laid in nests in riffles and runs with a gravel/sand substrate and a strong current. Once the larvae hatch, they burrow into the loose substrate of pools or slow-moving water near stream banks, where they feed on plankton for five to six years. Adults emerge in the late summer, breed the following spring, and then die (NatureServe 2007). Unlike the better-known sea lamprey (*Petromyzon marinus*), this species is harmless to fish, since the short-lived adults do not eat.

Threats and Stresses – Two roads cross this BDA. Runoff from dirt and gravel roads in close proximity to waterways can contribute to physical degradation of their channels and erosion and sediment pollution in streams and rivers. Riparian buffers along the stream are mostly intact, although there is one unbuffered agricultural area in the stream's headwaters and a residential development upstream of the core habitat. There is potential for non-point source pollution from agricultural and residential areas, although at this time no part of the watershed is considered impaired by DEP.

Conservation Recommendations – Maintaining suitable aquatic habitat is vital to the continued success of this species. Establishing riparian buffers along the unbuffered parts of the stream and encouraging local landowners to properly manage agricultural nutrients would aid in lessening the input of runoff into the stream. Remaining forest cover in the immediate watershed surrounding Cornplanter Run should be left intact to provide a buffer against non-point source pollutants such as sediments and chemicals. Further residential development within the riparian buffers should not occur.

Long Run Mine BDA – This site is an abandoned mine shaft that now provides habitat for **two species of concern**. Abandoned mines mimic the natural cave habitats that the species typically use. The riparian forests near the mine provide critical foraging habitat for these species, and others using the mine.

Threats and Stresses – Forest fragmentation would limit foraging and roosting habitat, and the use of insecticides could limit the prey base for these species of concern. The entrance to the mine has been gated to prevent disturbance, but trespassing and vandalism are still potential threats to this site.

Conservation Recommendations – Maintain the existing forests and replant the cleared areas with trees, especially along riparian corridors. Continue to gate the mine entrance and protect this site from trespassing and vandalism.

Murphy's Bottom BDA – This section of the floodplain along the Allegheny River was modified to allow dredgers to dump loads of gravel dug from the river bottom. It is no longer used in the dredging industry, but the disturbance to this site remains. Along with the wetlands in the floodplain, the surrounding forests support a large diversity of species. This site is now being studied and managed by Duquesne University.

Threats and Stresses – Having an industrial land use in the past has resulted in a significantly altered landscape. Abandoned mine drainage has also had impacts on the water quality of the wetlands and streams in this area. Invasive species can move quickly through disturbed landscapes, as well as along railroad tracks, which run along much of the Allegheny River.

Recommendations – Keep at least a 300 foot (100 meter) riparian buffer along all streams and wetlands. Monitor for the presence of invasive species, such as Japanese knotweed and multiflora rose. Remove invasive species before they are able to become well established.

Sugarcreek Township

	PNDI Rank ¹		Legal Status ¹	Last Seen	Quality ²
	Global	State	State (Proposed)		

NATURAL HERITAGE AREAS:

Allegheny River Pool #9 BDA		<i>Exceptional Significance</i>				
Elktoe (<i>Alasmidonta marginata</i>) – mussel	G4	S4	N(N)	2007	E	
Wavy-rayed lampmussel (<i>Lampsilis fasciola</i>) – mussel	G5	S4	N(N)	2007	E	
Pocketbook (<i>Lampsilis ovata</i>) – mussel	G5	S3S4	N(N)	1985	E	
Paper pondshell (<i>Utterbackia imbecillis</i>) – mussel	G5	S3S4	N(CU)	1997	E	
Red-head pondweed (<i>Potamogeton richardsonii</i>) – plant	G5	S3	PT(PR)	2002	E	
Sensitive species of concern ³	-	-	-	1991	E	
Sensitive species of concern ³	-	-	-	2000	E	
Sensitive species of concern ³	-	-	-	2001	E	
Sensitive species of concern ³	-	-	-	2000	E	

Beagle Club Road BDA		<i>Notable Significance</i>				
Featherbells (<i>Stenanthium gramineum</i>) – plant	G4G5	S1S2	N(N)	2007	E	

State Game Lands #259 BDA		<i>Notable Significance</i>				
Featherbells (<i>Stenanthium gramineum</i>) – plant	G4G5	S1S2	N(N)	2007	E	

LANDSCAPE CONSERVATION AREAS: Allegheny River LCA

PUBLICLY MANAGED LAND: State Game Land #105, State Game Land #259

1 = Please refer to Appendix I for an explanation of PNHP ranks and legal status
 2 = Please refer to Appendix II for an explanation of quality ranks
 3 = This species is not named by request of the jurisdictional agency

Armstrong County Natural Heritage Inventory Sugar Creek Township

Biological Diversity Areas

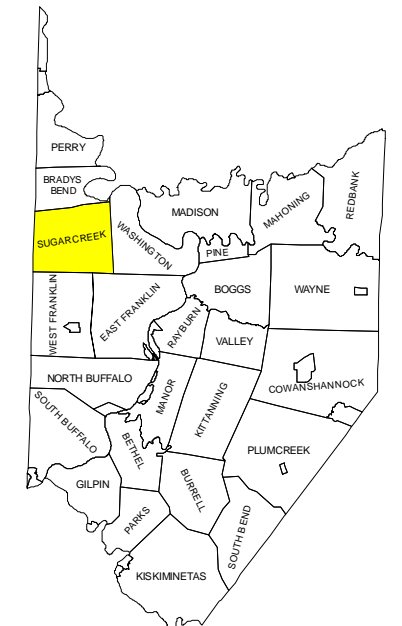
- Allegheny River Pool #9 BDA
- Beagle Club Road BDA
- State Game Lands #259 BDA

Landscape Conservation Areas

- Allegheny River LCA

Public Land

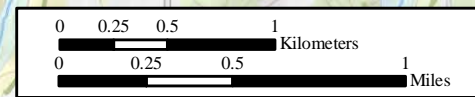
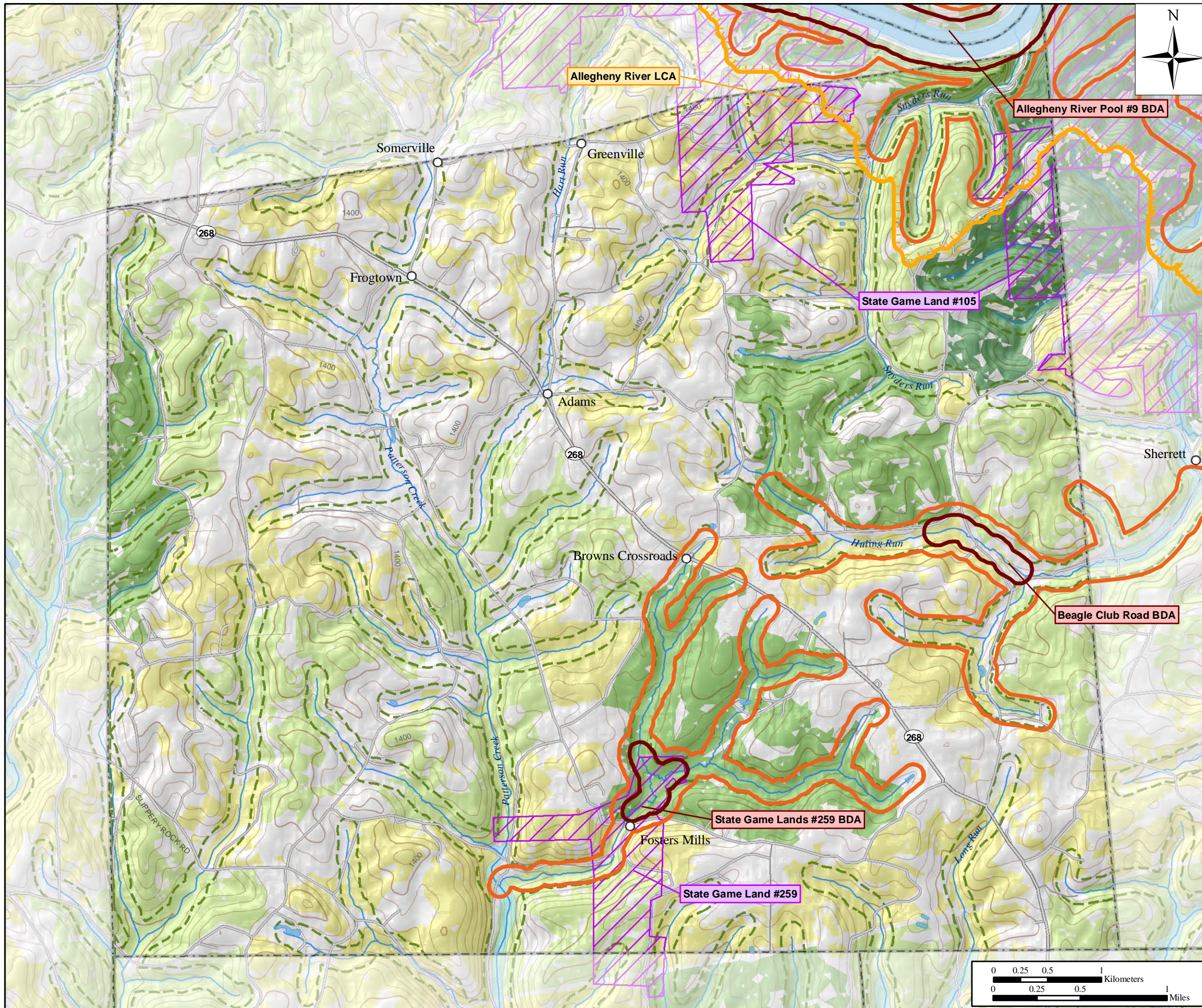
- State Game Land #105
- State Game Land #259



Legend

- Landscape Conservation Area (LCA)
- Biological Diversity Area (BDA)**
 - Core
 - Supporting Landscape
- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer
- Forest Blocks by Acre**
 - < 250
 - 251 - 500
 - 501 - 1000
 - > 1000
- Municipal Boundary
- PA Game Commission
- 40 Ft. Contour Line

PNHP
Pennsylvania Natural Heritage Program



Sugarcreek Township

Sugarcreek Township was settled in 1800 and incorporated in 1806. Sugarcreek, Redbank, Kittanning, and Plum Creek were the first townships established in Armstrong County along with two other townships now defunct. Sugarcreek is located in western Armstrong County and sits alongside Butler County. The township covers a 27 square mile area.

Patterson Creek and its tributaries make up the primary drainage for Sugarcreek Township. Siltation from agricultural practices affects the upper reaches of Patterson Creek (Department of Environmental Protection 2009). Snyders Run to the northeast and Huling Run in the east are the other major waterways. Conservation efforts should focus on creating forested buffers along streams where they are absent in order to reduce non-point pollution into the waterways.

Much of Sugarcreek Township is a part of the US Steel Mine Important Mammal Area (IMA) and over half of the township is within the Buffalo Creek Valley Important Bird Area (IBA). These two areas overlap. Public lands include State Game Lands (SGL) #259 and portions of SGL #105.

Land cover in the township is 38% agriculture and 55% forest. The largest forest block is 962 acres in size. Many of the smaller forest blocks are highly fragmented. Efforts to create greenways between patches of forest would benefit wildlife as well as reduce non-point source pollution into the streams.

Allegheny River Pool #9 BDA – The Allegheny River is one of the most ecologically significant areas in Armstrong County, including a large diversity of fish and mussel species. The Allegheny River begins in Potter County and flows north into New York. The river then turns south and flows down through Warren, Forest, and Venango Counties. As the Allegheny River enters Armstrong County it is free-flowing until it reaches Lock and Dam #9 north of Cosmus. The Allegheny River combines with the Monongahela River in Allegheny County, before it enters into the Ohio River. The lock and dam system was created in the 1920's and 1930's for navigation. The dams alter the natural flow of the river and create a different type of habitat than is found in the free-flowing sections. Allegheny River Pool #9 is located north of Cosmus. This section of the river will be described upstream south of Foxburg.

The health of the Allegheny River has been threatened by pollutants and other disturbance. Abandoned mine drainage has impacted many of the streams in Armstrong County. Few mussels were found in other waterways, due to lowered pH and diminished water quality. There are also some other notable point source pollutants to the Allegheny, such as the PPG dump near Ford City that is imputing heavy metals into the river. The Allegheny River, however, seems able to maintain populations of species that cannot tolerate low water quality.

Sand and gravel dredging is another threat facing aquatic species, especially mussels. The substrate is removed from the river bottom and is often used to build roads. This impacts the mussel habitat in areas that allow dredging, including Pool #9.

Despite the dams along the Allegheny River creating habitat that is deeper and slower moving than most of the free-flowing sections of the river, there are still some areas that have the shallow quick-moving riffle habitat that supports higher mussel populations. This habitat can especially be found below dams and near sediment deposits that have formed islands in the river.

Freshwater mussels are one group of organisms that require high water quality. While many mussel species historically known from the Allegheny River have been extirpated, certain sections of the river have some of the highest diversity of freshwater mussels in the state. Four freshwater mussel species of

concern are currently known in the Allegheny River Pool #9- **elktoe** (*Alasmidonta marginata*), **paper pondshell** (*Utterbackia imbecillis*), **pocketbook** (*Lampsilis ovata*), and **wavy-rayed lampmussel** (*Lampsilis fasciola*).

The PA-threatened **red-head pondweed** (*Potamogeton richardsonii*) grows submerged in the river, rooted in the cobble covered riverbed of the Allegheny River. As with the other rare species living in this stretch of the river, the continuation of red-head pondweed at this location depends largely on maintaining the water quality of the river.

Allegheny River Pool #9 also provides habitat for **four other aquatic animal species of concern**. All of these species, both rare and common, aquatic and terrestrial, rely on the water quality of the river to maintain healthy food webs.

Threats and Stresses – The habitat of the stream-dependent species can be considerably impacted from nearby land use decisions. Many of the steep hillsides and stream valleys along the Allegheny River are forested, but there are significant agricultural and mining operations on the banks of the river and within the Allegheny River watershed. In addition, the many impervious surfaces of the surrounding urban area, such as roads, parking lots and roof tops channel rain water directly into the waterways, taking numerous non-point source pollutants with them. Storm water runoff through urban and suburban areas can be a significant source of chemical pollutants for the waterways, which can severely impact water quality and the food chain of the river.

River dredging directly removes the substrate that the mussels imbed themselves in for most of their adult life. Fish also use this gravel habitat. Once the substrate has been removed, the flow of the river can be altered, and sediment can fill in the holes left behind. The sediment makes the river bottom uninhabitable for many species.

Invasive plants, such as purple loosestrife (*Lythrum salicaria*) and Japanese knotweed (*Polygonum cuspidatum*), can be quite common on the islands and along the banks of the river. These aggressive invasive plants dominate portions of the floodplain, outcompeting and displacing native vegetation. The zebra mussel (*Dreissena polymorpha*), another invasive species, has been located in several pools of the Allegheny River. This small mussel can grow on top of native mussels, substrate, and infrastructure in the water, altering the natural system and causing damage to pipes and other objects in the water.

Conservation Recommendations – Conservation efforts should focus on protecting and improving the quality of the surface water for both the local human community as well as for the habitat for the sensitive species of concern. Additional steps can be taken to protect and improve the aquatic habitat. Maintain and restore the natural hydrology of the Allegheny River. Restore floodplain habitats along the river's edge to slow and filter runoff before it enters the aquatic system. Improve water quality of the river by providing vegetated buffers along inflows to the creek and along the river shoreline. Stop river dredging to maintain the remaining potential habitat for the aquatic species. Control invasive species of plants by eliminating new small populations. Larger well-established populations of invasive species will require a sustained and continual suppression effort to prevent their spread. Contain zebra mussels to those areas already affected by cleaning boats and other items used in the water to control their spread into new areas.

Beagle Club Road BDA – A roadside occurrence of a plant species of concern, **featherbells** (*Stenanthium gramineum*), was documented along Beagle Club Road. This member of the lily family occurs in a variety of habitats, but is most frequently associated with the edges of wetlands. This plant has a limited distribution in Pennsylvania, occurring most frequently in Butler County, with scattered occurrences in the adjacent counties of Armstrong and Venango and a few other western counties. The

large, attractive, bright white flower clusters make this perennial plant easily observed when it is in bloom, while the wide, grass-like leaves are typically overlooked when it is not. At this location, the plants were observed growing above a wet roadside ditch. This plant is likely to occur in nearby areas as additional habitat for this plant is in the adjacent woodlands, around the edge of the nearby wetlands or along the banks of Huling Run.

Threats and Stresses – The precise habitat needs of this plant are not fully understood, since it occurs in a wide variety of habitats, from upland to wetland, full sun to full shade. The irregular mowing (every other year) that appears to be conducted along this roadside location may help to foster the proper conditions for this plant. Since featherbells flowers in late summer and early fall, late season mowing can hurt this population by decreasing the potential for these plants to flower and set seed. More frequent roadside mowing would likely eliminate this population as would indiscriminate roadside herbicide application.

Conservation Recommendations – Maintain the infrequent mowing schedule, preferably in the spring, to allow the plants time to grow, bloom and set seed between mowings. Mid and late season mowing and any herbicide application should be avoided at this location. Conduct additional surveys for this species around the adjacent woodlands, wetlands and along Huling Run.

State Game Lands #259 BDA – An occurrence of a plant species of concern, **featherbells** (*Stenanthium gramineum*), was found growing along a tributary of Patterson Creek. This member of the lily family occurs in a variety of habitats, but is most frequently associated with the edges of wetlands. This plant has a limited distribution in Pennsylvania, occurring most frequently in Butler County, with scattered occurrences in the adjacent counties of Armstrong and Venango and a few other western counties. The large, attractive, bright white flower clusters make this perennial plant easily observed when it is in bloom, while the wide, grass-like leaves are typically overlooked when not in flower.

Threats and Stresses – The current habitat appears to be well suited to sustain the population of featherbells if left undisturbed. Since this property is managed by the Game Commission, this area should be protected from development.

Conservation Recommendations – Maintain the forested habitat along this stream to protect this population. The Pennsylvania Game Commission should be notified of the presence of this species, so they are able to appropriately manage the population.



Rocky Gleason, PNHP

Featherbells (*Stenanthium gramineum*)

Valley Township

	<u>PNDI Rank</u> ¹		<u>Legal Status</u> ¹	Last Seen	Quality ²
	Global	State	State (Proposed)		

NATURAL HERITAGE AREAS:

Cowanshannock Creek at Stone House BDA	<i>Notable Significance</i>				
West Virginia white (<i>Pieris virginiensis</i>) – butterfly	G3G4	S2S3	N(N)	2008	E
South Fork Pine Creek at Oscar BDA	<i>Notable Significance</i>				
Sensitive species of concern ³	-	-	-	2008	E

LANDSCAPE CONSERVATION AREAS: Allegheny River LCA

PUBLICLY MANAGED LAND: None

1 = Please refer to Appendix I for an explanation of PNHP ranks and legal status

2 = Please refer to Appendix II for an explanation of quality ranks

3 = This species is not named by request of the jurisdictional agency

Armstrong County Natural Heritage Inventory Valley Township

Biological Diversity Areas

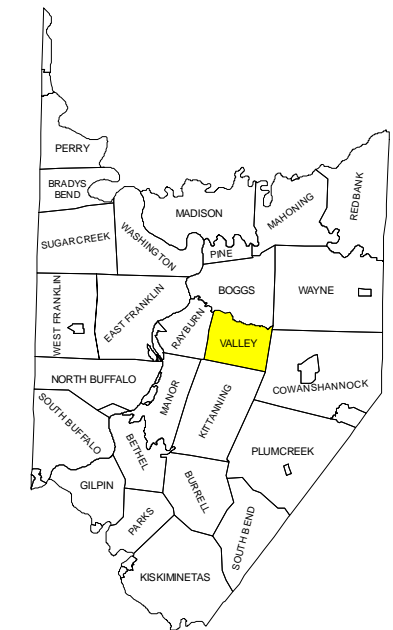
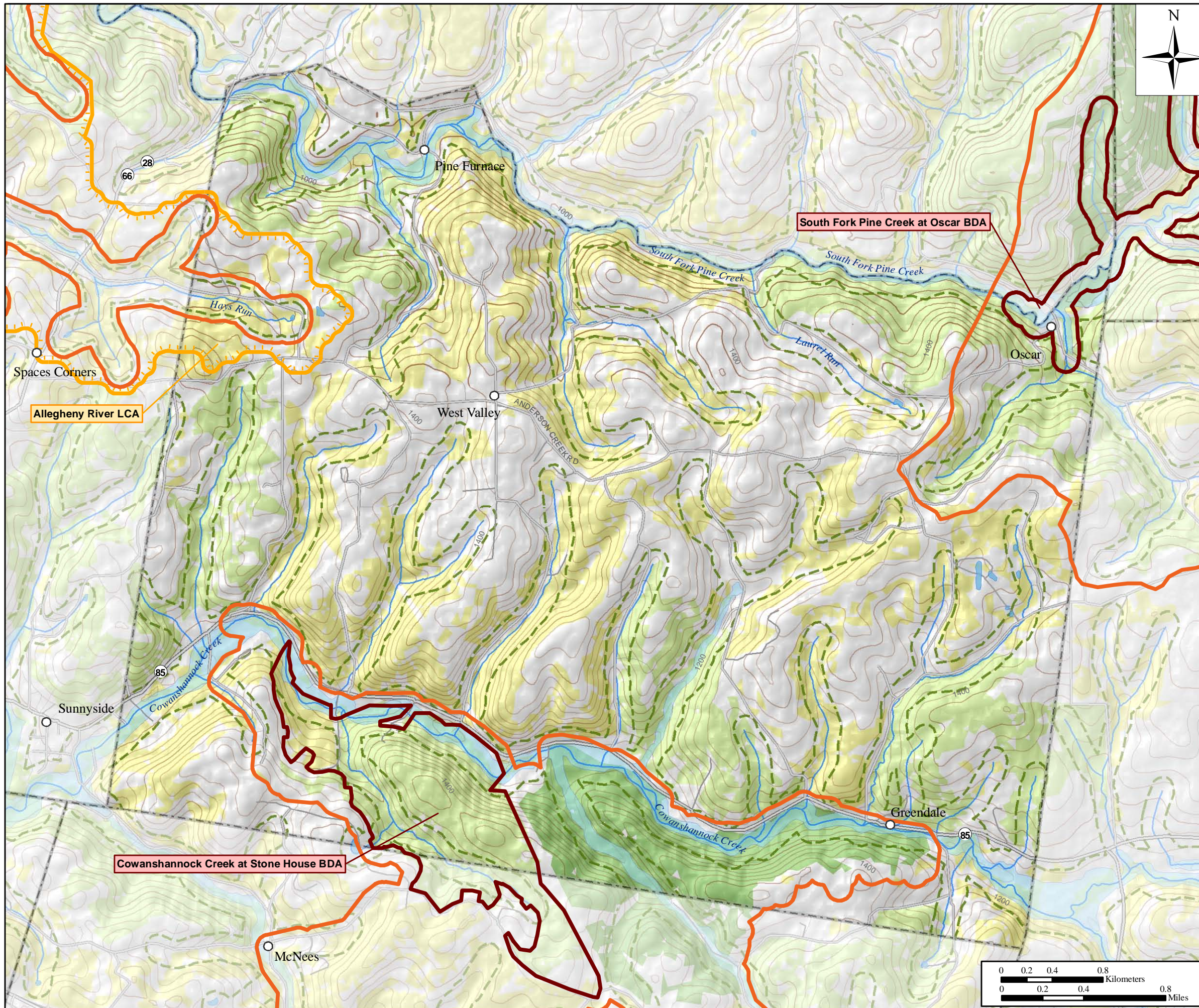
- Cowanshannock Creek at Stone House BDA
- South Fork Pine Creek at Oscar BDA

Landscape Conservation Areas

- Allegheny River LCA

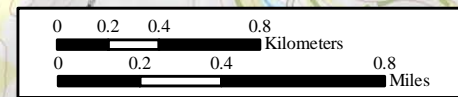
Public Land

- None



Legend

- Landscape Conservation Area (LCA)
- Biological Diversity Area (BDA)
 - Core
 - Supporting Landscape
- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer
- Forest Blocks by Acre**
 - < 250
 - 251 - 500
 - 501 - 1000
 - > 1000
- Municipal Boundary
- PA Game Commission
- 40 Ft. Contour Line



Valley Township

Valley Township is in central Armstrong County and covers 14.7 square miles. South Fork Pine Creek marks the boundary between Valley and Boggs Township. Much of this stream is buffered by forest. The Cowanshannock Creek and its tributaries drain the southern two-thirds of the township. Both streams travel westward through the township and are part of the Allegheny River watershed. All the streams in Valley Township support aquatic life (Department of Environmental Protection 2009). Forested stream buffers protect the water quality of the streams within them. Efforts should be made to protect the forest that covers 51% of the township. The largest forest blocks (400 – 600 acres) lie to the south of Cowanshannock Creek. Agriculture makes up 38% of the land use.



Denise Watts, PNHP

Garlic mustard is an invasive species that threatens West Virginia white populations.

Cowanshannock Creek at Stone House

BDA – Although much of the forests in this area of the county have been fragmented, the large patches of forest in the southern part of Valley Township provide habitat for the **West Virginia white** (*Pieris virginiensis*), a globally vulnerable and state imperiled butterfly species of concern. This small, white butterfly requires large patches of forest and will not regularly cross roads and other breaks in the forest canopy. The larval host plant of the West Virginia white is toothwort (*Cardamine diphylla*), while adults nectar on toothworts and other spring flowering plants. Adults are typically seen flying in April and May.

Threats and Stresses – West Virginia whites are often localized in high quality forests and are sensitive to disturbances in the forest.

Recolonization is difficult once the population is gone, since they do not readily cross non-forested areas. Forest fragmentation, overbrowsing of larval host plants and nectar plants by deer, and invasion by garlic mustard are major threats to West Virginia white populations. Garlic mustard is a common invasive species in Pennsylvania. Garlic mustard is related to the larval host plant, and adults may lay their eggs on this plant, but this species is toxic to the caterpillars if eaten. Spraying of Bt for gypsy moth control is also a threat to West Virginia white populations.

Conservation Recommendations – Unfragmented forests need to be kept intact. Even relatively small breaks in the forest canopy can create a barrier to movement by the adults. Disturbance also creates openings for invasive species, such as garlic mustard. Deer populations should be managed to stay in balance with the ecosystem as a whole. Areas with known West Virginia white populations should not be sprayed with Bt or any other insecticide.

South Fork Pine Creek at Oscar BDA – An occurrence of a **species of concern** was found along South Fork Pine Creek at this location. A narrow band of forest runs along this section of Pine Creek, but roads and agricultural areas fragment the forest into small sections. Relying on clean water to maintain healthy invertebrate prey populations, this species also uses bushy vegetation along the creek. Streamside vegetation along the creek is necessary for the maintenance of the water quality and to provide critical habitat for the species of concern found at this site.

Threats and Stresses – Riparian vegetation is important to this species as habitat and also as a filter for pollutants. Roads and agricultural areas have disturbed the riparian area. Removal of the riparian vegetation would destroy habitat and allow runoff to enter directly into the stream.

Recommendations – Maintain and restore riparian vegetation to provide habitat and protect water quality for the species of concern located at this site.

Washington Township

	PNDI Rank ¹		Legal Status ¹		Last Seen	Quality ²
	Global	State	State (Proposed)			

NATURAL HERITAGE AREAS:

Allegheny River Pool #7 BDA		<i>Exceptional Significance</i>				
River redhorse (<i>Moxostoma carinatum</i>) – fish	G4	S3S4	N(CU)	1997	E	
Elktoe (<i>Alasmidonta marginata</i>) – mussel	G4	S4	N(N)	2007	E	
Wabash pigtoe (<i>Fusconaia flava</i>) – mussel	G5	S2	N(PE)	2007	B	
Fragile papershell (<i>Leptodea fragilis</i>) – mussel	G5	S2	N(CR)	2005	D	
Pink heelsplitter (<i>Potamilus alatus</i>) – mussel	G5	S2	N(CR)	2005	CD	
Paper pondshell (<i>Utterbackia imbecillis</i>) – mussel	G5	S3S4	N(CU)	2001	E	
Sensitive species of concern ³	-	-	-	2007	E	
Sensitive species of concern ³	-	-	-	2005	E	
Sensitive species of concern ³	-	-	-	2007	E	
Allegheny River Pool #8 BDA		<i>Exceptional Significance</i>				
River carpsucker (<i>Carpiodes carpio</i>)	G5	S1	N(CU)	2000	E	
River redhorse (<i>Moxostoma carinatum</i>)	G4	S3S4	N(CU)	1997	E	
Longhead darter (<i>Percina macrocephala</i>)	G3	S2S3	N(PT)	2000	E	
Elktoe (<i>Alasmidonta marginata</i>) – mussel	G4	S4	N(N)	2007	E	
Wabash pigtoe (<i>Fusconaia flava</i>) – mussel	G5	S2	N(PE)	2007	B	
Wavy-rayed lampmussel (<i>Lampsilis fasciola</i>) – mussel	G5	S4	N(N)	2007	E	
Fragile papershell (<i>Leptodea fragilis</i>) – mussel	G5	S2	N(CR)	2005	D	
Round pigtoe (<i>Pleurobema sintoxia</i>) – mussel	G4G5	S2	N(PE)	2004	E	
Pink heelsplitter (<i>Potamilus alatus</i>) – mussel	G5	S2	N(CR)	2005	CD	
Red-head pondweed (<i>Potamogeton richardsonii</i>) – plant	G5	S3	PT(PR)	2002	E	
Sensitive species of concern ³	-	-	-	2007	E	
Sensitive species of concern ³	-	-	-	2007	D	
Sensitive species of concern ³	-	-	-	2005	E	
Sensitive species of concern ³	-	-	-	2007	E	
Allegheny River Pool #9 BDA		<i>Exceptional Significance</i>				
Elktoe (<i>Alasmidonta marginata</i>) – mussel	G4	S4	N(N)	2007	E	
Wavy-rayed lampmussel (<i>Lampsilis fasciola</i>) – mussel	G5	S4	N(N)	2007	E	
Pocketbook (<i>Lampsilis ovata</i>) – mussel	G5	S3S4	N(N)	1985	E	
Paper pondshell (<i>Utterbackia imbecillis</i>) – mussel	G5	S3S4	N(CU)	1997	E	
Red-head pondweed (<i>Potamogeton richardsonii</i>) – plant	G5	S3	PT(PR)	2002	E	
Sensitive species of concern ³	-	-	-	1991	E	
Sensitive species of concern ³	-	-	-	2000	E	
Sensitive species of concern ³	-	-	-	2001	E	
Sensitive species of concern ³	-	-	-	2000	E	
Allegheny River shoreline below Lock #9 BDA		<i>Notable Significance</i>				
Blue false-indigo (<i>Baptisia australis</i>) – plant	G5	S2	N(PT)	2008	A	
Wild bean (<i>Strophostyles umbellata</i>) – plant	G5	S2	N(PE)	2008	E	
Big bluestem - indian grass river grassland – natural community	GNR	S3	N(N)	2008	E	

Allegheny River slope at Cosmus BDA*Notable Significance*

Sensitive species of concern ³	-	-	-	2008	E
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LANDSCAPE CONSERVATION AREAS:

Allegheny River LCA

PUBLICLY MANAGED LAND:

State Game Land #105

1 = Please refer to Appendix I for an explanation of PNHP ranks and legal status

2 = Please refer to Appendix II for an explanation of quality ranks

3 = This species is not named by request of the jurisdictional agency

Armstrong County Natural Heritage Inventory Washington Township

Biological Diversity Areas

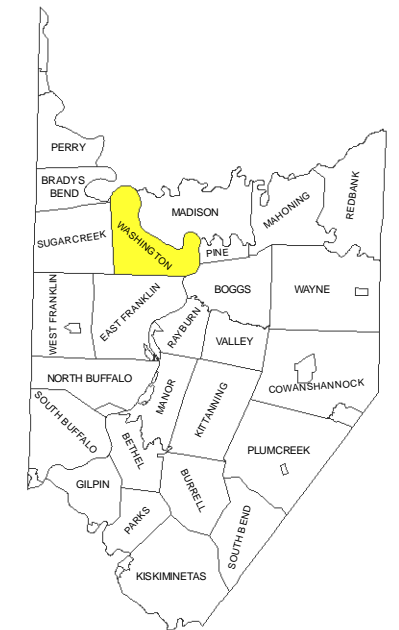
- Allegheny River Pool #7 BDA
- Allegheny River Pool #8 BDA
- Allegheny River Pool #9 BDA
- Allegheny River shoreline below Lock #9 BDA
- Allegheny River Slope at Cosmus BDA

Landscape Conservation Areas

- Allegheny River LCA

Public Land

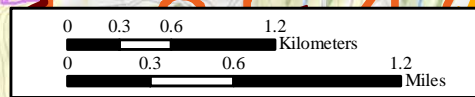
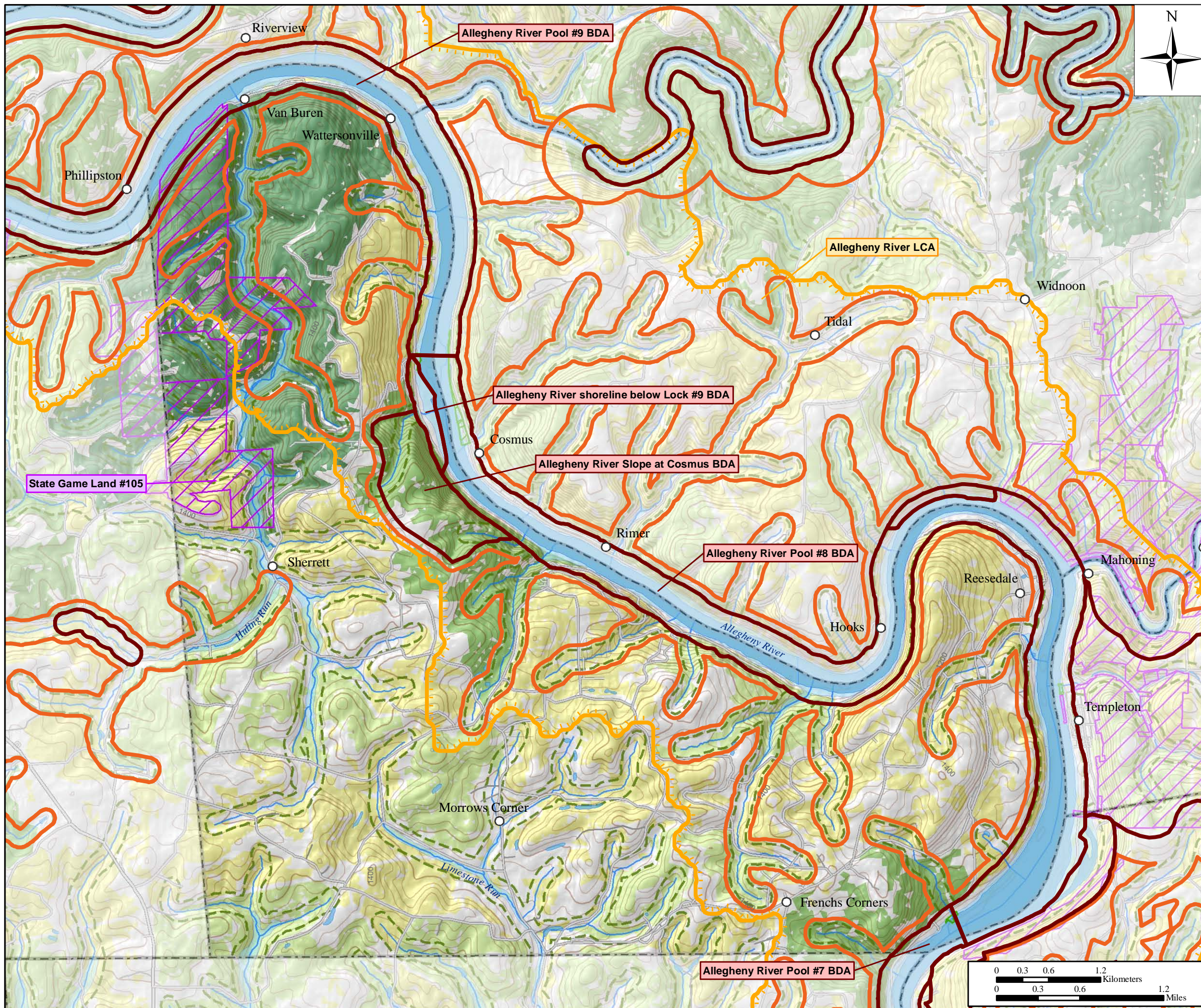
- State Game Land #105



Legend

- Landscape Conservation Area (LCA)
- Biological Diversity Area (BDA)**
- Core
- Supporting Landscape
- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer
- Forest Blocks by Acre**
- < 250
- 251 - 500
- 501 - 1000
- > 1000
- Municipal Boundary
- PA Game Commission
- 40 Ft. Contour Line

Pennsylvania Natural Heritage Program



Washington Township

Washington Township is in northern Armstrong County and covers 23.0 square miles. The Allegheny River flows along the northern and eastern borders of the township. The Huling Run drainage covers the eastern half of the township and flows due north from the southern part of the township to the Allegheny River. Abandoned mine drainage impairs this stream near its confluence with the Allegheny River as well as some of the tributaries in the southwest part of the township. Limestone Run flows south and east into East Franklin Township where it flows into the Allegheny River. Limestone Run and its tributaries are impaired by abandoned mine drainage (Department of Environmental Protection 2009). Restoration of these streams should be a priority.

The US Steel Mine Important Mammal Area (IMA) covers much of Washington Township except for the south central region. A large forest block of over 2000 acres occurs in the northwest. This coincides with portions of State Game Lands (SGL) #105. Forests make up 64% of the township and are a valuable resource that should be protected. Agriculture makes up 20% of the landscape.

Allegheny River Pool #7 BDA

Allegheny River Pool #8 BDA

Allegheny River Pool #9 BDA

The Allegheny River is one of the most ecologically significant areas in Armstrong County, including a large diversity of fish and mussel species. The Allegheny River begins in Potter County and flows north into New York. The river then turns south and flows down through Warren, Forest, and Venango Counties. As the Allegheny River enters Armstrong County it is free-flowing until it reaches Lock and Dam #9 north of Cosmus. The Allegheny River combines with the Monongahela River in Allegheny County, before it enters into the Ohio River. The lock and dam system was created in the 1920's and 1930's for navigation. The dams alter the natural flow of the river and create a different type of habitat than is found in the free-flowing sections.

The health of the Allegheny River has been threatened by pollutants and other disturbance. Abandoned mine drainage has impacted many of the streams in Armstrong County. Few mussels were found in other waterways, due to lowered pH and diminished water quality. There are also some other notable point source pollutants to the Allegheny, such as the PPG dump near Ford City that is imputing heavy metals into the river. The Allegheny River, however, seems able to maintain populations of species that cannot tolerate low water quality. Freshwater mussels are one group of organisms that require high water quality. While many mussel species historically known from the Allegheny River have been extirpated, certain sections of the river have some of the highest diversity of freshwater mussels in the state.

Sand and gravel dredging is another threat facing aquatic species, especially mussels. The substrate is removed from the river bottom and is often used to build roads. This impacts the mussel habitat in areas that allow dredging, including Pools #7, 8, and 9.

Despite the dams along the Allegheny River creating habitat that is deeper and slower moving than most of the free-flowing sections of the river, there are still some areas that have the shallow, quick-moving riffle habitat that supports higher mussel populations. This habitat can especially be found below dams and near sediment deposits that have formed islands in the river.

Allegheny River Pool #7 is located in Kittanning and continues upstream near the town of Frenchs Corners. This section of the Allegheny River flows through the more populated areas of the county, specifically Kittanning and Ford City. A large portion of Kittanning lies within the floodplain of the

Allegheny River, putting this area in danger of flooding. Five freshwater mussel species of concern are currently known in the Allegheny River Pool #7- **elktoe** (*Alasmidonta marginata*), **fragile papershell** (*Leptodea fragilis*), **paper pondshell** (*Utterbackia imbecillis*), **pink heelsplitter** (*Potamilus alatus*), and **wabash pigtoe** (*Fusconaia flava*). The Allegheny River is also home to a large number of fish species, including two species of concern. **River carpsucker** (*Carpiodes carpio*) and **river redhorse** (*Moxostoma carinatum*) have been located along this section of the Allegheny River. Allegheny River Pool #7 also provides habitat for **three other aquatic animal species of concern**.

Allegheny River Pool #8 is located just above the town of Frenchs Corners and continues upstream north of Cosmus. Six freshwater mussel species of concern are currently known in the Allegheny River Pool #8- **elktoe** (*Alasmidonta marginata*), **fragile papershell** (*Leptodea fragilis*), **pink heelsplitter** (*Potamilus alatus*), **round pigtoe** (*Pleurobema sintoxia*), **wabash pigtoe** (*Fusconaia flava*), and **wavy-rayed lampmussel** (*Lampsilis fasciola*). The Allegheny River is also home to a large number of fish species, including three species of concern. **Longhead darter** (*Percina microcephalus*), **river carpsucker** (*Carpiodes carpio*), and **river redhorse** (*Moxostoma carinatum*) have been located along this section of the Allegheny River. Allegheny River Pool #8 also provides habitat for **four other aquatic animal species of concern**.

Allegheny River Pool #9 is located north of Cosmus. This section of the river will be described upstream south of Foxburg. Four freshwater mussel species of concern are currently known in the Allegheny River Pool #9- **elktoe** (*Alasmidonta marginata*), **paper pondshell** (*Utterbackia imbecillis*), **pocketbook** (*Lampsilis ovata*), and **wavy-rayed lampmussel** (*Lampsilis fasciola*). The PA-threatened **red-head pondweed** (*Potamogeton richardsonii*) grows submerged in the river, rooted in the cobble covered riverbed of the Allegheny River. As with the other rare species living in this stretch of the river, the continuation of red-head pondweed at this location depends largely on maintaining the water quality of the river. Allegheny River Pool #9 also provides habitat for **four other aquatic animal species of concern**.

Threats and Stresses – The habitat of the stream-dependent species can be considerably impacted from nearby land use decisions. Many of the steep hillsides and stream valleys along the Allegheny River are forested, but there are significant agricultural and mining operations on the banks of the river and within the Allegheny River watershed. In addition, the many impervious surfaces of the surrounding urban area, such as roads, parking lots, and roof tops channel rain water directly into the waterways, taking numerous non-point source pollutants with them. Storm water runoff through urban and suburban areas can be a significant source of chemical pollutants for the waterways, which can severely impact water quality and the food chain of the river.

River dredging directly removes the substrate that the mussels imbed themselves in for most of their adult life. Fish also use this gravel habitat. Once the substrate has been removed, the flow of the river can be altered, and sediment can fill in the holes left behind. The sediment makes the river bottom uninhabitable for many species.

Invasive plants, such as purple loosestrife (*Lythrum salicaria*) and Japanese knotweed (*Polygonum cuspidatum*), can be quite common on the islands and along the banks of the river. These aggressive invasive plants dominate portions of the floodplain, outcompeting and displacing native vegetation. The zebra mussel (*Dreissena polymorpha*), another invasive species, has been located in several pools of the Allegheny River. This small mussel can grow on top of native mussels, substrate, and infrastructure in the water, altering the natural system and causing damage to pipes and other objects in the water.

Conservation Recommendations – Conservation efforts should focus on protecting and improving the quality of the surface water for both the local human community as well as for the habitat for the sensitive species of concern. Additional steps can be taken to protect and improve the aquatic habitat. Maintain and

restore the natural hydrology of the Allegheny River. Restore floodplain habitats along the river's edge to slow and filter runoff before it enters the aquatic system. Improve water quality of the river by providing vegetated buffers along inflows to the creek and along the river shoreline. Stop river dredging to maintain the remaining potential habitat for the aquatic species. Control invasive species of plants by eliminating new small populations. Larger well-established populations of invasive species will require a sustained and continual suppression effort to prevent their spread. Contain zebra mussels to those areas already affected by cleaning boats and other items used in the water to control their spread into new areas.

Allegheny River shoreline below Lock #9 BDA – A big bluestem –Indian grass river grassland natural community is located just below lock & dam #9. It is interesting to note that the shallowest portions of the river, that area just below the dam, is the only area within this navigational pool to contain this type of habitat. This is also the last good example of this community type from this point downstream to the Allegheny's confluence with the Ohio River at Pittsburgh. This natural community type is currently considered rare in the state, although it may have been more prevalent on the Lower Allegheny prior to the construction of the nine navigational dams between Kittanning and Pittsburgh (Zimmerman & Podniesinski 2008). A few of the best examples of this community type in the state occur along the Allegheny River between Franklin, Venango County and East Brady, Armstrong County (Zimmerman & Podniesinski 2008).

A good-quality population of the PA-threatened plant species of concern, **blue false-indigo, (*Baptisia australis*)** occurs within and adjacent to the grassland community on the shoreline delta. Blue false-indigo, like the grasslands it is often associated with, is found scattered along the Allegheny River and its major tributaries in areas that receive periodic flooding and scour disturbance. The occurrences of this species greatly diminish in the lower Allegheny River as compared to the free-flowing portions of the river further upstream.

An additional plant species of concern, the PA-endangered **wild bean (*Strophostyles umbellata*)**, occurs on this large sand and cobble riverside habitat. This species occurs primarily on sandy substrates in partial to full sun conditions. This occurrence in Armstrong County is far removed from most of PA's other populations, which occur in the southeast corner of the state.

Threats and Stresses – The grassland habitat at this location occurs along the shoreline of the river on a large sand and cobble delta below the dam. It is likely that if the system of locks and dams were not in place, that this rare plant community would be more prevalent along the lower Allegheny River. Portions of the tall native grassland are currently mowed along the riverfront at a campground. A large part of the blue wild-indigo population is also mowed at this location.

Succession to floodplain forests due to lack of flooding and scour events is another one of the major threats to blue false-indigo. Modification of the natural flow of the river can alter the disturbance regime that is necessary to maintain this habitat.

Invasive species of plants can displace native plant communities. Japanese knotweed, purple loosestrife, and garden loosestrife are currently present along the river shoreline.



Rocky Gleason, PNHP

A large portion of the riverfront grassland community has been repeatedly mowed including a significant part of the blue false-indigo population.

Conservation Recommendations – Any future riverfront development along the river should be setback a minimum of 100 feet from the river’s floodplain. As older riverfront buildings become unusable, the area they occupy should be converted to riverfront riparian buffer. In essence, human buildings and infrastructure should retreat from the river’s edge to protect and improve the quality of the water and habitat for all species including human communities.

Yearly or semi-annual fall mowing of the riverfront grassland may actually help to maintain the open conditions necessary for the big bluestem –Indian grass river grassland natural community in the absence of natural river flood and ice-scour events. However, frequent mowing is not suitable for this habitat. The riverfront grassland is an unusual natural community and could be viewed as an attraction for the tourist-based campground.

Invasive species of plants are frequently a problem along many riparian areas and control efforts need to be targeted and continuous.

Allegheny River slope at Cosmus BDA – The steep, forested hillside along the Allegheny River at this location supports a breeding population of a **species of concern**. This species relies on high water quality for prey and undisturbed breeding habitat.

Threats and Stresses – This species is sensitive to disturbance during the breeding season. Even casual visitation may cause abandonment of the breeding site. Logging is a direct threat due to habitat loss.

Conservation Recommendations – Disturbance of the species of concern should be avoided, especially during the breeding season from January – August. Avoid logging in this area.



Rocky Gleason, PNHP

A section to the river shoreline below lock & dam #9 contains a distinctive big bluestem – Indian grass river grassland natural community.

Wayne Township & Dayton Borough

	<u>PNDI Rank</u> ¹		<u>Legal Status</u> ¹	Last Seen	Quality ²
	Global	State	State (Proposed)		

NATURAL HERITAGE AREAS:

Glade Run at Dayton BDA			<i>Notable Significance</i>		
Stalked bulrush (<i>Scirpus pedicellatus</i>) – plant	G4	S1	PT(PT)	2007	E
Featherbells (<i>Stenanthium gramineum</i>) – plant	G4G5	S1S2	N(TU)	2007	E
Mahoning Creek Dam outflow BDA			<i>High Significance</i>		
Sensitive species of concern ³	-	-	-	2008	E
Mahoning Creek Reservoir Shoreline BDA			<i>Notable Significance</i>		
Cattail sedge (<i>Carex typhina</i>) – plant	G5	S2	PE(PT)	2008	AB
Sensitive species of concern ³	-	-	-	2008	E
South Fork Pine Creek at Oscar BDA			<i>Notable Significance</i>		
Sensitive species of concern ³	-	-	-	2008	E

LANDSCAPE CONSERVATION AREAS: None currently identified

PUBLICLY MANAGED LAND: None

1 = Please refer to Appendix I for an explanation of PNHP ranks and legal status

2 = Please refer to Appendix II for an explanation of quality ranks

3 = This species is not named by request of the jurisdictional agency

Armstrong County Natural Heritage Inventory

Wayne Township & Dayton Borough

Biological Diversity Areas

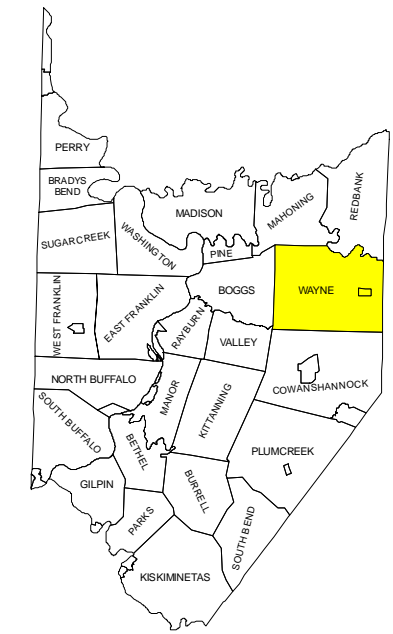
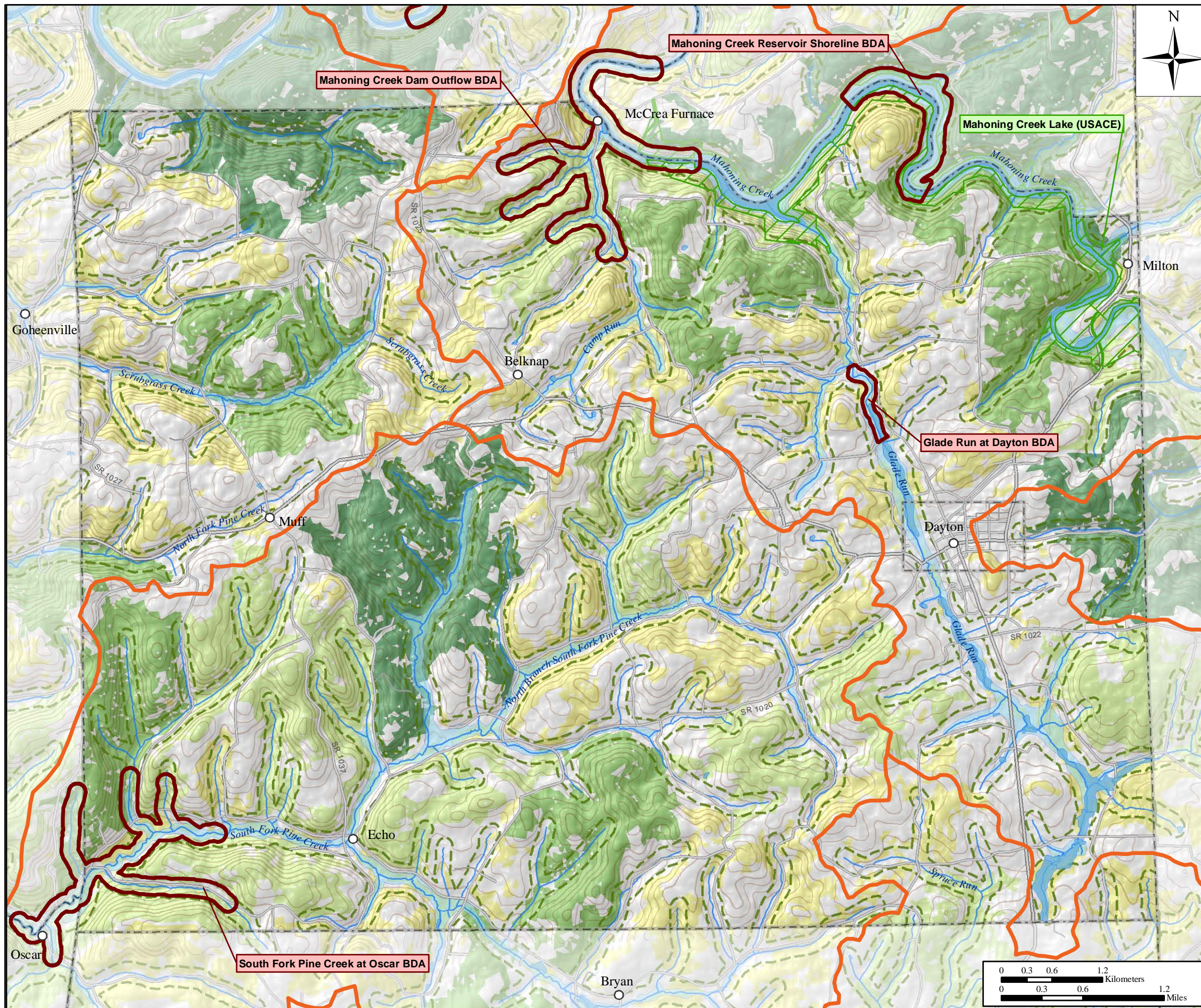
- Glade Run at Dayton BDA
- Mahoning Creek Dam Outflow BDA
- Mahoning Creek Reservoir Shoreline BDA
- South Fork Pine Creek at Oscar BDA

Landscape Conservation Areas

None Currently Identified

Public Land

- Mahoning Creek Lake (USACE)



Legend

- Landscape Conservation Area (LCA)
- Biological Diversity Area (BDA)**
- Core
- Supporting Landscape
- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer
- Forest Blocks by Acre**
- < 250
- 251 - 500
- 501 - 1000
- > 1000
- Municipal Boundary
- US Army Corps of Engineers
- PA Game Commission
- 40 Ft. Contour Line

Pennsylvania Natural Heritage Program

Wayne Township & Dayton Borough

Wayne Township covers 44.9 square miles in eastern Armstrong County. It sits alongside Jefferson County and is second only to Cowanshannock (46.3 square miles) in size. The Mahoning Creek forms a portion of the northern border. The Scrubgrass Creek drains the northwest corner and makes its way to the Mahoning Creek. The southcentral portions of the county drain into the North and South Branches of the South Fork Pine Creek. All of these streams support aquatic life (Department Environmental Protection 2009) and eventually flow into the Allegheny River.

Land use within the township is 41% agriculture and 51% forest. The largest forest block is in the center of the township and covers over 1000 acres. Maintaining the integrity of this large forest block should be a priority. In areas of the township where streams lack a forest buffer, streamside plantings of native trees and shrubs would help reduce non-point source pollution that flows into the waterways. Less than 1% of Wayne Township is developed.

Dayton Borough

Dayton Borough is in eastern Wayne County and covers 0.4 square miles. Thirteen percent of the borough is forest, 40% is in agriculture, and 45% is developed.



Rocky Gleason, PNHP

Glade Run at Dayton BDA – The narrow stream, Glade Run, meanders back and forth within its wide, marshy floodplain. The floodplain wetland is dominated by shrubs, grasses and mixed forbs. A plant species of concern, the PA-threatened, **stalked bulrush** (*Scirpus pedicellatus*) occurs within this marshy habitat. More of this species is likely to be found in similar marshy habitat along Glade Run upstream towards Dayton. The stalked bulrush is near the southern limit of its known range in Pennsylvania. This species may hybridize with the more common wool grass (*Scirpus cyperinus*) where the two co-occur, making determination difficult. Conservation of the naturally vegetated floodplain / shoreline habitat will help maintain viable populations of this species.

Although typically quite narrow, Glade Run meanders back and forth across a wide floodplain.

The forested edge of the floodplain also provides habitat for a population of a state critically imperiled plant species, **featherbells** (*Stenanthium gramineum*). This plant can grow in many different habitat conditions, but is most often found along wetlands. Featherbells has a large, white flower head with thin, grass-like leaves.

The floodplain of Glade Run becomes much narrower as it begins a steeper descent though a forested ravine before emptying into the Mahoning Creek Reservoir. The forested slopes adjacent to the creek provides critical habitat and also serves as a migration corridor for many common species of plants and animals moving through the area.

Threats and Stresses – There are no evident threats to this species at this location and management for this species does not seem to be necessary. The floodplain habitat is only marginally buffered from adjacent roads and agricultural activity.

Conservation Recommendations – Conservation of the stream’s natural hydrology, the floodplain vegetation, and an adequate forested buffer should be adequate to maintain this species at this location. Keep infrastructure improvements, such as roads, residences, and powerline rights-of-way a respectful distance away from the creek’s floodplain. Maintain forested riparian buffers where they already exist, and restore them where they are lacking.

Mahoning Creek Dam outflow BDA – An occurrence of a **species of concern** was found below the dam on Mahoning Creek. Most of this section of Mahoning Creek has a forested buffer of at least 100 meters (328 feet), which will help to keep the water quality high. Relying on clean water to maintain healthy invertebrate prey populations, this species also uses bushy vegetation along the creek. Streamside vegetation along the creek is necessary for the maintenance of the water quality and to provide critical habitat for the species of concern found at this site.

Threats and Stresses – Riparian vegetation is important to this species as habitat and also as a filter for pollutants. Some portions of the riparian area have been thinned for agriculture. Removal of the riparian vegetation would destroy habitat and allow runoff to enter directly into the stream.

Recommendations – Maintain riparian vegetation to provide habitat and protect water quality for the species of concern located at this site.



Rocky Gleason, PNHP

Stalked bulrush can be differentiated from the more common wool grass by its individual, long-stalked fruiting heads.



Cattail sedge (*Carex typhina*)

Rocky Gleason, PNHP

Mahoning Creek Reservoir Shoreline BDA – Mahoning Creek Reservoir was created by the damming of Mahoning Creek in 1941 as a means of controlling floodwaters in the lower Allegheny and Ohio Rivers. The water level in the reservoir fluctuates widely as floodwaters alternately fill and are released, establishing an ebb and flow, like an irregular tide. The difference between average summer water level height and full capacity at the dam breast is roughly 65 feet. Debris from past flood events such as tree parts as well as assorted trash litters the shoreline in a wide band extending up the slope of the shoreline.

The fluctuating water level along the shoreline helps to foster habitat conditions favorable for an unusually large and healthy population of the PA-endangered plant species of concern, **cattail sedge (*Carex typhina*)**. The species typically grows in wet woods and bottomlands, particularly around the edges of low spots that intermittently have standing water. Another **species of concern** was also located breeding at this site.

Threats and Stresses – There are no evident threats to this species at this location and management does not seem to be necessary. The artificially induced shoreline fluctuations actually help maintain favorable

habitat conditions for the cattail sedge. The plants are dispersed widely along the reservoir shoreline and are unlikely to be impacted by park recreational activities. Poorly sited infrastructure improvements such as access roads and parking lots could eliminate portions of the habitat for this species. Disturbance to the other species of concern at this site could affect nesting success.

Conservation Recommendations – Any future infrastructure improvements should remain a respectful distance from the active floodplain of the reservoir. Limit accessibility to nesting location of the species of concern, especially during the nesting period from January to June.

South Fork Pine Creek at Oscar BDA – An occurrence of a **species of concern** was found along South Fork Pine Creek at this location. A narrow band of forest runs along this section of Pine Creek, but roads and agricultural areas fragment the forest into small sections. Relying on clean water to maintain healthy invertebrate prey populations, this species also uses bushy vegetation along the creek. Streamside vegetation along the creek is necessary for the maintenance of the water quality and to provide critical habitat for the species of concern found at this site.

Threats and Stresses – Riparian vegetation is important to this species as habitat and also as a filter for pollutants. Roads and agricultural areas have disturbed the riparian area. Removal of the riparian vegetation would destroy habitat and allow runoff to enter directly into the stream.

Recommendations – Maintain and restore native riparian vegetation to provide habitat and protect water quality for the species of concern located at this site.

West Franklin Township & Worthington Borough

	PNDI Rank ¹		Legal Status ¹	Last Seen	Quality ²
	Global	State	State (Proposed)		

NATURAL HERITAGE AREAS:

Buffalo Creek at Craigs ville BDA		<i>Notable Significance</i>			
Lobed spleenwort (<i>Asplenium pinnatifidum</i>) – plant	G4	S3	N(PR)	2008	BC
Long Run Mine BDA		<i>Exceptional Significance</i>			
Sensitive species of concern ³	-	-	-	2006	D
Sensitive species of concern ³	-	-	-	2006	E
Upper Buffalo Creek BDA		<i>High Significance</i>			
Least brook lamprey (<i>Lampetra aepyptera</i>) – fish	G5	S3	PC(CR)	2003	E
Harpoon clubtail (<i>Gomphus descriptus</i>) – dragonfly	G4	S1S2	N(N)	2007	E
Sable clubtail (<i>Gomphus rogersi</i>) – dragonfly	G4	S1	N(N)	2007	E
Northern pygmy clubtail (<i>Lanthus parvulus</i>) – dragonfly	G4	S3S4	N(N)	2007	E
Sensitive species of concern ³	-	-	-	2007	E

LANDSCAPE CONSERVATION AREAS:

None currently identified

PUBLICLY MANAGED LAND:

None

1 = Please refer to Appendix I for an explanation of PNHP ranks and legal status

2 = Please refer to Appendix II for an explanation of quality ranks

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Armstrong County Natural Heritage Inventory West Franklin Township & Worthington Borough

Biological Diversity Areas

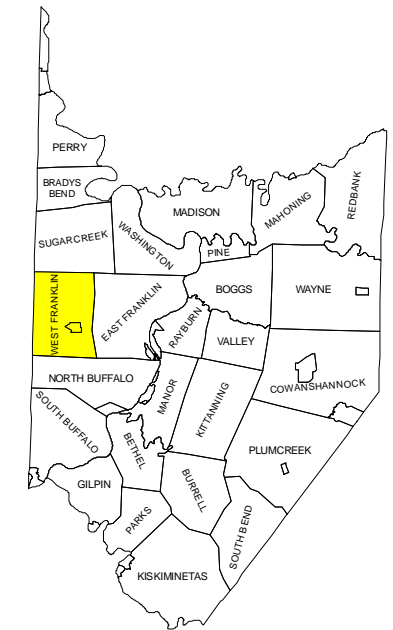
- Buffalo Creek at Craigsville BDA
- Long Run Mine BDA
- Upper Buffalo Creek BDA

Landscape Conservation Areas

None Currently Identified

Public Land

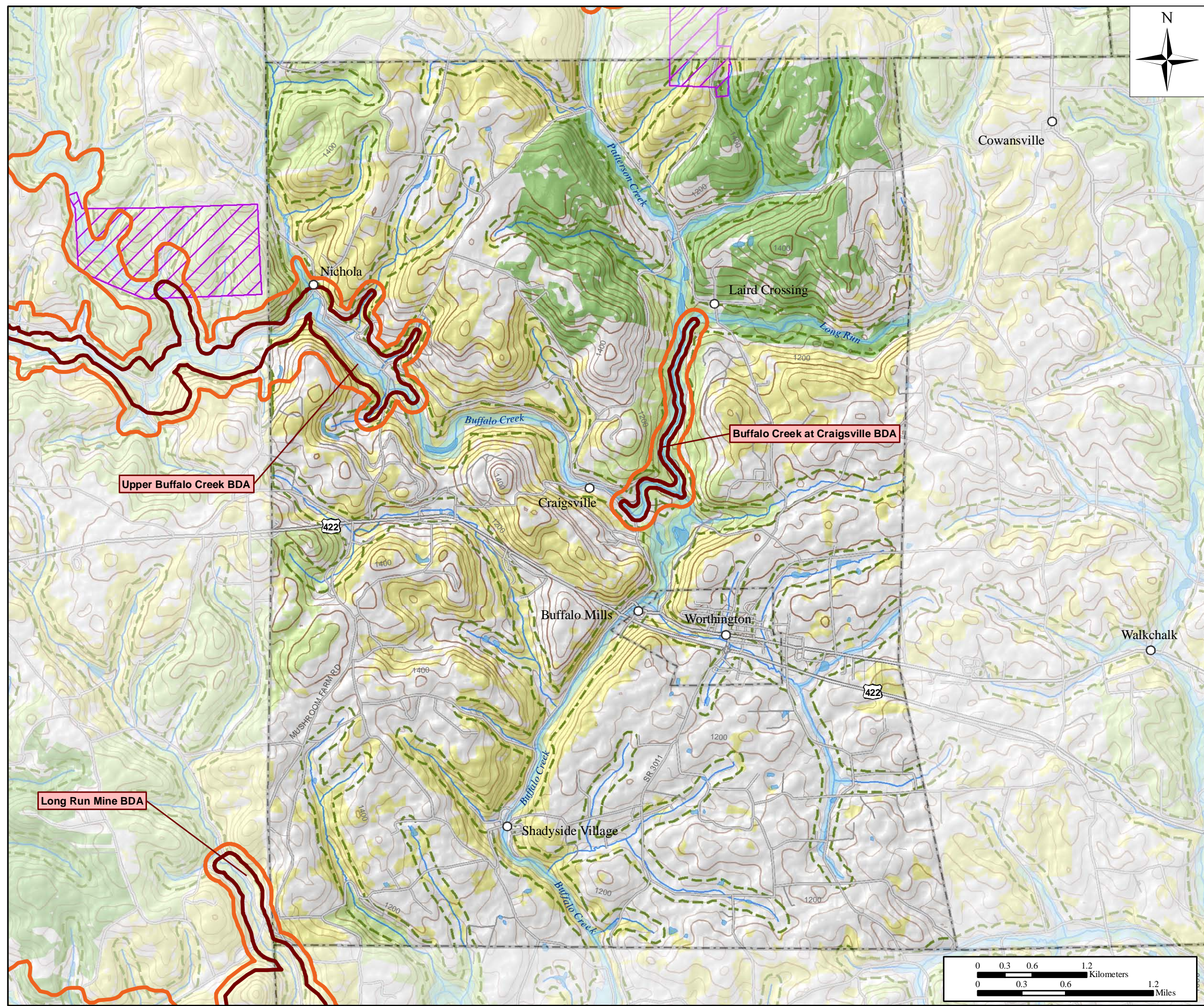
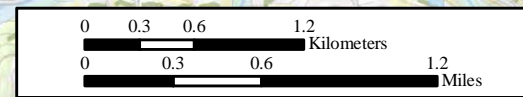
None



Legend

- Landscape Conservation Area (LCA)
- Biological Diversity Area (BDA)**
- Core
- Supporting Landscape
- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer
- Forest Blocks by Acre**
- < 250
- 251 - 500
- 501 - 1000
- > 1000
- Municipal Boundary
- PA Game Commission
- 40 Ft. Contour Line

PNHP
Pennsylvania Natural Heritage Program



West Franklin Township & Worthington Borough

West Franklin is a mid-sized township covering 26.3 square miles in western Armstrong County. It is bordered by Butler County. Worthington Borough is located within the township.

Buffalo Creek and its tributaries drain much of the township eventually flowing into the Allegheny River. Patterson Creek flows south from Sugarcreek Township to join Buffalo Creek in the center of West Franklin Township. Many of the streams which are tributaries to Buffalo Creek in the southern half of the township are degraded by siltation related to agricultural practices or grazing according to data from the Department of Environmental Protection (DEP) in 2009. Abandoned mine drainage also impairs some tributaries to Buffalo Creek coming in from the west. Forest buffers are needed alongside streams to reduce non-point source pollution into the stream. Clean up of damage caused by past mining practices is also needed.

Land cover in the township is 46% forest and 45 % agriculture. Sandstone and shale comprise the bedrock geology. The largest forest blocks occur in the northeast sector of the township and range in size from 300 to nearly 600 acres. Only two percent of the township is developed. Two Important Mammal Areas (IMA) cover parts of West Franklin Township. The Long Run Mine Important Mammal Area (IMA) covers over a third of the southern area of the township while the US Steel Mine IMA spreads across the north central region. Almost all of West Franklin Township is part of the Buffalo Creek Valley Important Bird Area (IBA). The IBA overlaps the two IMAs in the township

Worthington Borough

Worthington Borough covers 0.6 square miles and is located within West Franklin Township. A major tributary to Buffalo Creek flows through the borough. Wastewater impairs this water (Department of Environmental Protection 2009). Improvements to wastewater treatment should be undertaken to restore this stream to health. Within the borough, agriculture makes up 43% of the land use, forest 21% and development covers 34% of the landscape.



Rocky Gleason, PNHP

Lobed spleenwort (*Asplenium pinnatifidum*)

Buffalo Creek at Craigsville BDA– A population of lobed spleenwort (*Asplenium pinnatifidum*), a small fern, occurs along the banks of Buffalo Creek on a shaded rock outcrop. This species is considered vulnerable in the state. About two dozen populations, mostly with few individuals, are currently known to occur in Pennsylvania. Forested habitats flank most of the shoreline of Buffalo Creek and Patterson Creek near Craigsville providing critical riparian buffers to the creeks, trapping sediment and nonpoint sources of pollution before they enter the creeks. Many portions of the upland area have been impacted by past or current mining activity and also support

scattered agricultural fields and rural development.

Threats and Stresses –The population exists as a few scattered individual plants. The small population size and its specialized habitat make the plant susceptible to extirpation at this site. This plant species and its habitat can be damaged or destroyed by unauthorized collection, indiscriminate spraying of herbicide, quarrying, invasive species, and habitat degradation through forest fragmentation. Portions of the

population occur on outcrops directly adjacent to the railroad rights-of-way. Currently, clearing along the railroad has eliminated much of the tree cover along the bank of Buffalo Creek at Craigsville Road.

Recommendations – Removal of the forested canopy around rock outcrops can detrimentally alter the microhabitat conditions that the fern prefers; therefore, vegetation and logging operations should not occur along the floodplain and slopes facing Buffalo and Patterson Creeks. Rock outcroppings along this section of the railroad track should be posted as “no spray” zones and vegetation managed by mechanical means only, with the presence of the rare species always a consideration. The viability of existing populations and the rock outcrop habitat may be enhanced by establishing a surrounding buffer of undisturbed forest. Conservation of the forested riparian buffer of Buffalo and Patterson Creeks will help preserve the habitat necessary for the lobed spleenwort as well as help improve water quality throughout the area.

Long Run Mine BDA – This site is an abandoned mine shaft that now provides habitat for **two species of concern**. Abandoned mines mimic the natural cave habitats that the species typically use. These species are beneficial because of the large number of insects they eat. The riparian forests near the mine provide critical foraging habitat for these species, and others using the mine.

Threats and Stresses – Forest fragmentation would limit foraging and roosting habitat, and the use of insecticides could limit the prey base for these species of concern. The entrance to the mine has been gated to prevent disturbance, but trespassing and vandalism are still potential threats to this site.

Conservation Recommendations – Maintain the existing forests and replant the cleared areas with trees, especially along riparian corridors. Continue to gate the mine entrance and protect this site from trespassing and vandalism.

Upper Buffalo Creek BDA – Two PA critically imperiled odonate species were collected from this section of Buffalo Creek, **harpoon clubtail (*Gomphus descriptus*)** and **sable clubtail (*Gomphus rogersi*)**, as well as a PA vulnerable odonate species, **northern pygmy clubtail (*Lanthus parvulus*)**. Odonates begin their lives as larva in the stream bottom and vegetation. The larva then crawl out of the water on a piece of vegetation or other surface, and the adult emerges. This stretch of Buffalo Creek also provides habitat for the least brook lamprey. This species is not parasitic on other fish. The larva feed on organic material in streams, and the adults do not eat. An additional **species of concern** is known from this location. This section of Buffalo Creek is narrow and bordered by eastern hemlocks. This area also has several mining operations along Buffalo Creek and its tributaries.

Threats and Stresses – While some sections of this area are forested, some of the breeding and foraging habitat of these species passes through mining operations and is bordered by roads. This will allow sediment and other pollutants from the mines and roadways to wash directly into the stream. Degradation of the water quality will threaten the persistence of these populations at this site.

Conservation Recommendations – Restore the forested riparian area where it has been removed, and maintain the forests in areas where it still exists to protect water quality.

Conclusions and General Recommendations

Through the work required to complete the Natural Heritage Inventory (NHI), ecologists, botanists, and zoologists have explored many of the natural areas of Armstrong County. Although many hours over several field seasons were spent surveying, this is not a comprehensive inventory of the biological resources of Armstrong County. Additional explorations of the county will very likely yield additional populations of the species listed in the report, as well species previously unknown to the county.

This work represents an organized effort to inventory the biodiversity present throughout the county. Some of the earliest survey work in this area was completed by botanists and other naturalists during the early part of the 19th century. These early explorers documented many species in the region, including some early records that have been updated in this report. Much of the modern work has concentrated on ecologically significant areas such as the Allegheny River and other sites that harbor rare species. In the surveys conducted through the NHI, we have not only identified rare and endangered plants and animals, but also many common species, for which no formal records previously existed in museum and agency records.

How does Armstrong County contribute to the known biodiversity in Pennsylvania?

Armstrong County contains 117 extant occurrences of endangered, threatened, and rare species—ranking 37 out of the Commonwealth’s 67 counties. Many of these species are found in the Allegheny River and other unique habitats in the county. Municipal breakdowns of this data are presented in Figure 11.

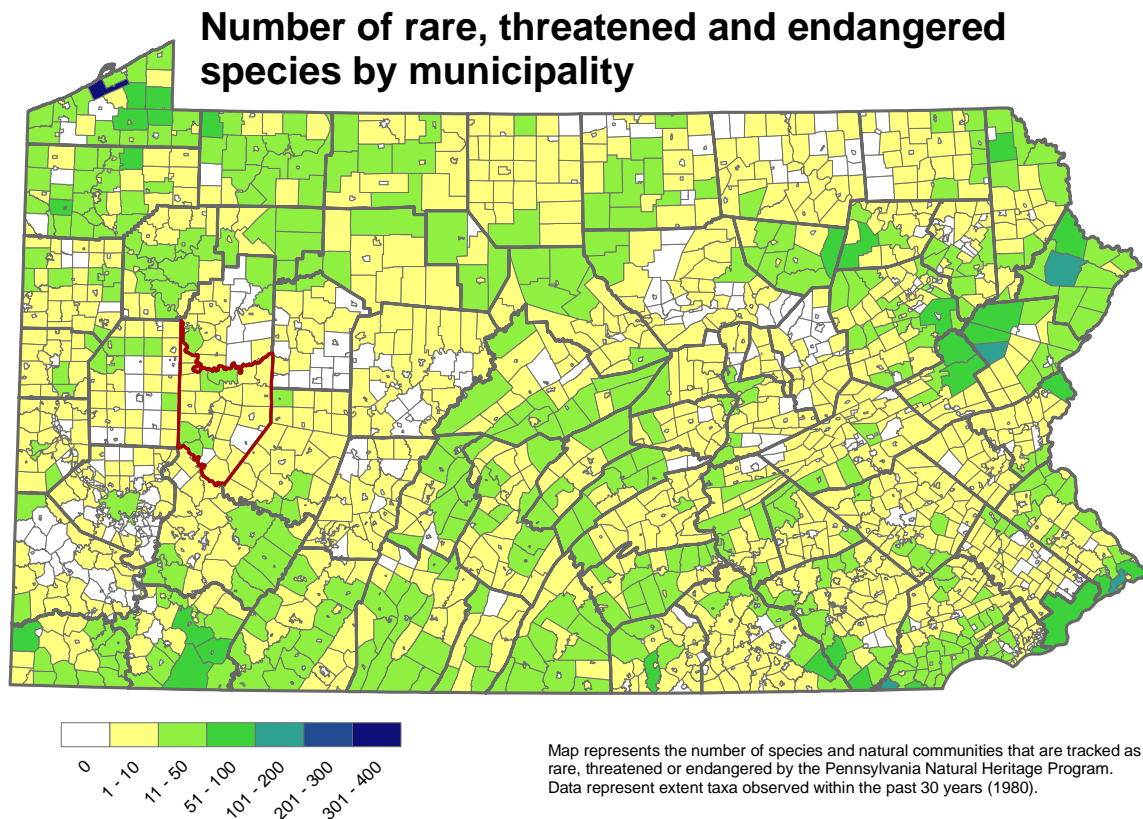


Figure 11. Distribution of endangered, threatened and rare species by municipality, darker colors indicate more occurrences these species in a given municipality. (PNHP Data 2010).

Although Armstrong County is not one of the top counties in terms of biodiversity within the state, it contains a number of species that are confined to this area of the state.

Several globally rare species are found in the unique habitats of Armstrong County, many of these occurring in the Allegheny River –therefore, upstream watershed protection is critical for the persistence of these species.

A breakdown of the rare threatened and endangered species found in Armstrong County by their official state legal status is presented in Table 13.

Additionally, three species in the county are currently protected through the US Endangered Species Act.

Future Study and Data Updates

The data presented in this report represents a snapshot of the species and ecological conditions present in the county. Natural systems are constantly changing due to variations in climate as well as impacts from human disturbance. Lack of access to some sites of interest prevented surveys that may have yielded additional information about the county. Therefore, this report focuses on the current conditions of the county. We hope that this report can be used as a working document to guide for conservation of known rare, threatened, and endangered species and habitats of importance, while also working to identify important natural resources previously undocumented in the county.

Submitting Additional Data

As the state repository for biodiversity data, the Pennsylvania Natural Heritage Program appreciates potential data regarding rare, threatened, and endangered species. Species we currently track are listed on our website at:
<http://www.naturalheritage.state.pa.us/>

A form is presented in Appendix III, for the public to submit their sightings of rare species to us.

Table 13. State conservation status of species of concern in Armstrong County.

State Status	# of occurrences
PA Endangered (PE)	29
PA Threatened (PT)	28
PA Rare (PR)	4
Watch List (W)	2
Tentatively Undetermined (TU)	2
Unknown Status	27

Refer to Appendix 1 for a description of the state status.

The Pennsylvania Natural Heritage Program can provide the County with formal updates to this report at regular intervals (typically five years). Additionally, we can provide a series of additional biodiversity and conservation planning services to supplement the results of this inventory. Please contact the Pennsylvania Natural Heritage Program for additional information regarding these services.

A Final Note on Protected Rare and Endangered Species

The rare and endangered species highlighted in this report are some of the several hundred species in Pennsylvania that are threatened with extirpation or extinction. There are many strong reasons for protecting a species from extinction. The first is that if a species is allowed to go extinct, its ecosystem will have lost a significant element. The second is that endangered species may be indicative of fragile ecosystems that have become degraded — protection of this species may help monitor the quality of the ecosystem. Degraded ecosystems may be indicators of negative effects (e.g. Osprey and the pesticide DDT).

Another reason for protecting rare species is for their value as unique genetic resources, with immeasurable scientific and potential economic importance. Every species may provide significant information for future use in genetic research and medical practices. Beyond these practical considerations, perhaps the most compelling reasons for stewardship are the aesthetic and ethical considerations—there is inherent beauty and recreational value in healthy, species-rich ecosystems.

The protection of rare and endangered species depends on several factors, including increasing scientific knowledge and concerted efforts from government agencies, private organizations and individuals, as well as

promoting awareness of the species through public education. The following section outlines general recommendations that are beginning steps to protect the species and natural heritage areas (NHAs) outlined in this report.

Using the Natural Heritage Inventory in the Armstrong County Planning Process:

The following are specific recommendations that will serve to incorporate the information in this report into planning and land conservation activities in Armstrong County.

Adopt the Armstrong County Natural Heritage Inventory (CNHI) by resolution. The CNHI report should be used as one of the primary sources of information on the location of sensitive natural features within the county.

Incorporate the CNHI information into the implementation of comprehensive plans. This CNHI report should be included as a resource for future revisions and amendments to the Comprehensive Plan (completed in April 2005) and the Comprehensive Recreation and Open Space Plan (in progress). Add the Biological Diversity Areas identified in the CNHI report to the County Comprehensive Plan's list of Environmentally Sensitive Areas (page 147). The County Future Land Use Map (page 199) currently lacks a category for resource conservation. Revise the Future Land Use Map to incorporate Biological Diversity Areas into a category of Resource Conservation Areas. Use the CNHI report to guide future planning, development, subdivision review, acquisition, and conservation initiatives.

Implementation of several of the goals in the Armstrong County Comprehensive Plan can lead to conservation of natural resources within the county:

- “Preserve natural resources and agricultural land by utilizing existing and abandoned properties for redevelopment of commercial and industrial uses” (page 104).
- “Integrate transportation policies with land use policies to make them mutually supportive, i.e., target transportation improvements to growth areas/corridors” (page 130).
- “...ensure that preservation of open space is an essential element of the future land use plan” (page 155).

Planning and zoning initiatives can help achieve a balance of growth and open space preservation within the municipalities. Within Armstrong County, only five out of 28 Townships & seven out of 16 Boroughs/Cities currently have zoning ordinances in place to help guide land use decisions. Lack of planning and control over the siting of development within the municipalities will likely result in haphazard growth patterns with costly infrastructure demands and discontinuous open space. Future municipal plans and zoning initiatives should be developed for all municipalities and incorporate the CNHI information of this report into a resource conservation category.

Incorporate the CNHI report information into the Armstrong County Greenway Plan Work to develop regional, multi-county green infrastructure plans to provide for regional greenway connectivity.

General Recommendations

Approaches to protecting a NHA are wide-ranging, and factors such as land ownership, time constraints, and tools/resources available should be considered when prioritizing protection of these sites. Prioritization works best when incorporated into a long-term, large-scale plan; however, opportunities may arise that do not conform to a plan and the decision on how to manage or protect a natural heritage area may be made on a site-by-site basis. Keep in mind that personnel in our program or staff from state natural resource agencies are available to discuss more specific options as needed.

1. **Consider conservation initiatives for NHAs on private land.**

Conservation easements protect land while leaving it in private ownership. An easement is a legal agreement between a landowner and a conservation or government agency that permanently limits a property's use in order to protect its conservation values. It can be tailored to the needs of both landowner and conservation organization and will not be extinguished with new ownership. Tax incentives may apply to conservation easements donated for conservation purposes.

Lease and management agreements also allow the landowner to retain ownership and temporarily ensure protection of land. There are no tax incentives for these conservation methods. A lease to a land trust or government agency can protect land temporarily and ensure that its conservation values will be maintained. This can be a first step to help a landowner decide if they want to pursue more permanent protection methods. Management agreements require landowners and land trusts to work together to develop a plan for managing resources such as plant or animal habitat, protection of a watershed, forest or agricultural land with land trusts offering technical expertise.

Land acquisition by a conservation organization can be at fair market value or as a bargain sale in which a sale is negotiated for a purchase price below fair market value with tax benefits that reduce or eliminate the disparity. Identify areas that may be excellent locations for new county or township parks. Sites that can serve more than one purpose such as wildlife habitat, flood and sediment control, water supply, recreation, and environmental education would be particularly ideal. Private lands adjacent to public lands should be examined for acquisition when a NHA is present on either property and there is a need for additional land to complete protection of the associated natural features.

Fee simple acquisition is when a buyer purchases land outright and has maximum control over the use and management of the property and its resources. This conservation initiative is appropriate when the property's resources are highly sensitive and protection cannot be guaranteed using other conservation approaches.

Unrestricted donations of land are welcomed by land trusts. The donation of land entitles the donor to a charitable deduction for the full market value, as well as a release from the responsibility of managing the land. If the land is donated because of its conservation value, the land will be permanently protected. A donation of land that is not of high biological significance may be sold, with or without restrictions, to a conservation buyer and the funds used to further the land trust's conservation mission.

Local zoning ordinances are one of the best-known regulatory tools available to municipalities. Examples of zoning ordinances a municipality can adopt include: overlay districts where the boundary is tied to a specific resource or interest such as riverfront protection and floodplains, and zoning to protect stream corridors and other drainage areas using buffer zones.

2. **Prepare management plans that address species of concern and natural communities.**

Many of the already-protected NHAs are in need of additional management recommendations to ensure the continued existence of the associated natural elements. Incorporate site-specific recommendations into existing management plans or prepare new plans. Recommendations may include: removal of exotic plant species; leaving the area alone to mature and recover from previous disturbance; creating natural areas within existing parks; limiting land-use practices such as mineral extraction, residential or industrial development, and agriculture; and implementing sustainable forestry practices. For example, some species simply require continued availability of a natural community while others may need specific management practices such as canopy thinning, mowing, or burning to maintain their habitat requirements.

Existing parks and conservation lands provide important habitat for plants and animals at both the county level and on a regional scale. For example, these lands may serve as nesting or wintering areas

for birds or as stopover areas during migration. Management plans for these areas should emphasize a reduction in activities that fragment habitat. Adjoining landowners should be educated about the importance of their land as it relates to habitat value, especially for species of concern, and agreements should be worked out to minimize activities that may threaten native flora and fauna.

3. Protect bodies of water.

Protection of creeks, rivers, wetlands and reservoirs is vital for ensuring the health of human communities and natural ecosystems; especially those that protect biodiversity, supply drinking water, and are attractive recreational resources. Many rare species, unique natural communities, or locally significant habitats occur in wetlands and water bodies and are directly dependent on natural hydrological patterns and water quality for their continued existence. Ecosystem processes also provide clean water supplies for human communities and do so at significant cost savings in comparison to water treatment facilities. Hence, protection of high quality watersheds is the only way to ensure the viability of natural habitats and water quality. Scrutinize development proposals for their impact on entire watersheds, not just the immediate project area. Cooperative efforts in land use planning among municipal, county, state, and federal agencies, conservation organizations, developers, and residents can lessen the impact of development on watersheds.

4. Provide for buffers around NHAs.

Development plans should provide for natural buffers between disturbances and Natural Heritage Areas (NHAs). Disturbances may include construction of new roads and utility corridors, non-sustainable timber harvesting, and fragmentation of large pieces of land. Storm runoff from these activities results in the transport of nutrients and sediments into aquatic ecosystems (Trombulak and Frissell 2000). County and township officials can encourage landowners to maintain vegetated buffers within riparian zones. Vegetated buffers (preferably of PA-native plant species) help reduce erosion and sedimentation and shade/cool the water. This benefits aquatic animal life, provides habitat for other wildlife species, and creates a diversity of habitats along the creek or stream. Staff at the Pennsylvania Natural Heritage Program (PNHP) or natural resources agencies can provide further guidance regarding buffer considerations appropriate for various kinds of natural resources within NHAs, e.g., barren community, wetland, water body, or forest.

Watersheds or subwatersheds where natural communities and species of concern occur (outlined on the township maps in this report) should be viewed as areas of sensitivity, although all portions of the watershed may not be zones of potential impact. As an example, conserving natural areas around municipal water supply watersheds provides an additional protective buffer around the water supply, habitat for wildlife, and may also provide low-impact recreation opportunities.

5. Reduce fragmentation of the landscape surrounding natural heritage areas.

Encourage development in sites that have already seen past disturbances. The reclamation of previously disturbed areas, or brownfield development, for commercial and industrial projects presents one way to encourage economic growth while allowing ecologically sensitive areas to remain undisturbed. For example, reclaimed surface mines can be used for wind and other development when feasible. Cluster development can be used to allow the same amount of development on much less land and leave much of the remaining land intact for wildlife and native plants. By compressing development into already disturbed areas with existing infrastructure (villages, roads, existing rights-of-way), large pieces of the landscape can be maintained intact. If possible, networks or corridors of woodlands or greenspace should be conserved, linking sensitive natural areas to each other.

Care should be taken to ensure that protected natural areas do not become "islands" surrounded by development. In these situations, the site is effectively isolated and its value for wildlife is reduced. Careful planning can maintain natural environments and plants and animals associated with them. A

balance between growth and the conservation of natural and scenic resources can be achieved by guiding development away from the most environmentally sensitive areas.

6. Encourage grassroots organizations.

County and municipal governments can do much of the work necessary to plan for the protection and management of natural areas identified in this report. However, grassroots organizations are needed to assist with obtaining funding, identifying landowners who wish to protect their land, and providing information about easements, land acquisition, and management and stewardship of protected sites. County and municipal governments should engage local land trusts and conservation organizations in activities occurring in their project areas. Increasingly, local watershed organizations and land trusts are taking proactive steps to accomplish conservation at the local level. When activities threaten to impact ecological features, the responsible agency should be contacted. If no agency exists, private groups such as conservancies, land trusts, and watershed associations should be sought for ecological consultation and specific protection recommendations.

7. Manage for invasive species.

Invasive species threaten native diversity by dominating habitat used by native species and disrupting the integrity of the ecosystems they occupy. Management for invasives depends upon the extent of establishment of the species. Small infestations may be easily controlled or eliminated but more well established populations might present difficult management challenges. Below is a list sources for invasive species information.

- The *Mid-Atlantic Exotic Plant Pest Council* (MA-EPPC) is a non-profit organization (501c3) dedicated to addressing the problem of invasive exotic plants and their threat to the Mid-Atlantic region's economy, environment, and human health by: providing leadership; representing the mid-Atlantic region at national meetings and conferences; monitoring and disseminating research on impacts and controls; facilitating information development and exchange; and coordinating on-the-ground removal and training. A membership brochure is available as a PDF file at <http://www.ma-eppc.org>.
- Several excellent web sites exist to provide information about invasive exotic species. The following sources provide individual species profiles for the most troublesome invaders, with information such as the species' country of origin, ecological impact, geographic distribution, as well as an evaluation of possible control techniques.
 - The Virginia Natural Heritage Program's invasive plant page at <http://www.dcr.state.va.us/dnh/invinfo.htm>
 - The Missouri Department of Conservation's Missouri Vegetation Management Manual at <http://mdc.mo.gov/nathis/exotic/vegman/>
 - U.S. Department of the Interior, National Park Service invasive species monitoring resources at <http://science.nature.nps.gov/im/monitor/invasives/index.cfm>
- The following site is a national invasive species information clearinghouse listing numerous other resources on a variety of related topics: <http://www.invasivespecies.gov/>

8. Incorporate CNHI information into planning efforts.

Through internal planning, decision-making related to land-use development, and participation in regional planning initiatives, counties, and municipalities could profoundly shape the land and landscapes of Pennsylvania. Natural Heritage Areas can be readily included in comprehensive plans, greenway and open space plans, parks and recreation plans, and regional planning initiatives. DCNR-funded greenway and open space plans, Heritage Region plans, and River Conservation Plans are good examples of planning efforts that reach beyond county boundaries.

GLOSSARY

Ambystomid: a small to moderate-sized terrestrial or semiaquatic New World salamander. Ambystomid salamanders possess lungs, as compared to plethodontid salamanders, which do not.

Anthropogenic: human caused.

Bedrock: the solid rock that underlies loose material such as soil, sand, clay, or gravel.

Biological Diversity Area (BDA): an area containing and important in the support of plants or animals of concern at state or federal levels, exemplary natural communities, or exceptional native diversity.

Bituminous coal: coal that contains more than 14% volatile matter. It is dark brown to black and burns with a smoky flame. Bituminous coal is the most abundant type of coal.

Bog: a low-nutrient, highly acidic wetland where sphagnum peat accumulates to the point where plant roots have minimal contact with either surface water or groundwater.

Calcareous: containing calcium carbonate. When the term is used to describe a type of rock, it implies that as much as 50% of the rock is calcium carbonate. Limestone is the most important and widely distributed of the carbonate rocks.

Ecology: the study of relations between organisms and their natural environment, living and nonliving.

Ecosystem: The biotic (living) community and its abiotic (nonliving) environment functioning as a system.

Endemic: a species or other taxonomic group that is restricted to a particular geographic region, owing to such factors as isolation or response to soil or climatic conditions.

Eutrophication: the process of nutrient enrichment (usually by nitrates and phosphates) in aquatic ecosystems, such that the productivity of the system ceases to be limited by the availability of nutrients. It occurs naturally over geologic time, but may be accelerated by human activities (e.g., sewage disposal or agricultural run-off).

Extant: in existence; not destroyed or lost.

Extirpated: species that have become locally extinct from an area

Food-web: a conceptual diagram that represents the feeding relationships of organisms within an ecosystem. It consists of a series of interconnecting food-chains, and shows the transfer of energy from primary producers (green plants) through a series of organisms that eat and are eaten. Only some of the many possible relationships can be shown in such a diagram and it is usual to include only one or two carnivores at the highest trophic levels.

Fragmentation: The process where a continuous habitat, such as forest, shrubland, or grassland, is subdivided into a number of separate components. It is a dynamic process, resulting in a changing pattern of habitats in the landscape through time.

Geomorphic: pertaining to the form of the earth or of its surface features.

Graminoid: Grass or grass-like plant, including grasses (*Poaceae*), sedges (*Cyperaceae*), rushes (*Juncaceae*), arrow-grasses (*Juncaginaceae*), and quillworts (*Isoetes*).

Instar: a stage in the life of an insect larva that is between one molt (ecdysis) of its exoskeleton and another. Instars are numbered and there are usually several during larval development.

Landscape Conservation Area (LCA): A large contiguous area; important because of its size, contiguous forest, open space, habitats, and/or inclusion of one or more Biological Diversity Areas, and although including a variety of land uses, has not been heavily disturbed and thus retains much of its natural character.

Mast: a fruit, especially of beech, but also of oak, elm, and other forest trees.

Mesic: refers to an environment that is neither extremely wet (hydric) nor extremely dry (xeric).

Mineral soil: a soil composed predominantly of, and having its properties determined predominantly by, mineral matter. Usually contains < 20% organic matter, but may contain an organic surface layer up to 30 centimeters thick.

Mycorrhiza: a close physical association between a fungus and the roots of a plant, from which both fungus and plant appear to benefit; a mycorrhizal root takes up nutrients more efficiently than does an uninfected root. A wide range of plants can form mycorrhizas of one form or another and some plants appear incapable of normal development in the absence of their mycorrhizal fungi.

Old-field ecosystem: the environment that develops on abandoned farmland as the land gradually reverts to forest.

Physiographic Province: A region of which all parts are similar in geologic structure and climate and which has consequently had a unified geomorphic history; a region whose relief features and landforms differ significantly from that of adjacent regions.

Riparian: pertaining to or situated on the bank of a body of water, especially of a river.

Trophic level: A step in the transfer of energy within a food-web. There may be several trophic levels within a system, for example: producers (autotrophs), primary consumers (herbivores), and secondary consumers (carnivores); further carnivores may form fourth and fifth levels.

Vernal: occurring in the spring.

Xeric: a dry, as opposed to a wet (hydric) or intermediate (mesic) environment.

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GIS DATA SOURCES

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APPENDICES

APPENDIX I: Federal and State Endangered Species Ranking

Several federal and state legislative acts have provided the authority and means for the designation of endangered, threatened, rare, etc. species lists. Those acts and status summaries follow. However, not all of the species or natural communities considered by conservation biologists (e.g., Pennsylvania Biological Survey) as "special concern resources" are included on the state or federal lists. In this county inventory report, "N" denotes those species of concern that are not officially recognized by state or federal agencies. Therefore: N = No current legal status, but is considered to be of concern in Pennsylvania, or is under review for such consideration, by conservation biologists. Contact the Pennsylvania Natural Heritage Program for more information.

Federal Status

All Plants and Animals: Legislative Authority: U.S. Endangered Species Act (1973), U.S. Fish and Wildlife Service, February 21, 1990, Federal Register.

- LE = Listed Endangered - Taxa in danger of extinction throughout all or a significant portion of their ranges.
- LT = Listed Threatened - Taxa that are likely to become endangered within the foreseeable future throughout all or a significant portion of their ranges.
- PE = Proposed Endangered - Taxa already proposed to be listed as endangered.
- PT = Proposed Threatened - Taxa already proposed to be listed as threatened.

Pennsylvania Status

Native Plant Species: Legislative Authority: Title 25 Chapter 82, Conservation of Native Wild Plants, January 1, 1988; Pennsylvania Department of Environmental Resources.

- PE = Pennsylvania Endangered - Plant species which are in danger of extinction throughout most or all of their natural range within this Commonwealth, if critical habitat is not maintained or if the species is greatly exploited by man. This classification shall also include any populations of plant species that are classified as Pennsylvania Extirpated, but which subsequently are found to exist in this Commonwealth.
- PT = Pennsylvania Threatened - Plant species which may become endangered throughout most or all of their natural range within this Commonwealth, if critical habitat is not maintained to prevent their future decline, or if the species is greatly exploited by man.
- PR = Pennsylvania Rare - Plant species which are uncommon within this Commonwealth because they may be found in restricted geographic areas or in low numbers throughout this Commonwealth.
- PX = Pennsylvania Extirpated - Plant species believed by the Department to be extinct within this Commonwealth. These plants may or may not be in existence outside the Commonwealth.
- PV = Pennsylvania Vulnerable - Plant species which are in danger of population decline within this Commonwealth because of their beauty, economic value, use as a cultivar, or other factors which indicate that persons may seek to remove these species from their native habitats.
- TU = Tentatively Undetermined - A classification of plant species which are believed to be in danger of population decline, but which cannot presently be included within another classification due to taxonomic uncertainties, limited evidence within historical records, or insufficient data.

Pennsylvania Status (continued)

Animals - The following state statuses are used by the Pennsylvania Game Commission (Legislative Authority: Title 34, Chapter 133 pertaining to wild birds and mammals, Game and Wildlife Code, revised Dec. 1, 1990) and by the Pennsylvania Fish and Boat Commission (Legislative Authority: Title 30 Chapter 75 pertaining to fish, amphibians, reptiles and aquatic organisms, Fish and Boat Code, revised February 9, 1991):

PE = Pennsylvania Endangered

Birds & mammals - Species in imminent danger of extinction or extirpation throughout their range in Pennsylvania if the deleterious factors affecting them continue to operate. These are: 1) species whose numbers have already been reduced to a critically low level or whose habitat is so drastically reduced or degraded that immediate action is required to prevent their extirpation from the Commonwealth; or 2) species whose extreme rarity or peripherality places them in potential danger of precipitous declines or sudden extirpation throughout their range in Pennsylvania; or 3) species that are classified as "Pennsylvania Extirpated", but which are subsequently found to exist in Pennsylvania as long as the above conditions 1 or 2 are met; or 4) species determined to be "Endangered" pursuant to the Endangered Species Act of 1973, Public Law 93-205 (87 Stat. 884), as amended.

Fish, amphibians, reptiles & aquatic organisms - All species declared by: 1) the Secretary of the United States Department of the Interior to be threatened with extinction and appear on the Endangered Species List or the Native Endangered Species List published in the Federal Register; or 2) are declared by the Pennsylvania Fish and Boat Commission, Executive Director to be threatened with extinction and appear on the Pennsylvania Endangered Species List published by the Pennsylvania Bulletin.

PT = Pennsylvania Threatened

Birds & mammals - Species that may become endangered within the foreseeable future throughout their range in Pennsylvania unless the casual factors affecting the organism are abated. These are: 1) species whose populations within the Commonwealth are decreasing or are heavily depleted by adverse factors and while not actually endangered, are still in critical condition; 2) species whose populations may be relatively abundant in the Commonwealth but are under severe threat from serious adverse factors that are identified and documented; or 3) species whose populations are rare or peripheral and in possible danger of severe decline throughout their range in Pennsylvania; or 4) species determined to be "Threatened" pursuant to the Endangered Species Act of 1973, Public Law 93-205 (87 Stat. 884), as amended, that are not listed as "Pennsylvania Endangered".

Fish, amphibians, reptiles & aquatic organisms - All species declared by: 1) the Secretary of the United States Department of the Interior to be in such small numbers throughout their range that they may become endangered if their environment worsens, and appear on a Threatened Species List published in the Federal Register; or 2) are declared by the Pennsylvania Fish and Boat Commission Executive Director to be in such small numbers throughout their range that they may become endangered if their environment worsens and appear on the Pennsylvania Threatened Species List published in the Pennsylvania Bulletin.

Internal Fish and Boat Commission Status Category:

PC = Pennsylvania Candidate

Species that exhibit the potential to become Endangered or Threatened in the future. Pennsylvania populations of these taxa are: 1) "rare" due to their decline, distribution, restricted habitat, etc.; 2) are "at risk" due to aspects of their biology, certain types of human exploitation, or environmental modification; or, 3) are considered "undetermined" because adequate data is not available to assign an accurate status. This category is unofficial and has no basis in any law (i.e., Chapter 75, Fish and Boat Code), as do the Endangered and Threatened categories.

Invertebrates - Pennsylvania Status: No state agency is assigned to develop regulations to protect terrestrial invertebrates, although a federal status may exist for some species. Aquatic invertebrates are regulated by the Pennsylvania Fish And Boat Commission, but have not been listed to date. Although no invertebrate species are presently state listed, conservation biologists unofficially assign numerous state status and/or state rank designations. NOTE: Invertebrate species are regularly considered under the U.S. Endangered Species Act for federal status assignments.

Global and State Ranking

Global and State Ranking is a system utilized by the network of 50 state natural heritage programs in the United States. Although similar to the federal and state status designations, the ranking scheme allows the use of one comparative system to "rank" all species in a relative format. Unlike state or federal status designation guidelines, the heritage ranking procedures are also applied to natural community resources. Global ranks consider the imperilment of a species or community throughout its range, while state ranks provide the same assessment within each state. Although there is only one global rank used by the heritage network, state ranks are developed by each state and allow a "one-system" comparison of a species or communities imperilment state by state. For more information, contact the Pennsylvania Natural Heritage Program.

Global Element Ranks

- G1 = Critically imperiled globally because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.
- G2 = Imperiled globally because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.
- G3 = Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range or because of other factors making it vulnerable to extinction throughout its range; in terms of occurrences, in the range of 21 to 100.
- G4 = Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.
- G5 = Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.
- GH = Of historical occurrence throughout its range, i.e., formerly part of the established biota, with the expectation that it may be rediscovered (e.g., Bachman's Warbler).
- GU = Possibly in peril range-wide but status uncertain; need more information.
- GX = Believed to be extinct throughout its range (e.g., Passenger Pigeon) with virtually no likelihood that it will be rediscovered.
- GNR = Global rank has yet to be assessed. A GNR rank does not indicate commonness or a globally secure distribution.
- G? = Not ranked to date.

State Element Ranks

- S1 = Critically imperiled in state because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extirpation from the state.
- S2 = Imperiled in state because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it vulnerable to extirpation from the state.
- S3 = Rare or uncommon in state (on the order of 21 to 100 occurrences).
- S4 = Apparently secure in state, with many occurrences.
- S5 = Demonstrably secure in state and essentially ineradicable under present conditions.

Global and State Ranking (continued)

- SA = Accidental (occurring only once or a few times) or casual (occurring more regularly but not every year) in state, including species which only sporadically breed in the state.
- SE = An exotic established in state; may be native elsewhere in North America (e.g., house finch or catalpa in eastern states).
- SH = Of historical occurrence in the state, perhaps having not been verified in the past 20 years, and suspected to be still extant.
- SN = Regularly occurring, usually migratory and typically nonbreeding species for which no significant or effective habitat conservation measures can be taken in the state.
- SR = Reported from the state, but without persuasive documentation which would provide a basis for either accepting or rejecting (e.g., misidentified specimen) the report.
- SU = Possibly in peril in state but status uncertain; need more information.
- SX = Apparently extirpated from the state.
- SZ = Not of significant conservation concern in the state, invariably because there are no (zero) definable element occurrences in the state, although the taxon is native and appears regularly in the state.
- S? = Not ranked to date.

NOTE: The study of naturally occurring biological communities is complex and natural community classification is unresolved both regionally and within Pennsylvania. The Global and State Ranking of natural communities also remains difficult and incomplete. Although many natural community types are clearly identifiable and are ranked, others are still under review and appear as G? and/or S?

APPENDIX II: Pennsylvania Element Occurrence Quality Ranks

Element occurrence ranks (also known as ‘EO ranks’ or ‘quality ranks’) provide a succinct estimate of the probability of a given population of a species to persist for a given period of time. Ranking helps to prioritize populations of rare, threatened, and endangered species for conservation planning and actions.

Quality Rank*	Explanation
A	Excellent occurrence: all A-rank occurrences of an element merit quick, strong protection. An A-rank community is nearly undisturbed by humans or has nearly recovered from early human disturbance; further distinguished by being an extensive, well-buffered occurrence. An A-rank population of a sensitive species is large in area and number of individuals, stable, if not growing, shows good reproduction, and exists in natural habitat.
B	Good occurrence: protection of the occurrence is important to the survival of the element in Pennsylvania, especially if very few or no A-rank occurrences exist. A B-rank community is still recovering from early disturbance or recent light disturbance, or is nearly undisturbed but is less than A-rank because of significantly smaller size, poorer buffer, etc. A B-rank population of a sensitive species is at least stable, in a minimally disturbed habitat, and of moderate size and number.
C	Fair occurrence: protection of the occurrence helps conserve the diversity of a region's or county's biota and is important to statewide conservation if no higher-ranked occurrences exist. A C-rank community is in an early stage of recovery from disturbance, or its structure and composition have been altered such that the original vegetation of the site will never rejuvenate, yet with management and time partial restoration of the community is possible. A C-rank population of a sensitive species is in a clearly disturbed habitat, small in size and/or number, and possibly declining.
D	Poor occurrence: protection of the occurrence may be worthwhile for historical reasons or only if no higher ranked occurrences exist. A D-rank community is severely disturbed, its structure and composition been greatly altered, and recovery to original conditions, despite management and time, essentially will not take place. A D-rank population of a sensitive species is very small with a high likelihood of dying out or being destroyed, and exists in a highly disturbed and vulnerable habitat.
E	Verified as extant, but has not been given a rank; additional information needed to evaluate quality.
F	While known from the site, the last survey failed to find sufficient evidence to verify the element still occurred at the site
H	Historical: there is a lack of recent field information verifying that the population still exists. This may be assigned based on historical collections data, or the population was ranked higher (A-E) at one time, but may be lost due to general habitat loss or degradation of the environment in the area.
X	Extirpated: the habitat or environment of the occurrence has been destroyed, or there is persuasive evidence of its eradication by experience observers.

* Intermediate ranks may also be assigned (e.g. ‘BC’).

APPENDIX III: 'EasyEO' form and instructions

This form allows the naturalists and the interested public to submit information about sightings and records of rare species, habitats and natural communities to the Pennsylvania Natural Heritage Program.

Current information on which species are tracked by PNHP may be found on our website at <http://www.naturalheritage.state.pa.us/>

Please submit this form to: Pennsylvania Natural Heritage Program
c/o Data Management
800 Waterfront Drive
Pittsburgh, PA 15222

SPECIES NAME:		SURVEYOR(S): <i>(Please include your address & phone #)</i>		
DATE OF VISIT:		TIME SPENT AT SITE:		
DIRECTIONS TO SITE:		<table border="1"> <tr> <td> GPS Coordinates: Latitude: _____ Longitude: _____ Coordinates differentially corrected? _____ </td> </tr> </table>		GPS Coordinates: Latitude: _____ Longitude: _____ Coordinates differentially corrected? _____
GPS Coordinates: Latitude: _____ Longitude: _____ Coordinates differentially corrected? _____				
OWNER INFORMATION: • Public Land: give tract name: _____ • Private Land: Please fill out landowner info below. NOTE: We cannot accept data collected on private land if you didn't have permission!				
Landowner Name:		Address:		
Phone Number:		City / State / Zip code:		
<ul style="list-style-type: none"> ▪ Landowner aware of the species of concern? YES _____ NO _____ ▪ Landowner aware that data are submitted to PA Natural Heritage Program? YES _____ NO _____ ▪ Landowners are welcome to call the PNHP- Pittsburgh office at 412-586-2314 for more information. ▪ IF A SPECIMEN WAS COLLECTED: Please ask for the landowner's signature for permission to save the specimen in a museum: Landowner Signature: _____ Date: _____ ▪ WHERE IS THE SPECIMEN BEING HELD _____ 				
HABITAT DESCRIPTION: Give a general description of the site. You might include other plant/animal species at site, substrate/soils, topography, land use, weather, etc. If revisiting a site, indicate any obvious changes to the habitat.				
DISTURBANCES/THREATS: Include human and/or natural disturbances and threats to the species at this site.				
SPECIES DATA: Fill out as much of the following as you can - include anything else you feel is of importance.				

♣ Give general description of what you saw (<i>i.e.</i> : <i>found scat, heard song, animal crossing road, found plant in bog.</i>)
♣ Count or estimate the number of plants / animals you observed & estimate the size of the area they occupy.
♣ Age and condition of individual(s) (<i>i.e.</i> : <i>fresh adult butterfly; healthy mature plants - 50% flowering and with immature fruit...</i>)
♣ Behavior (<i>animals</i>) (<i>i.e.</i> : <i>nectaring insect, breeding birds, turtle basking...</i>)
♣ If revisiting this site, compare the health and size of the population to previous visits.
♣ Confidence level on Identification: ID Positive ID Somewhat Uncertain ID Unknown
♣ Voucher specimen or photo taken? (<i>Please include if possible</i>)
♣ Additional information:

Mapping Locations of Species of Concern

- Maps made from USGS quadrangle maps are ideal, but a good topographical or gazetteer map will do.
- Draw with a thin red or other bright-colored pen so your lines are easy to see.
- Draw the location of the ‘found’ species as accurately as you possibly can. We encourage you to draw a precise polygon of the area the species occupies, rather than a vague circle or arrow pointed at the site. If you only find a few plants or one animal, a polygon would be impossible to draw at 1-24:000 map scale (our standard map scale), so a dot would suffice.
- Estimate the size of the area the species is directly observed to be occupying

Do not include in your polygon the ‘suitable’ habitat surrounding the location of the species **IF**:

- You did not survey the surrounding area.
- You searched but did not find the species in the surrounding area.

To further complicate things, we do want potential / suitable habitat information if you can provide it. But it must not be confused with the area where you **KNOW FOR CERTAIN** the species is found.

- To indicate suitable habitat (but not yet known for certain to be occupied), draw a dotted line around the area and label it as ‘suitable’ or ‘potential’ habitat.

APPENDIX IV: Species of Concern in Armstrong County documented in the Pennsylvania Natural Diversity Inventory database.

<u>Scientific Name</u>	<u>Common Name</u>	<u>Global Rank</u>	<u>State Rank</u>	<u>Legal Status</u>
Mammals				
<i>Myotis leibii</i>	Eastern small-footed myotis	G3	S1B,S1N	PT
<i>Myotis septentrionalis</i>	Northern myotis	G4	S3B,S3N	CR
<i>Myotis sodalis</i>	Indiana myotis	G2	SUB,S1N	PE; LE
Birds				
<i>Haliaeetus leucocephalus</i>	Bald eagle	G5	S2B	PT
<i>Rallus limicola</i>	Virginia rail	G5	S3B	N
<i>Porzana carolina</i>	Sora	G5	S3B	CR
Reptiles and Amphibians				
<i>Glyptemys insculpta</i>	Wood turtle	G4	S3S4	N
<i>Regina septemvittata</i>	Queen snake	G5	S3	N
<i>Necturus maculosus</i>	Mudpuppy	G5	S3S4	N
Fish				
<i>Carpiondes Carpio</i>	River carpsucker	G5	S1	CU
<i>Erimystax dissimilis</i>	Streamline chub	G4	S3	N
<i>Etheostoma camurum</i>	Bluebreast darter	G4	S2	PT
<i>Moxostoma carinatum</i>	River redhorse	G4	S3S4	CU
<i>Hiodon alosoides</i>	Goldeye	G5	S2?	PT
<i>Hiodon tergisus</i>	Mooneye	G5	S2S3	PT
<i>Percina copelandi</i>	Channel darter	G4	S2	PT
<i>Percina macrocephala</i>	Longhead darter	G3	S2S3	PT
Mussels				
<i>Alasmidonta marginata</i>	Elktoe	G4	S4	N
<i>Epioblasma torulosa rangiana</i>	Northern riffleshell	G2T2	S2	PE; LE
<i>Epioblasma triquetra</i>	Snuffbox	G3	S1	PE
<i>Fusconaia flava</i>	Wabash pigtoe	G5	S2	PE
<i>Lampsilis fasciola</i>	Wavy-rayed lampmussel	G5	S4	N
<i>Lampsilis ovata</i>	Pocketbook	G5	S3S4	N
<i>Leptodea fragilis</i>	Fragile papershell	G5	S2	CR
<i>Pleurobema clava</i>	Clubshell	G2	S1S2	PE; LE
<i>Pleurobema sintoxia</i>	Round pigtoe	G4G5	S2	PE
<i>Potamilus alatus</i>	Pink heelsplitter	G5	S2	CR
<i>Quadrula quadrula</i>	Mapleleaf	G5	S1S2	PT
<i>Simpsoniaias ambigua</i>	Salamander mussel	G3	S1?	PT

<i>Utterbackia imbecillis</i>	Paper pondshell	G5	S3S4	CU
<i>Villosa fabalis</i>	Rayed bean mussel	G2	S1S2	PE
<i>Villosa iris</i>	Rainbow mussel	G5Q	S1	PE

Insects

<i>Enallagma divagans</i>	Turquoise bluet	G5	S3	N
<i>Gomphus desertus</i>	Harpoon clubtail	G4	S1S2	N
<i>Gomphus viridifrons</i>	Green-faced clubtail	G3G4	S1	N
<i>Pieris virginensis</i>	West Virginia white	G3G4	S2S3	N
<i>Stylurus scudderii</i>	Zebra clubtail	G4	S1	N

Plants

<i>Asplenium pinnatifidum</i>	Lobed spleenwort	G4	S3	PR
<i>Baptisia australis</i>	Blue false-indigo	G5	S2	PT
<i>Carex typhina</i>	Cattail sedge	S2	G5	PE
<i>Erigenia bulbosa</i>	Harbinger-of-spring	G5	S4	PR
<i>Phaseolus polystachios</i>	Wild Kidney Bean	G5	S1S2	PE
<i>Platanthera peramoena</i>	Purple-fringeless Orchid	G5	S2	PT
<i>Potamogeton richardsonii</i>	Red-head Pondweed	G5	S3	PR
<i>Scirpus pedicellatus</i>	Stalked Bulrush	G4	S1	PT
<i>Stenanthium gramineum</i>	Featherbells	G4G5	S1S2	TU
<i>Strophostyles umbellatum</i>	Wild Bean	G5	S2	PE
<i>Trillium flexipes</i>	Declined Trillium	G5	S2	PT

Natural Communities

Bat hibernaculum		GNR	SU	N
Big bluestem-Indiangrass river grassland		GNR	S3	N
Cave		GNR	SNR	N

APPENDIX V: Sustainable Forestry Information Sources

The *Pennsylvania Forest Stewardship Program* is a voluntary program that assists forest landowners in better managing their forestlands by providing information, education, and technical assistance. Participation in the program is open to private landowners who own between 5 and 1,000 acres of forestland. Visit <http://vip.cas.psu.edu/PAprogram.html> more information or contact:

Jim Finley, Assistant Director for Extension
The Pennsylvania State University
School of Forest Resources
7 Ferguson Building
University Park, PA 16802
814- 863-0401; E-mail: fj4@psu.edu

The *Forest Land Enhancement Program* complements the Forest Stewardship Program by providing landowners with cost-share dollars to implement their management plans and follow-up technical assistance to encourage the achievement of their long-term forest management goals. For more information, contact:

Jim Stiehler, Forest Stewardship Coordinator
DCNR - Bureau of Forestry
6th Floor, Rachel Carson State Office Building
P.O. Box 8552
Harrisburg, PA 17105-8552
717-787-4777

The *Forest Legacy Program* acts to purchase conservation easements or title from willing private landowners. In this program, federal funding is administered through the state Bureau of Forestry to foster protection and continued use of forested lands that are threatened with conversion to non-forest uses. Emphasis is given to lands of regional or national significance. For more information, go to <http://www.fs.fed.us/spf/coop/programs/loa/flep.shtml> or contact:

Gene Odato, Chief, Rural & Community Forestry Station
DCNR – Bureau of Forestry
6th Floor, Rachel Carson State Office Building
P.O. Box 8552
Harrisburg, PA 17105-8552
717-787-6460; E-mail: godato@state.pa.us

The *Sustainable Forestry Initiative* (SFI) program is a voluntary, industry-driven effort developed to ensure that future generations will have the same abundant, healthy, and productive resources we enjoy today. Created in 1995 by the American Forest and Paper Association (the national trade organization representing the United States forest products industry), SFI is a program of comprehensive forestry and conservation practices. Through the SFI of PA program, landowners receive the information they need to enhance their ability to make good forest management decisions, and loggers learn safer, more productive skills and proper environmental practices. For more information, go to <http://www.sfiopa.org/> or contact:

SFI® of PA
315 S. Allen Street, Suite 418
State College, PA 16801
814-867-9299 or 888- 734-9366; E-mail: sfi@penn.com

APPENDIX VI: Sustainable Development Information Sources

Where is the best place, ecologically, to situate any given land use, such as a new housing development, road, shopping center, farm or nature reserve. Although the answer to this question probably depends largely on place specific variables such as slope or distance to existing development, landscape ecology can offer a useful generic answer, which can then be adapted to the planning and design questions at hand. Four “indispensable patterns” of natural vegetation must be maintained in order to protect native species and natural processes:

- 1) Large natural patches – Large patches are the only way to protect interior species and species with large home ranges. Large patches also allow natural disturbances, such as windthrows of trees, to not affect all of the land at once, thus, allowing several successional stages to be represented at any given time.
- 2) Vegetated riparian corridors – Naturally vegetated corridors are essential for protecting many aquatic species (e.g. fish, mussels, and amphibians) important to conservation
- 3) Connectivity between large patches – The landscape must provide functional connectivity for species of conservation interest—that is, linkages that these species can use for movement through their home range, migration, and dispersal into new sites. Functionality will most likely be served by wide continuous corridors, but step stones of suitable habitat may allow movement across less suitable habitat types.
- 4) Natural remnants in human-dominated areas – Within agricultural and urban landscapes, three types of natural remnants should be protected (in descending priority):
 - a. Areas of high conservation value; such as rare species habitat
 - b. Landscape types that provide essential ecosystem services (e.g. wetlands that provide flood control)
 - c. Remnants of the former natural landcover that provide edge species habitat and human access to nature.

These principles are considered indispensable because no feasible alternative exists for the functions that they provide.

The following development guidelines support the principles listed above:

Conservation Subdivision Design – A method of subdividing land for development that favors clusters of small lots adjacent to community or publicly owned open space. Differing from typically clustered development by developing a network of open space that can be protected. In addition to the value of increased land placed into conservation networks, infrastructure costs are greatly reduced due to fewer streets and associated utilities and property values are typically increased due to the close proximity to open space. (Randall Arendt, *Growing Greener: Putting Conservation into Local Plans and Ordinances*).

APPENDIX VII: PNHP Aquatic Community Classification

*Note: the following project description is adapted from *Classifying Lotic Systems for Conservation: Project Methods and Results of the Pennsylvania Aquatic Community Classification Project (2007a)* and *User's manual and data guide to the Pennsylvania Aquatic Community Classification (2007b)*.*

How were aquatic communities defined?

A statewide project of the Pennsylvania Natural Heritage Program, the Pennsylvania Aquatic Classification Project, collected aquatic datasets from state and federal agencies, interstate basin commissions, and universities, analyzed information with standard statistical methods, and identified community types and habitat associations. Flowing water habitats, such as rivers and streams, and their community types are described. Aquatic community types of non-flowing waters like lakes, wetlands, and ponds, have not been identified to date. Aquatic communities were identified within watersheds. The most common community type per watershed was chosen to represent typical watershed organisms and habitats. Although other community types may exist in a particular watershed, the major community type is described. The term watershed describes an area of land that drains down slope to the lowest point. Watersheds can be large or small. All of the land in the state is part of a watershed. Every stream, tributary, or river has an associated watershed, and small watersheds join to become larger watersheds. In the PNHP Aquatic Community Classification relatively small watersheds (hydrologic unit code 12 – huc12) are described by their community types. (For more information on huc12: <http://water.usgs.gov/GIS/huc.html>). Separate communities were identified for fish, macroinvertebrates, and mussels. Aquatic communities for each type of organism can be used to describe the aquatic resources, habitat types, and stream quality. Table 12 shows the aquatic communities that were identified within Armstrong County. Fact sheets describing these communities follow.

How are communities described?

Commonly occurring animals in the community type are listed. While not every organism described in a community will occur in every community location, organisms listed by community types give a general account of what organisms to expect in a community habitat. Species of concern (considered state or globally rare) that may occur with each community type are listed. State and global rank definitions are available at: <http://www.naturalheritage.state.pa.us/RankStatusDef.aspx>. Environmental and water quality habitats typically associated with the community type are also described.

1) Community Description and Habitat - the environment of the stream where the community occurs is described by watershed and stream characteristics. Average values of the community characteristics across their entire range from a large dataset are presented. Size of the stream and watershed, gradient (slope), elevation are a few habitat characteristics that may be important to the community type. Local conditions are also mentioned. Some water chemistry variables are also valuable in understanding the conditions of the community, including:

- pH – the measure of the concentration of hydrogen ions in a solution. The concentration of hydrogen ions determines the alkalinity (pH > 7) or acidity (pH < 7) of stream water.
- Water temperature - is important to stream organisms because it influences metabolism and growth of stream organisms. Each aquatic animal species has a tolerance for specific temperature ranges and cannot survive at extremely high or low temperatures.
- Conductivity – the ability of water to conduct an electrical current. It is expressed in microsiemens (µS) per centimeter at 25 °C. Conductivity is determined by the types and quantity of dissolved substances in water. In streams, conductivity can be elevated because of pollution or natural causes.
- Alkalinity – is a measure of how well a waterbody resists or does not resist changes in acidity. If a stream has high alkalinity and can neutralize acids sufficiently, then it is subject to little change in pH. A low alkalinity stream is less resistant to changes in acidity and may be naturally acidic or may become acidic due to acid precipitation or other causes.

2) Stream quality rating- Communities locations are generally ranked as low, medium, or high quality based on habitat, water chemistry, and sensitivity of organisms to pollution.

3) Threats and Disturbances - potential pollution sources or other threats that may alter the natural state of the community are listed, where known.

4) Conservation recommendations – for the county natural resource managers and land planners to consider in protection and management of the watersheds and communities are described.

What do fish, macroinvertebrates, and mussels tell me about streams and watersheds?

All three types of organisms hold unique places in Pennsylvania's streams and rivers.

Macroinvertebrates include aquatic insects, worms, and crustaceans, like crayfish and scuds, which occupy the lower levels of food webs in aquatic systems. The presence of certain macroinvertebrates reflects food availability, water quality, and habitats, and gives an overall picture of stream health.

Fish prey upon macroinvertebrates and other stream organisms. Food resources and spawning habitats can be specific for fish. They too are influenced by the stream quality and entire environment of the watershed. For example, sediment from erosion at a mismanaged construction site near a stream may cover gravel and cobble habitats where brook trout lay the eggs. Developing fish will be smothered by layers of fine particles.

As filter-feeders, which siphon water to extract particles of food, mussels also require relatively clean water to thrive. They are particularly sensitive to industrial discharge, abandoned mine drainage, and urban runoff pollution. Mussels require habitats where they can burrow into the stream bottom and typically occur in larger streams and in rivers that contain sufficient food particles

Many factors influence the occurrence of aquatic communities, including natural variations in stream habitats. Fast-flowing, cold streams originating from ridges provide a different environment than slower and warmer rivers meandering through valleys. Geology also varies across Pennsylvania and flowing water may have a unique chemical composition based on the rock that it contacts.

Over any natural habitat, variations are caused by human alterations to aquatic environments. Many changes within a watershed can be detected within its streams and rivers. If implemented improperly, timber harvest, agriculture, urban development, and roads are some alterations that may cause changes in water quality and stream habitats from non-point source pollution. A number of pollutants enter aquatic systems from point sources to flowing waters, such discharges from sewage treatment plants, mines, and industrial sources.

How does the PNHP Aquatic Community Classification identify conservation priorities?

Combining data from many parts of the Aquatic Community Classification project has resulted in a means of identifying the unique riverine conditions that cause certain watersheds to be of greater conservation concern than others. Some watersheds may be of importance due to a single occurrence of a natural feature, such as the presence of a fish rare species or a high quality mussel community, but watersheds that hold multiple traits of conservation value should be set apart as a higher protection priority. Least Disturbed Streams (LDS) were selected based on evidence of little human disturbance as indicated by watershed and riparian landcover, mines and point pollution sources, road-stream crossings, and dams.

Watershed conservation and restoration priorities were indicated by the density of least disturbed streams, by community habitats, and community quality metrics. Conservation priority watersheds were selected and then ranked as either Tier 1 or Tier 2 based on community types, metrics of community quality, and least-disturbed stream condition.

Table 11. Aquatic communities found in each watershed of Armstrong County

Watershed Name	Stocked Fish Present?*	Ohio Basin Fish Community	Macroinvertebrate Community	Ohio Basin Mussel Community
Allegheny River-Clarion River	Y	Ohio Coolwater Stream Community	not assessed	Spike Mussel Community
Allegheny River-Cowanshannock Creek	Y	Ohio Large River Community	Common Large Stream Community	not assessed
Allegheny River-Kiskiminetas River	Y	Ohio Large River Community	Common Headwater Stream Community	Fatmucket Community
Allegheny River-Sugar Creek	Y	Ohio Large River Community	Common Large Stream Community	Flutedshell Community
Bear Creek	Y	Ohio Coolwater Stream Community	High Quality Small Stream Community	not assessed
Blacklegs Creek	Y	Ohio Coolwater Stream Community	not assessed	not assessed
Buffalo Creek	Y	Ohio Warmwater Community	not assessed	not assessed
Buffalo Creek-Patterson Creek	Y	Ohio Coolwater Stream Community	not assessed	not assessed
Cherry Run	Y	Ohio Coolwater Stream Community	Common Large Stream Community	not assessed
Cowanshannock Creek	Y	Ohio Coolwater Stream Community	Common Headwater Stream Community	not assessed
Cowanshannock Creek-Huskins Run	N	Ohio Coolwater Stream Community	Common Large Stream Community	not assessed
Crooked Creek	Y	Ohio Large River Community	Common Large Stream Community	not assessed
Crooked Creek-Sugar Run	Y	Ohio Coolwater Stream Community	Common Large Stream Community	not assessed
Glade Run	Y	Ohio Coolwater Stream Community	Common Headwater Stream Community	not assessed
Kiskiminetas River	N	Ohio Large River Community	High Quality Headwater Stream Community	not assessed
Kiskiminetas River-Beaver Run	N	Ohio Coolwater Stream Community	Common Headwater Stream Community	not assessed
Little Mahoning Creek	Y	Ohio Warmwater Community	not assessed	Spike Mussel Community
Little Sandy Creek	Y	Ohio Coolwater Stream Community	Common Headwater Stream Community	not assessed
Mahoning Creek	Y	Ohio Coolwater Stream Community	not assessed	not assessed
Mahoning Creek-Pine Run	Y	not assessed	not assessed	not assessed
North Branch Plum Creek	N	not assessed	Common Large Stream Community	not assessed
Patterson Creek	Y	Ohio Coolwater Stream Community	not assessed	not assessed
Pine Creek	Y	Ohio Coolwater Stream Community	not assessed	not assessed

Watershed Name	Socked Fish Present?*	Ohio Basin Fish Community	Macroinvertebrate Community	Ohio Basin Mussel Community
Pine Run	N	not assessed	not assessed	not assessed
Plum Creek- North	Y	Ohio Coolwater Stream Community	High Quality Small Stream Community	not assessed
Plum Creek- South	Y	Ohio Large River Community	Low Gradient Valley Stream Community	Fatmucket Community
Redbank Creek	N	not assessed	Common Headwater Stream Community	not assessed
Redbank Creek- Leatherwood Creek	Y	not assessed	Common Large Stream Community	not assessed
Redbank Creek- Little Sandy Creek	Y	Ohio Warmwater Community	Common Headwater Stream Community	not assessed
Rough Creek	N	Ohio Coolwater Stream Community	not assessed	not assessed
South Branch Plum Creek	N	not assessed	Common Large Stream Community	not assessed
South Fork Pine Creek	Y	Ohio Coolwater Stream Community	High Quality Headwater Stream Community	not assessed
Sugar Creek	N	not assessed	High Quality Small Stream Community	not assessed

* Surveys by the Pennsylvania Fish and Boat Commission found one or more fish (trout or warmwater gamefish) present of hatchery origin. This suggests that this watershed or a nearby watershed is stocked. While prized by anglers, the introduction of non-native fish species disrupts the natural balance of the aquatic community and can decrease the overall quality of the waterway.

Coolwater Stream Community

Typified by: Blacknose dace (*Rhinichthys atratulus*), creek chub (*Semotilus atromaculatus*), stocked brown trout (*Salmo trutta*), white sucker (*Catostomus commersoni*), redbreast dace (*Clinostomus elongatus*), longnose dace (*Rhinichthys cataractae*), fathead minnow (*Pimephales promelas*), pearl dace (*Margariscus margarita*), and slimy sculpin (*Cottus cognatus*)

Species of concern: none

Community Description and Habitat:

In Armstrong County, many streams were classified as the Coolwater Stream Community. For instance, the Coolwater fish community was found in Huling Run, Limestone Run, Patterson Creek, Scrubgrass Creek, North Fork Pine Creek, South Fork Pine Creek, parts of Cowanshannock Creek, Plum Creek, Cherry Run, Roaring Run, Knapp Run, Glade Run, Crooked Creek, and Cornplanter Run.



Fathead Minnow

Photo source: <http://www.cnr.vt.edu/efish>

This community type has varied habitat characterized by generalist fish species, and, therefore, can represent a variety of stream conditions. The community can best be described by small- to medium-size streams that are faster than warm water streams and have temperature intermediate between warm and cold streams. These streams, may be called “Cold Water Fishery” or “Trout-Stocked Fishery” (such as North Fork Pine Creek and Plum Creek, Patterson Creek, and Glade Run) by PA DEP, and usually support wild or stocked brown trout in some parts of the stream. In many cases, fish tolerant of cool and warm temperatures are also present. Valley streams that have cobble and gravel substrates and cover for fish habitat are the best examples of Coolwater Stream Communities. In some cases, removal of streambank vegetation warms otherwise cold streams and may degrade stream habitats resulting in a loss of natural fish community. Transitional habitats between small headwater streams and warm large streams and rivers may also be called a Coolwater Stream Community.

Stream quality rating: Low-medium

Threats and Disturbances: This community occurs downstream of the headwaters, and these streams are not protected from human influences. A number of pollution types are found in watersheds where this community occurs. Abandoned mine drainage is a common associate of the Coolwater Community, indicating that the community can tolerate some poor water quality conditions.

In addition, the community may be found in streams impaired by agricultural and urban runoff or alteration of habitat. County streams with habitats for the Coolwater Community, like Patterson Creek, parts of the South Fork Pine Creek, and Knapp Run are classified as impaired by PA DEP (2006) because of siltation, excess nutrients, or stream bank modification. Nutrient enrichment from wastewater impairs Limestone Run (PA DEP 2006). Major threats to members of the Coolwater Community are associated with metals, low pH, and suspended solids from abandoned mine drainage. Parts of Cowanshannock Creek, Crooked Creek, Huling Run, Glade Run, and Roaring Run suffer from mine drainage effects.

Conservation Recommendations: Restoration of stream temperature, habitat, and water quality to natural conditions is recommended. Management of storm water runoff and riparian vegetation restoration are critical to improvement of community conditions. Addressing sediment and nutrient loading will improve water quality for this community type. Remediating mine drainage is recommended to improve the most toxic water pollution in the county.

Where stocking of non-native fish is occurring with the Coolwater community, native fish are displaced. Restoration of fish community to native fish is recommended. The habitat for the Coolwater community represents an important transition between cold headwater streams and warm, larger streams.

Warmwater Community

Typified by: Greenside darter (*Etheostoma blennioides*), central stoneroller (*Camptostoma anomalum*), rainbow darter (*Etheostoma caeruleum*), rosyface shiner (*Notropis rubellus*), johnny darter (*Etheostoma nigrum*), fantail darter (*Etheostoma flabellare*), logperch (*Percina caprodes*), stonecat (*Noturus flavus*), silver shiner (*Notropis photogenis*), golden redhorse (*Moxostoma erythrurum*), mimic shiner (*Notropis volucellus*), pumpkinseed (*Lepomis gibbosus*), yellow bullhead (*Ameiurus natalis*), large-mouth bass (*Micropterus salmoides*), green sunfish (*Lepomis cyanellus*), tonguetied minnow (*Exoglossum laurae*), Ohio lamprey (*Ichthyomyzon bdellium*)



Northern Hogsucker

Photo Source: <http://www.ohiodnr.com/dnap>

Species of concern: none

Community Description and Habitat: The Ohio Warmwater Community usually occurs in medium to large valley streams, like Buffalo Creek, Mahoning Creek and parts of Cowanshannock Creek. The streams are characterized by a diverse fish community, ranging from game fish to small, bottom-dwelling darters and minnows.

Warm water temperatures are characteristic of this community group. Thermal tolerances of fish in the community group are higher than the cold- and cool-water communities. This stream community, in an undisturbed condition, represents small to medium-size warmwater systems with little silt and turbidity. In impaired systems, poorer water quality conditions and increased turbidity and low dissolved oxygen occur.

The community streams, like Cowanshannock Creek and Buffalo Creek, may be called “Trout Stocked Fishery” by PA DEP, and have stocked trout as temporary community members in some parts of the stream. Parts of Mahoning Creek and Cowanshannock Creek are designated as a “Warm Water Fishery.”

Stream quality rating: Medium

Threats and Disturbances: Water quality and habitat may be influenced by point source and non-point source pollution. Runoff from impervious surfaces and poorly managed agricultural areas can be a threat to this community.

Point sources from municipal discharges and mines may negatively influence water quality in some Warmwater Community habitats. Discharge from sewage treatment plants may be damaging to streams through excessive nutrient loading. Impairment from wastewater inputs and siltation in Buffalo Creek (PA DEP 2006) threatens the health of the fish community. In other warm water streams, such as Cowanshannock Creek and Mahoning Creek, the low pH, metals or suspended solids from abandoned mine drainage impairs the stream and/ or its tributaries (PA DEP 2006).

Conservation Recommendations: This community is a high conservation priority. Warmwater Community streams in good condition are not common. The fish associates of this community type are not especially rare individually, however, the community group occupies habitats in need of protection in Pennsylvania.

Since warmwater streams occur in valleys downstream of human influences, they receive pollution inputs from a variety of sources. Curbing non-point source pollution from storm water and poor riparian buffer condition zones is important for maintaining healthy valley streams. We recommend addressing inputs of abandoned mine drainage and wastewater that are toxic to stream warm water streams.



Medium-sized streams, like Mahoning Creek, without many groundwater inputs, are typical of Warmwater Community streams. Streams provide a variety of habitats and support warmwater fish communities.

Photo source: PNHP

Large River Community

Typified by: Channel catfish (*Ictalurus punctatus*), sauger (*Sander canadensis*), freshwater drum (*Aplodinotus grunniens*), walleye (*Stizostedion vitreus*), quillback carpsucker (*Carpionodes cyprinus*), smallmouth buffalo (*Ictiobus bubalus*), river redhorse (*Moxostoma carinatum*), mooneye (*Hiodon tergisus*), white crappie (*Pomoxis annularis*), longnose gar (*Lepisosteus osseus*), brook silverside (*Labisthethes sicculus*)



Sauger

Photo Source: http://sites.state.pa.us/PA_Exec/Fish_Boat

Species of concern: mooneye (S2? G5), smallmouth buffalo (S2 G5), longnose gar (S2S3 G5), river redhorse (S3 G4), channel darter (S1S2 G4)

Community Description and Habitat: The Ohio Large River Community occurs most commonly in large streams and rivers in Armstrong County. Although the community is more typical of rivers like the Allegheny River, in some

cases, smaller streams with game fish may also be described by this community. River fish may occupy habitats in small streams close to a large river. The Kiskiminetas River, Allegheny River and some tributaries, such as Big Run, Taylor Run, Crooked Creek and the lower part of Mahoning Creek, have fish characteristic of the Large River Community. Parts of Mahoning Creek, Kiskiminetas River and Allegheny River are designated as a “Warm Water Fishery” by PA DEP.

Rivers and streams with diverse habitats are typical for this community. The large rivers offer varied habitats including shallow shorelines, deep channels, impoundments. The natural richness in Ohio River Basin streams has been augmented by the addition of stocked and/or introduced game fish, which occur with this community group.

Stream quality rating: Medium

Threats and Disturbances: In typical large streams and rivers, the cumulative degradation from a number of upstream watershed sources make managing habitat of this community challenging. Impoundments on the Allegheny River, Kiskiminetas River, and Crooked Creek alter natural fish communities, their habitats, and natural stream processes. However, many dams are unlikely to be removed in the near future. Management of flow and water quality in the receiving waters of impoundments is important for maintaining healthy fish communities and populations.

Non-point source pollution in upstream portions of the large river basins contributes nutrients and sediment. Agricultural non-point source pollution and habitat degradation influences Crooked Creek and Big Run, where DEP (2006) identified stream impairment for nutrient enrichment, low dissolved oxygen, siltation, and/or stream bank modification.



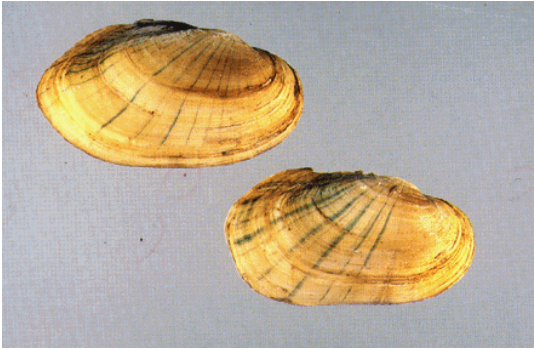
Large rivers, like the Allegheny River are common habitats of this community type.

Photo source: PNHP

Toxic waters and habitat loss affect the quality of the Large River Community. Mine drainage influences many of Armstrong County’s streams. Kiskiminetas River and Crooked Creek are impaired by abandoned mine drainage (DEP 2006), as are many other tributaries of the Allegheny River. Consumption of fish caught from parts of the Allegheny River is restricted because of PCB contamination. The Allegheny River also faces habitat loss from dredging. Removing cover and bottom substrate, and altering natural river contours is very detrimental to the habitat of some Large River Community fish.

Conservation recommendations: Addressing habitat loss and water quality issues resulting in stream impairment and habitat loss should be a priority for Armstrong County. Reducing excessive sediment and nutrient loading and mine drainage is recommended to benefit the Large River Community. Additionally, minimizing major habitat destruction from dredging and water quality disturbances will improve in-stream habitats for the Large River Community.

Fatmucket Mussel Community



Fatmucket

Photo source: <http://www.inhs.uiuc.edu>

Community Indicators: Fatmucket (*Lampsilis siliquoidea*), giant floater (*Pyganodon grandis*), three-ridge (*Amblema plicata*), Wabash pigtoe (*Fusconaia flava*)

Species of concern: Wabash pigtoe (S2 G5), three-ridge (S2S3 and G5)

Preferring quiet muddy waters, the Fatmucket Community inhabits large streams and rivers having moderate to low gradients. In Armstrong County, the community occurs in the Allegheny River.

The community occurs in rivers with sand and gravel substrate, but community members reach their greatest abundance in standing water, in clay, silt, or mud substrate (Parmalee and Bogan 1998). The fatmucket species prefers quiet or slow moving water with mud bottom, and avoids riffles (Parmalee and Bogan 1998). This species is ecologically widespread and occurs in a variety of habitats (Strayer and Jirka 1997).

The primary indicators are moderately strong indicators that this community is present, but are sometimes found in other community types (especially the fatmucket mussel). A moderate number of rare and intolerant taxa are associated with this community. The Fatmucket Community was common in many parts of the Ohio River basin.

Stream quality rating: Undetermined

Community rarity: No

Threats: Contaminants from industrial and municipal wastewater and from storm sewers in the Allegheny River degrade the quality. In the portion of the Allegheny River watershed that includes Armstrong County and the upstream catchment, there are over 2,000 point sources. Fish consumption on the river is restricted because of PCB contamination. Many of the tributaries to the Allegheny River in Armstrong County, including Cowanshannock Creek, Mahoning Creek, Redbank Creek, and Kiskiminetas River are degraded from abandoned mine drainage.

Threats to the habitat in the Allegheny River are from dredging and the presence of dams. The mussel habitat on river bottom is removed along with river bed materials during dredging. Additionally, the extensive lock and dam system on the Allegheny River greatly alters the natural condition of the river. Dams disrupt the natural flow cycle, the maintenance of habitat, and access to fish hosts.

Conservation recommendations: Conserving naturally low-gradient streams and the backwaters of rivers is a priority for the Fatmucket Community. Managing point sources and remediating discharges from mines in watershed will improve conditions for the Fatmucket Community. The most destructive threats to habitat in the Allegheny River, the lock and dam system and gravel mining, are not likely to be improved in the immediate future. Despite obstacles, minimizing habitat destruction from dredging is recommended to conserve in-stream habitats for the Fatmucket Community.



Slow-backwaters of rivers and streams are the primary habitat for the Fatmucket community.

Photo source: PNHP

Flutedshell Mussel Community



Fluted Shell

Photo source: <http://www.inhs.uiuc.edu>

Typified by: flutedshell (*Lasmigona costata*), kidneyshell (*Ptychobranchus fasciolaris*), mucket (*Actinonaias ligamentina*), elktoe (*Alasmidonta marginata*), squawfoot (*Strophitus undulatus*), pocketbook (*Lampsilis ovata*), plain pocketbook (*Lampsilis cardium*), wavy-rayed lamp-mussel (*Lampsilis fasciola*)

Species of concern: fluted shell (S4 G5), kidneyshell (S4 G4G5), mucket (S4 G5), elktoe (S4 G4), squawfoot (S2S4 G5), pocketbook (S3S4 G5), plain pocketbook (S3S4 G5), wavy-rayed lamp-mussel (S4 G4)

Community Description and Habitat: The Flutedshell Mussel community is characteristic of large streams and

medium size rivers. It is found throughout the upper Allegheny River. Community habitats have sand and gravel beds, and occur at low gradients. A number of rare and intolerant taxa are associated with this community. Thus, this community may be found in ecosystems that are still able to support species that cannot survive in other areas.

Stream quality rating: High

Threats and Disturbances: The community habitat may be challenged by poor water quality and habitat degradation. Industrial point sources, municipal wastewater, storm sewers, gravel dredging, and the lock-and-dam system on the Allegheny River are the biggest threats to the community. (Please see the description of the Allegheny River in the Fatmucket Mussel Community)

Conservation Recommendations: This community is characterized by high mussel diversity; rare species may be associated with the community. Very few community members can tolerate pollution. The community is a high conservation priority. The community watersheds have special conservation value because of diverse mussel assemblages.



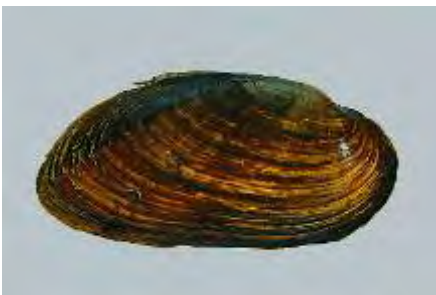
This community type is common in large creeks and rivers, in low gradient habitats with sand and gravel substrates.

Photo source: PNHP

Conserving naturally low-gradient streams and the backwaters of rivers is a priority for the Flutedshell Mussel Community. Managing point sources and remediating discharges from mines in watershed will improve conditions for the Flutedshell Mussel Community. The most destructive threats to habitat in the Allegheny River, the lock and dam system and gravel mining, are not likely to be improved in the immediate future. A diverse freshwater mussel assemblage appears to survive in the Allegheny River in the lock and dam system despite disruption to the natural ecosystem. However, gravel mining has greatly reduced the available habitat for mussels. Because of the severity of its impact, minimizing habitat destruction from dredging is recommended to conserve in-stream habitats for the Flutedshell Mussel Community.

Spike Mussel Community

Typified by: Spike mussel (*Elliptio dilatata*), and black sandshell (*Ligumia recta*)



Spike mussel

Photo source: <http://www.inhs.uiuc.edu>

Several other mussels including the mucket (*Actinonaias ligamentina*), fatmucket (*Lampsilis siliquoidea*), fluted-shell (*Lasmigona costata*) and pocketbook (*Lampsilis cardium*), are also found in this community, but are common components of other communities as well.

Species of concern: black sandshell (S3S4 G5), mucket (S4 G5), fatmucket (S4 G5), fluted-shell (S4 G5)

Stream quality rating: High

Habitat: The habitat range for the Spike Community includes medium streams to large rivers. Waters may range from moderate gradient to relatively slow-flowing and low gradient. In Armstrong County, the community was found in the Allegheny River

The species in this community are typically found in medium to large rivers in sand and gravel substrate, and are often associated with riffles. The spike mussel exists in a wide range of habitats, having varied stream size and depth. It is one of the most abundant mussels in the Allegheny basin (Strayer and Jirka 1997). A number of rare and intolerant taxa are often associated with this community. Thus, this community is found in ecosystems that are able to support species that cannot survive in other areas, and is a high protection priority.

Threats:

The community habitat may be challenged by poor water quality and habitat degradation. Industrial point sources, municipal wastewater, storm sewers, gravel dredging, and the lock-and-dam system on the Allegheny River are the biggest threats to the community. (Please see the description of the Allegheny River in the Fatmucket Mussel Community)



The spike community is found in low gradient areas of the Allegheny River.

Photo source: PNHP

Conservation Recommendations: Similar to the Flutedshell Mussel Community, this community is characterized by high mussel diversity, many rare species, and few species that can tolerate pollution, and is a high conservation priority. Protection of high quality mussel habitat is important for the long-term viability of the Spike Mussel Community in large river systems.

Conserving naturally low-gradient streams and the backwaters of rivers is a priority for the Spike Mussel Community. Managing point sources and remediating discharges from mines in watershed will improve conditions for the Spike Mussel Community. The most destructive threats to habitat in the Allegheny River, the lock and dam system and gravel mining, are not likely to be improved in the immediate future. A diverse freshwater mussel assemblage appears to survive in the lock and dam system despite disruption to the natural ecosystem. However, gravel mining has greatly reduced the available habitat for mussels. Because of the severity of its impact, minimizing habitat destruction from dredging is recommended to conserve in-stream habitats for the Spike Mussel Community.

High Quality Headwater Stream Community

Other community members: Rolledwinged stonefly (Leuctridae), small minnow mayfly (Baetidae), crayfish (Cambaridae), trumpetnet caddisfly (Polycentropodidae), damner dragonflies (Aeshnidae)



Small minnow mayfly

Photo Source: www.guillaume.doucet.free.fr

Habitat: Typically found in small, swift streams, this community is indicative of high quality stream habitats. This community is typified by a diverse group of macroinvertebrates that are sensitive to organic pollution. Small, forested tributaries to South Fork Pine Creek, to Cowanshannock Creek, to Kiskiminetas River, to Glade Run, and to Sugar Creek typified the community habitat in Armstrong County.

Stream quality rating: High

Community rarity: No

Threats: This community type occurs in watersheds with some contributions of non-point source pollution from urban and agricultural sources. However, the small headwater streams occupied by this community type are not impaired and have good water quality.

Conservation recommendations: Conserving small headwater streams in good condition is important for maintaining watershed health and the Community habitats. Reducing runoff from poorly buffered agricultural land would be beneficial for improving stream quality for the High Quality Headwater Stream Community. In agricultural watersheds, runoff and stream bank erosion can be controlled by installing riparian buffers of an adequate width along pastures and crop fields and excluding livestock from streams and riparian zones. Stream habitats will improve over time with the addition of riparian buffers.



Small, high-gradient streams with rocky habitats are typical of this community type.

Photo source: PNHP

Management of stormwater from roads and urban developments and mitigation of any direct stream discharges are recommended. Retention and treatment of storm water would ideally ameliorate water quality in streams receiving urban effluents. In addition, improvements in water quality from sewage treatment effluents would also better community conditions.

Measures to protect small, high quality streams through conservation easements, land acquisition, and private land stewardship are recommended. Conservation practices at the headwaters will ensure better water quality throughout the watershed.

High Quality Small Stream Community

Typified by: Brushlegged mayfly (Isonychiidae), fingernet caddisfly (Philopotamidae), dobsonfly (Corydalidae), saddlecase maker (Glossosomatidae), watersnipe fly (Athericidae), common burrower (Ephemeraidae), snail-case maker caddisfly (Helicopsychidae)

Community Description and Habitat: This community is found in small to medium-size streams with intermediate gradient. It is found in slightly larger streams than the High Quality Headwater Stream Community. Small streams, such as Holder Run (tributary to Sugar Creek), Brady Run (tributary to Kiskiminetas River), and small tributaries to North Branch of Bear Creek, to Plum Creek, to Cherry Run, to South Fork Pine Creek, and to Redbank Creek, are some examples of the community habitat.



Brushlegged Mayfly

Photo source: www.dec.state.ny.us

The High Quality Small Stream Community is typically found in streams with mainly sandy bottoms, mixed with larger cobble and boulders. This community type is indicative of high quality streams. The organisms associated with this community are generally intolerant of pollution.

Stream quality rating: High

Threats and Disturbances: Organisms in this community type are sensitive to organic pollution and habitat degradation. Low levels of water quality degradation may occur in watersheds where the community is present.

In Armstrong County, this community occurs in watersheds with some agriculture and having urban centers. Impairments resulting from poorly buffered agricultural land may include excess nutrient and sediment input from cropland or livestock pastures. In some locations, mine drainage and runoff from impervious surfaces also affects water quality. Abandoned mine drainage impairs streams in the Sugar Creek and the Bear Creek watersheds (PA DEP 2006) and degrades community habitat. Excessive nutrients from residential runoff impair the aquatic life in Brady Run (DEP 2006).



Typical community habitats are small to medium-sized streams with diverse stream-bottom habitats and high water quality.

Photo source: PNHP

Conservation Recommendations: While some non-point source pollution occurs in watersheds supporting the High Quality Small Stream Community, the pollution problems here are less severe than in other stream types. Protecting high quality small streams from residential and agricultural runoff should be a priority for watershed managers.

Small, headwater streams need to be protected from additional threats. Mitigating one of the most common and severe threats to streams in Armstrong County, abandoned mine drainage, will improve habitat for this community type.

Common Headwater Stream Community

Typified by: little plain brown sedge (Lepidostomatidae), slender winter stonefly (Capniidae), spiketail dragonflies (Cordulegastridae)

Habitat: The Common Headwater Stream Community is generally found in small, high gradient streams. Community habitats appear to have a diversity of in-stream habitat types with little channelization or riparian disturbance.

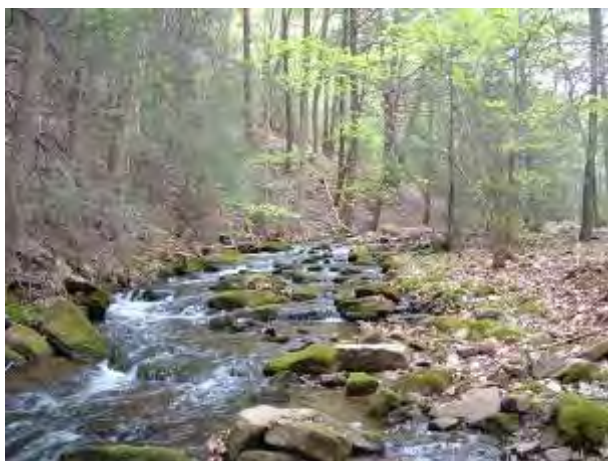


slender winter stonefly

photo source: www.dec.state.ny.us

Streams that support this community type generally have low amounts of dissolved ions; this community type is associated with non-calcareous streams. The community habitat is small tributary streams, like the headwaters of Crooked Creek, headwaters of Roaring Run, Watson Run (a small tributary to Allegheny River), and tributaries to Plum Creek, to Huling Run, and to Redbank Creek.

Stream quality rating: Low to moderate



Small, high-gradient tributaries are typical of this community type.

Photo source: PNHP

Threats:

Because small, headwater streams are the most numerous in Pennsylvania waterways and contribute the most stream miles of all flowing water types, the quality of small streams can have a great influence on the overall status of the Commonwealth's waters. The community habitat or water quality may be threatened by point sources, mining, or watershed disturbances. Low pH, siltation, and metals from mine drainage impairs many small streams in Armstrong County. Additionally, near the urban centers in the county, storm sewers and runoff from impervious surfaces also damage the condition of small streams.

Conservation Recommendations:

Conservation measures like easements and land protection for headwater streams will ensure that high quality headwater streams will persist. Improving storm water management practices will ameliorate habitat and water quality problems in small streams. Reducing the amount of stormwater from storm drains will improve damaging and artificially high stream flows after precipitation events. We also recommend placement of stormwater mitigation structures for future development projects. Improving water quality from streams receiving abandoned mine drainage, one of the most damaging pollution types, in small streams will improve water quality and ensure continued habitat for the Common Headwater Stream Community.

Low Gradient Valley Stream Community

Typified by: Riffle beetle (Elmidae), waterpenny beetle (Psephenidae) net-spinning caddisfly (Hydropsychidae), Asian clam (*Corbicula fluminea*), narrow-winged damselfly (Coenagrionidae), rusty dun mayfly (Caenidae), fingernail clam (Sphaeriidae), freshwater limpet (Ancyliidae), broad-winged damselfly (Calopterygidae)

Community Description and Habitat: This community generally occurs in medium-sized, valley streams, but it may also be found in small, degraded streams. The intermediate gradients of valley streams characterize this stream community. Dissolved ions are higher in this type of stream than streams associated with other communities. Community members can tolerate some organic pollution and are not very sensitive to habitat alteration.

Streams associated with this community in Armstrong County are Sugar Run, small tributaries to Allegheny River and to Huskins Run, Elder Run, and parts of Garretts Run.

Stream quality rating: Intermediate



Riffle Beetle

Photo source: www.epa.gov



This community is typically found in low gradient valley streams with some influence from agricultural practices in the watershed.

Photo source: PNHP

(DEP 2006).

Threats and Disturbances:

The exotic Asian clam (*Corbicula fluminea*) commonly occurs with this community type. The Asian clam is a threat to other bivalves because of competition for food resources and habitat.

The habitat for this community type may receive pollution from a variety of sources. In streams where this community is found, water quality may be moderately degraded from excess nutrients, habitat modification, and siltation from storm water discharges and runoff. Similar to other community types in Armstrong County, the habitat of the Low Gradient Valley Stream Community is threatened by abandoned mine drainage; DEP (2006) classifies Sugar Creek as impaired because of abandoned mine drainage. Parts of Garretts Run are impaired for excess nutrients, siltation, and removal of stream bank vegetation contributed by urban runoff and storm sewers

Conservation Recommendations: Where this community is common, pollution from the surrounding watershed may be contributing to degraded water quality and habitat conditions. Although this community type does not signify extremely poor stream quality, some stresses to stream condition are indicated.

Watersheds with many roads and storm sewers have altered hydrology and degraded water quality. Reducing the amount of stormwater from storm drains will improve damaging and artificially high stream flows after precipitation events. We also recommend placement of stormwater mitigation structures for future development projects. Ameliorating abandoned mine drainage, one of the most damaging pollution types, in small streams will improve water quality and ensure continued habitat for the Low Gradient Valley Stream Community.

Common Large Stream Community

Typified by: Nemourid broadback stonefly (Nemouridae), Ameletid mayfly (Ameletidae), Taeniopterygid broadback stonefly (Taeniopterygidae)

Community Description and Habitat: The streams that support the Common Large Stream Community have high gradient with a diverse assemblage of organisms. Typically, the habitat is medium to large streams in good condition. However, in some locations the community type may also occur in smaller streams. Some examples of the community habitat are Glade Run, Nicholson Run, South Fork Pine Creek, Limestone Run, Sugar Creek, and small tributaries to Crooked Creek, to North Branch Cherry Run, to Plum Creek, to Cowanshannock Creek, and to Redbank Creek.

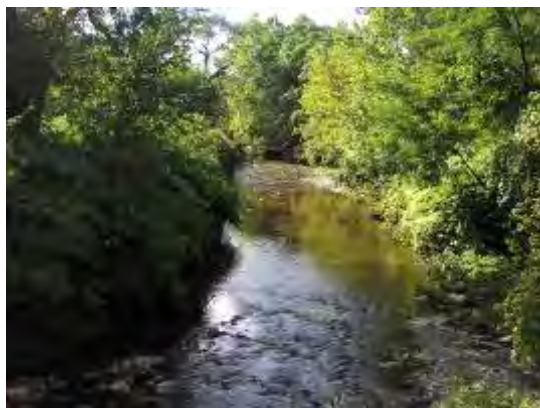


Nemourid broadback stonefly

Photo source: www.dec.state.nv.us

Stream quality rating: Medium

Threats and Disturbances: Excess siltation and nutrients from agricultural sources may disturb valley streams, where this community is found. Impervious surfaces also contribute to poor water quality and stream flashiness in some valley streams. Habitat degradation from channel scouring and siltation may also occur in watersheds with urban and agricultural influences. In community locations, like South Fork Pine Creek, the stream is impaired for siltation and nutrient loading (PA DEP 2006). In Sugar Creek, the stream is impaired from abandoned mine drainage (PA DEP 2006).



Large to medium sized high gradient streams are typical of the community type. Non-point source pollution can cause excess stream sediment or other poor water quality conditions.

Photo source: PNHP

Conservation Recommendations: In areas where non-point source agricultural pollution degrades the Common Large Stream Community, runoff and stream bank erosion can be controlled by installing vegetative buffers of an adequate width along streams in pastures and crop fields. Excluding livestock from streams and riparian zones will also help improve stream habitats over time. Watersheds with many roads and storm sewers have altered hydrology and degraded water quality. Reducing the amount of stormwater from storm drains will improve damaging and artificially high stream flows after precipitation events. Mitigating mining discharges is also important for improving the community habitat and water quality for the community.

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APPENDIX VIII: Species of Concern Fact Sheets

The following fact sheets are presented to provide additional information and management guidelines for a subset of species of concern found within Armstrong County. Additional copies of these fact sheets and those for other species may be downloaded from <http://www.naturalheritage.state.pa.us/>

Bald eagle (*Haliaeetus leucocephalus*)

Pennsylvania Threatened Bird Species

State Rank: S2B (impaired, breeding) **Global Rank: G4** (apparently secure)

Identification

Bald eagles are large raptors with a body length up to 32 inches and a wingspan up to 80 inches. Male and female bald eagles are similar in plumage. The most notable features are a white head and upper neck, white tail, dark brown body, and a heavy yellow bill. Juveniles are dark brown overall, and gradually acquire adult plumage over a period of four years. Juveniles have a dark bill and cere, dark brown body plumage, including head and tail, variable amounts of white on the undertail coverts, belly, and back.



photo source: Ron Austing

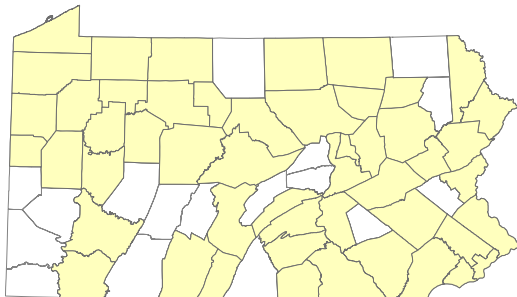
Range

Bald eagles have extensive breeding populations in Alaska, with major populations in the coastal regions. This species breeds throughout most of Canada, especially along coastal areas. In the continental United States, Bald Eagles breed extensively along the Atlantic Coast from Florida to the Maritime Provinces of Canada. This species also breeds in the Great Lake States in Minnesota, Michigan, and Wisconsin, and in the Pacific Northwest (California, Oregon, and Washington). Breeding populations occur along the Gulf Coast in Louisiana and Texas. In Pennsylvania, bald eagle populations have been increasing, and can now be found throughout Pennsylvania, with most sightings concentrated in the northwestern and southeastern corners of the state.

Habitat

This species is typically associated with forested areas adjacent to large bodies of water. Bald eagles nest in trees, rarely on cliff faces, and ground nest in treeless areas. The majority of bald eagle nesting areas are found in mature and old-growth forests with some habitat edge, usually within 1.2 miles (2 kilometers) to water with suitable foraging opportunities. The quality of foraging areas are defined by diversity, abundance, and vulnerability of the prey base, structure of aquatic habitats, such as the presence of shallow water, and the absence of human development and disturbance. In Pennsylvania, this species nests on islands in major rivers and in forested areas and on erected platforms along major rivers, reservoirs, large wetlands, lakes, ponds, and streams.

Pennsylvania Distribution by County



Pennsylvania Natural Heritage Program Data 2009

Conservation Status

This species is currently listed as a Threatened species at the state level, although it has been delisted at the federal level. Bald eagles breeding in Pennsylvania have made a major contribution to the downgrading of this species from Endangered. In the 1970's, bald eagle nesting pairs were at an all time low of two due to the effect of the insecticide DDT and pollution of major waterways. Since then, this species has made a comeback, and recently, over 100 nests have been recorded across the state. Continued success of the breeding areas will depend on protection from human persecution and

environmental contaminants. Other threats include water quality degradation, disturbance of nesting areas, and disease. If ecological conditions in Pennsylvania continue to improve, there is no reason why this species will not increase nesting populations to increase assurance that bald eagles will be around for generations to come.

References

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- Brauning, D.W. (ed). 1992. Atlas of Breeding Birds in Pennsylvania Univ. of Pittsburg Press, Pittsburgh, PA. 484 pp.
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Virginia Rail (*Rallus limicola*)

Pennsylvania Bird Species of Concern

State Rank: S3B (Vulnerable, Breeding) Global Rank: G5 (Secure)

Identification

A denizen of the cattail edges of large marsh complexes and small isolated wetlands, the Virginia Rail (*Rallus limicola*) is probably the most common rail species in the Commonwealth. Distinguished from similar species by the combination of smaller size (9-inches) and a long bill (1.5-inches), this species is a rusty brown with a grey cheek patch. The bill and legs, a noticeable red to orange-brown, are also easily picked out among the marsh vegetation.

Migrating into Pennsylvania as wetlands re-green in the spring, nesting begins in May with the chicks hatching in June and fledging in July. Fall migration may begin as early as mid-August and generally most birds have left by mid-October, but individuals have been recorded in marshes until freezes force them south.

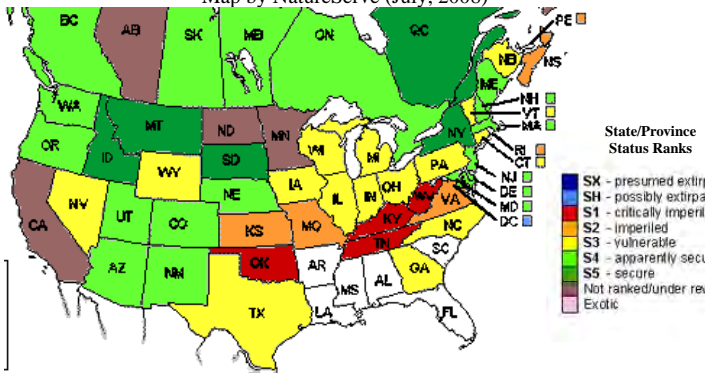


photo source: Denis Kamia

Virginia Rail (*Rallus limicola*)

North American State/Province Conservation Status

Map by NatureServe (July, 2008)



Range

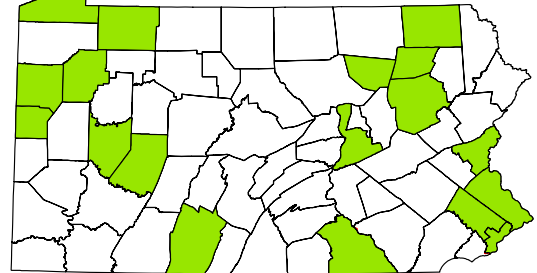
Virginia Rails are found breeding in suitable habitat throughout northern North America with wintering grounds composed by wetlands along the Gulf Coast and into Mexico.

Habitat

Virginia Rails prefer early-successional marshlands with little standing-dead vegetation to impede movement and foraging. They nest in similar habitat over water in a woven nest concealed by marsh vegetation. They utilize mudflats and shallow water (<6 in deep) in emergent wetlands for foraging with a vegetative canopy seeming to be an important component. Areas of open water near foraging habitat are important for increased invertebrate production.

Pennsylvania Distribution

Rallus limicola



PNHP data, 2010

Conservation Status

This species faces to different threats to its continued presence and prevalence in the Commonwealth. The first is the destruction of existing marsh habitat through draining, filling, flooding, development, and invasion by non-native invasive species. The second is the succession of existing wetland habitat into an unsuitable tangle of standing-dead vegetation that the Virginia Rail cannot use. To maintain this species in the Commonwealth existing marshlands must be protected from modification or destruction. Additionally, early-successional marsh habitat composed of native wetland species must be created on a regular basis to provide for adequate nesting and foraging habitat.

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Indiana bat (*Myotis sodalis*)

Pennsylvania Endangered Species

State Rank: SUB (not yet assessed, breeding), **S1N** (critically imperiled, non-breeding), **Global Rank: G2** (imperiled)

Identification

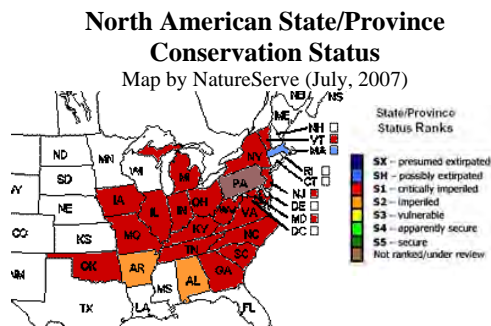
The Indiana bat, *Myotis sodalis*, is small (7.1 to 9 centimeters, or about 3 to 3.5 inches) and grayish-brown, similar to the much more common little brown bat (*Myotis lucifugus*). *M. sodalis* is distinguishable from its cousin, however, by its duller brown fur, unique triple bands of color running down each of its hairs, and its tight clustering during hibernation – Indiana bats huddle on cave walls at densities of up to 2,700 individuals per square meter (250 per square foot).

Habitat/Behavior

Indiana bats hibernate in caves and abandoned mines, generally near the cave entrance where winter temperatures are cooler – at lower temperatures, the bats' metabolisms slow down, so they use less of their fat reserves as they hibernate. In the summer, the bats frequent wooded areas near streams, roosting in crevices under tree bark or in hollow trees; trees that receive direct sunlight during the day are preferred. Females roost alone or in colonies to bear young. At the south of their range, which runs from the eastern seaboard west to Oklahoma, Indiana bats eat mostly terrestrial insects, including beetles and Lepidoptera (moths and butterflies). In the north, and nearer the Great Lakes, they eat more aquatic species, such as caddisflies.



photo source: WPC 2002



Status

The Indiana bat is vulnerable to human disturbance of its roosting sites, especially during its winter hibernation – if the bats are aroused while hibernating, they expend the fat reserves they need in order to survive until spring. Contamination of their food supply through the use of pesticides in agricultural areas and loss of summer habitat may also be contributing to the species' decline. A 1995-97 census showed population declines of around 60 percent since monitoring began in the 1960s. The species is protected under the U.S. Endangered Species Act.

Conservation

Preservation of caves used by Indiana bats for hibernation presents an interesting challenge. Access to the caves should be restricted to prevent human disruption of the bats' hibernation; but access restrictions such as doors or walls can block the caves' airflow and raise the temperature inside, preventing the bats from hibernating as deeply and causing them to use their fat reserves more quickly. Such alterations in airflow can have a large impact: Richter et. al (1993) report that replacement of a cave's door with steel bars (which did not impede airflow) was associated with a 10,000-individual increase in the cave's bat population.

Although more research is needed to understand the summer habitat requirements of the Indiana bat, it is known that they roost under the bark of mature trees or dead snags in forests. Increase of old-growth forest acreage and forest contiguity, especially within several miles of hibernation sites, will likely improve prospects for this species. Understanding the pesticide load which bats are exposed to in areas where they summer is also important to determining whether the bats are being significantly impacted by these chemicals.

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Northern Myotis (*Myotis septentrionalis*)

Pennsylvania Mammal Species of Concern

State Rank: S3B (vulnerable, breeding), **S3N** (vulnerable, non-breeding), **Global Rank: G4** (apparently secure)

Identification

The Northern Myotis (*Myotis septentrionalis*), also known as the Northern Long-eared Myotis, is characterized by its long-rounded ears that when folded forward, extend beyond the tip of the nose. Also, the shape of the tragus, the flap of skin inside the ear area, is long and dagger shaped compared to the little brown bats curved and blunted tragus. This species has a longer tail and larger wing area than other similar sized bats in this genus. The fur is dull yellow/brown above and a pale gray on the belly. Another characteristic of this species is that the calcar, a spur extending from the foot, lacks a keel. These bats weigh only 6 to 8 grams and have a wingspan of 9 to 10 inches.



photo source: Aura Stauffer

Habitat/Behavior

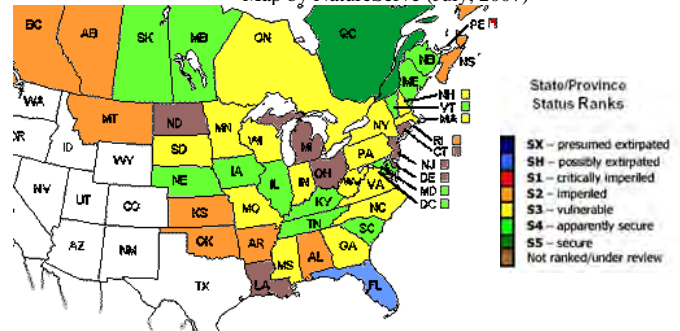
In the more northern parts of their range the northern long-eared bat is associated with boreal forests. In Pennsylvania, this bat is found in forests around the state. Northern Myotis hunt at night over small ponds, in forest clearings, at tree top level and along forest edges. They eat a variety of night-flying insects including caddisflies, moths, beetles, flies, and leafhoppers. This species uses caves and underground mines for hibernation and individuals may travel up to 35 miles from their summer habitat for hibernation. Maternity roosts are located in tree cavities, under exfoliating tree bark and in buildings.

Status

The status of the Northern Myotis in Pennsylvania is uncertain. The state status of this species currently is candidate rare (CR). More information is needed before adequate management decisions can be made. It occurs throughout Pennsylvania, but has been found in relatively low numbers. Traditionally, bats have been unpopular with the public because of a misunderstanding of their ecology and due to their presence as pests in homes and barns. However, bats play a very important role in the environment by eating large amounts of insects. For example, a single little brown bat (*Myotis lucifugus*) can eat up to 1,200 mosquito-sized insects in just one hour.

North American State/Province Conservation Status

Map by NatureServe (July, 2007)



More than 50% of American bat species are rapidly declining or already listed as endangered. The loss of bat species in Pennsylvania could greatly affect our ability to protect our plants from pests and enjoy the outdoors. For more information on bats and bat houses visit the Bat Conservation International website at <http://www.batcon.org/>.



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Eastern Small-footed Myotis (*Myotis leibii*)

Pennsylvania Threatened Mammal

State Rank: S1B, S1N (critically imperiled) Global Rank: G3 (vulnerable)

Identification

The small-footed myotis may be distinguished from other small brown bats by its diminutive size (3 ½ inches, including a 1 ½-inch tail), black face, small feet (less than 1/3-inch), and short forearms (less than 1 ½ inches). Its wing and tail membranes are blackish brown. This bat, however, is so similar in appearance to our most common bat, the little brown bat, and several other species that field identification is difficult. Positive identification is best determined only by examining skull characteristics.



Photo Credit: Merlin Tuttle

Biology-Natural History

The small-footed myotis is noted for hibernating closer to cave openings than other bats, and for hibernating alone, not clustered like the more common little brown bat. Because this bat occurs in such small numbers, the likelihood of encountering any outside of hibernating areas is extremely remote. Therefore, little is known of this animal's habitats when not in hibernation.



Habitat

Small-footed bats apparently prefer caves and abandoned mine shafts located in the Allegheny mountains, with a possible preference for those located in hemlock-covered foothills and near water.

Reasons for Being Threatened

The small-footed myotis has always been considered rare in Pennsylvania, but it is classified as threatened because of an apparent population decline between the 1930s and the late 1970s. Between 1930 and 1944, mammalogist Charles E. Mohr made repeated surveys of hibernating

bats in more than 100 caves in Pennsylvania and West Virginia. He found only 363 small-footed myotis, all in only seven of the surveyed caves, and all of these in central Pennsylvania. In 1978 and 1979 these seven caves were surveyed again, and no small-footed myotis were found. Subsequent to 1979, more than 200 abandoned mines and caves were surveyed for hibernating bats. Small-footed bats were found at 32 sites. At 25 of these sites, this species was represented by fewer than five individuals.

Management Practices

Some caves and <http://www.dcnr.state.pa.us/wrcf/define1.aspx> mines where this species hibernates have been gated to eliminate human access, as disturbance during this period causes the animals to needlessly expend energy reserves needed to sustain them through the winter. Regular surveys are being conducted to monitor the status of the small-footed bat, and summertime mist-netting at likely caves and overrock-crevices may uncover more about where this species goes at that time.



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Queen Snake (*Regina septemvittata*)

Pennsylvania Reptile Species of Concern

State Rank: S3 (vulnerable), Global Rank: G5 (secure)

Description

Queen snakes have an olive brown dorsum and a creamy yellow venter with four characteristic longitudinal dark stripes running the length of the belly. These slender snakes may reach up to 36 inches, but are usually between 12 and 24 inches. Adult females tend to be longer and heavier than the males. Juvenile queen snakes are similar in appearance to adults, but in older specimens the stripes on the belly may fuse and only be distinct on the chin.

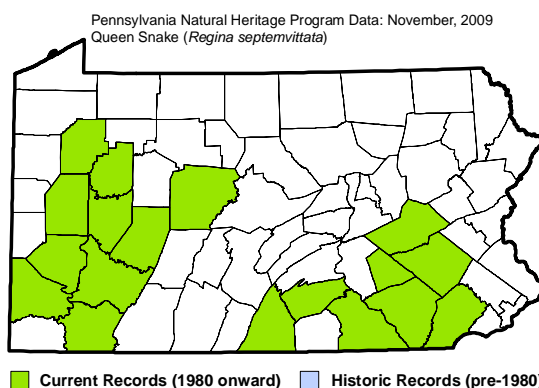
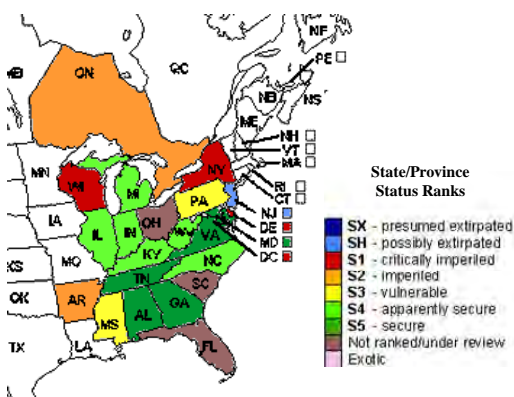


Sally Ray (PNHP)

Queen Snake (*Regina septemvittata*)

Habitat and Natural History

Queen snakes frequent areas near small to medium sized waterways, reservoir edges, and marshes where the water is unpolluted and crayfish are present. Much like the far more common northern water snake (*Nerodia sipedon*) queen snakes will bask in shrubs that overhang the water allowing them to drop into the water if disturbed. Queen snakes have a highly specific diet, consisting almost exclusively of newly molted, soft shelled crayfish. Predators of the queen snake are those that frequent the same aquatic habitat such as herons,



mink, and raccoons.

Females reach reproductive maturity in their third year while males mature in their second year. Queen snakes breed in the spring, with females birthing 4-15 live young in August.

Queen snakes are active from late April through October and then seek suitable overwintering sites such as a muskrat lodges, crayfish burrows, or a crevice along the rocky areas of a stream. Queen snakes are known to hibernate communally. The species is highly tied to their aquatic habitats and is rarely found away from water.

Conservation Considerations

In Pennsylvania, the range of the queen snake occurs in two disjunct populations in the eastern and western sectors of the state. Being dependent on high water quality to maintain a stable food source, queen snakes are particularly susceptible to water pollution.

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Darters

Genus *Ammocrypta*, *Etheostoma*, and *Percina*

Description:

Darters are a diverse group of freshwater fish that make up the bulk of the Perch family (Percidae) in eastern North America. They are generally quite small, usually less than ten centimeters (four inches) long, with small ctenoid, or toothed, scales. Like all percids, darters have two dorsal fins, the foremost of which is spiny. Their pelvic fins, which each have one anterior spine, are located well forward on the thorax. Most darters have smaller teeth than other percids.

Darter species native to Pennsylvania include:

The **eastern sand darter** (*Ammocrypta pellucida*), which is considered critically imperiled in Pennsylvania and throughout the Northeast;

The **spotted darter** (*Etheostoma maculatum*), which is imperiled in the commonwealth and throughout the Ohio River drainage;

The **bluebreast darter** (*Etheostoma camurum*), which is imperiled in the commonwealth and at risk throughout the eastern United States; and

The **gilt darter** (*Percina evides*), which is considered imperiled to critically imperiled in the commonwealth and throughout the mid-Atlantic states.

Habitat:

Most darter species have either reduced swim bladders or none at all, which gives them less control of their buoyancy than other percids. Thus they spend most of their time swimming along the bottom of streams and lakes, where they hunt under rocks and pebbles for small crustaceans and insects. Darter species are found in clear streams, ponds, and lakes across North America.



The bluebreast darter, *Etheostoma camurum*, and the gilt darter, *Percina evides*

NatureServe - Noel Burkhead & Virginia Dept of Game and Inland Fisheries (*Fishes of Virginia*)

Darters' use of microhabitats within a stream or pond varies with their reproductive cycle. During the mating season, habitat use may be fairly complex, with males establishing and defending territories in riffles, often surrounding rocks or other areas suitable for egg deposition. Females partition their habitat use as well, searching for food in pools, away from the males' territories in the riffles. Some darter species will migrate upstream at the beginning of the mating season to find breeding habitat.

Threats to Pennsylvania's darters:

Darters are vulnerable to a wide variety of direct and indirect human interference with their environment. They may be harmed by pollutants dumped directly into the water and by polluted runoff from agricultural and residential pesticide or fertilizer applications. Sudden, irregular changes in streamflow caused by hydroelectric dams may

significantly harm fish communities as lowering water levels may leave small fish stranded and rising water levels expose small, shallow-water species to predation by larger, deep-water species.

Obstructions to fish movement such as dams and weirs may block darters' migration to breeding habitat, disrupting mating behaviors and significantly reducing mating success. Sedimentation and alteration of streambeds can also significantly affect the health of darter populations, which need clear water and specific kinds of substrates.

Conservation considerations:

Preservation of Pennsylvania's rare and endangered darter species will require coordinated efforts on several fronts. Darter populations need protection from water pollution and habitat alteration. They can benefit from protection and expansion of wetlands, which help to clean and clarify runoff water, as well as from the removal of movement barriers such as lowhead dams. Establishing more uniform flow regimes below hydroelectric dams is also likely to improve conditions for darters.

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Elktoe (*Alasmidonta marginata*)

Freshwater

Mussel Species of Concern

State Rank: S4 (apparently secure), Global Rank: G4 (apparently secure)



Photo:
http://www.lwatrous.com/missouri_mollusks/mussels/images/a_marginata.jpg

Identification

The Elktoe (*Alasmidonta marginata*) is a moderately sized mussel, commonly reaching 75 mm in length. The shell is trapezoidal or rhomboid shaped, inflated, and thin (Parmalee 1998, Strayer and Jirka 1997). The anterior margin is rounded, with a somewhat straight ventral margin. The ventral and posterior margins meet in a blunt, squared point (Parmalee 1998). The posterior ridge is the focal point of the shell and is sharply angled. The posterior slope is flattened with fine, well-developed ridges crossing the growth lines. The beaks are high, inflated, and are comprised of three to four heavy double-looped ridges. The periostracum (outer covering) is usually yellowish or greenish, with green rays and darker spots that may appear connected to the rays (rays may appear interrupted). Lateral teeth are vestigial and appear as nothing more than indistinct bumps along the hinge line. The nacre (inner iridescent coloring) is usually bluish-white (Parmalee 1998; Sietman 2003; Strayer and Jirka 1997).

Habitat

The Elktoe can be found in medium to large size streams, but is most common in smaller streams. This species is present in greatest abundance in small shallow rivers with a moderately fast current and riffles. The preferred substrate is fine gravel mixed with sand (Parmalee 1998; Sietman 2003; Strayer and Jirka 1997; NatureServe 2005).

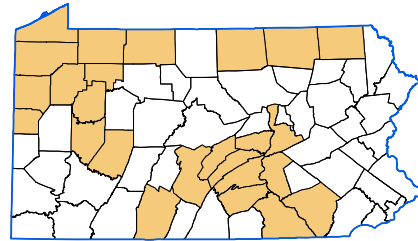
Host Fish

Hosts for Elktoe glochidia include the white sucker, northern hogsucker, shorthead redhorse, rockbass, and warmouth (Parmalee 1998; Strayer and Jirka 1997).

Status

Populations of *Alasmidonta marginata* can be found from Ontario, Canada to Alabama. Its eastern boundary ranges along the east coast from New York to Virginia and the western boundary ranges from North Dakota to Oklahoma. Most populations are located in Ohio, Indiana, and Illinois. This mussel is thought to have been extirpated from Alabama since it has not been reported during surveys for several decades (NatureServe 2005; Parmalee 1998; Strayer and Jirka 1997). This species is not common in Pennsylvania but has been found in the Susquehanna River and Ohio drainages. The proposed state status of the Elktoe is not ranked (N), meaning there is insufficient data available to provide an adequate basis for assignment to specific categories concerning the security of known populations (PNHP). The state rank of this species suggests it is secure at some sites within Pennsylvania state boundaries. However, more surveys are required to determine the status of this species and other freshwater mussels in Pennsylvania.

Pennsylvania Distribution by County



Pennsylvania Natural Heritage Program data 2007

Alasmidonta marginata is typically thought of as an interior basin species. It is not well understood how *Alasmidonta marginata* reached the Susquehanna River basin from its native range. Some researchers believe it may have drifted from the Allegheny River basin to Susquehanna via postglacial influences. An alternative theory states this species was introduced to the Susquehanna River basin via human activity (Strayer and Jirka 1997).

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328 pp.

Paul, MN 140

Northern Riffleshell (*Epioblasma torulosa rangiana*)

Pennsylvania Endangered Freshwater Mussel

State Rank: S2 (imperiled) Global Rank: G2T2 (imperiled)

Identification

The northern riffleshell is a small to medium size mussel with an oval shaped shell 2-3 3/4 inches long and 1-2 1/2 inches high. Base color is light tan to olive-green with numerous fine greenish wavy lines radiating outward. Male and female species are of different shapes (see photo). Internal shape of a dead shell aids in identification.

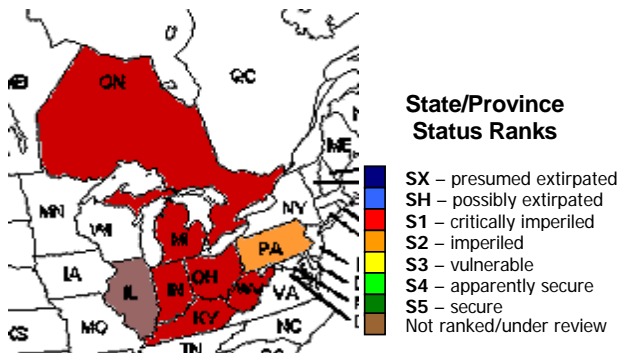


Biology-Natural History

All 65 species of PA's freshwater mussels filter food and absorb dissolved oxygen from water drawn in and released by way of a tubular siphon system. A muscular "foot" allows some slow movement, but this species, like most others, is largely sedentary. The male discharges sperm into the surrounding water, which fertilizes eggs when siphoned in by a mature female. After gestation, tiny larvae are discharged and quickly attach to certain fish for several days before dropping to the stream bottom where they grow, adding concentric rings of shell material similar to the growth rings of a tree. The life span of the riffleshell is about 15-20 years; much less than other species. Predators include the muskrat and raccoon.

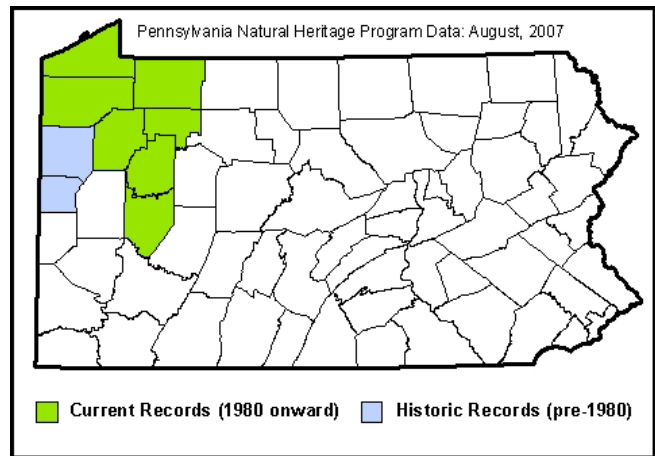
North American State/Province Conservation Status

Map by NatureServe (August 2007)



Habitat

Northern riffleshells occupy swift runs and riffles with beds of clean gravel, sand, and stones. In Pennsylvania it has been recorded from streams ranging from medium size creeks to large rivers in drainages of glacial landscapes of the Ohio River basin. The riffleshell shuns areas of calm water or deep silt.



Reasons for Being Endangered

Imperiled throughout its range, the surviving Pennsylvania populations are some of the best remaining in the world. Water pollution, darn construction and dredging are the major causes for its decline, but other threats include stream sedimentation, channelization and reduced host fish populations. The *Epioblasma* mussels are some of the most environmentally sensitive species in North America.

Management Practice

In Pennsylvania, the Pennsylvania Fish & Boat Commission holds responsibility for aquatic organisms and is <http://www.dcnr.state.pa.us/wrcf/define1.aspx> supporting on-going research to describe the riffleshell's range and status. Threats to this species should be monitored. The host fish or fishes need to be identified. Because the host fish is the critical factor in the reproductive cycle and allow for dispersal, such fish must also be protected. If damaged habitat is reclaimed, the northern riffleshell might expand to recolonize parts of its earlier range.



References:

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Fact Sheet adapted from: Felbaum, Mitchell, et al. *Endangered and Threatened Species of Pennsylvania*. Harrisburg, PA: Wild Resource Conservation Fund, 1995.

Snuffbox (*Epioblasma triquetra*)

Freshwater Mussel Species of Concern

State Rank: S1 (critically imperiled), Global Rank: G3 (vulnerable)

Identification

The shell of the snuffbox (*Epioblasma triquetra*) is triangular in shape and thick for its size. Length is up to 2.5 inches. The shells of both sexes are longer than wide. Shells of the females tend to be inflated. The exterior covering of the shell (periostracum) is yellow to yellowish green with greenish rays and blotches or chevron marking.



Tam Smith (WPC)

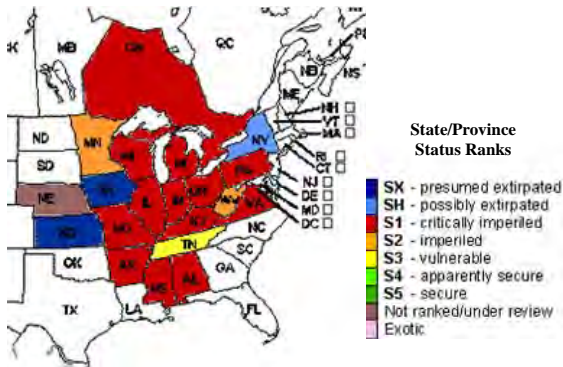
Epioblasma triquetra: male on left; female on right

Habitat

The snuffbox inhabits the riffles of large to medium sized rivers in areas with sand or gravel substrates, though individuals have been found in Lake Erie outside of Pennsylvania waters. The snuffbox is found from northern Ontario, south to Mississippi and Alabama and as far west as Nebraska and Kansas. It ranges to the east from New York to Virginia. Within Pennsylvania it is known only from the Ohio and Lake Erie drainage basins.

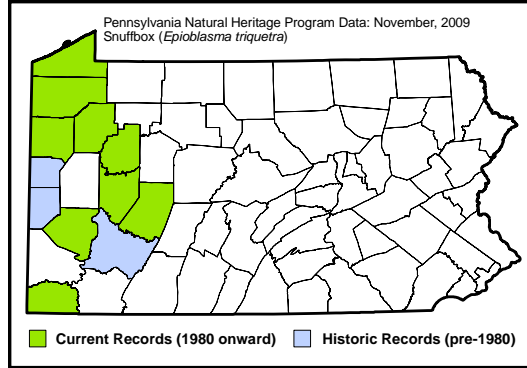
North American State/Province Conservation Status

Map by NatureServe (November 2009)



Host Fish

Known host fish for this species include the logperch (*Percina caprodes*), blackside darter (*P. maculata*), and mottled sculpin, (*Cottus bairdi*) among other species not found in Pennsylvania.



Status

The snuffbox, once widespread in the Ohio and Erie drainages, is left with only one stronghold in Pennsylvania: the French Creek basin. While there are a few disparate populations left in the western portion of the state, most of these may be unviable in the long run. Maintaining this species depends on maintaining cold, clean, clear, fast flowing waterways and healthy populations of this species host fishes. The Pennsylvania Biological Survey (PBS) has suggested a state status of Pennsylvania Endangered (PE) for *Epioblasma triquetra* because it is in danger of extirpation from the state.

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Wavy-rayed Lampmussel (*Lampsilis fasciola*)

Freshwater Mussel Species of Concern

State Rank: S4 (apparently secure), Global Rank: G5 (secure)

Identification

The overall length of the wavy-rayed lampmussel (*Lampsilis fasciola*) is usually less than 3 inches. The shells are short and rounded. The periostracum that covers the outer shell is light yellow to yellowish green in color, and marked with numerous wavy green rays.

Habitat

The wavy-rayed lampmussel lives in the riffles of medium to large sized rivers and creeks in water that is clear.

Host Fish

A host for this mussel is the smallmouth bass (*Micropterus dolomieu*). The wavy-rayed lampmussel has adapted part of its internal tissue to look like a small prey fish, probably a darter. This “lure” is used to attract its host fish, the smallmouth bass.



Photo source: WPC

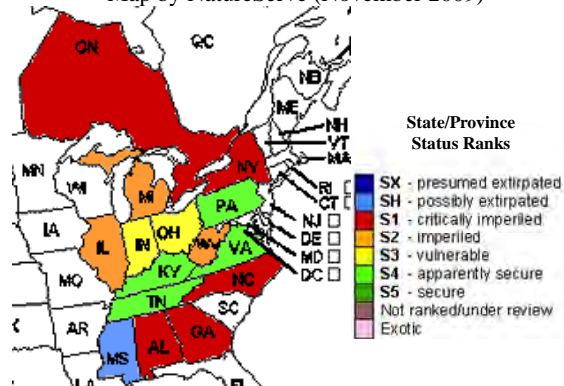


Photo source: WPC

Wavy-rayed lampmussel (*Lampsilis fasciola*) (above). Wavy-rayed lampmussel with exposed (below).

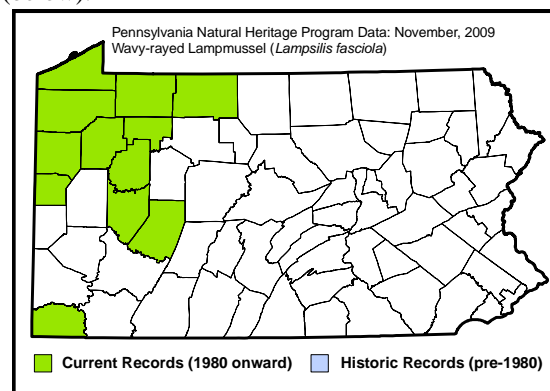
North American State/Province Conservation Status

Map by NatureServe (November 2009)



Status

The wavy-rayed lampmussel is found in the Great Lakes and Ohio-Mississippi drainages from Ontario, Canada south to Mississippi and eastward. In Pennsylvania the *Lampsilis fasciola* is found in the Ohio and Lake Erie drainage basins. The Pennsylvania Biological Survey (PABS) has given *Lampsilis fasciola* a Condition Undetermined (CU) designation indicating that there is insufficient data to assign it to another class or category.



This species has no current legal status (N) in Pennsylvania but is under review for future listing. More studies are needed in order to determine the status of this species in the state. Threats to native freshwater mussels include dams and stream channel alteration, development, pollution and siltation due to improper agriculture and timbering practices, and invasive species such as the zebra mussel (*Dreissena polymorpha*).

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Round Pigtoe (*Pleurobema sintoxia*)

Freshwater Mussel Species of Concern

State Rank: S2 (imperiled), Global Rank: G4G5 (apparently secure/secure)

Identification

The round pigtoe (*Pleurobema sintoxia*) has a variable shell and is part of a genus with very difficult to differentiate species. In general, the shell is roughly circular and lacking ridges or rays. The shells of this species are inflated when in large rivers, while those in smaller order streams are more compressed. The shell is moderately thick and reaches lengths up to 4 inches. The periostracum or outer covering of the adult shell is chestnut to dark brown.

Habitat

This mussel is found in the mud, sand, or gravel of large to medium rivers.

Host Fish

In Pennsylvania, known hosts for the larval glochidia include the: bluegill (*Lepomis macrochirus*), bluntnose minnow (*Pimephales notatus*), and creek chub (*Semotilus atromaculatus*).

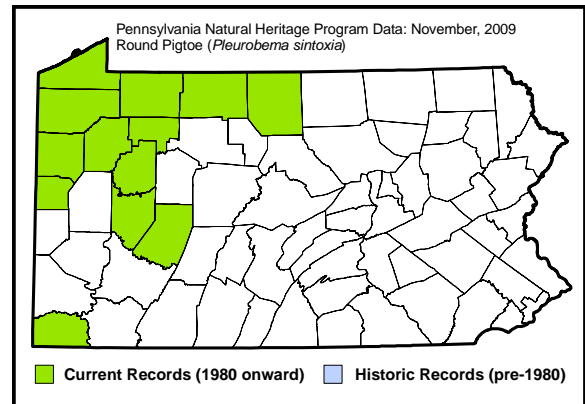
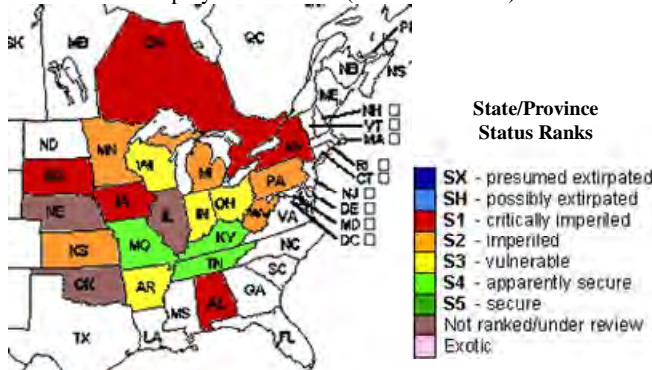


Photo source: Tam Smith (WPC)

Round pigtoe mussel (*Pleurobema sintoxia*)

North American State/Province Conservation Status

Map by NatureServe (November 2009)



Status

This species is found in eastern North America from Ontario, Canada south to Alabama. Its range extends westward from South Dakota to Oklahoma. It is absent from the Atlantic drainage.

In Pennsylvania the round pigtoe is restricted to the Ohio and Lake Erie drainages. The Pennsylvania Biological Survey (PABS) has proposed a state status of Pennsylvania Endangered (PT) for *Pleurobema sintoxia*. This species is threatened throughout its range in Pennsylvania.

References

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Paper Pondshell (*Utterbackia imbecillis*)

Freshwater Mussel Species of Concern

State Rank: S3/S4 (vulnerable/apparently secure) Global Rank: G5 (secure)

Identification

The shell of the paper pondshell (*Utterbackia imbecillis*) is thin, elongate in shape and grows to nearly 3 inches in length. The beak is flat and does not extend above the hinge. The shell is green and covered with fine rays, while the beak is a light yellow (Bogan 1993; Strayer and Jirka 1997).



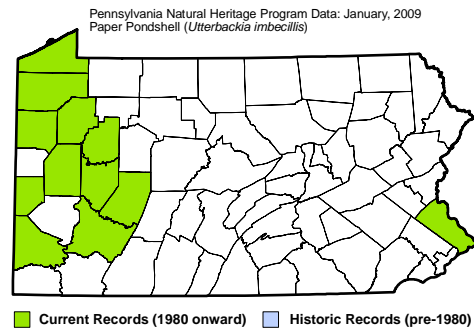
Photo source: Mary Walsh (PNHP)

Habitat

Typical habitat is the soft substrate of slow moving creeks, rivers, lakes, ponds and other impoundments (Strayer and Jirka 1997; Bogan 2002).

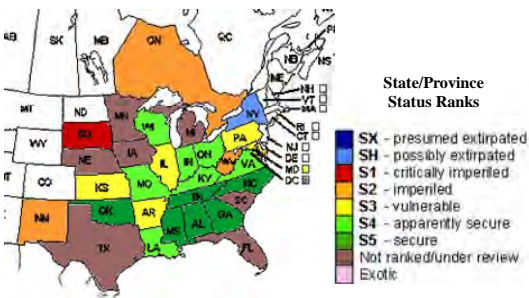
Host Fish

Potential fish hosts include: rock bass (*Ambloplites rupestris*), green sunfish (*Lepomis cyanellus*), pumpkinseed (*L. gibbosus*), bluegill (*L. macrochirus*), largemouth bass (*Micropterus salmoides*), black crappie (*Pomoxis nigromaculatus*), yellow perch (*Perca flavescens*), banded killifish (*Fundulus diaphanus*) and creek chub (*Semotilus atromaculatus*) (Cummings and Watters 2009). This mussel can also use surrogate hosts such as the bullfrog (*Lithobates catesbeiana*) and northern leopard frog, (*L. pipiens*) (Watters and O’Dee 1997).



North American State/Province Conservation Status

Map by NatureServe 2008



Status

The range of the paper pondshell extends from Ontario south to New Mexico and from New York to Florida (NatureServe 2008). In Pennsylvania it occurs in the Ohio and Lake Erie drainages with a disjunct population in the Delaware drainage (PNHP 2008). The Pennsylvania Biological Survey (PABS) has given *Utterbackia imbecillis* an N designation indicating that it is under study for future listing.

References

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- Cummings, K. and T. Watters. 2009. Mussel/Host Database. Ohio State University (OSU) Molluscs Division. <http://128.146.250.235/MusselHost/> (accessed March 5, 2009).
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Rainbow Mussel (*Villosa iris*)

Freshwater Mussel Species of Concern

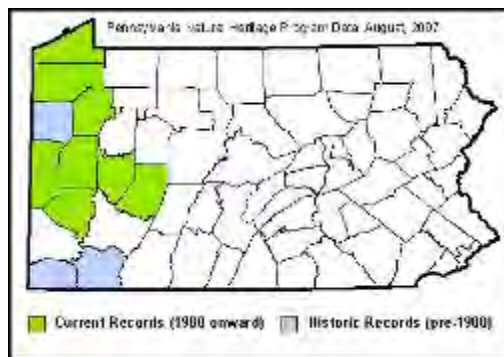
State Rank: S1 (critically imperiled) Global Rank: G5 (secure)

Identification

The Rainbow mussel is subelliptical to subovate with straight dorsal and ventral margins. The shell is somewhat thin, becoming thicker towards the anterior end (www.ncwildlife.org, Parmalee 1998). It is slightly inflated and the beaks are low (not above the hinge line). The shell has a rounded anterior end with an arched posterior ridge. The periostracum (outer coloring) is yellowish brown with fine green radiating rays that become wider on the posterior portion of the shell (rays may appear interrupted at growth lines) (www.ncwildlife.org, Parmalee 1998, Strayer and Jirka 1997).



www.lwatrous.com/missouri_mollusks/mussels/images/v_iris.jpg



Habitat

The Rainbow mussel is commonly found within or directly below riffles in small streams with moderate to strong currents. Preferred substrates include coarse sand, gravel, and mud in clean, well-oxygenated areas that are less than 1 m deep (www.ncwildlife.org/pg07_WildlifeSpeciesCon/pg7b1a1_31.htm, Parmalee 1998). It has also been found in large rivers and lakes (Strayer and Jirka 1997).

Host Fish

The Rainbow mussel may use one of several fish hosts to complete their life cycle, including largemouth bass, smallmouth bass, spotted bass, rock bass, Suwannee bass, and western mosquitofish (www.ncwildlife.org/pg07_WildlifeSpeciesCon/pg7b1a1_31.htm).

Status

The Rainbow mussel is widespread throughout the St. Lawrence, upper Mississippi, Ohio, Tennessee, and Cumberland River basins (www.ncwildlife.org, www.natureserve.org/explorer, Parmalee 1998). This species is rarely encountered in the Allegheny basin in New York and Pennsylvania even though it appears to be widespread throughout other areas in New York (Strayer and Jirka 1997). The rainbow mussel is found in the Susquehanna drainage in Pennsylvania. The state status of the rainbow mussel is Pennsylvania critically imperiled (S1) since few individuals have been observed throughout their native range within state boundaries (www.naturalheritage.state.pa.us). The Rainbow mussel was listed as stable in an assessment of the conservation status of the freshwater mussels of the United States by the American Fisheries Society (Williams et al. 1993). More extensive surveys are necessary to determine the current status of this species in Pennsylvania and the United States.

References

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- Williams, J.D., M.L. Warren, K.S. Cummins, J.L. Harris, and R.J. Neves. 1993. Conservation Status of Freshwater Mussels. Fisheries. 18(9): 6-22.



Lobed Spleenwort (*Asplenium pinnatifidum*)

Description

Lobed spleenwort is a small fern that grows from a short rhizome. The leaves, narrowly triangular in shape and tapering to an elongated tip, may be up to 7 inches (17 cm) long but are often much shorter. The leaf margins have a lobed outline, with the lobes tending to get deeper near the base of the leaf. The leaf stem is mostly green, but maroon at the base. As in most ferns, the spores are produced on the underside of the leaves.



Photo source: PNHP

Distribution & Habitat

Lobed spleenwort has a range from New Jersey west into Wisconsin, and south into Georgia and Oklahoma.

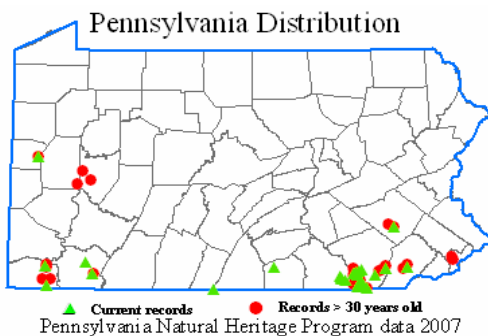
In Pennsylvania, it has been documented historically at scattered locations in the southern counties. It grows on dry shaded cliffs and rock outcrops, particularly on sandstone and schist.

Current State Status

The PA Biological Survey (PABS) considers lobed spleenwort to be a species of special concern, based on the few occurrences that have been recently confirmed and its specialized habitat. It does not have a PA legal rarity status, but has been assigned a suggested rarity status of Rare by PABS. About two dozen populations, mostly with few individuals, are currently known.

North American State/Province Conservation Status

Map by NatureServe 2007



Conservation Considerations

This species and its habitat have threats such as indiscriminate spraying of herbicide, quarrying, invasive species, and forest fragmentation. The viability of existing populations and the rock outcrop habitat may be enhanced by establishing a surrounding buffer of forest.

NatureServe conservation status ranks

G4 – Apparently secure globally;
S3 – Vulnerable in Pennsylvania.

References

NatureServe. 2006. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.1. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer> Rhoads, A.F. and T.A. Block. 2007.

The Plants of Pennsylvania: An Illustrated Manual. 2nd edition. University of Pennsylvania Press, Philadelphia.



Blue False-indigo (*Baptisia australis*)

Description

Although shrub-like in size and form, blue false-indigo is actually an herb that dies back to the ground annually. The large purple, bilaterally-symmetrical flowers look like large pea flowers, and this plant is indeed a legume. The large fruits, as well as the leaves, turn black late in the season. The thick leaves are divided into three obovate (egg-shaped, with the widest part above the middle) leaflets.

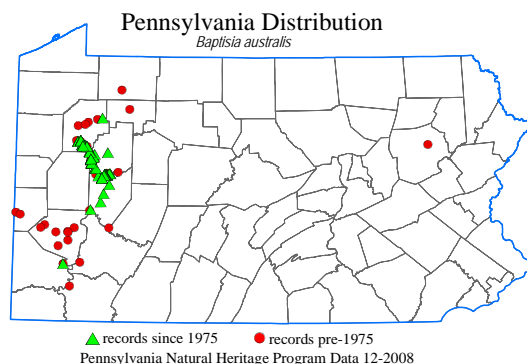
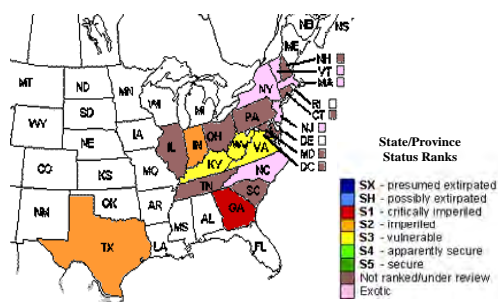


Photo source: Denise Watts, PNHP

Distribution & Habitat

Baptisia australis is mostly confined to the Ohio River system, which includes in Pennsylvania the Allegheny, the Monongahela, and the Youghiogheny in addition to the Ohio. Urbanization in the Pittsburgh area has led to isolation of the Allegheny River occurrences at the northeastern limit of the range of the species. The species grows in rocky habitats, sometimes along large boulders, along large rivers. It is often associated with prairie species such as big bluestem (*Andropogon gerardii*).

North American State/Province Conservation Status



Current Pennsylvania Status

Blue false-indigo has been recommended for status as Pennsylvania Threatened by the Pennsylvania Biological Survey.

Conservation Considerations

Although locally common on parts of the Allegheny River, the species has declined due to conversion of the rivers in the Pittsburgh area to navigation pools. Further decline is expected as invasive species such as Japanese knotweed (*Polygonum cuspidatum*) invade its habitat, and more habitat is lost to development. The isolation of the Allegheny River occurrences could lead to decline by a phenomenon known as genetic drift, in which genetic diversity of isolated populations tends to become progressively lower, reducing the viability of the population due to decreased ability to adapt to changing conditions.

NatureServe conservation status ranks: G5 – Globally secure; S2 – Imperiled in Pennsylvania



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- NatureServe. 2006. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.1. NatureServe, Arlington, Virginia. Available at <http://www.natureserve.org/explorer>.
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Cattail Sedge (*Carex typhina*)

State Rank: S2 (imperiled), **Global Rank: G5** (secure)

Identification

Cattail sedge is a grass-like perennial that grows from 30 to 90 centimeters tall. The leaves are long and narrow, with parallel veins and a pronounced midrib. The lowest leaves grow from a point on the stem well above the ground, rather than at the base of the stem, a feature described as phyllopod. Flowers are small, simple, and unisexual, grouped in a spike-like head at the apex of the stem. Pistillate (female) flowers form a cylindrical head above the smaller cluster of staminate (male) flowers.



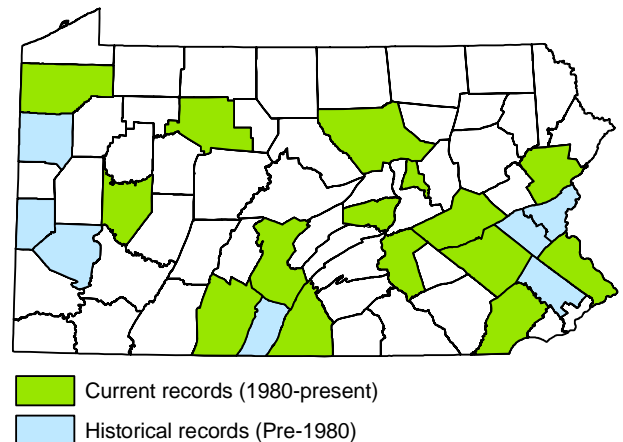
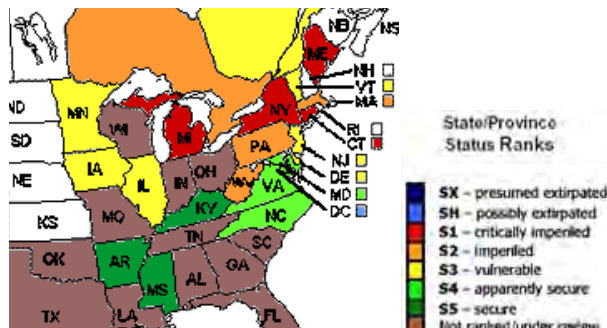
Robert H. Mohlenbrock, USDA-NRCS PLANTS Database - from *Midwest wetland flora: Field office illustrated guide to plant species.* (USDA SCS, Midwest National Technical Center, Lincoln, NE., 1989)

Habitat

Cattail sedge tolerates shade and acidic soil, but requires very moist conditions. It grows in wet woods, along occasionally flooding streams, and in marshes from Québec south to Florida and Texas.

North American State/Province Conservation Status

Map by NatureServe (July, 2007)



Status

Cattail sedge populations have been harmed most by disturbance and alteration of their wet, wooded habitats, whether in the form of logging, draining for use in agriculture or development, or changes created by flood control regimes.

Conservation

Conservation of cattail sedge will require preservation and protection of its wetland habitat, particularly wooded areas along rivers. Prevention of wetland draining and flood regime alterations is also expected to help this species recover.

References

- Gleason, Henry A. and Arthur Cronquist. 1991. *Manual of Vascular Plants of Northeastern United States and Adjacent Canada*. Second ed. New York: The New York Botanical Garden. 735.
- NatureServe. 2004. *NatureServe Explorer: An online encyclopedia of life* [web application]. Version 4.1. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. Accessed 3 March 2005.
- United States Department of Agriculture-Natural Resources Conservation Service. 2005. *The PLANTS Database* [web application]. National Plant Data Center, Baton Rouge, Louisiana. Available at <http://plants.usda.gov>. Accessed 24 February 2005.



Harbinger-of-spring (*Erigenia bulbosa*)

Description

Harbinger-of-spring is a delicate perennial herb with a weak, hairless stem that may grow up to 6 inches (15 cm) in height. The hairless leaves are subdivided into numerous linear or narrowly oblong leaflets. This species represents one of the earliest-blooming wildflowers in Pennsylvania, with the flowers generally appearing from March into early April. The tiny individual flowers occur in small clusters at the end of a long stalk. Each flower has 5 white petals that are only about 1/8 of an inch (3-4 mm) in length, and contrast noticeably with the blackish anthers. The tiny fruit breaks into 2 sections at maturity. The leaves and stem usually die back to the ground in June.

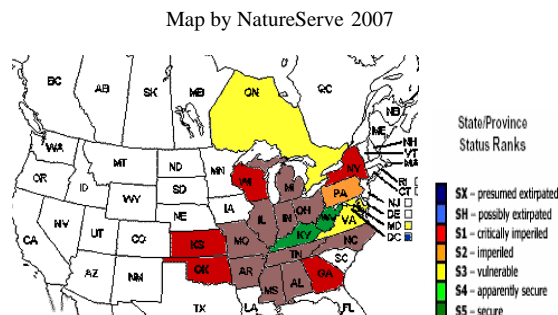


Photo source: John Kunsman (PNHP)

Distribution & Habitat

Harbinger-of-spring has a range from southern Canada south into the Great Lakes states and the Middle Atlantic states. In Pennsylvania, it has been documented historically in several western and southeastern counties. It grows on wooded slopes, floodplain forests, and in rich woodlands.

North American State/Province Conservation Status



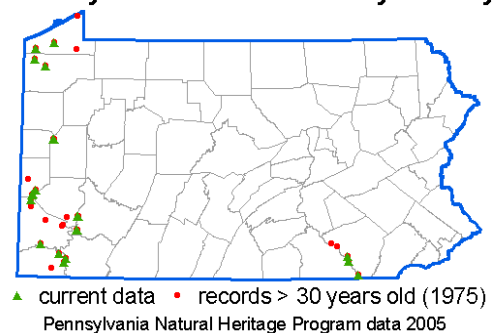
Current State Status

The PA Biological Survey considers harbinger-of-spring to be a species of special concern, based on the relatively few occurrences that have been recently documented. It has a PA legal rarity status and a PABS suggested rarity status of Threatened. About 40 populations are currently known from the state.

Conservation Considerations

The known populations of harbinger-of-spring have threats from habitat loss, invasive species, and in some locations, excessive browsing by deer. Establishing buffers around fragmented forested habitat and removal of invasive species will help to maintain populations.

Pennsylvania Distribution by County



NatureServe conservation status ranks

G5 – Secure globally; S2– Imperiled in Pennsylvania

References

- NatureServe. 2006. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.1. NatureServe, Arlington, Virginia. Available at <http://www.natureserve.org/explorer>.
- Pennsylvania Natural Heritage Program. 2007.
- Rhoads, A.F. and T.A. Block. 2007. The Plants of Pennsylvania: An Illustrated Manual. 2nd edition. University of Pennsylvania Press, Philadelphia.



Red-head Pondweed (*Potamogeton richardsonii*)

Description

Red-head pondweed, often known as Richardson's pondweed, is a submerged aquatic plant with leaves that clasp the stem. It only rarely produces floating leaves. The flowers are held above the surface of the water and are wind pollinated. The only other pondweed in our flora with clasping leaves is perfoliate pondweed (*Potamogeton perfoliatum*), which has smaller, less sharply pointed leaves, and can sometimes be distinguished only with great difficulty. The leaves are usually wavy-margined, which can lead to misidentification as the invasive curly pondweed (*Potamogeton crispus*), which has sessile, but not clasping leaves which, unlike those of any of our native pondweeds, have minutely toothed margins.



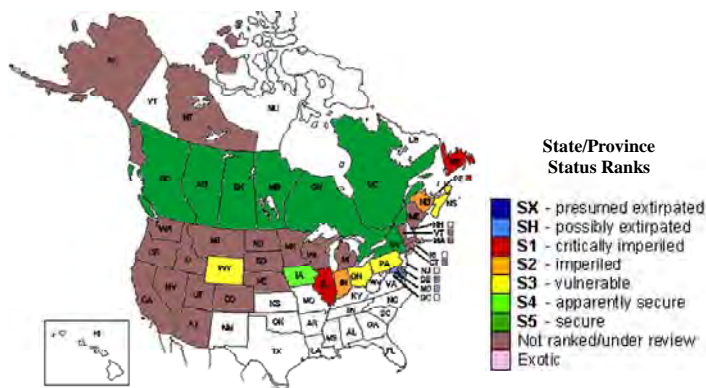
Photo by Mary Shaw

Distribution & Habitat

Red-head pondweed is found in calcareous (i.e. high pH) lakes and streams across northern North America (but not on other continents), and reaches the southern limit of its range in the east in Pennsylvania and Maryland.

North American State/Province Conservation Status

Map by NatureServe 2008

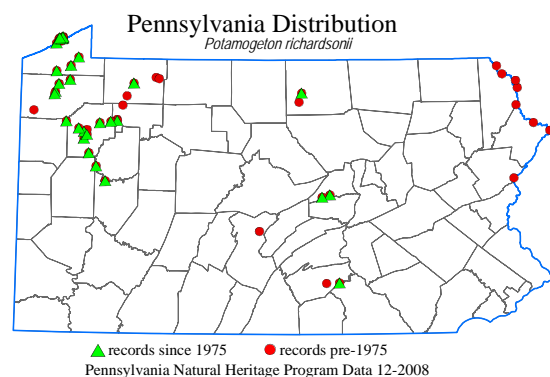


Current State Status

Red-head pondweed is listed as Pennsylvania Threatened. Due to the discovery of new localities for the species, the Pennsylvania Biological Survey has recommended an adjustment in the status to Pennsylvania Rare.

Conservation Considerations

Native submerged aquatic plants are in great danger of displacement by exotic invasive species, especially Eurasian water-milfoil (*Myriophyllum spicatum*).



NatureServe conservation status ranks: G5 – Globally secure; S2 – Imperiled in Pennsylvania

References

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- NatureServe. 2006. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.1. NatureServe, Arlington, Virginia. Available at <http://www.natureserve.org/explorer>.



Featherbells (*Stenanthium gramineum*)

Description

Featherbells is a showy plant in the lily family (Liliaceae) with a basal rosette of long, strap-shaped leaves and a terminal inflorescence with stalk-less (sessile), white, six-petaled flowers on branches at the base, and directly on the main axis above. It is similar to Virginia bunch-flower (*Melanthium virginicum*, or *Veratrum virginicum*), which differs in having usually wider leaves, and having yellowish petals which have distinct stalks.



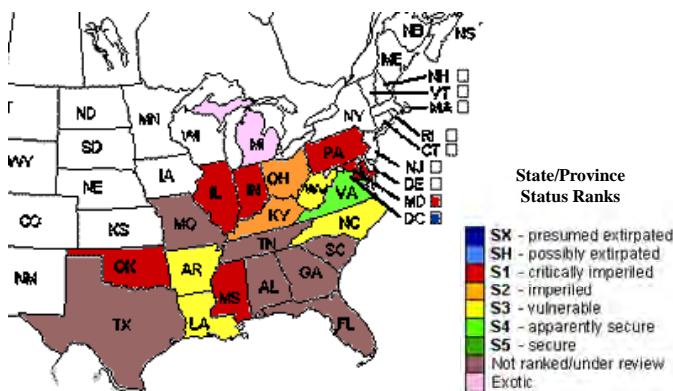
Photo Source: Rocky Gleason (PNHP)

Distribution & Habitat

This plant is found from the Mississippi Valley to the Atlantic, from Missouri and Pennsylvania south to extreme eastern Texas and the panhandle of Florida, but absent in much of the southern portion of this range. It flowers in mid summer, and grows in moist, open habitats, often along streams.

North American State/Province Conservation Status

Map by NatureServe 2008

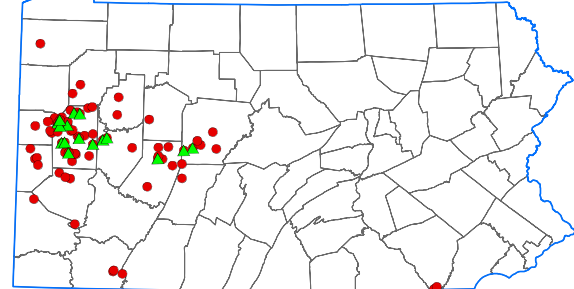


Current State Status

The Pennsylvania Biological Survey has proposed a status of Tentatively Undermined, indicating the need for further fieldwork before assignment of a definite status.

Pennsylvania Distribution

Stenanthium gramineum



▲ records since 1975 ● records pre-1975
Pennsylvania Natural Heritage Program Data 12-2008

Conservation Considerations

Featherbells grows in natural (and to some extent artificial) disturbance habitats, which makes it particularly vulnerable to exotic invasive species, most notable of which are Japanese knotweed (*Polygonum cuspidatum*) and its sister species giant knotweed (*Polygonum sachalinense*). Many of the known populations are small, and thus could be displaced by aggressive non-native plant species. It has been noted that it often does not set fruit, raising concern that pollinators may be scarce.

NatureServe conservation status ranks: G5 – Globally secure; S2 – Imperiled in Pennsylvania

References

- NatureServe. 2006. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.1. NatureServe, Arlington, Virginia. Available at <http://www.natureserve.org/explorer>.
- Rhoads, A.F. and T.B. Block. 2007. The Plants of Pennsylvania: An Illustrated Manual. 2nd edition. University of Pennsylvania Press, Philadelphia.



Declined Trillium (*Trillium flexipes*)

Description

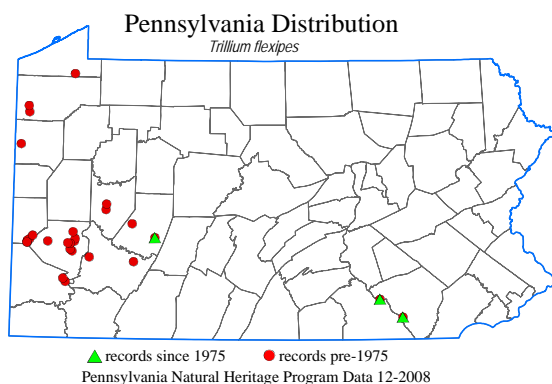
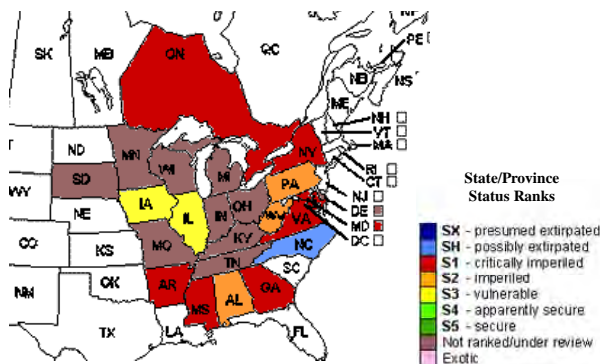
The genus *Trillium* is well-known; the plants with three leaves and three-parted flowers comprise a conspicuous, showy element of the spring flora. It is easy to recognize a trillium as a trillium, but distinguishing the species can be difficult, and is often complicated by hybridization. This species has flowers usually held above the leaves, with white petals and a white, deeply lobed ovary, which turns red in fruit. White petals can be found on individuals of the usually red-petaled wakerobin (*Trillium erectum*), with which this species often hybridizes. The ovaries of *Trillium erectum* are consistently maroon. Declined trillium, like most trilliums, blooms in April to early May.



Photo source: Denise Watts, PNHP

North American State/Province Conservation Status

Map by NatureServe 2008



Distribution & Habitat

Declined trillium is primarily a mid-western species. It is found mostly in the upper Mississippi and Ohio River drainages and the lower Great Lakes area, also extending south in the mountains to northern Alabama and, at least as hybrids with *Trillium erectum*, along the lower Susquehanna in Pennsylvania. It grows on wooded slopes in soils with high pH.

Current State Status

Declined trillium is imperiled in Pennsylvania. Due to extensive hybridization, it is not clear how much pure *Trillium flexipes* is in the state (the map below includes hybrids). Because the hybrids with *Trillium erectum* are stable and fertile, the hybrids are also of conservation concern. The legal status of the species in Pennsylvania is Tentatively Undetermined. The Pennsylvania Biological Survey recommends a status of Pennsylvania Threatened for both the species and the hybrids.

Conservation Considerations

Trilliums are a favored food of deer, and all *Trillium* species are locally threatened when deer populations are high. Poor logging practices can convert a rich forest ecosystem hosting this species into a disturbed forest dominated by invasive species where declined trillium cannot compete. Much of the historic habitat in the Pittsburgh area has been lost to urbanization.

NatureServe conservation status ranks: G5 – Globally secure; S2 – Imperiled in Pennsylvania.

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- NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available at <http://www.natureserve.org/explorer>.
- Case, F.W. and R.B. Case. Trilliums. 1997. Timber Press. Portland, Oregon.

