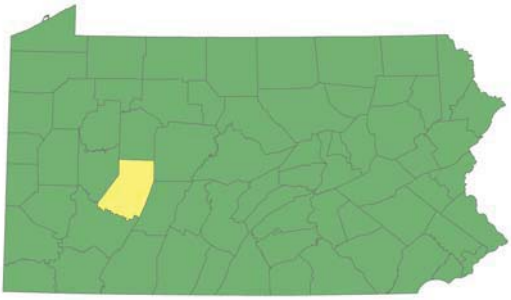
Indiana County
Natural Heritage Inventory



Pennsylvania Natural Heritage Program

photos (clockwise from top-right): drooping trillium, timber rattlesnakes, a stream running through an old growth forest, Suncliff.

photos by,PNHP

INDIANA COUNTY
NATURAL HERITAGE INVENTORY

February 2011

Prepared for:

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Indiana, PA 15701-1705

Prepared by:

Pennsylvania Natural Heritage Program
Western Pennsylvania Conservancy
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Pittsburgh, PA 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 and a grant from the Heinz Foundation.

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

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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 new information and to 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 Indiana CNHI focuses on the best examples of *living ecological resources* in the county. These resources are by no means the only significant resources in the county. Historic, cultural, educational, and scenic resources are among the many other resources that the county must address through other projects and programs. This inventory presents the known outstanding natural features in the county, and maps the locations of the best habitats (natural communities) and plant and animal species of concern along with recommendations for their preservation.

Although this inventory was conducted using a tested and proven methodology, it is best viewed as a preliminary report rather than the final word on the subject of Indiana County's natural heritage. Further investigations could, and likely will, uncover new areas of significance. Likewise, more in-depth investigations of sites already listed in this report could reveal features of further or greater significance than those documented. Finally, as land use patterns in the county change, species may be lost, changing the significance of already documented sites. We encourage additional inventory work across the county to further the efforts begun with this study.

Consider this inventory as an invitation for Indiana County's residents to explore and discuss their natural heritage, and to learn about and participate in the conservation of their resources. Ultimately, it will be up to the landowners and residents of Indiana County to determine how to use this inventory. Some applications of this information for local groups follow:

Natural Heritage Inventories and Environmental Review

The results presented in this report represent a snapshot in time; they highlight sensitive natural areas within Indiana County. The sites in the Indiana County Natural Heritage Inventory have been identified to help guide wise land use and county planning. The Indiana 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.

Planners and Government Staff: Typically, the planning office in a county administers a CNHI. Often, the inventories are used in conjunction with other resource information (agricultural areas, slope and soil overlays, floodplain maps, etc.) for review of various projects, and for comprehensive planning. Natural Heritage Areas may be included under various categories of zoning such as: conservation areas, forest zones, parks, greenways, or agricultural security areas. There are many possibilities to provide for the conservation of Natural Heritage Areas 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 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 (e.g. high diversity streams or wetlands), and as a reference for encouraging best 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 impacted resources be known and understood. Decisions made with inadequate information can lead to substantial and costly delays. By using data provided on the biological resources (including rare, threatened, or endangered plants and animals) provided in this CNHI, consultants can identify potential conflicts long before establishing footprints, developing detailed plans, and applying for permits. This allows projects to adapt early on when flexibility is at a maximum.

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

Developers: Utilizing this inventory allows developers to consider options that not only protect key resources, but also add value to projects. 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. County Natural Heritage Inventories can suggest areas where development and conservation can complement one another.

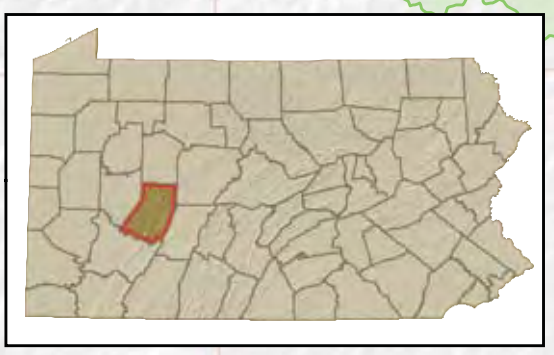
Educators: Curricula in primary, secondary and college level biology classes often focus on the chemical or microbiological level; field sciences do not always receive the attention that they require. Local natural areas can provide unique opportunities for students to witness, first-hand, the organisms and natural communities that are critical to maintaining biological diversity. By developing curriculum for Environment and Ecology Academic Standards around Natural Heritage Areas, educators can show students where and why local and regional diversity occurs, and why it is significant. With proper permission and guidance, students can increase their understanding of Natural Heritage Areas by establishing research or monitoring projects.

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

The Pennsylvania Natural Heritage Program

The Pennsylvania Natural Heritage Program (PNHP) is a partnership between The Western Pennsylvania Conservancy (WPC), The Department of Conservation and Natural Resources, The PA Fish and Boat Commission, and the PA Game Commission. The PNHP is responsible for collecting, tracking, and interpreting information regarding the Commonwealth's biological diversity. CNHIs are an important part of the work of the PNHP. The PNHP is a member of NatureServe, an organization that coordinates Natural Heritage efforts through an international network of natural heritage programs and conservation data centers operating in all 50 states, Canada, Latin America, and the Caribbean.

The Western Pennsylvania Conservancy served as the principal investigator, prepared the report, and created the maps for this study. Established in 1932, WPC is a private non-profit conservation organization headquartered in Pittsburgh. WPC's mission is to save the places we care about by connecting people to the natural world. As part of its mission, WPC works to sustain the natural heritage of the Commonwealth: its native plant, animal, and habitat resources. To reach these goals, WPC initiates conservation projects independently, and establishes partnerships with like-minded agencies and organizations



Jefferson County
Armstrong County
Westmoreland County
Cambria County
DAYTON
VALIER
PUNXSUTAWNEY
MC GEES MILLS
ALUMVILLE
MARION CENTER
ROCHESTER MILLS
BURNSIDE
CLYMER
COMMODORE
BARNESBORO
ELDERTON
MC INTYRE
INDIANA
ERNEST
BRUSH VALLEY
COLVER
AVONMORE
SALTSBURG
BLAIRSVILLE
BOLIVAR
NEW FLORENCE
STRONGSTOWN
VINTONDALE
WILPEN
RACHELWOOD
NORTH MAHONING
WEST MAHONING
SOUTH MAHONING
EAST MAHONING
CANOE
BANKS
GRANT
MONTGOMERY
WASHINGTON
RAYNE
GREEN
CHERRYHILL
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Scale 1:215,000
0 1 2 4 6 8 Miles
0 2 4 8 12 Kilometers

PNHP
Pennsylvania Natural Heritage Program

Site and LCA Identification # and Significance

- *exceptional significance*
- *high significance*
- *notable significance*
- *county significance*

- Core Habitat
- Supporting Landscape
- Landscape Conservation Area

- TOWNSHIP BOUNDARIES
- *USGS Quadrangles*

Indiana County Natural Heritage Inventory Site Index

#	Site Name
1	Mahoning Creek
2	Little Mahoning Creek – Lower
3	Mudlick Run
4	Little Mahoning Creek - Upper
5	Rochester Mills
6	Nashville Swamp
7	Johnsonburg
8	Bear Run
9	Glen Campbell
10	Kilns Run
11	Little Mahoning Creek at Nashville
12	Dixon Run
13	North Branch Plum Creek
14	Creekside
15	South Branch Plum Creek
16	Porter Floodplain
17	Curry Run
18	Anthony Run
19	White's Woods
20	Onberg
21	State Game Lands #185
22	South Branch Two Lick Creek
23	Little Yellow Creek
24	Yellow Creek
25	Yellow Creek State Park - Nature Trail Woods
26	Yellow Creek State Park - Nature Trail Field
27	Dragonfly Pond
28	Suncliff
29	Brush Creek at Brush Creek Road
30	Yellow Creek State Park - Lake
31	Yellow Creek State Park - Uplands
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33	Yellow Creek at Route 422
34	Two Lick Creek
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36	Cherry Run North
37	Conemaugh Reservoir
38	Aultmans Run
39	Blairsville Borough
40	Strangford Cave
41	Chestnut Ridge/Penn View Mountain - North
42	Pine Ridge County Park
43	Claghorn
44	Black Lick Creek Floodplain & Natural Area
45	Conemaugh Gorge
46	Buttermilk Falls Natural Area
47	Robindale

#	Landscape Conservation Areas
L-48	Little Mahoning Creek
L-49	Little Yellow Creek

Table 1: Biological Diversity Areas categorized by significance. See Table 15 (page 54) for definitions of significance levels.

BDA	Municipality	Description	page
Exceptional Significance			
Little Mahoning Creek-Lower BDA	South Mahoning Township, West Mahoning Township	a high-quality stream that provides habitat for numerous dragonflies, mussels, and other species of concern	181
Strangford Cave BDA	Burrell Township	a limestone cave that is habitat for Allegheny woodrats and 3 invertebrate species of concern	99
High Significance			
Brush Creek at Brush Creek Road BDA	Brush Valley Township	a section of Brush Creek near its headwaters that provides habitat for 2 dragonfly species of concern	85
Chestnut Ridge/Penn View Mountain - North BDA	Burrel Township, West Wheatfield	steep forested slopes above the Conemaugh River that support Allegheny woodrats and thick-leaved meadow-rue	98
Conemaugh Gorge BDA	East Wheatfield Township	a gorge that Conemaugh River has cut through limestone and other rocks, creating habitat for several rare species	132
Little Mahoning Creek - Upper BDA	East Mahoning Township, North Mahoning Township West Mahoning Township	habitat for 2 mussel species and one additional species of concern	153
Little Yellow Creek BDA	Brush Valley Township, Buffington Township, Pine Township	a section of Little Yellow Creek that supports 2 dragonfly species and 3 additional species of concern	159
Mahoning Creek BDA	West Mahoning Township	a high quality creek and adjacent forest that support several freshwater mussels, mountain bugbane, and another species of concern	182
South Branch Two Lick Creek BDA	Cherryhill Township, Green Township, Pine Township	habitat for 4 species of concern along the South Branch of Two Lick Creek	143
Suncliff BDA	Brush Valley Township, Buffington Township	a large calcareous cliff and floodplain along Yellow Creek	86
Yellow Creek State Park - Lake BDA	Brush Valley Township	a marsh along Yellow Creek that supports 3 marsh-nesting bird species of concern	89
Notable Significance			
Anthony Run BDA	Armstrong Township	a stream that supports a species of concern	69
Aultmans Run BDA	Conemaugh Township, Blacklick Township	a creek and the adjacent forest provide habitat for a species of concern	81

Bear Run BDA	Banks Township	a stream that supports three dragonfly species of concern	75
Blairsville Borough BDA	Blairsville Borough, Burrell Township	stream and riparian habitat for two species of concern	97
Cherry Run North BDA	Center Township	stream and riparian habitat for a species of concern	111
Claghorn BDA	East Wheatfield Township, West Wheatfield Township	forest near Black Lick Creek that supports 2 plant species of concern	133
Conemaugh Reservoir BDA	Conemaugh Township	a reservoir that supports osprey and another species of concern	123
Creekside BDA	Washington Township	meadow, forest, and creek habitat for featherbells and another species of concern	175
Curry Run BDA	Armstrong Township	a stream that supports a species of concern	69
Dixon Run BDA	East Mahoning Township	a damp meadow that supports featherbells	127
Glen Campbell BDA	Banks Township	an early successional area that supports a species of concern	76
Johnsonburg BDA	Banks Township	a patchwork of fields and forests that is habitat for a species of concern	76
Kilns Run BDA	Montgomery Township	stream and riparian habitat for a species of concern	149
Little Mahoning Creek at Nashville BDA	Canoe Township	a section of Mahoning Creek that supports 2 dragonfly species of concern	139
Mudlick Run BDA	North Mahoning Township	a damp meadow that supports featherbells	154
Nashville Swamp BDA	Canoe Township	a hemlock swamp that supports northern pygmy clubtails	105
North Branch Plum Creek BDA	South Mahoning Township	a section of North Branch Plum Creek that supports a species of concern	169
Onberg BDA	Rayne Township	a creek that supports a species of concern	165
Robindale BDA	East Wheatfield Township, West Wheatfield Township	a moist meadow and woods that supports 2 plants of concern	134
Rochester Mills BDA	Canoe Township	an old growth hemlock forest	106
South Branch Plum Creek BDA	Washington Township	a section of South Branch Plum Creek supporting the Wabash pigtoe mussel and another species of concern	176
State Game Land #185 BDA	Green Township	a hemlock swamp	143
Two Lick Creek BDA	Center Township	stream and riparian habitat for a species of concern	112
Yellow Creek BDA	Cherryhill Township	a section of Yellow Creek that supports a species of concern	117

Yellow Creek at Route 422 BDA	Brush Valley Township, Center Township, White Township	a section of Yellow Creek that supports 2 dragonfly species and one other species of concern	194
Yellow Creek State Park - Nature Trail Fields BDA	Brush Valley Township, Cherryhill Township	a damp meadow that supports featherbells	89
Yellow Creek State Park - Nature Trail Woods BDA	Cherryhill Township	a rich floodplain forest that supports the West Virginia white butterfly	118
Yellow Creek State Park - Uplands BDA	Brush Valley Township	upland forest and shrubland that is habitat for a species of concern	89
Local Significance			
Blacklick Valley Floodplain and Natural Area BDA	East Wheatfield Township	a high-quality floodplain forest along Black Lick Creek	131
Buttermilk Falls Natural Area BDA	West Wheatfield Township	a spectacular waterfall along Hires Run	187
Cherry Run Reservoir BDA	Center Township	a reservoir that supports a mussel species of concern	112
Dragonfly Pond BDA	Brush Valley Township	a manmade pond that supports a mussel species of concern	86
East Pike BDA	White Township	roadside habitat for small wood sunflower	193
Pine Ridge County Park BDA	Burrel Township	a rich mesic forest that supports a species of concern	99
Porter Floodplain BDA	Armstrong Township	a high-quality forested floodplain along Crooked Creek	70
White's Woods BDA	White Township	a high quality forest	194

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. A very special thank you goes out to the people of Indiana County for their interest and hospitality.

We especially thank:

- George Urban, Indiana County Office of Planning and Development
- Leann Chaney, Indiana County Office of Planning and Development
- Jeff Raykes, Indiana County Office of Planning and Development
- Dr. Carol Loeffler, pilot for the aerial reconnaissance of the county and botanist
- The Indiana County Natural Heritage Inventory Advisory Committee including:
  - Whit Watts, Indiana University of Pennsylvania
  - Ed Patterson, Indiana County Parks and Recreation
  - Jerry Pickering, Indiana University of Pennsylvania (retired)
  - Jim Resh, Indiana County Conservation District
  - Anne Daymut, Indiana County Conservation District (former)
  - Delbert Highlands, Indiana County Planning Commission
  - Laurie Lafontaine, Indiana County Planning Commission
  - Cindy Rogers, Evergreen Conservancy
  - John Somonick, resident
  - Bob Lankard, Evergreen Conservancy
  - Tom Clark, Indiana County Conservation District (former)
  - Ted Kuckock, Indiana County Conservation District
  - Adam Cotchen, Indiana County Conservation District
  - John Dudash, PA Senior Environment Corps
  - JoAnne Ferraro, PA Senior Environment Corps
  - Dave Frick, Indiana County Commissioner
  - Linda Gwinn, Blairsville
  - Dennis McConnell, Indiana County Farm Bureau
- Bonnie Isaac, Carnegie Museum of Natural History, Section of Botany
- Loree Speedy, Carnegie Museum of Natural History, Section of Botany

We would like to thank the Pennsylvania Department of Conservation and Natural Resources for providing funding to make this project possible through their Wild Resource Conservation Program. Additional support was provided by the Heinz Foundation.

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 JoAnn Albert, Jake Boyle, Kierstin Carlson, Robert Coxe, Tony Davis, Jeremy Deeds, Alice Doolittle, Charlie Eichelberger, Rocky Gleason, Steve Grund, Jim Hart, Susan Klugman, Matt Kowalski, John Kunsman, Betsy Leppo, Beth Meyer, Ryan Miller, Sally Ray, Erika Schoen, Shana Stewart, Andrew Strassman, Jeff Wagner, Mary Walsh, Denise Watts, Peter Woods, and Ephraim Zimmerman. Additionally, this report has incorporated ideas and approaches developed for conservation science initiatives recently undertaken in other states, most notably the Massachusetts BioMap project, and the Maryland Green Infrastructure project. We gratefully acknowledge the vision of these projects for providing the basis for improved ways to represent conservation information in the County Natural Heritage Inventory reports.

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.

Christopher Tracey, Ecologist/Conservation Planning Coordinator
Pennsylvania Natural Heritage Program

EXECUTIVE SUMMARY

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 new information and to 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 Indiana CNHI focuses on the best examples of *living ecological resources* in the 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.

Natural Heritage Inventories and Environmental Review

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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.

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 Indiana 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.

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 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 Indiana 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. Each BDA consists of two layers:

Core areas are the immediate habitat of the species of concern.

Supporting Landscape areas maintain ecological processes important to the species of concern, or are secondary habitat for those species.

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 species of concern.

Supporting Landscape areas typically can accommodate some degree of low-impact activities, but intensive development of these areas would put the species of concern at risk.

Christopher Tracey, PNHP

Buttermilk Falls is a 45-foot high waterfall located along Hires Run.

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

The preparation of this report has resulted in the identification of 47 BDAs and two LCAs (see Figure 1, page v, and Table 1, page vii). 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 *species of concern.* The Department of Conservation and Natural Resources (DCNR) is 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 Indiana County are the two BDAs determined to have Exceptional Significance: Strangford Cave BDA (see page 99) and Little Mahoning Creek – Lower BDA (see page 181).

Two LCAs have been identified for Indiana County, representing the watersheds of Little Mahoning Creek and Little Yellow Creek. Because of their size, ownership of lands within these LCAs is divided among many entities: individual, corporate, and public. Almost all of the land encompassed by each LCA is under private ownership, which presents issues in performing large scale management and biodiversity conservation.

Emily Falk

Conemaugh Gorge, part of the forested landscape surrounding Strangford Cave

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 Indiana 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.

Indiana County's contribution to biodiversity in Pennsylvania

Indiana County has 81 occurrences of species tracked by PNHP, including those listed as endangered, threatened, and rare species; it falls 52nd out of the Commonwealth's 67 counties. Figure 12 on page 201 shows the distribution of these species by municipality across the Commonwealth.

Although Indiana County is not in the top tier of biodiversity among Pennsylvania's counties, it contains a number of rare species and communities that are significant to western Pennsylvania. Some of these, including hellbenders, several of dragonfly species, the West Virginia white butterfly and two species of isopods are considered globally rare.

Ryan Miller, PNHP

A hellbender, the largest salamander in North America and a globally vulnerable species, is found in Indiana County.

Future research in Indiana County natural resources

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/

Though many hours of field research over multiple years were undertaken for this inventory, this is not a comprehensive, final word on Indiana County's natural resources. The data in this report represents a snapshot of Indiana 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 Indiana 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:

- Invertebrates in general, which have received far less survey attention than plants and vertebrates.
- 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.

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 Indiana 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.

Lance Merry

A wavy-rayed lampmussel (*Lampsilis fasciola*), displaying its lure to attract fish. When a fish bites, the mussel will spit out its larvae. If the fish is of the right species, the larvae will hitch a ride on its gills for a few days or weeks.

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.

General Recommendations

The following are general recommendations for the protection of the Natural Heritage Areas within Indiana 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 recommendations are described in more detail on page 204.

- Consider conservation initiatives for natural heritage areas on private land
  - *Conservation easements*
  - *Lease and management agreements*
  - *Land acquisition*
  - *Unrestricted donations*
  - *Local zoning ordinances*
- Prepare management plans that address species of concern and natural communities
- Protect bodies of water
- Provide for buffers around natural heritage areas
- Reduce fragmentation of the landscape surrounding natural heritage areas
- Encourage grassroots organizations
- Manage for invasive species
- Incorporate natural heritage inventory information into planning efforts
- Evaluate proposed activity within Natural Heritage Areas

Len Blumin

an osprey (*Pandion haliaetus*) perching with a fish that it has just caught.

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How to Use This Document

This County Natural Heritage Inventory is designed to provide information about the biodiversity of Indiana County. The introduction of the report has an overview of the process behind this inventory as well as an overview of the natural history of Indiana County. A section on natural history includes information about the common plants, animals, and communities that one would expect in Indiana County. Next, a description of the Natural Heritage Areas designated by PNHP ecologists is included. Methods of their designation are included. Results are presented at the broad landscape view, then moving into finer scale conservation areas presented by township. Natural Heritage Areas that cross municipal boundaries are cross-referenced in each township section. Finally, conclusions and general recommendations follow the township sections.

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This report may be cited as: Pennsylvania Natural Heritage Program. (2011). A Natural Heritage Inventory of Indiana County. Western Pennsylvania Conservancy. Pittsburgh, PA.

INTRODUCTION

Our natural environment is vital for 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 material 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. Fully functional ecosystems are the key indicators of a healthy environment and maintaining functioning 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). The survival of any species or the continuation of a given natural process depends upon the system as a whole; in turn, these species and processes contribute to maintaining the system. Another 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: genes, species, natural communities, and landscapes.

Biodiversity typically allows species or communities to adapt successfully to environmental changes or disease. Genetic diversity, for example, refers to the variation in genetic makeup between individuals and populations of organisms. Though sugar maple (*Acer saccharum*) may be found in many areas of Pennsylvania, those in Indiana County likely have a different genetic makeup than those in Philadelphia County; this allows these trees to survive in the unique conditions in which they grow. In order to conserve genetic diversity, plants native to an area from local genetic stock should be used as much as possible in both private and public plantings. It is also important to maintain natural patterns of gene flow; this is made possible through the preservation of migration paths and corridors across the landscape, and through encouraging the dispersal of pollen and seeds among populations (Thorne et al., 1996). Furthermore, declines in native species diversity can alter ecosystem processes such as nutrient cycling, decomposition, and plant productivity (Naeem et al., 1999, Randall, 2000). Because of the interdependent nature of our natural systems, including those we directly depend on for our livelihood and quality of life, it is essential to conserve native biodiversity at all scales (genes, species, natural communities, and landscapes) if ecosystems are to continue functioning.

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 Biomap, 2000). A natural community is "an interacting assemblage of organisms, their physical environment, and the natural processes that affect them" (Thompson and Sorenson, 2000). Natural communities are usually defined by their dominant plant species or the geological features on which they depend; Indiana County examples include the Hemlock Palustrine Forest and Herbaceous Vernal Pond. Each type of natural community represents habitat for a different group 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. Classifying these communities gives ecologists, planners, managers, and landowners a common language with which to discuss land conservation.

At the landscape scale, it is important to consider whether communities and habitats are isolated or connected. It is important to maintain corridors of natural landscape traversable by wildlife, and to preserve natural areas large enough to support viable populations and ecosystems.

The Pennsylvania Natural Heritage Program

The Pennsylvania Natural Heritage Program (PNHP) was established in 1982 and is currently a joint effort of the Western Pennsylvania Conservancy, the Pennsylvania Department of Conservation and Natural Resources (formerly the Pennsylvania Department of Environmental Resources), the Pennsylvania Fish and Boat Commission, and the Pennsylvania Game Commission. PNHP is part of a network of *Natural Heritage Programs* that utilize common methodology developed by Heritage Programs and The Nature Conservancy, and refined through NatureServe – the organization that represents the network of Natural Heritage Programs. Natural Heritage Programs have been established in each of the 50 United States, as well as in Canada and Latin America.

PNHP collects and stores location and baseline ecological information about rare plants, rare animals, unique natural communities, significant habitats, and geologic features in Pennsylvania. Presently, the PNHP database is Pennsylvania's chief storehouse of such information with over 20,000 detailed digital occurrence records. Additional data are stored in extensive manual files documenting over 150 natural community types, more than 5,000 plant and animal species, and about 1,100 managed areas. Though not a regulatory organization, as part of its function PNHP provides expert input on species impacted by projects that require permits as issued by the Pennsylvania Department of Environmental Protection (DEP). The environmental review function of the PNHP is referred to as PNDI or the Pennsylvania Natural Diversity Inventory and is housed within DCNR.

As part of the information maintained by PNHP, a system of *global ranks* and *state ranks* is used to describe the relative degree of rarity for species and natural communities. This system is especially useful in understanding how imperiled a resource is throughout its range, as well as understanding the rarity of resources that do not have official state status, such as invertebrate animals and natural communities. A summary of global and state ranks can be found in Appendix II on page 223.

PNHP is valuable for its ability to supply technically sound data that can be applied to natural resource decisions. Information on the occurrences of elements of special concern (species and natural communities) gathered from museums, universities, colleges, and recent fieldwork by professionals throughout the state is used by PNHP to identify the areas of highest natural integrity and significance in Indiana County.

The Indiana County Natural Heritage Inventory (CNHI) report presents the known outstanding natural features in the county. The CNHI provides maps of the best natural communities (habitats) and all the known locations of animal and plant species of conservation concern (including rare, threatened, or endangered species) in Indiana County. A written description and a summary table of the sites, including quality and degree of rarity are included. Potential threats and some suggestions for protection of the rare plants or animals at the site are included in many of the individual site descriptions. Selected geologic features of statewide significance are also noted. In addition, the inventory describes areas that are significant on a county-wide scale, but do not merit state-wide status as exemplary natural communities. These *locally significant* sites represent good examples of habitats that are relatively rare in the county, support a high diversity of plant species, and/or provide valuable wildlife habitat on a local level.

The information and maps presented in this report provide a useful guide for planning development and parks, for conserving natural areas, and for setting priorities for the preservation of the most vulnerable natural areas. All of the sites in this report were evaluated for their importance in protecting biological diversity on a state and local level, but many also have scenic value and provide water quality protection; they are also often potential sites for low-impact passive recreation, nature observation, and environmental education.

This inventory will be provided to each municipality through the Indiana County Planning Commission. The inventory is one tool that will aid in the creation of municipal and county comprehensive plans, and the

emphasis on biological diversity should inform county and regional open space and greenways plans already underway. Indiana County, its municipalities, land trusts, and other organizations, can also use the CNHI to identify potential protection projects that may be eligible for funding through state or community grant programs such as Growing Greener. Landowners will also find this inventory useful in managing and planning for the use of their land; it gives them the opportunity to explore alternatives that will provide for their needs and still protect the species and habitats that occur on their land. For example, the Forest Stewardship program, coordinated by PA DCNR-Bureau of Forestry, assists landowners in creating management plans. This plan is developed based on landowner objectives (e.g., wildlife or timber management). Land managers may wish to consult this report and the Pennsylvania Natural Diversity Inventory (PNDI) in an effort to avoid potential conflicts in areas with species of concern, and to identify ways of enhancing or protecting this resource. Users of this document are encouraged to contact the Pennsylvania Natural Heritage Program for additional information.

Current Status of Pennsylvania's Natural Heritage

Pennsylvania's natural heritage is rich in biodiversity; 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. The extensive tracts of forest in the northern and central parts of PA represent a large fraction of areas remaining in the mid-Atlantic region with habitat suitable 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 3,500 species of animals and vascular plants that have been documented in the state, more than one in ten are currently imperiled. Since European settlement, 156 plant and animal species have been lost, and 351 are threatened or endangered (Pennsylvania 21st Century Environment Commission, 1998). Many of these species are imperiled because available habitat in the state has been reduced and/or degraded.

Aquatic Environments

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), 60% of those Pennsylvania lakes that have thus far been assessed for biological health are listed as impaired. Of the 83,000 miles of stream in Pennsylvania, almost 70,000 miles have been assessed for water quality; nearly 11,000 miles have been designated as impaired due to abandoned mine discharges (AMD), acid precipitation, and agricultural and urban runoff (DEP, 2004). The species that depend on these habitats are correspondingly under threat: 58% of threatened or endangered plant species are wetland or aquatic species; 13% of Pennsylvania's 200 native fish species have been lost with an additional 23% imperiled, and 18 of Pennsylvania's 67 native freshwater mussel species are extinct with another 22 imperiled (Goodrich et al., 2003).

Forested Environments

Prior to European settlement, over 90% of Pennsylvania's land area was forested. Today, 60% of the state is still forested, but much of this forest is fragmented by non-forest uses such as roads, utility rights-of-way, agriculture, and housing. Only 42% of our state's forest is interior forest habitat; therefore, 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 loss of needed nutrients leading to stunted tree growth), overbrowsing by deer, and invasive species also threaten forest ecosystem health.

The Role of County Natural Heritage Inventories

The Pennsylvania Natural Heritage Program (PNHP) assesses the conservation needs of animal and vascular plant species native to Pennsylvania. While Pennsylvania also hosts a diversity of other life forms such as mosses and fungi, too little is known of these species to assess their conservation status. The goal of this report is to identify areas important in sustaining biodiversity at the species, natural community, and landscape levels, and to provide this information so landowners can be more fully informed when making land use decisions. PNHP's County Natural Heritage Inventories (CNHIs) identify areas in the county that support Pennsylvania's rare, threatened, or endangered species, as well as natural communities that are considered to be rare or exceptional in the state. The areas that support these features are identified as Biological Diversity Areas (BDAs). Broader landscape-level features, termed Landscape Conservation Areas (LCAs), are also designated. 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, or regions in which a high number of biodiversity features are concentrated.

Areas designated as BDAs and LCAs for Indiana County are included in this report. 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 as much information as possible when planning for biodiversity conservation, this report also includes species and natural community fact sheets, references, links to information on invasive exotic species, and mapping from other conservation planning efforts such as the Pennsylvania Audubon's Important Bird Area Project. Coupled with other available land use information, this report can help to guide the planning and land management necessary to maintain the ecosystems on which our living heritage depends.

INDIANA COUNTY OVERVIEW

Indiana County lies in western central Pennsylvania; bordered by Armstrong County to the west, Jefferson County to the north, Clearfield and Cambria Counties to the east, and Westmoreland County to the south. The county has a total area of 834 mi² (2,162 km²), midrange for Pennsylvania county sizes.

It is composed of 24 townships and 14 boroughs. The 2007 population was estimated at 87,888 people spread out between 34,699 households (U.S. Census Bureau, 2009). The population has decreased by 2,106 persons since 1990. Population density is approximately 105 people/mi² (41 people/km²). Despite this decline in population, development pressure still exists in Indiana County's scenic and rural areas. Without careful planning of growth and development, it will be difficult to protect the integrity of the natural systems that support human and wildlife needs. The information in this inventory can be a useful reference for identifying and conserving open space and natural areas in the county, and allow a balance between the area's growth and conservation of the scenic, environmentally sensitive, and natural resources of Indiana County.

Figure 2. Townships of Indiana County, boroughs are not shown due to scale limitations.

The Indiana County area was first settled around 1727 by French traders. The majority of the county's land was purchased from the Iroquois Six Nations in 1768 and 1784 (The Historical and Genealogical Society of Indiana County, 2009). Created from parts of the five surrounding counties, Indiana County was created by an act of legislature in 1803. The county seat of Indiana was founded in 1805 on land donated by George Clymer, one of the Nation's Founding Fathers. By 1920 the county's population had ballooned to almost 81,000 on an economy based primarily on farming and natural resource extraction and refining (The Historical and Genealogical Society of Indiana County Pennsylvania, 2009). The borough of Indiana is the population center of the county with 14,895 inhabitants as of the 2000 census, which does not include the large student body of Indiana University of Pennsylvania (U.S. Census Bureau, 2007). Primary economic activities today include light industry (including healthcare, metal, and wood products), mining, agriculture, education, and tourism.

The existing land use patterns within the county are influenced and shaped by the region's mountains, valleys, and waterways. More than half the land throughout the county is forested (61%), with agricultural use including pastures and row crops making up more than a quarter of the remaining land use (33%), and a little more than 4% of the land considered developed (Figure 3). Over 94% of the land is under private ownership; the remainder of this total is managed by the state and other organizations

Table 2. Ownership breakdown of land within Indiana County. 81.5% of the County is privately owned; 18.5% is publicly managed land. Figures are approximate, and based upon best available data in 2008. *Excludes US Army Corps of Engineers flood protection lands.

Ownership	Area (acres)	% area
PA DCNR – Bureau of Forestry	430	<0.1
PA DCNR – Bureau of State Parks	2,810	0.5
Pennsylvania Game Commission	12,703	2.4
County and Local Parks	1,176	0.2
Federal	0*	0*
Non-profit Private	0	0.0
Private Ownership	517,768	95.9
Total Area	534,887	100.0

as conservation land (Table 2). Managed lands include: Yellow Creek State Park, Prince Gallitzin State Forest, Pine Ridge County Park, and various portions of eight State Game Lands (SGL #276 is the largest). Given Indiana County's mining legacy, it would be expected that a greater amount of mine lands would be seen in the county land use pattern. However, the lower percentage shown may relate to the significant resources invested in mine land mitigation and restoration over the past 20 years in Indiana County.

U.S. Routes 422 and 119 split the county into rough quadrants as they intersect south of Indiana. Overall, there are 2,872 miles (4,624 kilometers) of roads in the county (ESRI Streetmap USA).

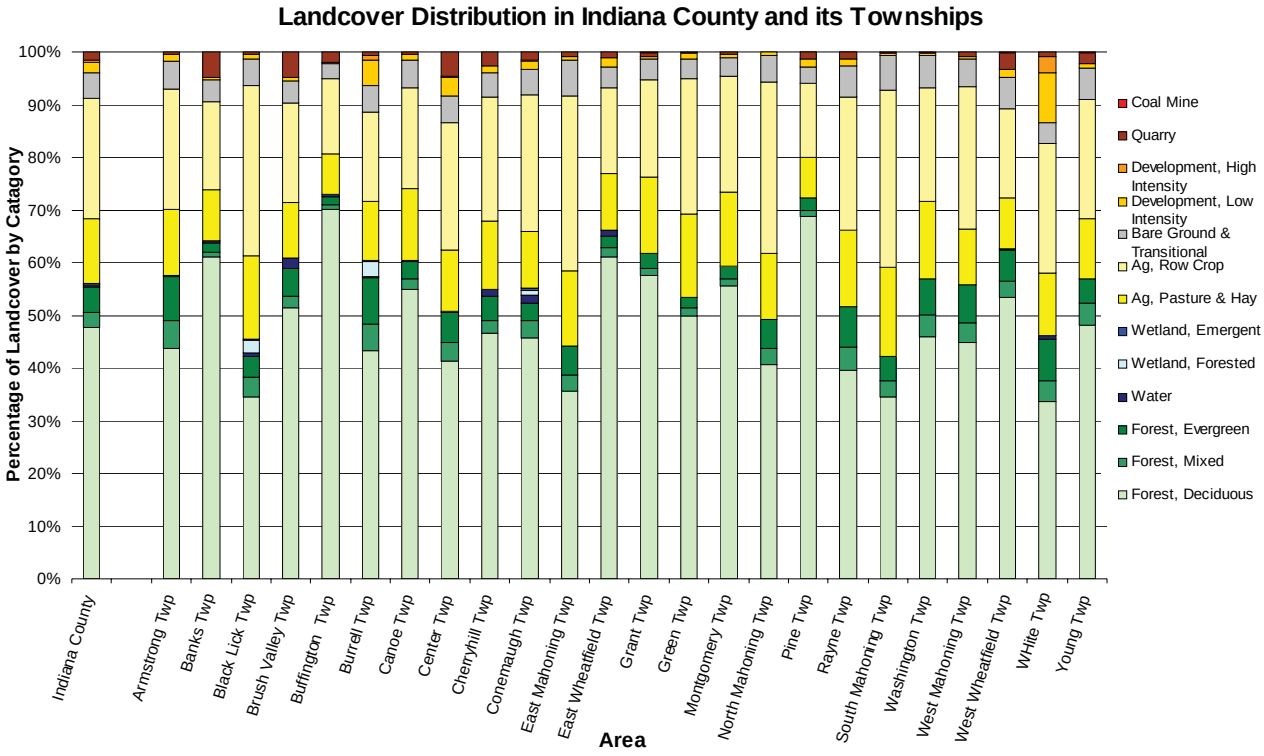


Figure 3. Landcover distribution among Indiana County's townships. Over half of the land within each township is forested except in five townships where agriculture and development make up a greater percentage of the land use. Boroughs are not shown because they are typically developed (USGS, 2001).

OVERVIEW OF THE NATURAL FEATURES OF INDIANA COUNTY

Indiana County's landscapes are an expression of its living organisms (including people) and the physical environment with which they interact. Climate (photoperiod, maximum and minimum temperatures, and exposure), geology (bedrock, soil, and topography), and chemical factors (fire or acid deposition) 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, and thus locating and identifying landscape areas 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 Indiana County.

Physiology and Geology

A physiographic province is a geographic region in which all parts are similar in geologic structure and climate, and which has a unified geomorphic or surficial history. This means that the landforms on the surface were formed similarly, and have comparable bedrock and climate. A region's topography and climate, along with bedrock type, significantly impact soil development, hydrology (movement, distribution, and quality of water), and land use patterns in an area. Additionally, both physiography and geology are important to the patterns of plant and animal distributions. Because of the differences in climate and soils, certain plants and animals are expected to occur within some physiographic provinces and not others.

Indiana County lies entirely within the Appalachian Plateau Province. This physiographic province extends throughout western and northern Pennsylvania from Greene County north to Erie, then east to Pike County. The Appalachian Plateau Province is characterized by "high, flat-topped divides separated by steep-sided valleys in which flow deeply entrenched streams" (Willard, 1976) (Figure 4). The sedimentary rock below the province is fairly uniform having not been folded or faulted like much of the other bedrock in Pennsylvania. The sandstone and shale bedrock originated when sediment was laid down in the shallow inland seas that covered much of Pennsylvania. The lower layers of sediment were compressed over time by the weight of the newer layers piled above them. Individual grains were cemented together by minerals that precipitated (minerals solidified out of the solution between the grains) out from the pressure (Van Diver, 1990). Next, these layers of sedimentary rock were uplifted 500-400 million years ago when two island chains collided with the eastern edge of North America (during the Taconic and Acadian Orogenies, or mountain-building events) to form a plateau elevated above the surrounding regions. 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.

The highest elevations in the county (above 2,180 feet) are located in Burrell Township in the southern part of the county on Penn View Mountain. Elevations range from 820 feet (335 meters) along the Conemaugh River in Conemaugh Township, to 2,200 feet (671 meters) above sea level near the Westmoreland County border. The southern border of the County is the Conemaugh River. The county straddles two major basins, the Allegheny and the Susquehanna, draining 93% and 7% of the county respectively.

The rock layers that reach the surface in Indiana County are classified according to their age of origin into eight formations: the Allegheny Formation, Burgoon Sandstone, Casselman Formation, Glenshaw Formation, Mauch Chunk Formation, Monongahela Formation, Pottsville Formation, and Shenango Formation through Oswayo Formation. The Glenshaw Formation is the principal bedrock formation at the surface in Indiana County. Sandstone is the predominant rock type in most of the county, with shale, limestone, siltstone, and coal layers also interspersed.

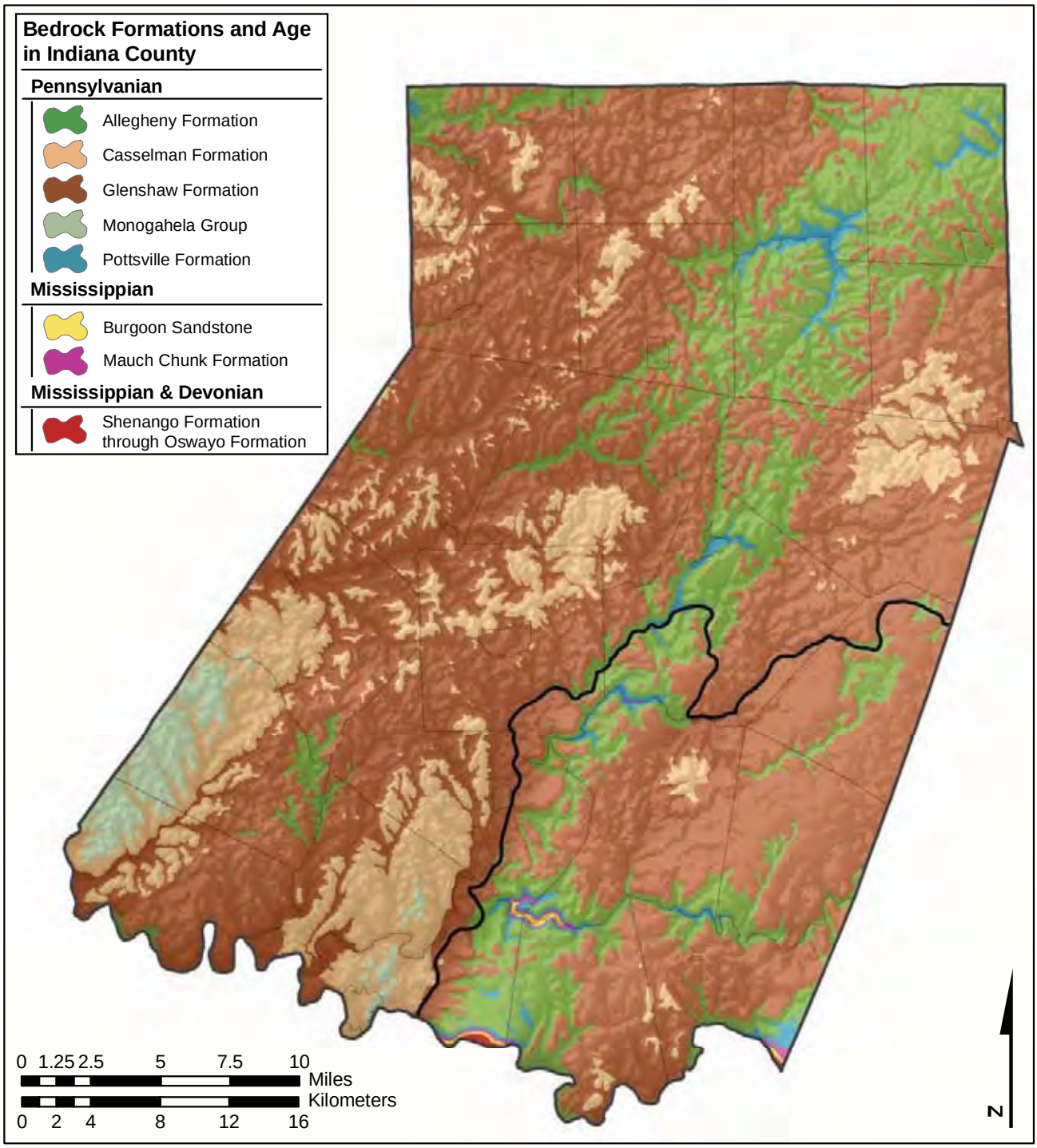


Figure 4: Bedrock geology and physiographic regions of Indiana County. North of the black line is the Appalachian Plateau Physiographic Province – Pittsburgh Low Plateaus and below the line lies the Appalachian Plateau Physiographic Province – Allegheny Mountain Section. Municipalities are outlined in gray.

Indiana County is primarily underlain by bedrock from the Pennsylvania period which occurred 318 to 299 million years ago (Table 3). Bituminous (soft) coal beds were laid down in Pennsylvania during the Carboniferous Period of geologic time (359-299 mya); conifer trees also became established during this time period. The Pennsylvanian bedrock occurs over 35% of the state, mostly under the Appalachian Plateau of which Indiana is a part (Schultz, 1999). The sandstone, shale, clay, coal, and limestone originated as

sediments laid down in a shallow sea that covered much of Pennsylvania when it was close to the equator hundreds-of-millions of years ago (Schultz, 1999). The oldest rocks in the county are found in the Shenango Formation through Oswayo Formation in southern Indiana County along the Conemaugh River. These rocks are predominantly sandstone, siltstone, and shale. The formation of some occurred in the Devonian period (359-416 mya). Mississippian and Pennsylvanian age flat-lying rocks are stratigraphically higher, and thus younger, than most of the other rocks within the county. No igneous or metamorphic rocks of any kind are known within the county, which is consistent with the geologic history of the region.

Table 3: Geologic ages and description of the types of bedrock material found in Indiana County (Gradstein and Ogg, 2004).

Geologic Period	Description
Pennsylvanian (299-318 million years ago)	Cyclic sequences of sandstone, red/grey shale, conglomerate, clay, coal, and limestone
Mississippian (318-359 mya)	Red and gray sandstone, shale, and limestone
Devonian (359-416 mya)	Red sandstone, gray shale, black shale, limestone, and chert

Several important habitat types are linked directly to the geology and geomorphic history of the county including vernal pools. For example, vernal pools are temporary pools which provide a place protected from predators where certain amphibian species can safely breed. Geology is an important factor in the location of vernal pools, with the origins of most of the depressions that collect water being from geological processes such as glaciation (Colburn, 2004).

In addition to these habitat types, the DCNR Bureau of Topographic and Geologic Survey (TopoGeo) maintains an inventory of unique geologic features within the Commonwealth (Geyer and Bolles, 1979; Geyer and Bolles, 1987). One feature, Suncliff, is a 100- to 200-foot cliff showing the exposed Brush Valley syncline among mixed layers of sandstone, limestone, and shale with some interbedded coal and clay from the Casselman and Glenshaw Formations. The other two originated through the erosive action of the Conemaugh River. They are the Conemaugh Gorge and Conemaugh Water Gap where hundreds of millions of years of bedrock were exposed as the river successively cut through Laurel Hill and Chestnut Ridge. All three are mapped and discussed under the appropriate townships within the Results section of this report.

Soils

A soil association is a "natural grouping of soils based on similarities in climatic or physiographic factors and soil parent materials" (Canadian Soil Information System, 1995). It includes a number of soil types, usually one or two major soils and a minor soil; it is named after the major soils. The soils of Indiana County are made up of six main series as described in Table 4 (Weaver and Ruffner, 1968).

Table 4 summarizes information from the Soil Survey about soil associations found in Indiana County. Soil character exerts a strong influence on vegetation, as all plant species have individual requirements for soil qualities such as nutrient availability (like nitrogen, potassium, or phosphorus), moisture levels, and pH (acidity or alkalinity of the soil).

Climate

Indiana County is in USDA hardiness zones 5b and 6a (USDA, 1990), and is in Pennsylvania Climatic Region 9. The last freeze of the season is typically during the month of May, and the first freeze is typically in early October. The growing season is usually between 121 and 180 days. Over the last 20 years, precipitation has averaged 42 inches per year, with somewhat more precipitation in the summer (PA State Climatologist, 2010).

Table 4: Soil associations of Indiana County. See the soil Survey of Indiana County, Pennsylvania (Weaver and Ruffner, 1968) for more detailed information.

Soil Association	Parent Materials	Description	Land Use
Hazleton-Dekalb-Buchanan	Acidic sandstone, with some shale	Primarily deep, well drained, rapidly permeable soils on flat to very steep slopes.	These soils are primarily hardwood forests with small areas cleared for pasture and a limited amount of row crops
Gilpin-Weikert-Ernest	Shale, siltstone, and sandstone	Shallow to very deep upland soils that exhibit poor to good drainage and moderate permeation on flat to very steep slopes.	These soils are primarily used for farming and pasture lands with some remnant hardwood forest intermixed
Gilpin-Wharton-Ernest	Shale, clay shale, siltstone, and sandstone	Shallow to very deep upland soils that exhibit poor to good drainage and moderate to slow permeation on flat to steep slopes.	These soils are primarily farmland and pasture land on the lower flat areas with hardwood forest on the steeper slopes
Gilpin-Wharton-Weikert	Shale, clay shale, siltstone, and sandstone	Shallow to very deep upland soils that exhibit poor to good drainage and moderate to slow permeation on flat to very steep slopes.	These soils are primarily farmland and pasture land on the lower flat areas with hardwood forest on the steeper slopes
Monongahela-Philo-Atkins	Alluvium derived from sandstone and shale	Very deep, poorly to moderately well drained soils and moderate to slow permeation on primarily flat ground.	These soils support a significant amount of development with the remainder being primarily in farm and pasture lands with a few remnant hardwood forests
Westmoreland-Gilpin-Culleoka	Siltstone, sandstone, limestone, and sandstone	Deep, well drained soils on uplands with moderate permeability on flat to steep slopes.	These soils are primarily agricultural in supporting a wide variety of crops and pasture uses with a few remnant woodlands on less fertile areas

Vegetation

The interaction of geology, climate, and history produces the pattern of vegetation expressed on the landscape today. Vegetation provides several critical functions in the landscape including the regulation of cycles (such as the water, carbon, and nitrogen cycles), soil formation, and wildlife habitat. Within a region, these vegetation patterns governed by natural ecosystem processes and disturbances can be classified as plant communities that exist as repeating patterns across the landscape. A plant community is defined as an assemblage of plant populations sharing a common environment and interacting with each other, with animal populations, and with the physical environment (Fike, 1999). The classification of vegetation communities typically revolves around common plant species co-occurring within a site, their habit (growth form), and physical site characteristics (climate, slope, soils, pattern of disturbance). Upland and wetland plant community types, defined by present vegetation, were described for Pennsylvania by the Pennsylvania Natural Heritage Program and Pennsylvania Bureau of Forestry for scientific and site management purposes (Fike 1999). As with rare plant and animal species PNHP identifies and monitors uncommon plant community types and lists rare types as elements of special conservation concern. In addition to rare types, high quality examples of common naturally occurring plant communities, such as old growth forest, are also monitored by PNHP. Upland and wetland plant community types occurring in Indiana County are described in this report, and rare and high quality examples are included in the Biological Diversity Areas described in the results section below. Rare plant communities often contain populations of rare plants. It is important to note that unlike species, boundaries between community types in nature are generally blurry and difficult to

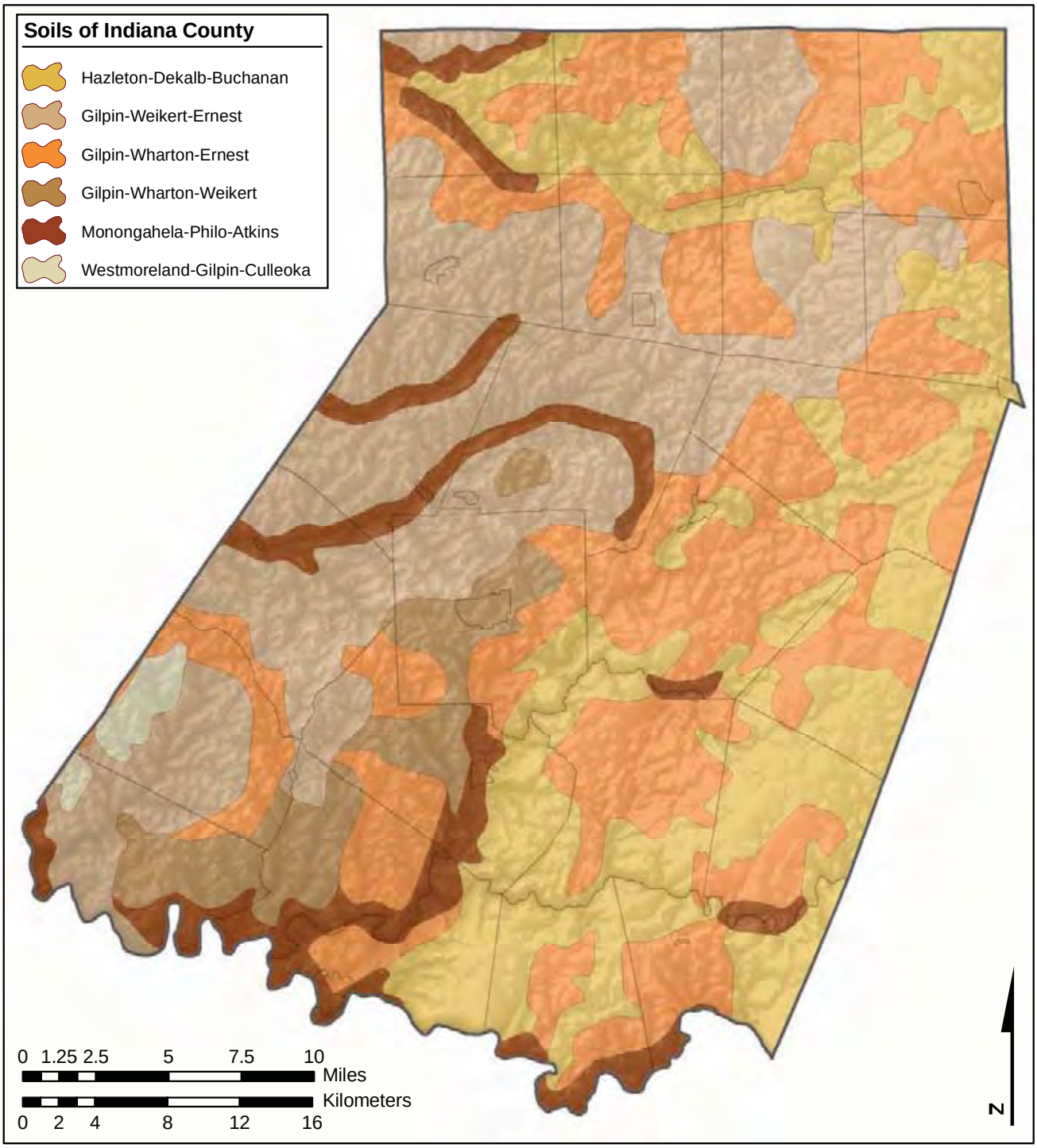


Figure 5: Generalized soil associations of Indiana County.

define; wide transitions may exist between distinct communities. For mapping purposes the best representation of the lines between communities are drawn; it is acknowledged that some boundaries between community types in the field are less distinct than others. A sampling of community types is presented below.

Upland Forest Communities

Accounts dating to the 1800s describe the forests the region as composed predominantly of white oak (*Quercus alba*), black oak (*Q. velutina*), chestnut (*Castanea dentata*), sugar maple (*Acer saccharum*), beech (*Fagus grandifolia*), hickory (*Carya* spp.), pines (*Pinus* spp.) and hemlock (*Tsuga canadensis*) (PA-Roots, 2007). The composition of forests of Indiana County has undergone significant changes following settlement of the region by European Americans. Large scale timber harvesting, human-caused fires, and forest clearing for agriculture have greatly altered the composition of the county's forests. The timber harvesting and forest clearing for agriculture resulted in the forested landscape of today, dominated by second or third growth stands of oak, maple, hickory, white pine (*Pinus strobus*), and hemlock (Weaver and Ruffner, 1968). The forests were also impacted by the chestnut blight fungus (*Cryphonectria parasitica*). The blight, introduced into the United States in the early 1900s, virtually eliminated the American chestnut throughout its range. Within the forests of the Oak-Chestnut region near the introduction of the chestnut blight, 100% of the trees were infected by 1930 (Braun, 1950). The American chestnut is thought to have been a large component of most communities in the region now dominated by oak species; however, it is largely impossible to determine its proportion of the forest canopy prior to the chestnut blight or the cumulative effects on forest dynamics and wildlife habitat.

The configuration of the forestland in Indiana County has also been altered significantly by human development activities. The contiguous forests that once dominated the landscape exist now as relatively small islands, isolated by developments, agriculture, and linear features such as roads and railroads. Smaller linear features such as utility rights-of-way, off road vehicle trails, and snowmobile trails further dissect the forested landscape. Ecological impacts of these fragmenting features include direct mortality of wildlife from vehicles, disruption of wildlife dispersal, habitat fragmentation and degradation, imposition of edge effects, spread of exotic invasive species, and alteration of the chemical environment (Trombulak and Frissell, 2000).

Forest Management Assistance

There are many resources available to landowners with a forested property. A good place to start is at the DCNR's Private Forest Landowner program (http://www.dcnr.state.pa.us/forestry/privatelands.aspx) where interested landowners can gain information on forestry assistance, and the contact information for Indiana's local service forester.

The mountainous uplands hold the largest remaining contiguous blocks of forest in the county, as human settlement and farmland now occupy most of the flat land at lower elevations. As is true for most of western Pennsylvania, forests of Indiana County are largely second-growth forests that grew back following logging. The high and dry upper slopes in the county are typically vegetated by oaks (*Quercus* spp.), pitch pine (*Pinus rigida*), white pine, black gum (*Nyssa sylvatica*), sassafras (*Sassafras albidum*), and birch (*Betula* sp.). These forests typically exhibit a dense layer of blueberries (*Vaccinium* sp.), huckleberries (*Gaylussacia* sp.) and mountain laurel (*Kalmia latifolia*). After the loss of the American chestnut, several species of oak (including red, black, white, scarlet, and chestnut) came to dominate the forests; however, the widespread forest loss due to gypsy moth (*Lymantria dispar*) infestation and poor recruitment of oak species following logging is causing the forest compositions to again change. Often species composition shifts to shade tolerant species such as red maple (*Acer rubrum*) and sugar maple, which are able to outcompete oak seedlings in the understory in the absence of fire. The relatively high white-tailed deer (*Odocoileus virginianus*) population is also cited as often impacting oak-seedling recruitment on sites where oak species dominate the canopy.

Down slope of the ridge and mountaintop forests, the diversity of the vegetation increases as the soil moisture and nutrient availability increases. Forests on the lower sections of the ridges have a greater proportion of forest wild flowers, and contain tree and shrub species requiring more soil moisture. Common tree species include tuliptree (*Liriodendron tulipifera*), red oak (*Quercus rubra*), red and sugar maple, American basswood (*Tilia americana*), American beech, eastern hemlock, and white ash (*Fraxinus americana*). These forests typically support richer shrub and herbaceous layers as well.

Wetland Communities

Wetlands provide critical habitat for many plant and animal species, and provide valuable ecosystem services such as water filtration and flood control. Wetlands are transitional lands between terrestrial and aquatic systems; they are communities dominated by water for at least some part of the growing season each year. As with upland ecosystems, wetlands are heavily influenced by local soil type, disturbance history, bedrock composition, and hydrologic regime. Saturation by water influences the soil development, which in turn influences the type of plants and animals able to use that habitat. Wetlands differ regionally based on topography, geology, climate, hydrology, vegetation, and human influences (Stewart, 2001). Ephemeral pools, wetlands occurring in river and stream floodplains, provide food resources, refuges, and nursery areas for fish, including those prized by anglers (Graff and Middleton, 2007). Typical plants found in wetlands include sedges, grasses, ferns, shrubs, and some trees.

In Indiana County, types of wetlands range from open marshes that are permanently saturated to forested seeps where groundwater saturates the surface only when heavy precipitation raises the water table. Many of Indiana's wetlands are associated with streams and rivers. These include floodplain forest, forested swamps, shrub swamps, and marshes. Two important wetland types known from the area, found in uplands above the floodplains, are seepage swamps and vernal pools. Wetlands resulting from excavations and impoundments are also present in the local landscape but were typically not targeted in this study because they typically do not host as rich or distinctive an assemblage of native species as do natural wetlands.

Floodplain forests occur along both large and small rivers and streams in low lying areas. These locations are periodically inundated by floodwaters resulting from spring runoff and intense storm events. In Indiana County, forests along larger waterways are characterized by a canopy containing some combination of silver maple (*Acer saccharinum*), sycamore (*Platanus occidentalis*), tuliptree, black willow (*Salix nigra*), green ash (*Fraxinus pennsylvanica*), American elm (*Ulmus americana*) and box-elder (*Acer negundo*). Shrubs and vines commonly found in these forests include spicebush (*Lindera benzoin*), ninebark (*Physocarpus opulifolius*), silky dogwood (*Cornus amomum*), Virginia creeper (*Parthenocissus quinquefolia*), and poison ivy (*Toxicodendron radicans*). Though floodplains on smaller waterways typically receive less intense disturbances, they are still periodically flooded. Pin oak (*Quercus palustris*), swamp white oak (*Quercus bicolor*), silver maple, red maple, ash (*Fraxinus* spp.), sycamore, and black walnut (*Juglans nigra*) are frequent on wetter bottomland soils associated with these smaller creeks. Understory species include spicebush, violets (*Viola* spp.), nettles (*Urtica dioica*; *Laportea canadensis*), cut leaf coneflower (*Rudbeckia laciniata*), golden alexanders (*Zizia aurea*), and many other wildflowers. Floodplains sustain intense natural disturbances such as severe inundation, scouring by floodwaters, ice, and debris flow, and the scouring and deposition of considerable quantities of sediment. Floodplain species tolerate and depend on these disturbances to reproduce and survive. Alteration of the natural flooding pattern and severity can lead to changes in the plant composition of floodplain communities, allowing the establishment of species not typically able to tolerate the natural disturbances, and competition with the native floodplain plants for light and resources.

Herbaceous marshes are wetlands with little or no tree canopy dominated by plants such as cattails (*Typha latifolia*), sedges (*Carex* spp.), and grasses. These wetlands may occur on floodplains or in upland areas with groundwater seepages. Herbaceous marshes in the county are frequently formed as communities grow around

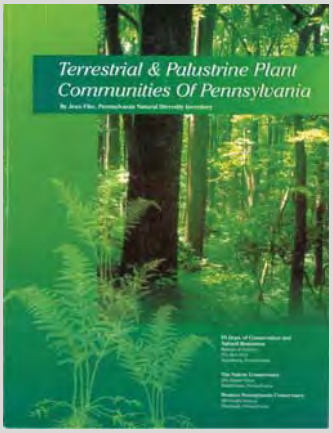
beaver dams or other impoundments. These wetlands frequently have high plant species diversity, and provide important breeding habitat for numerous amphibians, reptiles, invertebrates, and birds.

Seepage swamps are relatively small, forested or shrub-dominated wetlands found on lower slopes where water emerges at the surface. These seep areas are frequently dominated by hemlock, yellow birch (*Betula alleghaniensis*) and red maple, with a thick understory of rhododendron (*Rhododendron* spp.), swamp azalea (*Rhododendron viscosum*), spicebush and/or highbush blueberry (*Vaccinium corymbosum*). Common herbs in these seepage wetlands include skunk cabbage (*Symplocarpus foetidus*), violets, manna grass (*Glyceria* spp.), various sedges and ferns, including cinnamon fern (*Osmunda cinnamomea*), royal fern (*Osmunda regalis*) and sensitive fern (*Onoclea sensibilis*). Sphagnum (*Sphagnum* spp.) and other mosses can form a thick mat in these wetlands.

Vernal pools, also known as ephemeral, seasonal, or fluctuating pools, are wetlands that fill annually from precipitation, surface runoff, and rising groundwater (Kenney and Burne, 2000). These pools are a unique type of wetland habitat. They are typically small, shallow, and temporary, and unlike a pond or a lake, they have no permanent inlet or outlet. Many species of plants and animals require these pools to breed and survive. As water evaporates, the pools typically become completely dry at some point in the summer; this prevents the establishment of fish populations. Vernal pools become important breeding grounds for certain amphibian species (salamanders and frogs), many of which breed solely in these due to the protection from predation provided by the absence of fish (see the Reptiles and Amphibians of Indiana County section below for a discussion of these species). More information about vernal pools and PNHP's seasonal pool registry, where citizens can report the location of these temporary pools, can be found at http://www.waterlandlife.org/54.

Wetlands are a 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. Open water aquatic communities do exist within Indiana County in the form of farm ponds as well as larger lakes such as Kyle Lake. These artificial systems also support emergent and submerged aquatic communities, and a diverse fauna including fish, reptiles, amphibians, birds, and insects.

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/fikebook.aspx

Flowing Water and Major Stream Systems

Flowing water forms aquatic systems of great diversity within Indiana County. Flowing water systems begin as high mountain brooks which form from surface runoff, springs, and seeps. These are the headwaters which unite to become larger stream systems lower in the watershed. Upper elevation 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, the larger aquatic systems offer a variety of microhabitats which support many stream-dwelling organisms. The two major stream microhabitats are riffles and pools. Riffles are shallow, fast flowing, well-aerated rapids flowing over rocky sections of the stream bottom. They support a diverse animal community dominated by insects, crustaceans, mussels, and fish. Interspersed between riffle sections are pools; quiet, deeper water habitats that tend to support a different stream biota than the riffle sections. These pools become important habitat during the dry portion of the year.

Twelve major (HUC10) watersheds drain Indiana County into the Allegheny and Susquehanna River Basins (Figure 6). There are no streams in Indiana County designated as Exceptional Value Streams due primarily to mining and forestry impacts on local water quality. Two watersheds of note in Indiana County are the Little Mahoning Creek and Two Lick Creek watersheds.

- Little Mahoning Creek – This watershed occupies much of the northern portion of Indiana County. Unlike many of the creeks in the region, Little Mahoning Creek has escaped much of the damage from activities related to coal mining. However, it still has been degraded from agricultural runoff and sedimentation from dirt and gravel roads. The Western Pennsylvania Conservancy is leading a restoration project for the creek.
- Two Lick Creek – The largest tributary of Black Lick Creek, Two Lick Creek has been plagued with abandoned mine drainage (AMD) throughout much of its length. However, natural processes and AMD remediation projects completed by the Blacklick Creek Watershed Association and the Pennsylvania Department of Environmental Protection (PA DEP) have improved portions of Two Lick Creek to the point that fish populations, including a large population of reproductive trout, are recolonizing areas previously devoid of such communities.

Floodplains are flat, often flooded areas along streams and rivers, which behave more like dry riverbed than occasionally flooded upland. 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, but may be reflooded throughout the season. The flooding regime influences the natural communities that can persist there

Maintaining vegetated riparian buffers (Figure 7a) along streams and other bodies of water provides vital benefits such as protection of water quality, reduced erosion, flood control, and wildlife habitat. Elimination of riparian vegetation (Figure 7b) removes the capacity of floodplains to buffer the effects of the surrounding landscape and floodwaters, and consequently reduces the water quality in the stream. Two major effects of the loss of riparian buffers are sedimentation and nutrient enrichment of the stream. Vegetated riparian areas (Figure 7a) serve as protective buffers 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. Furthermore, intact, forested riparian buffers preserve the water temperature, food resources, and cover necessary for healthy populations of game fish such as the native brook trout (Welsch, 2007).

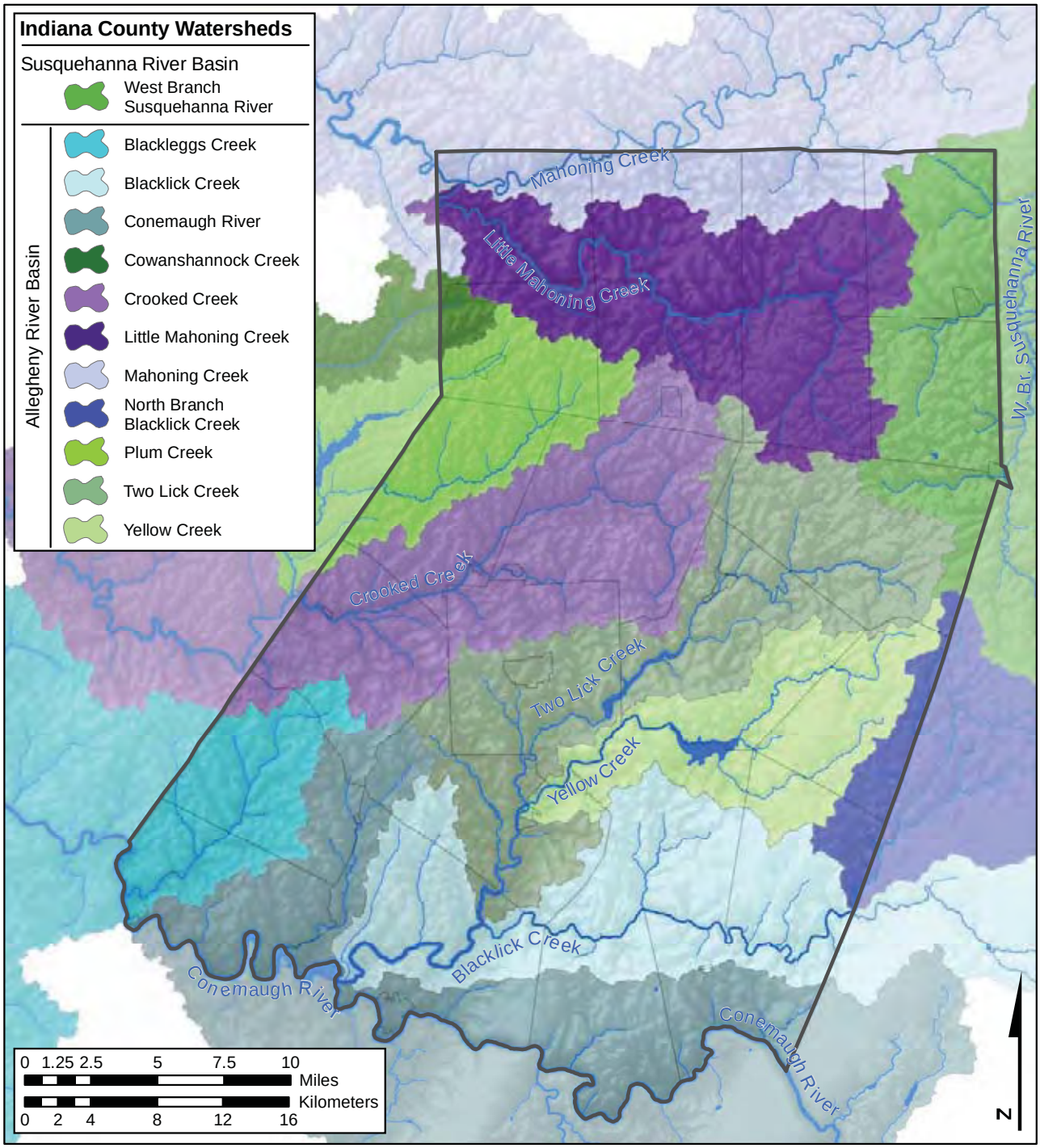


Figure 6. Watersheds of Indiana County

PNHP

Figure 7. Vegetated riparian buffers. Figure 7a (left) shows a well-buffered stream, while Figure 7b (right) demonstrates an un-buffered stream.

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Mining, forestry, 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 of surface and groundwater resources from degradation contributes to the future wellbeing of all plants and animals including human communities. The Pennsylvania State-wide Surface Waters Assessment Program (http://www.portal.state.pa.us/portal/server.pt?open=514&objID=554010&mode=2) can provide information on specific potential sources of water impairment within Indiana 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 VI on page 265. In addition to flowing water systems, standing water aquatic communities do exist within Indiana County, in the form of numerous farm ponds as well as three large manmade lakes. These systems may have similar vegetation to some of the wetland communities around their shallow edges and support a diverse fauna including fish, reptiles, amphibians, and insects.

Conservation Priority Watersheds (CPWs)

Multiple aspects of stream and watershed condition were used to rank all small watersheds in Pennsylvania according to water quality, aquatic habitat quality, and biological diversity. Three types of information were employed to determine Pennsylvania's Conservation Priority Watersheds:

- The *ACC biological community information* provides a way to examine watersheds based on stream habitat types and the organisms that occur within them. Those communities which are of the highest-quality demonstrate where the most intact aquatic habitat exists.
- *Biological metric calculations* provide a way to quantitatively rank streams and watersheds on habitat and water quality. Both fish and macroinvertebrate data were used to score streams. Streams with high-scoring metrics were used to select the CPWs.
- High-quality stream reaches, referred to as *Least-Disturbed Streams* (LDSs), provide examples of the highest quality streams in a given region. They were determined based on ten different data types that represent disturbances such as pollution, hydrologic alteration, stream connectivity, quality of riparian habitat, and information about surrounding land use. LDSs represent the top 10% of all stream reaches in Pennsylvania; those with the highest water quality and intact habitat. The results of the *Least-Disturbed Streams* (LDS) analysis were included in the CPW designation by calculating the total number of LDS reaches in each small watershed.

Classification of Aquatic Communities in Pennsylvania


PNHP

PNHP staff sampling for mussels.

The Pennsylvania Aquatic Community Classification Project (ACC), a statewide project of the Pennsylvania Natural Heritage Program, was completed in 2007. The goal of the ACC was to create a centralized information system about Pennsylvania's rivers and streams and the animals that live in them. To begin the project, a database of aquatic information was assembled using data contributed from nearly 80 agencies and organizations, including the Pennsylvania Department of Environmental Protection, Pennsylvania Fish and Boat Commission, U.S. Environmental Protection Agency, U.S. Geological Survey, and the Susquehanna and Delaware River Basin Commissions. Data on freshwater mussels, macroinvertebrates, fish, water chemistry, and stream habitat were all included in the database and analyzed with standard statistical methods. Community types and habitat associations were modeled in each watershed.

Community types were found to vary with stream size, water temperature, and water quality. GIS information, such as land use and upstream pollution sources, was used to model streams with the lowest likely amount of disturbance in their watersheds. These streams are designated as *Least Disturbed Streams* (LDSs). LDS reaches were used in combination with the biological community data to select watersheds that were expected to hold the highest water quality, habitat quality, and species diversity. These are called *Conservation Priority Watersheds* and should be primary candidates for preservation efforts. *Restoration Priority Areas*, those with the lowest likely quality, were also identified, and should be targeted for restoration activities. More information on the ACC, its methods, and stream designations can be found on the PNHP website: http://www.naturalheritage.state.pa.us/aquatics.aspx

The CPWs in Indiana County can be seen in Figure 13 (Appendix VI, page 265). It is important to note that these CPWs have been selected for their potential water and habitat quality. The watersheds listed as part of this category should be used only to guide conservation efforts; on-the-ground site visits and knowledge of specific streams and watersheds will be needed to verify conditions that have been described here.

Restoration Priority Watersheds (RPWs)

Multiple aspects of stream and watershed condition were used to rank all small watersheds in Pennsylvania according to water quality, aquatic habitat quality, and biological diversity. This was completed in order to determine which small watersheds in Pennsylvania are in the worst condition and are thus a priority for habitat restoration. The United States Geological Survey's HUC12 small watersheds are defined as having an average size of approximately 30 square miles. By combining multiple features of the landscape and characteristics of the stream biota, the Heritage Program was able to determine which watersheds have significant disturbances, and are, therefore, in need of active restoration to reduce negative effects on stream quality, habitat, and diversity. Three types of information were employed to determine the watersheds listed as Restoration Priority Watersheds (RPWs):

- The *ACC biological community information* provides a way to examine watersheds based on stream habitat types and the organisms that occur within them. Those communities which are of the lowest-quality demonstrate where the most disturbed aquatic habitat exists.
- *Biological metric calculations* provide a way to quantitatively rank streams and watersheds on habitat and water quality. Both fish and macroinvertebrate data were used to score streams. Streams with low-scoring metrics were used in the RPW analysis.
- High-quality stream reaches, referred to as *Least-Disturbed Streams* (LDSs) are examples of the highest quality streams in a given region. They were determined based on ten different data types that

represent disturbances such as pollution, hydrologic alteration, stream connectivity, quality of riparian habitat, and information about surrounding land use. LDSs represent those streams with the highest water quality and intact habitat. Only watersheds without any LDS reaches are included in the RPW analysis.

The RPWs identified in Indiana County can be seen in Figure 13 (Appendix VI, page 265). In these streams, ranked in the lowest 10% of Pennsylvania's waterways, there is likely significant disturbance, and the stream habitat is expected to support only the most pollution-tolerant organisms. It is important to note that the watersheds listed as part of this category should be used only to guide conservation efforts; on-the-ground site visits and knowledge of specific streams and watersheds will be needed to verify conditions that have been described here.

Conservation Recommendations

Preservation of water quality in rivers and streams starts in the headwaters and smaller streams. Well-vegetated riparian buffers provide the leaves and woody debris that sustain the food web, and lead to properly functioning stream ecosystems in the lower reaches. The riparian zone is also important to provide the shade necessary to maintain cool water temperatures. Another important function of the riparian buffer is to filter out sediments and other compounds from overland water flow. Sedimentation occurs in highly erodible areas where sediments are transported into streams at unnaturally high levels. The excess sediment in streams fills in the spaces between gravel and rocks that provide habitat for the invertebrates that fish feed on, and also covers substrate needed for fish spawning and egg development. Eggs laid in these areas can be smothered by sediments starving them of oxygen and eventually killing them. Sedimentation is best controlled by establishing and maintaining buffers of native vegetation and adequate width along all streams.

Water quality issues often change as streams become larger. Non-point source pollution is still present (poorly buffered agricultural areas, stormwater runoff from urban areas, etc.), but point-source pollution (such as effluent directly discharged from sewer treatment plants and industries) is a more common occurrence in populated areas along larger rivers. Riparian buffers can still be effective in controlling non-point source pollution in larger streams and rivers, but point-source discharges are generally overseen by regulatory agencies like the DEP.

Many organizations produce recommendations for protections of watersheds, waterways, and their associated floodplains and riparian areas. The following are some actions landowners can take to protect these resources.

- Maintain a native vegetated buffer around water bodies, including areas around fields and dirt roads with a preference towards native trees and shrubs, rather than native grasses
- If it is necessary to mow, avoid important breeding and feeding times (between May 1 – August 15 for breeding birds, and between April – November if amphibians and reptiles are present)
- Reduce the amount and frequency of chemical applications including pesticides, herbicides, and fertilizers
- Reduce the size of lawn and mown areas by planting self-managing native vegetation

Disturbance

Disturbances, whether natural or man-made, are pivotal in shaping many natural communities. The nature, scale, and frequency of disturbance are influential in the evolution and occurrences of natural communities and associated rare species. Examples of natural and anthropogenic disturbance events are presented below in Table 5.

Table 5. Examples of natural and anthropogenic disturbances (adapted from Scott et al., 1999).

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

*Entries in italics are disturbances which are more easily reversible, while those in normal type represent disturbances that would require long-term changes in land use to reverse.

Natural Disturbances

Natural disturbances such as fire and flooding can benefit certain natural communities and plant and animal species. Prescribed burns in such areas stimulate new growth of the pioneer species characteristic of these communities, and keep species that would move in during later stages of succession from taking over and altering the character of the community. Floodplain forests benefit from the periodic scouring and deposition of sediments that occurs as streams overtop their banks.

In contrast, over abundant deer populations have been implicated for a number of negative impacts on the flora and fauna of Pennsylvania (Rhoads and Klein, 1993). Over-browsing can result in a lack of forest regeneration, a reduction in the diversity and density of forest understory, decreased songbird diversity, and direct loss of rare plants (Yahner, 2000).

Anthropogenic Disturbances

In many cases, human caused disturbances have clearly been destructive to natural habitats and the species associated with them. In Indiana County, logging and mining have played major roles in altering the landscape. Repeated timbering of the forests has restricted older forests to steep, nearly inaccessible, slopes. Mining has altered topography and vegetation. Reclaimed mine lands can provide valuable nesting and wintering habitat for many species of grassland birds.

Although some species, including several rare species, are aided by on-site disturbance (e.g. clearing or mowing), in general, human-caused disturbance negatively impacts natural systems. With wide-ranging anthropogenic disturbance, some plant and animal species may become completely extirpated from an area because they cannot compete or survive under altered conditions. Human disturbances are now a permanent part of the landscape, but decisions about the type, timing, and extent of future disturbances are important for the protection of Indiana's remaining ecological diversity. Furthermore, mitigation after human-caused disturbance can restore ecological function.

Conservation Recommendations

Many grasslands conservation programs are working to create guidelines for proper reclamation of degraded lands, including strip mines. Massachusetts's chapter of the Audubon Society (http://www.massaudubon.org/Birds_and_Birding/grassland/) and DCNR's Grassland Wildlife Status Program (http://www.dcnr.state.pa.us/wlhabitat/farmlands/farm_wildlife.aspx) are good places to start for conservation information surrounding reclamation of lands with anthropogenic disturbances.

Invasive Species in Indiana County

Natural habitats within Indiana County are threatened by the invasion of exotic (non-native) plant and animal species. These invasive species are plants, animals, and 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 been removed from the control of their natural enemies, they usually spread rampantly. Once established, it is extremely difficult to 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).

The introduction of non-native species into Pennsylvania began with the initial European settlement in the 17th century (Thompson 2002) and continues to this day. 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 global trade and transportation. These introductions have had drastic effects on Pennsylvania's biodiversity over time. For example, over 37% of the plant species now found in the Commonwealth did not occur here during the first period of European settlement (Thompson 2002).

Invasive Plants

Currently, over 285 invasive plant species are impacting Pennsylvania. Qualities that make these plants invasive include their ability to reproduce rapidly and spread quickly over the landscape, and the fact that they have few, if any, natural controls (such as herbivores and diseases) to keep them in check. Invasive plants share a number of common characteristics that allow them to spread rapidly, and make them difficult to remove or control. These characteristics include:

- Utilization of runners or rhizomes that allow them to rapidly colonize new areas;
- Production of large numbers of seeds that survive to germinate;
- Designs that allow for extensive dispersal of seeds away from the parent plant by wind, water, wildlife, and people.

Invasive plants are capable of displacing native plants from natural communities, especially rare and vulnerable plants in small populations (Swearingen et al., 2002). This impact is worsened by the tendency for native wildlife to prefer native species over invasive species for food (Swearingen et al., 2002). In addition, 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).

Table 6: Significant invasive plant species known or suspected to be in Indiana County

Species	Description and Threat
Autumn olive (*Elaeagnus umbellata*)	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.
Black jetbead (*Rhodotypos scandens*)	A shrub that forms dense thickets that displace native woody plants and shades out herbaceous groundcover. This species has not yet been reported in Indiana County, but there is the threat of spread from surrounding areas.
Bush honeysuckles (*Lonicera tatarica, L. morrowii, and L. maackii*)	Found in most environments. Competes with native plants for moisture, nutrients and pollinators and shades out native plant seedlings. Fruits do not provide high energy food for migrating birds.
Canada thistle (*Cirsium arvense*)	A Pennsylvania listed noxious weed. Invades a variety of dry to moist open habitats displacing native plants and disrupting community processes.
Garlic mustard (*Alliaria petiolata*)	An increasingly common invasive biennial herb spreading through natural areas throughout the region. Recent scientific evidence has shown that this species can disrupt mycorrhizal relationships that trees depend on for growth.
Japanese barberry (*Berberis thunbergii*)	Commonly planted ornamental that escapes and forms dense stands in a variety of habitats, including forests and wetlands, displacing native vegetation.
Japanese honeysuckle (*Lonicera japonica*)	This vine covers native vegetation, outcompeting native plants for light and other resources; it also girdles and kills trees.
Japanese and Giant knotweed (*Fallopia japonica, P. sachalinensis*)	These large fast-growing exotics displace natural vegetation and greatly alter natural ecosystems. Typically found along stream banks and other low-lying areas, as well as old home sites and waste areas.

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 (Swearingen et al., 2002). The decrease in plant diversity can, in turn, impact the mammals, birds, and insects in the area since the invasive plants do not provide the same food and cover value as the native plant species (Swearingen et al., 2002).

Control methods for invasive plants can range from hand pulling, to mechanical methods (like mowing) to herbicides. Herbicide control should be only performed by individuals with proper training and licensing by the Pennsylvania Department of Agriculture. When working in sensitive habitats such as wetlands, *only 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 conducted before these species disperse their seed each year. Specific control methods for these species can be found at: http://www.invasive.org/eastern/.

Table 6 continued

Species	Description and Threat
Japanese stiltgrass (*Microstegium vimineum*)	A fast-spreading grass that is typically found along forest roads, streambanks, and other cool moist habitats. Outcompetes native vegetation and may have an effect on animal species that use streamside microhabitats.
Mile-a-minute (*Polygonum perfoliatum*)	A vine that invades open and disturbed areas and scrambles over native vegetation, limiting their photosynthesis. This species is listed as a Pennsylvania noxious weed.
Multiflora rose (*Rosa multiflora*)	Widely planted shrub that invades a variety of habitats excluding most native shrubs and herbs. May be detrimental to the nesting of native birds.
Oriental bittersweet (*Celastrus orbiculatus*)	This vine covers native vegetation, outcompeting native plants for light and other resources; it can also girdle and kill trees.
Privet (*Ligustrum* spp.)	These shrubs form dense thickets in floodplains, forests, wetlands, and fields that can outcompete native vegetation.
Purple loosestrife (*Lythrum salicaria*)	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.
Spotted knapweed (*Centaurea biebersteinii*)	Competes with native species by capturing moisture and nutrients. Poses a high threat to shale barrens and other dry habitats and produces carcinogenic chemicals.
Tree-of-heaven (*Ailanthus altissima*)	Introduced to Philadelphia from China in the early 1800s, it is present in disturbed places throughout the county. This fast growing tree is a prolific seed producer and can also proliferate through vegetative means, outcompeting native vegetation.
Winged burning bush (*Euonymus alatus*)	A shrub that can form dense thickets that displace native woody and herbaceous plants.

Invasive Animals

In addition to invasive plants, Pennsylvania now harbors many non-native invasive species of animals including mammal, bird, fish, reptile, and invertebrate species. Some of these invasive animals such as the Norway rat (*Rattus norvegicus*) are all too common in our homes and built areas. These invasive animal species directly threaten populations of native animals through direct competition, predation, or modification of habitat through the alteration of cover and diversity. The following are examples of invasive animals that are currently or may soon be impacting natural areas in Indiana County.

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.

Arguably, one of the most significant invasive animal threats to Indiana County 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

Table 7: Significant invasive animal species known or suspected to be in Indiana County.

Species	Description and Threat
Asian clam (*Corbicula fluminea*)	Found in extremely high densities along major tributaries and rivers, this clam directly competes with native mussels for food and habitat.
Chestnut blight (*Cryphonectria parasitica*)	A fungus which has nearly extirpated the American chestnut (*Castanea dentata*) from the eastern U.S. since its introduction in the 1800s.
Common carp (*Cyprinis carpio*)	Introduced as a food fish, this carp is now found anywhere with warm, slow-moving water. As it feeds along the bottom, it mobilizes a large amount of sediment.
Common pine shoot beetle (*Tomicus piniperda*)	This beetle damages terminal shoots of pine trees (*Pinus* spp.) stunting their growth, weakening the trees, and increasing their susceptibility to other pests.
Emerald ash borer (*Agrilus planipennis*)	Devastating ash trees (*Fraxinus* spp.) across the eastern US, emerald ash borer larva kill the tree's sapwood. It was first detected in Indiana County in 2009, resulting in a mandatory firewood quarantine and lumber movement restrictions.
European starling (*Sturnus vulgaris*)	This bird competes directly with native cavity-nesting birds, and also causes severe crop damage.
Feral swine (*Sus scrofa*)	Wild hogs, though not yet found in Indiana County, should be monitored for due to their high mobility and negative impact on livestock, property, and natural areas.
Grass carp (*Ctnopharyngodon idella*)	A voracious herbivore, this carp was introduced to control weeds in eutrophied lakes. It now causes significant damage to native wetland vegetation important for reducing nutrients in waterways.
Gypsy moth (*Lymantria dispar*)	Though it feeds preferentially on oak trees (*Quercus* spp.) and their relatives, this moth will eat almost any plant, and can cause severe environmental and economic damage.
Hemlock woolly adelgid (*Adelges tsugae*)	This insect is causing severe damage to eastern hemlock (*Tsuga canadensis*), killing up to 90% of infected trees, and greatly modifying ecosystems.

and eggs along the underside of the branch tips of the hemlock. Hemlock decline and mortality typically occurs within four to ten years of initial infestation. Adelgid infestations have caused up to 90% mortality in eastern hemlocks throughout the state. These important trees shade most high-quality trout streams, and provide habitat for about 90 species of birds and mammals. Several control options are currently being tested. As of 2010, this species had not been found in Indiana County, but is present in adjacent counties and is expected to arrive in coming years.

The Pennsylvania landscape was drastically altered by chestnut blight (*Cryphonectria parasitica*), a fungus, that was most likely introduced to North America from infected nursery stock from China in the 1890s (American Chestnut Foundation, 2008). First detected in New York City in 1904, it has since 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 damaged trees remain, and the chestnut's gap in Pennsylvania's forest canopy composition has been filled by its associate species, including oak and hickory.

The gypsy moth (*Lymantria dispar*) has caused extensive defoliation of Pennsylvania's forests. This non-native moth was intentionally introduced to the U.S. from Europe in 1869 as part of a commercial silk production venture. The gypsy moth was first discovered in Pennsylvania in Luzerne and Lackawanna Counties in 1932; thirty-eight Pennsylvania counties were infested by 1980 (DCNR, 2007c). Though mainly

Table 7 continued

Species	Description and Threat
House cat (*Felis silvestris*)	House cats, both domestic and feral, can each kill several small animals every day, causing the death of many amphibians, reptiles, birds, and mammals each year.
House mouse (*Mus musculus*)	Ubiquitous throughout the world, this mouse carries diseases, competes directly with many native species, and causes significant damage to crops and structures.
House sparrow (*Passer domesticus*)	Generally found near humans, this sparrow competes with small, native, cavity nesting birds, and can also cause crop damage.
Multicolored Asian ladybird beetle *(Harmonia axyridis)*	Likely introduced in an attempt to control non-native aphids, this beetle now preys on native insects, and invades houses each winter.
Mute swan (*Cygnus olor*)	Though introduced for its beauty, this European swan causes significant damage to wetland vegetation. It is also fiercely competitive, and will exclude all other native waterfowl from its nesting territory, sometimes killing intruders.
Norway rat (*Rattus norvegicus*)	The Norway rat is typically a pest in human made structures, but is also found around rivers and other water systems. A known carrier for many diseases, this rat is a threat anywhere it occurs.
Rusty crayfish (*Orconectes rusticus*)	Found in many of our streams, this recent invader is displacing native crayfish, reducing fish populations, and generally disrupting aquatic systems.
Sirex woodwasp (*Sirex noctilio*)	A recent invader to the U.S., this species attacks living pines and is likely to cause great amounts of damage to pine trees throughout the nation.
Snakehead (*Channa* sp.)	Prized as a food species in Asia, this fish was recently introduced to the East Coast and has quickly taken root. Though not currently found in Indiana County, monitoring for snakehead is recommended.
Zebra mussel (*Dreissena polymorpha*)	This non-native mussel negatively affects industry and recreation, as well as native species of fish and mussels.

targeting oak species, gypsy moth caterpillars will eat almost any vegetation when pressed and tree defoliation by this species can result in reduced growth rate or even death of the tree.


Photo from www.wvnet.edu .
Gypsy moth caterpillar.

The European starling (*Sturnus vulgaris*) is an invasive bird species established in North America in the late 1890s 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 North America (USDA, 2008). In addition to competing with native bird species for food and space, large flocks of this species numbering over 100,000 individuals can destroy fields of crops (Cabe, 1993). Another non-native bird, the house sparrow (*Passer domesticus*), has become widely distributed after its introduction in several U.S. locations in the late 1800s. House sparrows, while also causing crop damage, have been documented killing native adult and juvenile birds or smashing their eggs. The house sparrow is partially responsible for a decline of birds that nest in tree cavities such as the eastern bluebird (*Sialia sialis*) in the United States (Lowther, 2006).

Feral swine (*Sus scrofa*), also called wild hogs, are potentially one of the most influential upcoming invasive animal species in Pennsylvania's forests. Escaped or deliberately released swine now exist in relatively low

numbers in Pennsylvania. Feral swine transmit diseases that can impact livestock, and they cause significant ecological and property damage by destroying native herbs and trees while rooting for food, and inducing erosion along river banks and streams from their wallowing. The potential exists for the numbers of feral swine and their negative ecological effects to explode and significantly impact forest lands and agricultural activity over the next decade. Jurisdiction over feral swine control and management in Pennsylvania is under the Pennsylvania Game Commission. Recommendations for feral swine in PA include:

- The status of swine in PA should be examined
- Existing populations of feral swine should be identified and quickly eradicated from Pennsylvania
- New individuals should be prevented from entering the Commonwealth

Aquatic Environments

Aquatic environments are also impacted by invasive animal species which are spreading throughout the streams, rivers, and lakes of Pennsylvania; in many cases the impact of these species remains uninvestigated. The zebra mussel (*Dreissena polymorpha*) was introduced to the Great Lakes in the 1980s and has been spreading through Pennsylvania's waters. This mussel poses a great threat to industry, recreation, native fish, and native mussel species, and should be controlled wherever it occurs. 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 the 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 to many of Pennsylvania's watersheds from its native range in the Midwestern United States. 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 native crayfish, freshwater mussels, and reptile and amphibian populations by outcompeting them for food and habitat or by directly preying on young individuals.

Overall Invasive Recommendations

Although Indiana County has many sites that are free from non-native species, invasive species are an increasing threat to biodiversity. Successful control of invasive plant species is a time, labor, and resource-intensive process. Prevention or control during the early stages of establishment is the best money-saving strategy. In areas where invasive plants are well established, multiple control strategies and follow-up treatments will be necessary. Specific treatment depends on the target species biological characteristics and population size. Invasive plants can often be controlled using biological, mechanical, or chemical methods. The recommendations below give resources for where to find invasive species information:

- Biological Diversity Areas (BDAs) identified in this report can serve as priority areas for early detection, control, and monitoring of invasive species.
- Many educational resources are available on 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. This organization's website is http://www.ma-eppc.org/
- Pennsylvania has a Noxious Weed law that prevents the propagation, sale, or transport of thirteen weed species within the Commonwealth. Pennsylvania's Noxious Weed List can be found on the USDA's PLANTS website at http://plants.usda.gov/java/noxious?rptType=State&statefips=42. Some of the thirteen species that are currently listed are agricultural weeds; 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 weeds that often threaten natural areas.

- The Pennsylvania Fish and Boat Commission maintains a list of aquatic invasive species 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. More information can be retrieved from the Fish and Boat Commission's website at http://www.fish.state.pa.us/ais.htm.
- The Pennsylvania Game Commission focuses its invasive species work on a few taxa, most notably the feral swine. Additionally, many of the game lands are managed for invasive plant species.
- 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/weed_mgmt_areas/wma_overview.html.

After intensive removal of invasive species, replanting with native species is often needed to restore the natural habitat and prevent reinvasion. Specialized nurseries, landscape architects, and horticultural professionals can assist with native plant restoration. Complete eradication of invasive non-native plants from a site may not always be achievable, 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, and therefore requires continuous monitoring efforts.

Natural Resources

Humans value natural ecosystems for the resources that they provide: food, energy, and materials. Resources available for use can be separated into renewable, where the resource will naturally replenish itself in a timescale that is comparable to its use, and non-renewable, where the extracted resource is available only in a fixed amount or cannot be replaced before it is exhausted or sometimes ever replaced. Human use of natural resources and the infrastructure that brings these resources to communities can have significant effects on local and regional biodiversity.

Effects of natural resource development include habitat destruction, fragmentation, introduction of invasive species, and many of the other effects outlined in the disturbance section above.

Renewable

Sources of water in the county are dug and drilled wells, springs, and storage reservoirs. Groundwater is typically found 100 to 200 feet below the surface in most areas of the county. Conservation recommendations in the water resources sections of this report will help ensure the protection of public and private water supplies in the County.

Approximately 49% (317,317 acres) of the land within Indiana County is currently under forest cover. Wood products and forestry contributes over $39.6 million to Indiana County's economy annually (Penn State Timber Market Report, 2009).

Farming is one of Indiana County's chief industries with the production of hay, corn, oats, wheat, dairy and beef cattle being the major products produced (Weaver and Ruffner, 1968). Measures to preserve Indiana County's soil and water resources can ensure that quality agricultural lands are conserved.

Pennsylvania has seen an increase in discussion around wind turbines. Typically wind power generation facilities are situated in the Ridge and Valley province; the areas with the highest suitability to wind power development are ridgelines, but development is expanding to all regions of the state. Wind power development may be in conflict with the preservation of large blocks of forests as well as migratory bird

corridors and landscape aesthetics. The more proactive the state can be in identifying suitable sites for wind power while working to preserve bird and bat migration corridors and Pennsylvania's natural resources, the more likely it will be able to alleviate conflicts around this renewable resource.

Non-renewable

Indiana County is underlain by significant fossil fuel resources including coal, oil and natural gas. Development of these resources has significantly influenced the region's economy and has also left a legacy on the landscape and the environment.

The county has a long history of shallow gas well development with approximately 9,700 oil and gas wells (citation). The status of these wells and the completeness of the data is unknown so it is possible there are many older wells that remain unrecorded. Additionally, the county is underlain by the Marcellus shale—a deep formation that is the cause of the current gas boom. Recovery of natural gas from the Marcellus shale involves a process known as hydraulic fracturing, where water and chemicals are pumped under pressure to open up cracks in the shale from which the gas is extracted. This method of drilling requires much more land area and the subsequent disposal of the waste water is currently of concern by the environmental community.

Abandoned mine lands occur in every township in the county, totaling nearly 9,565 acres (based on mapped records, total is likely higher). As of 2007, forty-four active coal mines were known to be in the county—these are primarily surface mining operations. The county maintains 10 active quarries that provide stone for various construction and road building activities.

A REVIEW OF THE ANIMALS OF INDIANA COUNTY

Although this Natural Heritage Inventory predominantly focuses on Indiana County's rare, threatened, and endangered species, it is important to mention the diverse number of more common species that make their home in this region. This section provides an overview of these animals, and makes general conservation recommendations for their continued success.

Mammals of Indiana County

Indiana County lies within the Appalachian Plateaus Province and contains portions of the Pittsburgh Low Plateau and High Plateau Sections. Approximately 20% of the land area in Indiana County is contained within public lands including county and local parks, Pennsylvania State Game Lands (SGL), and Department of Conservation and Natural Resources (DCNR) properties. When best forest management practices are employed, the county's public lands allow for considerable mammal habitat conservation; however, on private lands there exists the chance that habitats will be lost to future development.

Charlie Eichelberger, PNHP

White-tailed deer are important economic resources in Indiana County.

With over 11,000 white-tailed deer (*Odocoileus virginianus*) taken in Indiana during the 2002 hunting season, it is easy to see why many people from throughout Pennsylvania, and beyond, travel to Indiana County for the state's most popular game species. The county's black bear (*Ursus americanus*) population seems to be stable, with 33 to 58 bear being harvested annually; the fluctuating bear harvest numbers may be attributable to the county's rough terrain. While deer and bear appear to be the most significant game species within the county, other important mammal species, including the gray and fox squirrels (*Sciurus carolinensis & S. niger*), eastern cottontail rabbits (*Sylvilagus floridanus*), and fur-bearers such as the mink (*Mustela vision*) and other weasels, are also important to the county's economy. The economics of hunting are well known; what is less well known is the fact that the forested habitats known for game species also support a diverse and important non-game mammal fauna.

Many of the species occurring throughout the county possess abilities that ensure their survival in a wide range of habitat types. These *generalist* species are typically well represented throughout Pennsylvania, and include: shrews and moles such as the northern short-tailed shrew (*Blarina brevicauda*), rodent species like the white-footed mouse (*Peromyscus leucopus*), striped skunk (*Mephitis mephitis*), Virginia opossum (*Didelphis virginiana*), coyote (*Canis latrans*), and the ubiquitous eastern chipmunk (*Tamias striatus*). Though they are currently in no jeopardy of disappearing from the landscape, monitoring of these species should occur to ensure they remain healthy throughout Indiana County.

Other species that have fairly restricted habitat needs are termed *specialists*. They may be restricted to grasslands, forest interior, upper elevation ridgelines, wetlands, vernal pools, streams, caves, or mines. Examples of these species and their habitats include the meadow vole (*Microtus pennsylvanicus*) of the grasslands and meadows, fisher (*Martes pennanti*) of the forest interiors, Allegheny woodrat (*Neotoma*

magister) of the upper elevation ridges, muskrat (*Ondatra zibethicus*) and beaver (*Castor canadensis*) of the wetlands and streams, and most bat species that hibernate in caves and mines.

Several species that historically occurred within the county, such as the Allegheny woodrat, eastern small-footed bat (*Myotis leibii*) and northern flying squirrel (*Glaucomys sabrinus*), are of special concern due to population declines throughout their natural range. These species are very dependant on large, undisturbed forest habitats that include very specific habitat types. One federally endangered species which also requires large blocks of mature forest, the Indiana bat (*Myotis sodalis*), remains unreported from Indiana County, but may occur during the summer months.

Hal Korber, PA Game Commission.

The PGC reports that black bear (*Ursus americana*) numbers have increased substantially in Pennsylvania since the 1970s.

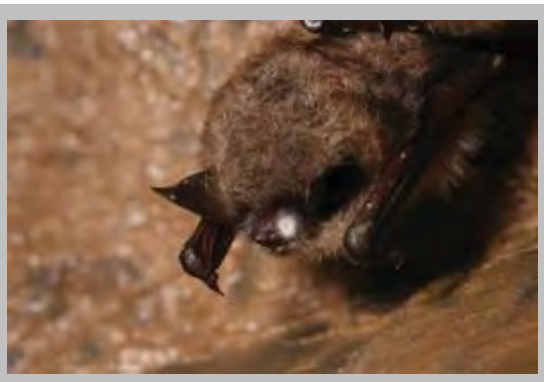
Habitat availability is just one of a number of factors that determine whether a species of mammal is going to persist within the county. Food resources are an extremely important factor, since reproductive females and migrating or dispersing individuals require substantial, consistently available food resources to bear young, nurse, and relocate or travel between nesting and foraging areas. In fact, the Allegheny woodrat has most likely declined due to a lack of food resources; their primary foodstuff, the American chestnut (*Castanea dentata*), was nearly lost to the chestnut blight during the early 1900s. Forced now to rely on more ephemeral food resources, such as the mast of oaks and other trees and a diverse array of greens, woodrats become energy-stressed when food resources become limited. This is compounded during mild, damp falls and winters which cause increased decay of their food caches. Competition for food resources with other, more numerous mammal species also reduces the survival chances for woodrat populations. Furthermore, these woodrat populations are becoming isolated from others of their own kind, reducing the likelihood of successful, healthy reproduction. Development of land, splitting of habitats with barriers such as major highways, draining of wetlands, and environmental degradation have all served to confine many mammal species to localized populations. These small populations become limited in their ability to survive any major change or disruption in food resources, nesting habitat, or predation pressures. Populations of mammals like the Allegheny woodrat may be doomed to what is termed as *localized extinction* - if enough of these populations disappear from the landscape, or become so small that inbreeding reduces their genetic diversity, these species' existence in Pennsylvania may be in jeopardy.

John Hall

Allegheny woodrats are pack rats and should not be confused with the non-native Norway rat.

Populations of several mammal species had become so low that they were thought to be gone (extirpated) from Indiana County. Two of these species, the fisher and the river otter (*Lontra canadensis*) have been reintroduced by the Pennsylvania Game Commission (PGC) in portions of their historic range where necessary habitat still exists. Though not released in all habitats that might support them, the released populations have expanded, and likely now occur in Indiana County. It is expected that they will be confirmed in the future by hunters and fishermen along water courses throughout the county as well as interior portions of the existing forests.

Wetlands and streams play a major role in providing mammal habitat, while also serving as corridors for dispersal. Whenever biologists research mammals, some of the first habitats investigated are marshes, bogs, and streams, as they are often sites where the number of species of mammals, or diversity, is highest. A high-quality wetland habitat may contain six species of shrews, nine or ten species of rodents, four to five species of weasels, and six or seven species of bats, as well as sign of squirrel, bear, deer, and various medium-sized carnivores.



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 will be able to 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

Open land in the form of meadows and reverting grasslands are habitat types that are not usually associated with much of Indiana County. Normally a product of agricultural practices, these habitats are most often found within the small stream valleys and along plateaus throughout the county. The most well known mammal occurring in these grasslands is the meadow vole (*Microtus pennsylvanicus*), a very successful disperser along mountain trails and rights-of-way. The runways formed by this small rodent can be spotted under decaying vegetation during the summer months and under the icy crust forming on snow during the winter months. Meadow voles are so successful at dispersing throughout the county 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 rights-of-way. Several other species of mammal are known to occur within successional lands including the eastern cottontail rabbit (*Sylvilagus floridanus*), woodchuck (*Marmota monax*) and red fox (*Vulpes vulpes*).

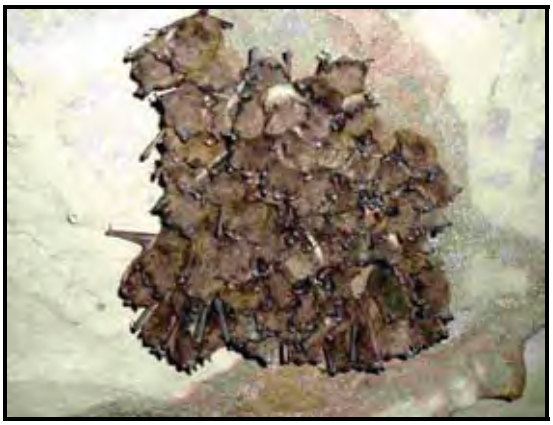
While the open lands mentioned above are familiar to many, one type that is often overlooked is scrub-shrub openings. Although commonly made up of scrub oak (*Quercus ilicifolia*), blueberry (*Vaccinium* spp.) and other low-growing plants, they do not have the large expanses of canopy high overhead, as found in forests. The understory in these habitats is fairly open, as there are few low-growing plants except in areas that may have suffered from the recent burns that are common along these dry sites. These habitats are extremely important to several species as either foraging areas or nesting sites and include the black bear, Appalachian cottontail (*Sylvilagus obscurus*) and snowshoe hare (*Lepus americanus*). Open lands such as these can most often be found along upper elevation forests in areas where soils are thin and the climate fairly dry.

Bats are a common component of the forests of Indiana County, most often encountered during the summer months along the county's streams and open bodies of water. During the winter months, however, bats most likely disappear from most of Indiana County, as it lacks the accessible caves and mines that are important overwintering sites.

One rarely encountered bat species, the silver-haired bat (*Lasionycteris noctivagans*), may be found within Indiana County during the early spring or late fall months as it migrates through the state on its way to and from its summer habitat in the northern portion of the U.S. and Canada. Hibernating bat species such as the little brown bat (*Myotis lucifugus*) and the big brown bat (*Eptesicus fuscus*) probably migrate either to large mines in New York or southeast to caves in central Pennsylvania. Several bat species, such as the hoary bat

(*Lasiurus cinereus*) and red bat (*Lasiurus borealis*), leave Pennsylvania and migrate south to the Carolinas or Florida, where they hibernate under deep patches of leaf and forest floor litter.

Indiana County contains very diverse habitats able to support the mammal fauna of Pennsylvania. The county's large blocks of forested land and vegetated stream corridors are serving as avenues of dispersal for its mammals. Continued vigilance and adoption of appropriate management practices will ensure that Pennsylvania's mammalian wildlife is preserved.



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.

Birds of Indiana County

Pennsylvania is an important state to birds because it offers a wide range of habitats, from Great Lakes glacial wetlands and Atlantic Coast tidal marshes to 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).

Indiana County is important for breeding bird communities since it offers a wide variety of habitats, with many forest blocks, edge habitat, and a significant amount of grassland within the county. Wetland communities, the agricultural landscape, and floodplain forests are also important to bird life in the county since several species of concern are also known from these areas.

Forest Dependant Birds

As forested landscapes are fragmented into smaller patches by development, roads, mining, and timber harvesting, some bird populations are declining (Askins et al., 1991). These birds are considered forest interior species and require large blocks of contiguous interior forest (300 feet from a non-forest edge) in order to breed (Robbins, Dawson, and Dowell, 1989); these species include a variety of owls, hawks, woodpeckers, thrushes, vireos, and warblers. Forest fragmentation negatively affects their nesting success because it can lead to increased predation from animals that use edges for hunting. Fragmentation also leads to brood parasitism from brown-headed cowbirds (*Molothrus ater*), which use perches along edges to prospect for nests of other species in which to lay their eggs (Marini, et al., 1995; Robinson, 1994).

Jacob Dingel, PGC

Scarlet tanager, an interior forest bird species.

Of the species listed in Table 8 below, four occupy a special niche within the interior forest. The Acadian flycatcher, cerulean warbler, Louisiana waterthrush, and red-shouldered hawk all specialize in the interior forest's riparian corridors and wetlands. The needs of the more generalist species, those that are less specific in their habitat needs, and edge species, those that prefer the edges of forests and grassland habitats, are often met by processes of human and natural disturbance. Habitat for these interior species needs to be a

Table 8: Examples of forest interior bird species found in Indiana County. State status is for breeding populations unless otherwise noted (B refers to a breeding population; N refers to a non-breeding population).

Common Name	Genus Species	State Status
Acadian flycatcher	*Empidonax virescens*	Secure
Black-billed cuckoo	*Coccyzus erythropthalmus*	Secure
Black-throated blue warbler	*Dendroica caerulescens*	Apparently Secure
Cerulean warbler	*Dendroica cerulea*	Apparently Secure
Kentucky warbler	*Oporornis formosus*	Apparently Secure
Louisiana waterthrush	*Seiurus motacilla*	Secure
Pileated woodpecker	*Dryocopus pileatus*	Secure
Red-shouldered hawk	*Buteo lineatus*	Apparently Secure-B, Vulnerable-N
Scarlet tanager	*Piranga olivacea*	Secure
Wood thrush	*Hylocichla mustelina*	Secure

conservation focus, since it takes much more time to develop suitable interior habitat. These interior habitats, formerly common in Pennsylvania, are being converted to other uses at an alarming rate. As conversion continues, these interior species will become rarer due to habitat loss, and may eventually warrant formal protection as threatened or endangered species.

Conservation Recommendations

Whenever possible, avoid fragmentation of large (at least 500 acres in size) contiguous forest tracts. Diverse, well developed forests identifiable by an uneven age of trees (i.e. not all the same age due to clear-cutting or large-scale disturbances) and an intact shrub and herbaceous understory should be maintained. Care should be taken not to increase feeding and parasitizing opportunities for cowbirds by keeping roads, trails, and other disturbance corridors narrow with a closed canopy. Dead trees, snags, and slash-piles should be preserved because they serve many wildlife functions including foraging sites, nesting cavities, hunting perches, and shelter.

Wetland Dependant Birds

Wetland obligate bird species are those that need wetland habitat in order to survive and breed. In Pennsylvania, 56 percent of all state bird species of concern are wetland obligate species, and an even higher percentage of special concern species use wetlands at some point during their life cycle (Gross, 2002). Unfortunately, wetlands and riparian zones are an imperiled habitat across the state (Dahl, 1990, Myers et al., 2000). From 1956 to 1979, 38% of Pennsylvania's wetlands with emergent (underwater) vegetation were drained, filled, or succumbed to succession (Tiner, 1990), reducing habitat for these wetland obligate species. Riparian forests typically have larger, older trees occupied by cavity-dependent and bark-utilizing species; they provide nesting sites for raptor species and colonial waterbirds, and take centuries to replace once removed.

Indiana County has wetland habitats that range in size from small vernal pools to larger shrub swamp complexes along the Mahoning and Little Mahoning Creeks. These areas provide breeding and foraging habitat for various raptors such as the osprey (*Pandion haliaetus)* and the bald eagle (*Haliaeetus leucocephalus*). Other wetlands species, including waterfowl, shorebirds, and wading birds for example, also require these habitats for nesting and foraging. Wading birds, like the great blue heron, prefer clumps of dead trees surrounded by water in which to nest. These herons nest colonially in rookeries where they are more protected from predators (see the Fact Sheet in Appendix V, page 238). Because many of these wetland species are very secretive, well camouflaged, and difficult to flush, and because they live in habitats that can be challenging to survey, our knowledge of the true range and status of these species is limited.

Table 9: Examples of riparian and wetland bird species found in Indiana County and their state status. All state statuses are for breeding populations unless otherwise noted (B refers to a breeding population; N refers to a non-breeding population).

Common Name	Genus Species	State Status
Alder flycatcher	*Empidonax alnorum*	Vulnerable
American black duck	*Anus rubripes*	Apparently Secure
Bald eagle	*Haliaeetus leucocephalus*	Imperiled
Belted kingfisher	*Ceryle alcyon*	Secure
Canada warbler	*Wilsonia canadensis*	Apparently Secure
Great blue heron	*Ardea herodias*	Vulnerable-B, Apparently Secure-N
Green heron	*Butorides virescens*	Secure
Willow flycatcher	*Empidonax traillii*	Secure

Conservation Recommendations

The conservation and proper management of wetland habitat is crucial to sustaining healthy populations of these bird species, maintaining general ecosystem viability, and preserving a reliable water supply. Immediate needs include the preservation 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 (filling in by sediments), pollution, and invasion by non-native invasive species. In riparian areas, floodplain forests should be maintained, at minimum, by limiting harvest within the riparian zone as per Pennsylvania Bureau of Forestry Aquatic Habitat Buffer guidelines. Best Management Practices (BMPs) for forest management can be found at the following sites:

- Department of Environmental Protection: http://www.forestrybmp.net/Members/dcassidy/BMPManual.2005-01-05.1751/view
- Penn State bureau of forestry: http://rnrext.cas.psu.edu/PDFs/FSPrinciples.pdf
- Pennsylvania Bureau of Forestry Aquatic Habitat Buffer guidelines: http://www.dcnr.state.pa.us/forestry/sfrmp/documents/Water_Aquatic_Buffer_Guidelines.pdf

Grassland Dependant Birds

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 by Native Americans also periodically opened up forested areas. With European colonization during the 1800s, grasslands became widespread as forests were cleared for pastures and hayfields. This allowed grassland species to flourish. Today, with farmland reverting back to forest or being replaced by residential, commercial, and industrial developments, species dependent on grasslands are declining, in some cases severely. Many grassland birds associated with open areas are experiencing declines due to habitat loss and modern, high-intensity agricultural practices (Jones and Vickery 1997).

Grassland habitat in Indiana County consists primarily of agricultural land such as hay fields and pastures, and maintained areas such as reclaimed mines. In parts of western Pennsylvania where open areas are maintained as grassland habitat or farmers are participating in the Conservation Reserve Enhancement Program (CREP), several grassland-dependent species, such as the northern harrier (*Circus cyaneus*) and the grasshopper sparrow (*Ammodramus savannarum*), have been able to maintain small strongholds. Additionally, some grassland species have adapted to the unique habitat found on abandoned surface mines allowing them to utilize this all too common habitat type to their advantage.

Table 10: Examples of grassland and shrubland bird species found in Indiana County and their state status. All state statuses are for breeding populations unless otherwise noted (B refers to a breeding population, N refers to a non-breeding population).

Common Name	Scientific Name	State Status
American kestrel	*Falco sparverius*	Secure
Bobolink	*Dolichonyx oryzivorus*	Apparently Secure
Clay-colored sparrow	*Spizella pallida*	SNA
Grasshopper sparrow	*Ammodramus savannarum*	Apparently Secure
Henslow's sparrow	*Ammodramus henslowii*	Apparently Secure
Northern harrier	*Circus cyaneus*	Vulnerable-B, Apparently Secure-N
Savannah sparrow	*Passerculus sandwichensis*	Secure-B, Imperiled-N

Conservation Recommendations

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 re-growth, and limit development in areas where grassland-dependent species are known to reside. Safe dates for mowing to avoid bird casualties are typically listed as before the breeding season (prior to May 1st) or after the breeding season (after August 15th). The exploration of best management practices for power line maintenance may be a way to preserve grassland species while also maintaining a service for communities; however, herbicide use in these areas should be limited or eliminated, and mowing and clearing should only take place within the safe dates listed above. The creation of additional grassland habitats is not considered beneficial at this time, and thus should not be a primary activity for grassland bird conservation. Additional information about the status of Pennsylvania's bird species and their recommended management can be found at the Partners In Flight (PIF) website http://www.partnersinflight.org, and in the PIF Handbook on Species Assessment.

Reptiles and Amphibians of Indiana 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 75 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.

Jurisdiction and Monitoring of Reptiles and Amphibians

In Pennsylvania, the Fish and Boat Commission (PFBC) has jurisdiction over, and the authority to regulate and make decisions concerning the State's reptiles and amphibians. When regulations concerning Pennsylvania's herptiles were recently reviewed, considerable changes were made including the drafting of a list of no-take species – there is a no open hunting season and a possession limit of 0 for these species which 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.

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/.

Much of Pennsylvania's natural areas have undergone habitat degradation, destruction, and fragmentation due to land development. Indiana County has not escaped this trend with many of its large forest blocks fragmented by mining, roads, and oil development. However, the array of habitats within the remaining forested blocks serves both generalist and specialist species.

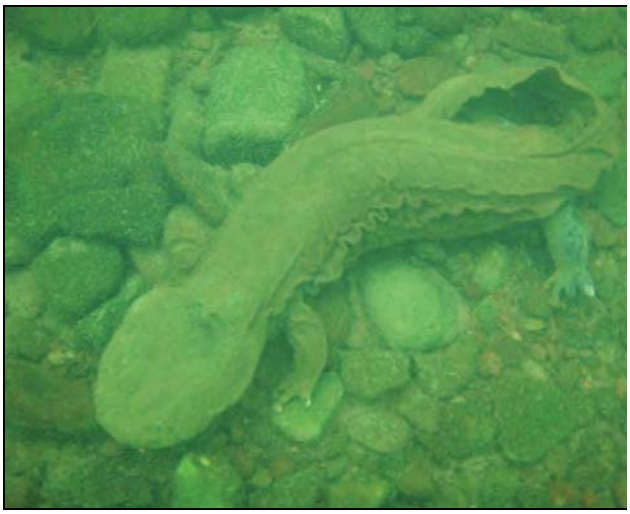
Indiana County is home to many common, generalist species, such as the eastern garter snake (*Thamnophis sirtalis*), the red-spotted newt (*Notophthalmus viridescens*), the bull and green frogs (*Lithobates catesbeianus*, *L. clamitans*), and the painted and snapping turtles (*Chrysemys picta*, *Chelydra 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, Indiana 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.

Salamanders

The terrestrial woodland salamanders depend on canopied forests with adequate amounts of leaf litter. These salamanders are voracious predators of 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, valley and ridge, and Wehrle's salamanders (*Plethodon cinereus*, *P. glutinosus, P. hoffmani, P. wehrlei*) are the most common woodland species in Indiana County's forests.

The numerous waterways and streams of Indiana County provide habitat for the streamside salamanders, including the northern and mountain dusky salamanders (*Desmognathus fuscus, D. ochrophaeus*), the seal salamander (*D. monticola*), 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 throughout 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 the time under large flat rocks in swift moving, high quality waters. Hellbender populations have been declining very 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 the 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 sediment loads can be detrimental to the hellbenders and mudpuppies inhabiting affected streams.



PNHP

A two foot, four pound hellbender found during stream surveys in the county.

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 salamander (*Ambystoma maculatum*), which is a vernal pool obligate, is known in Indiana County. Marbled salamanders (*A. opacum*) were historically known from Indiana County, but have not been seen in many years. While the Jefferson salamander (*A. jeffersonianum*) has not yet been documented in the county, this shy species likely occurs in Indiana County. These species 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 streamsides 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.

A special salamander species in Indiana County is Wehrle's salamander (*Plethodon wehrlei*). This secretive species may be exceptionally common in dry upland woods, but never noticed because of its foraging patterns. Wehrle's salamander is named after a naturalist, Richard W. Wehrle, who lived in Indiana, Indiana County.

PNHP

Wehrle's salamander (*Plethodon wehrlei*).

Frogs

The wood frog (*Lithobates sylvaticus*), like the ambystomid 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 gray tree frog (*Hyla versicolor*) are regular visitors to many different types of wetlands where they breed and forage. The Fowler's toad (*A. fowleri*) is generally less common than the related American toad, with the former typically inhabiting areas of sandy soils and the latter being far more general in its habitat requirements.

The pickerel frog (*Lithobates palustris*) and northern leopard frog (*L. pipiens*) require heavily vegetated streams and creeks. 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. The mountain chorus frog (*Pseudacris brachyphona*) is primarily a woodland species and only congregates around water during the breeding season. This species breeds in temporary wetlands and has declined precipitously in the past few decades for unknown reasons, and its continued presence in Indiana County is in question.

Turtles

The semi-aquatic 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 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 larger tributaries of the Allegheny River. Female spiny softshells are much larger than the males, and females' shells may reach nearly 20 inches in Pennsylvania. 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. This is due to a number of reasons including predation by raccoons and other animals as well as collection of juvenile turtles for the pet trade.

Lizards and Snakes

The northern fence lizard (*Sceloporus undulatus*) is the only lizard known from Indiana County. Five-lined skinks (*P. fasciatus*) have not been documented in the county, but are found elsewhere in the region and may occur in Indiana County. 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.


PNHP

A queen snake (*Regina septemvittata*) found near a stream. Notice the light belly and brown back, which serve as identifying characteristics.

The northern black racer (*Coluber constrictor*) and the black 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 watersnake (*Nerodia sipedon*) is a widespread resident of Indiana County. This species hunts along open waterways, searching for amphibians and small fish. Often overlapping habitats with the northern watersnake is the queen snake (*Regina septemvittata*). This snake is smaller than the northern watersnake, 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 the invasive rusty crayfish.

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 apparently secure in the state. The eastern hognose snake (*Heterodon platirhinos*) has historically been recorded in Indiana County. This harmless, toad-eating snake is known to flare its neck into a hood, and strike at predators while hissing loudly. If the performance doesn't work, this snake will feign death and roll on its back while becoming limp and gaping its mouth.

Several small and secretive snake species in the county include the northern brown snake (*Storeria dekayi*), the northern red-bellied snake (*S. occipitomaculata*), and the ringneck snake (*Diadophis punctatus*). 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. The forested ridges of Indiana County provide wonderful habitat for these species. Rattlesnakes are able to use a wide range of habitats and may be encountered throughout 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. This species forages in a variety of habitats, but favors forested areas with healthy small mammal populations. Hibernacula, or dens, often are found under canopy cover but are usually located within several hundred meters of an open basking site. Persistence of these sites relies on forestry practices that maintain a diversity of open areas adjacent to forested foraging habitat. Copperheads are able to use a wide range of habitats 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.

Timber rattlesnakes are still considered a game species by the Pennsylvania Fish and Boat Commission and can be collected with an appropriate PFBC permit. Despite the allowance of rattlesnake hunting, the timber rattlesnake is considered a species of concern because it is declining due to human persecution. Timber rattlesnakes are a protected species in every surrounding state where the snake occurs and are considered during environmental review in Pennsylvania. The wooded habitats along the ridges of Indiana County provide a tempting location for housing development, however housing locations at these sites are not recommended to reduce human-snake encounters.

Indiana County is a significant spot in the state for the Commonwealth's reptiles and amphibians. The large unfragmented forested tracts and numerous waterways and wetlands provide critical habitat for the reptiles and amphibians. Of utmost importance to the conservation of the county's herpetofauna is the protection of the region's forests, streams, marshes, and meadows. The rich and diverse herpetofauna of Indiana County is unique to Pennsylvania and should be considered in the long term plan of the region.

This text has been created by examining the range maps of Pennsylvania herptiles species and examining records found in museums, databases, and various monographs. While this information has been based on decades of scientific research and inventories, the secretive nature of herptiles make them difficult to survey. Therefore, there could be other herptile species that occur in the county that have not yet been recorded.

Freshwater Mussels of Indiana County

Freshwater mussels are found in most medium to large streams and rivers in Pennsylvania. There are over 40 species of freshwater mussels in Pennsylvania, and hardly any species are found in both the Ohio River and Atlantic drainage basins. Mussels generally burrow into gravel, cobble, or sandy substrates. They are capable of limited movement by extending their fleshy foot into the substrate and pushing themselves around. They are filter feeders, which means that they filter stream water through siphons, straining particles from the water column for food. Their major predators are muskrats and otters.

PNHP

This adult plain pocketbook mussel (*Lampsilis cardium*) is displaying a lure to attract a fish host. Note the eyespot and fin-like appendages of the lure for fish species in the perch and sunfish families.

Freshwater mussels have developed a fascinating and intricate system for reproduction. As mostly stationary animals, they must rely on other animal species, and luck, to reproduce successfully. First, male mussels release their sperm into the water column. If the sperm finds its way to a female mussel, she will then take it in through her incurrent siphon. If fertilization is successful, female mussels must then release larval mussels, called glochidia, onto a host (usually a fish). Mussels attract fish hosts by displaying specialized appendages, which are often shaped and colored to mimic actual fish. Many species of mussels have specific hosts; if their host is extirpated from the stream, they are unable to successfully reproduce. When a fish is attracted close to the lure, the mussel can sense the fish's presence and will release its glochidia. The glochidia, which look like tiny mussels or clams, attach to the gills of the host fish. Even though the glochidia are technically parasitic, they generally do not hurt the host fish. After they grow and develop sufficiently to enter the next stage of their life cycle, the glochidia release themselves from the fish and fall to the substrate. It is here that individual glochidia will develop into adult mussels, eventually reproducing and starting this elaborate cycle over again.

Freshwater mussels have become one of the most globally imperiled groups of organisms. Eighteen of Pennsylvania's original 67 native mussel species are extinct and another 22 are imperiled (Goodrich et al. 2003). Much of the loss of mussel species is due to loss of riparian buffers and reduced water quality. Preserving the whole aquatic system, rather than targeting an individual species, is a practice that is gaining favor among resource managers. All species are protected: the common, the rare, and those not yet known (Higgins et al., 1998). Pennsylvania is fortunate to harbor many inland freshwater mussels that are globally rare. By conserving the processes that support these mussels, we are better able to conserve the species; therefore, it is important to protect examples of each mussel community, and protect watersheds that contain or may one day contain rich mussel populations to effectively protect the biodiversity of the county, state, and the nation.

Mussel species are typically found in watersheds at least 30 mi^2 (78 km^2) in size that are drained by medium or large sized streams. Mussel richness generally increases with increasing watershed size (Strayer and Jirka, 1997), so the largest rivers in Pennsylvania, like the Ohio, Allegheny, Susquehanna, and Delaware Rivers, tend to have the most mussel species. Unfortunately, large streams and rivers of good quality, without major habitat alterations, are few.

Table 11: Mussel communities predicted through the PNHP Aquatic Community Classification (ACC) to be occurring in Indiana County. See AppendixVI for more information on the ACC.

Mussel Community	Indicator Species
Spike mussel community	Spike mussel (*Elliptio dilatata*), and black sandshell (*Ligumia recta*). Several other mussel species including mucket (*Actinonaias ligamentina*), fatmucket (*Lampsilis siliquoidea*), flutedshell (*Lasmigona costata*), and plain pocketbook (*Lampsilis cardium*) may also occur in this community, but are more common in other mussel communities.

Threats and Stresses

Freshwater mussel populations are rapidly declining in North America. In the past 100 years, more than 10% of the continent's mussels have become extinct. Nearly 25% of the mussels in the U.S. are federally endangered or threatened, and 75% are listed as endangered, threatened, or of special concern by individual states (Nedeau et al., 2005). Many species of mussels in Pennsylvania are conservation priorities. As one of the most sensitive groups of animals, living in one of the most imperiled habitats in the world (Master 2000), immediate conservation actions for freshwater mussels is imperative in the state.

Water quality threats to mussels include toxic and organic compounds released from industrial and municipal point sources. In recent decades, regulations of these discharges have sufficiently improved water quality and allowed mussels to re-colonize some streams and rivers (Strayer and Jirka, 1997). Non-point source pollution contributed from large areas, like farms and cities, can also threaten the high water quality needed by mussels. Agricultural practices vary greatly, as do their influences on mussel communities. In some instances, mussels are seemingly undisturbed by agricultural pollution, compared to other aquatic organisms; but excessive sedimentation and habitat alteration from agricultural practices can be detrimental to mussel communities. Runoff from urban and suburban developments appears to be more damaging to mussels, most likely due to the combined effects of altered hydrology, excess sediment and nutrients, and warmer water temperatures (Strayer and Jirka, 1997).

Dams impact mussel communities through hydrologic alteration, disrupted connectivity, habitat alteration, changes in water temperatures, and restriction of fish migration. Mussels need host fish for their larvae to survive. Some mussels can only breed if one specific species of fish exists in their aquatic habitat. Host fish movement is restricted by dams, and larval mussels (glochidia) carried by these host fish are thus similarly restricted. Alterations in the stream channel above and below the dam may potentially alter available habitat for mussel communities. Water quality and temperature can be largely altered in a reservoir. Therefore, impoundment management and well designed drawdown plans can be important for maintaining mussel communities.

Invasive aquatic species pose a serious threat to native freshwater mussels. Zebra mussels (*Dreissena polymorpha*) especially have been shown to displace native mussels in some habitats. They can do this by outcompeting them for resources, or by direct colonization of the mussel's shell which can suffocate the native mussel and starve it of nutrients (Hakenkamp et al., 2001; Strayer and Jirka, 1997). During a 2006 survey by ecologists at the Pennsylvania Natural Heritage Program, the non-native bivalve, the Asian clam (*Corbicula fluminea*), was found in the Mahoning Creek in Armstrong County west of Indiana County. This non-native bivalve can alter an aquatic system to the point where many native mussels, fish, invertebrates, and plants can no longer live in it (Phelps 1994, Cherry et. al. 2005).

Conservation Recommendations

Many elements of the freshwater mussel's life history make them very sensitive to declines or changes in water quality, and habitat disturbance, but specific mussel habitat requirements remain poorly understood.

Protecting their fish hosts is also necessary for the continued survival of mussels. Safeguarding waterways from major channel alterations (bridges, dams, dredging) is important for maintaining habitat. Alleviating stresses from excessive amounts of sediments, nutrients, and toxins in streams and rivers will maintain the water quality necessary to support healthy mussel communities.

Zoning, stormwater mitigation ordinances, and natural resource protection ordinances are resources available to municipalities for waterway protection. Reducing the effects of urbanization through control of quantity and quality of stormwater will also help protect these habitats. As long lived filter feeding species, mussels store pollutants and chemicals from the water column in their body tissues. Even small amounts of these pollutants in the water can accumulate over time and become concentrated in the mussel tissue, potentially in lethal concentrations.

Dams are among the greatest threats to the persistence of native mussel fauna due to the changes they cause in water quality and flow patterns. Mussels cannot avoid these changes in their habitat since they are not capable of far-ranging dispersal. Not only do dams alter the flow of river water, changing water conditions and habitat, they also impede the passage of fish. The fish hosts that carry glochidia are the primary dispersal agent for mussel populations. If the fishes are blocked from dispersing, mussel reproduction will become ineffective and the population will eventually die off.

Prevention and management of invasive species is also mandatory to maintain healthy mussel populations in Indiana County. Waterways in the county need to be continually monitored for invasive zebra mussel and Asian clam to understand which populations are most threatened. Boat washing stations and education for boaters and fishermen will help reduce the unintentional spread of these species.

The Fish of Indiana County

Fish are among the most important and interesting animals found in streams and rivers. Many people know about sport fish, such as brook trout and smallmouth bass, but these two species are just small parts of the elaborate ecosystem found in the Commonwealth's flowing waters.

Fish have a diverse diet and most fish are predatory and eat other stream animals such as small invertebrates, other fish, mollusks, crayfish, salamanders, or frogs. The diet of predatory fish changes throughout their life; as young fish, many species will eat algae, plankton, and other small invertebrates. As they grow their prey becomes larger, generally going from microorganisms to invertebrates, and eventually including fish and other vertebrates. There are some species of fish that eat only plant material throughout their lives, like the algae that grows on the rocks on the stream bottom.

Fish mating is called spawning, and many species migrate to specific spawning grounds within the watershed. As such, smaller streams can be important habitat for fish both for the act of spawning and for the development of young fish. Fish often create and guard nests for spawning and egg development. For example, river chubs assemble piles of gravel up to two feet across that are easily seen while walking in streams. Trout make nests called redds which are trough-like depressions in the stream bottom. The orientation of the redd creates currents in the water that supply the eggs with extra oxygen while they develop. Channel catfish lay their eggs in undercut banks, sunken logs, or even abandoned muskrat holes. Sunfish, such as bluegills and redbreast sunfish, create depressions in sand and gravel on the stream bottom. The male stays at the nest; first to guard the developing eggs from predators, and then to defend the young larvae until they are able to fend for themselves.

There are nearly 200 different species of fish that live in Pennsylvania's streams and rivers. One of the rare species that has been documented in Indiana County is the least brook lamprey (*Lampetra aepyptera*), considered threatened in Pennsylvania. Other, more common species found in Indiana's waterways include: bass, bullhead, sucker, dace, sculpin, minnow, shiner, pumpkinseed, bluegill, chub, and trout. Stream size and water temperature typically determine which species of fish will be in any given stream:

- Headwater streams are the smallest streams, and water temperatures are often cold (less than 70°F). The water is fast-moving, well-oxygenated, and usually slightly acidic. These streams often hold *Coldwater Fish Communities*, with species such as brook trout and mottled sculpin.
- Mid-reach streams are slightly warmer (65 to 75°F) and have a mixture of stream habitat types, such as pools, riffles and runs (*runs* are areas of streams where the water is visibly flowing, but the surface is not broken). These streams usually have *Coolwater Stream Fish Communities*, with smallmouth bass, creek chubs and a variety of shiner, sucker and dace species.
- Lower Reaches of streams often have warmer waters (greater than 75°F) and slower flows. Pools and runs become more prominent than riffles. These streams usually have *Warmwater Fish Communities*, with largemouth bass, bluegill, and darter species.
- Large rivers, such as the Allegheny, Ohio, Susquehanna, and Delaware Rivers, usually have warmer, slower waters. When they are dammed, the habitat can be similar to lake conditions since the water is very still. Since large rivers usually flow through well-populated areas, they are often impacted by many pollutants and declines in water quality compared to smaller streams. Rivers may have *Large River Fish Communities* or *River & Impoundment Fish Communities* with fish species such as channel catfish, sauger, freshwater drum, and river redhorse. There are no rivers in Indiana County large enough to support these communities.

Threats and Stresses

A primary threat to freshwater ecosystems is the degradation of the aquatic habitat, occurring from water pollution, sedimentation due to erosion of stream banks or runoff from impervious surfaces, nutrient inputs,

stormwater runoff, removal of riparian vegetation, building of dams and impoundment of water, removal of water for human use, and the introduction of exotic invasive species. In Indiana County, a key threat is alteration of hydrology from mining activities and abandoned mine drainage (AMD), which increases erosion, makes the pH of the stream highly acidic, and increases dissolved metals. Dams and other impoundments may affect the natural passage of fish, as well as reduce the diversity of aquatic habitats available. Impoundments reduce flow and oxygen content, increase water temperature, decrease run and riffle habitat, and create a large amount of pool habitat. Stream and river species are adapted to habitats with stronger flows which have higher oxygen content than pools. Many fish found in flowing waters have a low tolerance for silt, and require high amounts of oxygen; therefore, altering hydrology may reduce their chances for survival.

Table 12: Fish communities determined through the PNHP Aquatic Community Classification (ACC) to be occurring in Indiana County. See Appendix VI for more information on the ACC.

Fish Community	Indicator Species
Ohio Coldwater Community	Brook trout (*Salvelinus fontinalis*) mottled sculpin (*Cottus bairdii*), brown trout (*Salmo trutta*), rainbow trout (*Oncorhynchus mykiss*)
Ohio Coolwater Community – The primary community in Indiana County	Blacknose dace *(Rhinichthys atratulus*), creek chub (*Semotilus atromaculatus*), brown trout (*Salmo trutta*, stocked), white sucker (*Catostomus commersoni*), redside dace (*Clinostomus elongatus*), longnose dace (*Rhinichthys cataractae*), fathead minnow (*Pimephales promelas*), pearl dace (*Margariscus margarita*)
Ohio Warmwater Community	Greenside darter (*Etheostoma blennioides*), northern hogsucker (*Hypentelium nigricans*), river chub (*Nocomis micropogon*), central stoneroller (*Campostoma anomalum*), shiners (*Notropis* spp.), bass (*Micropterus* spp.), darters (*Etheostoma* spp.), logperch (*Percina caprodes*), stonecat (*Noturus flavus*), blackside darter (*Percina maculata*), golden redhorse (*Moxostoma erythrurum*), green sunfish (*Lepomis cyanellus*), streamline chub (*Erimystax dissimilis*), yellow perch (*Perca flavescens*), black red-horse (*Moxostoma duquesnei*), bullhead (*Ameiurus* spp.), grass pickerel (*Esox americanus*), trout perch (*Percopsis omiscomaycus*), Ohio lamprey (*Icthyomyzon bdellium*), and many more.
Atlantic Coldwater Community	Brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), rainbow trout (*Oncorhynchus mykiss*)
Atlantic Coolwater 1 Community	Slimy sculpin (*Cottus cognatus*), stocked brown trout (*Salmo trutta*), fathead minnow (*Pimephales promelas*), pearl dace (*Margariscus margarita*)
Atlantic Coolwater 2 Community	Blacknose dace (*Rhinichthys atratulus*), white sucker (*Catostomus commersoni*), golden shiner (*Notemigonus crysoleucas*)

Conservation Recommendations

Preserving water quality in rivers and streams is important to fish as some species, such as native brook trout and several of the darters, are intolerant of poor water quality and will be readily lost from streams when water quality starts 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. Preserving intact riparian buffers and reducing new development near waterways can keep water quality high.

Another human-caused alteration to fish populations is the stocking of non-native fish such as brown trout, rainbow trout, and some varieties of muskellunge. These fish are introduced for their appeal as sport fish and their capability to thrive in new environments. Unfortunately, their success usually comes at the expense of native fishes. Stocked species are often more aggressive than native species and can outcompete the natives for food and habitat; they may also introduce new parasites and diseases. This leads to losses in biodiversity, as the native fishes are displaced or die. If sport fish stocking must occur, then stocking native fish such as the brook trout is preferable. The Pennsylvania Fish and Boat Commission (PFBC) has jurisdiction of the fish within the Commonwealth. Rules and Regulations on the taking of wildlife can be found through consultation with the PFBC (http://www.fish.state.pa.us/mpag1.htm). For more information on Pennsylvania's fish species, see: http://www.fish.state.pa.us/pafish/fishhtms/chapindx.htm.

Insects of Indiana County

Pennsylvania is home to a great variety of insect species including bees, beetles, dragonflies, damselflies, butterflies, and moths. Many of these insects are beneficial to people, but poorly studied and understood. Two familiar major groups of insects, the *Odonata* (dragonflies and damselflies) and the *Lepidoptera* (butterflies and moths) are discussed below. Conservation recommendations follow the family sections.

Dragonflies and Damselflies of Indiana County

Dragonflies, and the closely related damselflies, are grouped together in a scientific group called *Odonata* (or informally, the odonates). The word *Odonata* comes from the Greek word *odon*, which means tooth. Both the adult and larval odonates possess two sets of jaws armed with serrated, tooth-like edges, and grasping hooks to help them catch and eat their prey.

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. Reductions 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 to destroy or alter habitats so that they are no longer suitable for dragonflies or damselflies, or can only support a few tolerant species.

Jeremy Deeds, PNHP

This adult dragonfly, the dragonhunter (*Hagenius brevistylus*), is emerging from its larval form into its adult life stage. This species begins its life in streams or ponds.

Alteration of hydrology can also lead to odonate declines. For example, poor storm water management can cause unusually large fluctuations in water flow during rain events. Heavy water demand can lead to lower water tables, and decreased flow of water in streams. If natural water flow patterns are altered in the aquatic habitat, habitat qualities such as sedimentation rates, nutrient loading, floodplain area and water depth, hydroperiod, temperature, dissolved oxygen levels, and the types and amounts of vegetation in and around the aquatic habitat can be altered. All of these factors are important in proper development of odonate eggs and larvae.

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 120 species of dragonflies and 55 species of damselflies are known to occur (PABS, 2007).

Table 13 lists dragonfly and damselfly species currently known to occur in Indiana County. No state agency is currently directly responsible for managing odonates. Scientists suspect downward population trends are occurring for many of these species within the State.

Table 13: Odonate species known to occur in Indiana County (PNHP Odonate Database). **Bolded** species are of conservation concern in Pennsylvania.

Common Name (*Scientific Name*)	Common Name (*Scientific Name*)
shadow darner (*Aeshna umbrosa umbrosa)*	eastern pondhawk (*Erythemis simplicicollis*)
common green darner (*Anax junius*)	**spine-crowned clubtail (*Gomphus abbreviatus*)**
great spreadwing (*Archilestes grandis*)	**mustached clubtail** (***Gomphus adelphus*)**
unicorn clubtail (*Arigomphus villosipes*)	**harpoon clubtail (*Gomphus descriptus*)**
springtime darner (*Basiaeschna janata*)	**rapids clubtail (*Gomphus quadricolor*)**
ocellated darner (***Boyeria grafiana***)	**sable clubtail (*Gomphus rogersi*)**
fawn darner (*Boyeria vinosa*)	dusky clubtail (*Gomphus spicatus*)
ebony jewelwing (*Calopteryx maculata*)	Dragonhunter (*Hagenius brevistylus*)
calico pennant (*Celithemis elisa*)	citrine forktail (*Ischnura hastata*)
aurora damsel (*Chromagrion conditum*)	eastern forktail (*Ischnura verticalis*)
tiger spiketail (*Cordulegaster erronea*)	**northern pygmy clubtail (*Lanthus parvulus*)**
twin-spotted spiketail (*Cordulegaster maculata*)	southern pygmy clubtail (*Lanthus vernalis*)
arrowhead spiketail (*Cordulegaster obliqua*)	spotted spreadwing (*Lestes congener*)
stream cruiser (*Didymops transversa*)	common spreadwing (*Lestes disjunctus australis*)
black-shouldered spinyleg (*Dromogomphus spinosus*)	slender spreadwing (*Lestes rectangularis*)
rainbow bluet (*Enallagma antennatum*)	swamp spreadwing (*Lestes vigilax*)
azure bluet (*Enallagma aspersum*)	dot-tailed whiteface (*Leucorrhinia intacta*)
double-striped bluet (*Enallagma basidens*)	widow skimmer (*Libellula luctuosa*)
tule bluet (*Enallagma carunculatum*)	twelve-spotted skimmer (*Libellula pulchella*)
familiar bluet (*Enallagma civile*)	Illinois river cruiser (*Macromia illinoiensis*)
skimming bluet (*Enallagma geminatum*)	blue dasher (*Pachydiplax longipennis*)
orange bluet (*Enallagma signatum)*	eastern amberwing (*Perithemis tenera*)
slender bluet (*Enallagma traviatum*)	common whitetail (*Plathemis lydia*)
vesper bluet (*Enallagma vesperum*)	least clubtail (*Stylogomphus albistylus*)
beaverpond baskettail (*Epitheca canis*)	ruby meadowhawk (*Sympetrum rubicundulum*)
common baskettail (*Epitheca cynosura*)	**band-winged meadowhawk (*Sympetrum semicinctum*)**
Prince baskettail (*Epitheca princeps*)	yellow-legged meadowhawk (*Sympetrum vicinum*)

Butterflies and Moths of Indiana County

Butterflies and moths are grouped together in the insect order called Lepidoptera. This group of insects undergoes a complete metamorphosis, beginning 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 its body to expand. Next, the pupa stage occurs 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 and ranges from a few days to over winter, the adult emerges, the wings dry, and the moth or butterfly takes off on its maiden flight.

Butterflies and moths are closely related insects; they have similar life histories, and they utilize a comparable suite of habitats. Despite this, 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, though there are many day-

Table 14: Butterfly species known to occur in Indiana County (2009 PA Butterfly Atlas). **Bolded** species are of conservation concern in Pennsylvania.

Common name (*Scientific name*)	Common name (*Scientific name*)
Hoary edge (*Achalarus lyciades*)	**Swarthy skipper (*Nastra lherminier*)**
Milbert's tortoiseshell (*Aglais milberti*)	Mourning cloak (*Nymphalis antiopa*)
Pepper and salt skipper (*Amblyscirtes hegon*)	Compton tortoiseshell (*Nymphalis vaualbum jalbum*)
Common roadside skipper (*Amblyscirtes vialis*)	Appalachian tiger swallowtail (*Papilio appalachiensis*)
Delaware skipper (*Anatrytone logan*)	**Giant swallowtail (*Papilio cresphontes*)**
Least skipper (*Ancyloxypha numitor*)	Eastern tiger swallowtail (*Papilio glaucus*)
Tawny emperor (*Asterocampa clyton*)	Black swallowtail (*Papilio polyxenes*)
Pipevine swallowtail (*Battus philenor*)	Spicebush swallowtail (*Papilio troilus*)
Meadow fritillary (*Boloria bellona*)	White M hairstreak (*Parrhasius m-album*)
Juniper hairstreak (*Callophrys grynea*)	Common sootywing (*Pholisora catullus*)
Eastern pine elfin (*Callophrys niphon*)	Pearl crescent (*Phyciodes tharos*)
Summer azure (*Celastrina neglecta*)	Cabbage white (*Pieris rapae*)
Appalachian azure (*Celastrina neglectamajor*)	**West Virginia white (*Pieris virginiensis*)**
Cherry gall azure (*Celastrina serotina*)	Hobomok skipper (*Poanes hobomok*)
Common wood nymph (*Cercyonis pegala*)	Zabulon skipper (*Poanes zabulon*)
Silvery checkerspot (*Chlosyne nycteis*)	Long dash (*Polites mystic*)
Orange sulphur (*Colias eurytheme*)	Crossline skipper (*Polites origenes*)
Clouded sulphur (*Colias philodice*)	Peck's skipper (*Polites peckius*)
Eastern tailed blue (*Cupido comyntas*)	Tawny-edged skipper (*Polites themistocles*)
Monarch (*Danaus plexippus*)	Comma (*Polygonia comma*)
Northern pearly eye (*Enodia anthedon*)	Question mark (*Polygonia interrogationis*)
Silver-spotted skipper (*Epargyreus clarus*)	Little glassywing (*Pompeius verna*)
Wild indigo duskywing (*Erynnis baptisiae*)	Little yellow (*Pyrisitia lisa*)
Sleepy duskywing (*Erynnis brizo*)	**Acadian hairstreak (*Satyrium acadicum*)**
Dreamy duskywing (*Erynnis icelus*)	Banded hairstreak (*Satyrium calanus*)
Juvenal's duskywing (*Erynnis juvenalis*)	Striped hairstreak (*Satyrium liparops*)
Baltimore (*Euphydryas phaeton*)	**Coral hairstreak (*Satyrium titus*)**
Dun skipper (*Euphyes vestris*)	Appalachian brown (*Satyrodes appalachia*)
Zebra swallowtail (*Eurytides marcellus*)	Aphrodite fritillary (*Speyeria aphrodite*)
Harvester (*Feniseca tarquinius*)	Great spangled fritillary (*Speyeria cybele*)
Leonard's skipper (*Hesperia leonardus*)	**Regal fritillary (*Speyeria idalia*)**
Indian skipper (*Hesperia sassacus*)	Gray hairstreak (*Strymon melinus*)
Common buckeye (*Junonia coenia*)	Northern cloudywing (*Thorybes pylades*)
American snout (*Libytheana carinenta*)	European skipper (*Thymelicus lineola*)
Viceroy (*Limenitis archippus*)	Long-tailed skipper (*Urbanus proteus*)
White admiral (*Limenitis arthemis arthemis*)	Red admiral (*Vanessa atalanta*)
Red-spotted purple (*Limenitis arthemis astyanax*)	Painted lady (*Vanessa cardui*)
Bronze copper (*Lycaena hyllus*)	American lady (*Vanessa virginiensis*)
American copper (*Lycaena phlaeas*)	Northern broken dash (*Wallengrenia egeremet*)
Little wood satyr (*Megisto cymela*)	

flying moth exceptions, while butterflies fly during the day. Butterfly pupae have a smooth exterior called a chrysalis, while moth pupae form a cocoon typically wrapped in silky fibers. Many butterflies and moths depend not only on specific habitat, but also on a specific plant species within that habitat, a single host plant.

For example, the monarch butterfly (*Danaus plexippus*) only uses milkweed (*Asclepias* spp.) as its larval food plant. Maintenance of populations of the host plants is vital for the continued success of these insect species.

In North America north of the Mexican border, there are an estimated 13,000 butterfly and moth species (Wagner, 2005). Pennsylvania's varied habitats support a large range of butterflies. Altogether, the state supports around 156 species of butterflies and the closely related skippers, and probably a minimum of 1,200 species of moths (Wright, 2008; PNHP, 2006). A list of known butterfly species in Indiana County is presented in Table 14; too many moth species occur for listing in this report. No state agency is directly responsible for managing butterflies and moths, and scientists suspect downward population trends for many species within the Commonwealth.

Pete Woods, PNHP

the hobomok skipper (*Poanes hobomok*) is one of the common butterflies in Indiana County

One example of a rare butterfly found in Indiana County is the West Virginia white (*Pieris virginiensis*), considered imperiled in Pennsylvania. The West Virginia white is threatened by the invasion of non-native garlic mustard, unmanaged deer populations, and forest fragmentation (NatureServe, 2009). Adults of this species rarely cross non-forested areas, therefore, establishment in new sites, or movement between sites is greatly reduced for this butterfly.

Aquatic Invertebrates

Nearly every stream contains aquatic invertebrates, or *macroinvertebrates*. There are a wide variety of macroinvertebrates, each having different habitat requirements, feeding activities, tolerances to pollution, and responses to changes in water quality and stream characteristics. Freshwater snails, bivalves, and crayfish are aquatic macroinvertebrates that remain in the aquatic habitat during their entire life. Most macroinvertebrates are juvenile stages of insects that utilize terrestrial habitat as adults. For example: mayflies (*Ephemeroptera*), caddisflies (*Trichoptera*), stoneflies (*Plecoptera*), and dragonflies and damselflies (*Odonata*) all spend their larval stage in aquatic habitats such as wetlands or streams before they emerge from the water and transform into a winged adult. Other common aquatic invertebrates include true flies (*Diptera*), beetles (*Coleoptera*), and hellgrammites (*Megaloptera*). Some species are aquatic larvae for a few weeks, while longer-lived species can remain larvae for two to three years. Aquatic macroinvertebrates can feed on algae, diatoms, leaf litter, woody debris, and sometimes other invertebrates.

Freshwater macroinvertebrates are an essential food source for fish, and generally serve as the base of the food web in aquatic systems. Stream macroinvertebrates are also collected the world over to monitor water quality and provide information about stream and watershed health and quality. The Pennsylvania Aquatic Community Classification (ACC) identified twelve types of stream macroinvertebrate communities in the state, in streams which vary in size, habitat type, and water quality. See the ACC reports for more information about macroinvertebrates and aquatic communities in Pennsylvania (Walsh et al. 2007; http://www.naturalheritage.state.pa.us/aquaticsIntro.aspx).

General Conservation Recommendations for Insects

The specific habitat requirements of most non-pest insects are not well understood. Protecting habitats where species of concern currently occur is a first step towards ensuring their long term survival. Alteration and destruction of habitat is the greatest threat to populations of these groups of insects.

When conserving Odonata and Lepidoptera species, three major criteria should be covered that are unique to these taxa:

1. **Protect the specific habitat required for each stage of the lifecycle (egg, larvae, pupae, adult) for the species of concern.** Most research has focused on the larval habitat and food plants of dragonflies, damselflies, butterflies, and moths. This makes sense because of the more sedentary nature of the larvae compared to the adult, and the tighter association of larvae to specific habitat requirements. Adults are also associated with the larval habitat during mating and egg laying, but there is limited understanding of the adult's habitat for perching and upland feeding areas.
2. **Maintain the balance that is necessary between predators and their prey.** Larval and adult odonates feed on other insects that share their habitat such as mosquitoes, midges, gnats, and other flies. This helps to control many pest species; however, chemical control may have unintended effects on these species. Pest control can also severely reduce populations of butterflies and moths. For example, insecticides, such as *Bacillus thuringiensis (*Bt) and diflubenzuron (Dimilin) used for the control of gypsy moths and protection of timber resources may affect populations of native butterflies and moths miles from the spray location. Timing of spraying, conditions acceptable for application, and the size of spray blocks must be adjusted to protect native populations. Most populations are vulnerable to changes in the distribution and abundance of their host plants, and mowing or spraying while eggs or larvae are on the plants can extirpate local populations.
3. **Protect the species and their habitat within healthy functioning ecosystems.** Landscape scale conservation of aquatic, meadow, and forested habitats is needed for the preservation of these insect groups. Reduced use of pesticides for lawn care and landscaping can help improve the water quality and reduce native insect mortality.

Pete Woods, PNHP

Great spangled fritillaries nectaring on ironweed.

Summary and Conservation Planning Application for Indiana County's Animals

Indiana County is highly diverse in terms of the habitats available to the Commonwealth's species. Here, as in many portions of the state, ecosystems necessary for the survival of many species are fragmented into small blocks. Land development, drainage of wetland areas and environmental degradation, and splitting of habitats by impassable barriers such as roads and highways have confined many animal species to very localized populations. This reduces their ability to survive major changes in food resources, availability of nesting habitat, or increased predation. These populations are left susceptible to what is termed localized extinction. If enough of these populations disappear from the landscape, the persistence of these species in Pennsylvania may be in jeopardy.

Development of extensive agricultural, urban, and suburban areas can make it difficult for animals to move long distances across this unsuitable habitat. Large obstacles, such as highways and developed areas, are hard to navigate for odonate species which 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 they will not be able to find suitable habitat at the end of their journey in the fragmented landscape created by development. The inability of odonates to move between sites isolates the gene pool collectively held by that group of animals. When animals cannot move between populations, inbreeding takes place; 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, increasing the chances that the population will not be able to survive over the long-term.

Pennsylvania's State Wildlife Action Plan (SWAP)

In 2001, the U.S. Congress asked each state to develop a wildlife action plan, known technically as a comprehensive wildlife conservation strategy. These plans examine the health of wildlife and prescribe actions to conserve wildlife and vital habitat before they become more rare and more costly to protect Pennsylvania's wildlife action plan presents strategies and priorities at the species, habitat, and community levels so that diverse stakeholders can find meaningful recommendations for their scale and scope of interest.

The goal of the State Wildlife Action Plan (SWAP) is to preserve Pennsylvania's native wildlife and habitats through proactive measures emphasizing voluntary and incentive-based programs. The SWAP is a non-regulatory effort designed to create partnerships, to identify needs and to implement actions at state and local levels through its presentation as a statewide overview of the integrated efforts needed to sustain wildlife and habitat.

http://www.wildlifeactionplans.org/pennsylvania.html

Please contact the appropriate jurisdictional agency (i.e. Pennsylvania Game Commission or the Pennsylvania Fish and Boat Commission) for information about the management of these species.

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 (BDAs and LCAs), as well as Pennsylvania Audubon's Important Bird Areas (IBAs), Important Mammal Areas (IMAs), and Outstanding Geologic Features are included in the report.

Biological Diversity Areas (BDAs)

BDAs are areas containing plants or animals of special concern at state or federal levels, exemplary natural communities, or exceptional native diversity. BDAs include both the immediate habitat and the surrounding lands important in the support of these special elements, and 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 Landscape*** areas maintain vital ecological processes or secondary habitat that may be able to accommodate some types of low impact activities.

Landscape Conservation Areas (LCAs)

LCAs are large contiguous areas that are important because of their size, open space, habitats, and/or inclusion of one or more BDAs. Although an area designated as an LCA can incorporate lands with a variety of land uses, LCAs typically have not been heavily disturbed, and thus retain much of their 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 preserve these landscape functions by limiting the overall amount of land converted to other uses, thereby minimizing fragmentation of these areas.

Important Bird Areas (IBAs)

Audubon Pennsylvania administers the state's IBA program, and defines an IBA as "a site that is part of a global network of places recognized for their outstanding value to bird conservation" (Audubon Pennsylvania, 2008). An IBA can be large or small, public or private and must meet one of several criteria developed by the Ornithological Technical Committee of the Pennsylvania Biological Survey detailed at http://pa.audubon.org/iba/. These criteria include areas where large concentrations of birds congregate, sites utilized by special concern, threatened, or endangered birds, habitats which are unique or representative, or lands where long-term avian research occurs. Planning for these areas should consider how best to maintain their value as bird habitat. The value of some large scale IBAs may be due to the forest interior habitat contained within them, while natural communities that have a particular habitat value for birds (such as wetlands) are typically the basis for small scale IBAs. A high degree of protection should be given to these sites, and conservation plans are in the process of being completed for all IBAs in the state.

Important Mammal Areas (IMAs)

The Important Mammal Areas Project is being carried out by a diverse alliance of sportsmen, conservation organizations, wildlife professionals, and scientists. Areas nominated must fulfill at least one of five criteria developed by the Mammal Technical Committee of the Pennsylvania Biological Survey (http://www.pawildlife.org/imap.htm). Criteria are similar to those used for IBAs, and include areas utilized by special concern, threatened, or endangered mammals, habitats which are unique, or lands important for public education. Planning for these areas should consider how best to maintain their value as mammal habitat. Stewardship plans are in the process of being completed for all IMAs in the state.

Outstanding Scenic Geologic Features

These include those areas that illustrate regional geologic processes, landforms, or scenery and are those that are recognized as outstanding in Pennsylvania by Geyer and Bolles (1979; 1987). These sites are not included in the Natural Heritage Areas, but are important natural history features in the county. These geologic sites may be of interest for preservation due to their unique historic value, and often offer good opportunities for onsite natural history education. Suncliff and Conemaugh Gorge are outstanding scenic geologic features which are discussed under the appropriate townships later in the Results section.

METHODS

County inventories have been completed for sixty-five of Pennsylvania's sixty-seven counties to date. The methods used in the Indiana County Natural Heritage Inventory followed established Pennsylvania Natural Heritage Program procedures, which are based on those used by Davis et al. (1990) and Reese et al. (1988). Natural Heritage Inventories proceed in four 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

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 Indiana County (see Appendix IV for a table of these rare species and tracked communities in Indiana County). Local citizens knowledgeable about the flora and fauna of Indiana County were contacted for site suggestions. Individuals from academic institutions and state and federal agencies that steward natural resources (Pennsylvania Game Commission, Pennsylvania Bureau of Forestry, Carnegie Museum of Natural History, etc.) were also contacted to obtain information about lands or resources they manage. National Wetland Inventory (NWI) data, compiled by the U.S. Fish and Wildlife Service, were 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. Initial study of aerial photos revealed large scale natural features (contiguous forest, wetlands) and disturbances (utility line rights-of-way, surface mines, timbered areas). Once preliminary site selection was completed, reconnaissance flights over chosen areas of the county were undertaken. Information concerning extent, quality, and context within the landscape can be gathered easily from the air. Interesting geological features, riparian areas, wetlands, and contiguous blocks of forest were of primary interest during flyovers in Indiana County. Based on the aerial photo interpretation and aerial surveys, some sites were eliminated from consideration because they were highly disturbed, fragmented, lacked the targeted natural feature, or were purely human-made features (such as impoundments, clearings, or farm fields).

Ground Surveys

Areas identified as inventory sites were scheduled for ground surveys. Ecologists conducted field surveys throughout Indiana County from 2004 through 2006. 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. Boundaries for each site were drawn on USGS 1:24,000 topographic maps. 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. Photo documentation was taken when possible. 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 was not obtained, or if enough 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 fieldwork were combined with prior existing data and summarized. Plant and animal nomenclature used in this report follows that adopted by the

Pennsylvania Biological Survey, and natural community descriptions primarily follow Fike's 1999 classification document. All sites with rare species and/or natural communities were selected for inclusion in Biological Diversity Areas (BDAs). Spatial data on the element of concern were then compiled in a GIS format using ESRI ArcGIS 9.2 software. Boundaries defining *core* habitat and *supporting* natural landscape 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 (slope, aspect, hydrology), ecological factors (species composition, disturbance regime), and jurisdictional governmental agency input. BDA 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 migratory waterfowl and the other does not. The Natural Heritage Areas were then assigned a significance rank based on their importance to the biological diversity and ecological integrity of Indiana County (Table 15). These ranks can be used to help prioritize future conservation efforts.

Landscape Conservations Areas (LCAs) were designated around landscape features and landscape-scale ecological processes that function as a linking element for an aggregation of BDAs.

Table 15: Biological Diversity Area (BDA) significance rank definitions

Rank	Description
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 rare natural community types 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 rate as areas with high potential for protecting ecological resources in the county because they are large and/or relatively undisturbed. Sites of high significance merit strong protection.
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 of lower state and federal rank (not as imperiled over their range), are of smaller size and extent than exceptional or high ranked areas, or are compromised in quality by land use activity or disturbance. Sites of notable significance merit protection within the context of their quality and their 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. Sites of local significance merit countywide protection when possible.

RESULTS

The preparation of this report has resulted in the identification of forty-eight Biological Diversity Areas (BDAs) and two Landscape Conservation Areas (LCAs). Additional information on two Important Bird Areas (IBAs), and two scenic geologic features of importance are also presented. These are discussed in turn, beginning with larger, landscape level conservation areas followed by the discussion of Biological Diversity Areas.

Most species of concern mentioned in this report are described by name. The Pennsylvania Natural Heritage Program believes that making this information freely available is in the 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), while others are very sensitive to disturbance by well-meaning visitors. Naming such a species in this report could negatively impact the preservation of the species. The decision to withhold a name is made on a species by species basis by the jurisdictional agencies, and if the species is unable to be named it is referred to in this report simply as a *species of concern.* The Department of Conservation and Natural Resources (DCNR) is responsible for all state and federally 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 and federally listed terrestrial birds and mammals. At the request of these agencies, the names of a small set of sensitive species have been removed from this report.

Landscape-scale Conservation

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 invasive species; and 6) alteration of the chemical environment. LCAs are identified to illustrate the large, contiguous natural areas in Indiana County where major fragmenting features do not exist.

Forest Fragmentation

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 8a; Goodrich et al., 2003; Myers et al., 2000). Figure 8b shows the division 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-way, all-terrain vehicle trails, snowmobile trails, railroads, and patches of non-forested lands. Figure 8c 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.

Roads

Roads, wide trails, and grass corridors can also function as barriers restricting the movements of certain invertebrates and amphibians. Populations of microhabitat specific species, like land snails and salamanders that generally require moist habitats, may be isolated by inhospitable, dry corridors (Williams, 1995; Blaustein et al., 1994). Roads can be a significant source of mortality for a variety of animals. Amphibians may be especially vulnerable to road-kill because their life histories often involve inconspicuous individuals migrating between wetland and upland habitats. One study conducted in southeastern Pennsylvania

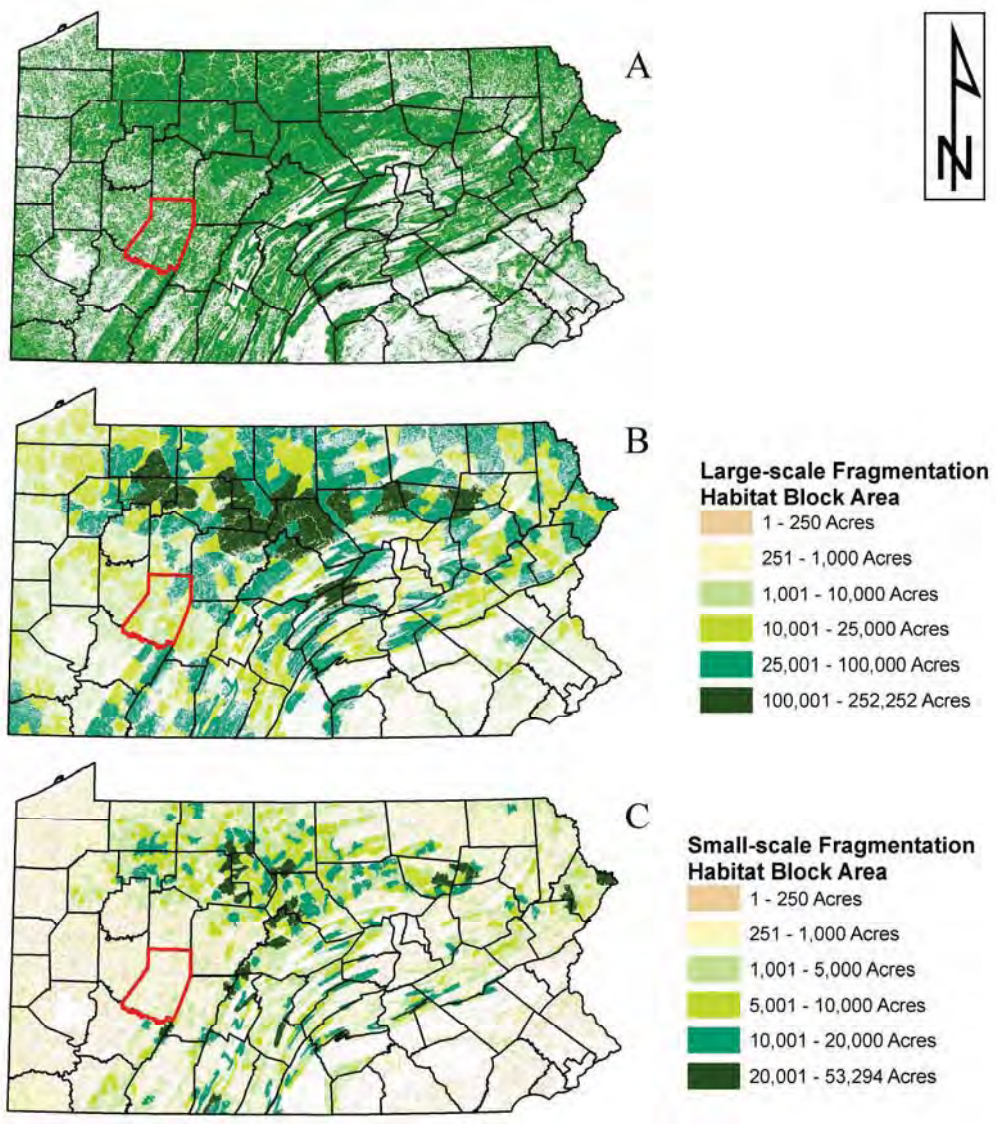


Figure 8. Pennsylvania forest blocks. Forest and wetland areas of Pennsylvania are shown at varying scales of fragmentation due to human-created linear landscape features (Indiana County outlined). **A**. Forest and wetland areas in Pennsylvania derived from the National Land Cover Data Set for Pennsylvania (USGS 2001). **B**. Forest and wetland areas greater than one acre, fragmented by interstate, US, and state highways. Roads of this magnitude function as a barrier to all animals. These habitat blocks represent potential contiguous habitat for animals relatively insensitive to smaller-scale fragmenting features, such as black bear and white-tailed deer. **C**. Forest and wetland areas greater than one acre, fragmented by interstate, US, and state highways, state and local roads, public forest roads, and active railroads. These habitat blocks represent potential contiguous habitat for animals sensitive to all scales of fragmenting features, such as forest interior birds and amphibians.

documented over 100 road-killed salamanders and frogs on a single one-mile stretch of road on one rainy night during 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). Bobcat (*Lynx rufus*) road-kills reported in Pennsylvania between 1985 and 2000 totaled 637 (Goodrich et al., 2003).

Animals may alter their behavior in the presence of a road. One study found that small forest mammals (such as the eastern chipmunk, the eastern gray squirrel, and the deer mouse) were reluctant to venture onto road surfaces where the distance between forest margins exceeded 65.6 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).

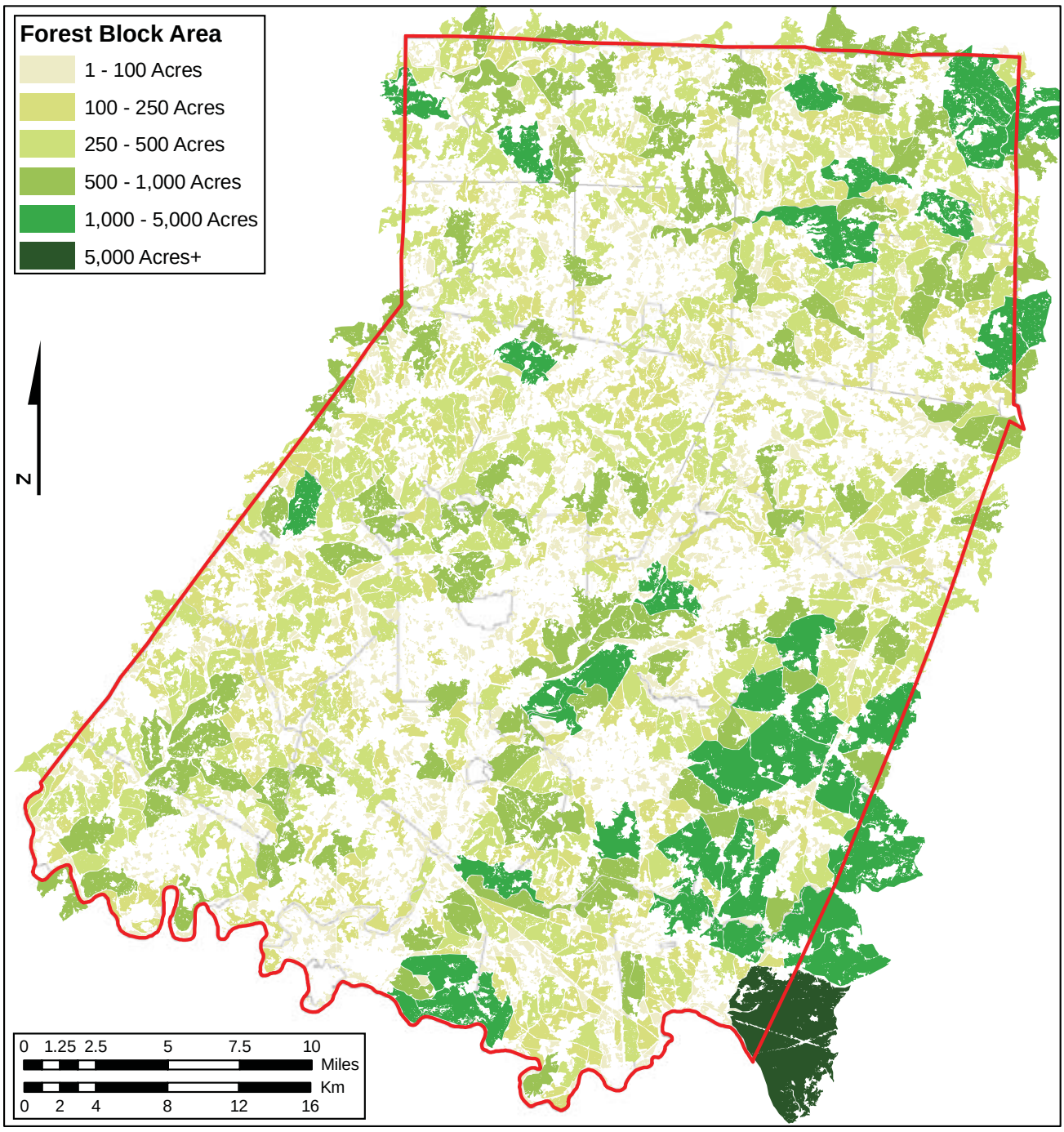


Figure 9: Forest blocks of Indiana County.

Traffic noise has been shown to interfere with songbird vocal communication, which affects their territorial behavior and their mating success (Seiler, 2001). Some forest butterflies, such as the West Virginia white (*Pieris virginiensis*), will not cross open habitats; 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 reduced breeding success, which may ultimately result in local extinctions (Seiler, 2001).

Using Forest Patches in Land Use Planning

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 land cover 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 prevent natural disturbances, such as windthrows of trees, from affecting 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 stepping 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. Used together, they form the basis of the coarse-filter/fine-filter approach to conservation.

Fragmentation of contiguous forested landscapes into smaller, isolated tracts has an effect on plant and animal distribution and community composition. When a large piece of forest tract is fragmented, or split into pieces, the resulting forest islands may lack some of the habitats 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, et al., 1995). Area-sensitive species such as the northern goshawk (*Accipiter gentilis*), barred owl (*Strix varia*), bobcat, and timber rattlesnake (*Crotalus horridus*) require interior forest areas in excess of 6,000 acres (2,428 hectares) to accommodate breeding and foraging territories (Ciszek, 2002; Mazur and James, 2000; Squires and Reynolds, 1997).

Edge forest is composed of a zone of altered microclimate and contrasting community structure distinct from the interior or core forest (Matlack, 1993). Along with a reduction in total forested area, forest fragmentation creates a suite of *edge effects* which can extend around 1,000 feet (300 meters) into the remaining fragment (Forman and Deblinger, 2000). *Edge effects* include increased light intensity, reduced depth of the leaf-litter layer, altered plant and insect abundance, reduced numbers of macroinvertebrates, and fewer species of macroinvertebrates (Haskell, 2000; Watkins et al., 2003; Yahner, 1995). The macroinvertebrates in the leaf litter are significant for the pivotal role they play in energy and nutrient cycling; these macroinvertebrates also provide prey for salamanders and ground-feeding birds (Voshell, 2002). Additionally, a number of studies have shown that the nesting success of forest-interior songbirds is lower near forest edges than in the interior due to increased densities of nest predators and brooding parasites.

Not only do roads act to fragment forests, but roads can also act as corridors for invasive plant dispersal and toxic chemicals, and pollute nearby aquatic systems (Forman and Alexander, 1998; Trombulak and Frissell, 2000; Watkins et al., 2003; Williams, 1995). Vehicles and road construction operations transport exotic plant seeds into previously un-infested areas, while road construction and maintenance operations provide sites for seed germination and seedling establishment (Schmidt, 1989; Trombulak and Frissell, 2000). Road traffic and maintenance of rights-of-way also contribute at least six different kinds 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, invertebrates, and vertebrates up to 656 feet (200 meters) from roads (Trombulak and Frissell, 2000). Deicing salts alter the soil's chemical composition (including the pH), 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 almost 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 results in the transport of nutrients and sediments into aquatic ecosystems, particularly where roads abut or cross water bodies. Drifting or misapplied herbicides applied to roadsides and utility rights-of-ways to control woody plant growth may damage forest edge and interior plant species (Williams, 1995).

Humans 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 created by utility corridors, or disturbance-adapted plants that colonize roadsides; however, as is more often the case, species with specific habitat requirements suffer declines 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 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 disturbances regimes. Additionally, large forested areas also serve to filter and regulate the flows of streams within watersheds and store large quantities of carbon as biomass.

Landscape Conservation Areas

LCAs are large contiguous areas that are important because of their 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. These LCAs can be viewed as regional assets; they improve quality of life by providing a landscape imbued with 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 preserve these landscape functions by limiting the overall amount of land converted to other uses, thereby minimizing fragmentation of these areas. Because of their size, ownership is typically divided among many entities: individual, corporate, and public (Table 16). Site descriptions and conservation recommendations are presented below. Both of Indiana County's LCAs were drawn around high-quality aquatic systems.

Table 16. Ownership of lands within Landscape Conservation Areas (LCAs).

Landscape Conservation Area	Total Area (acres)	Private Ownership (%)	Public Ownership (%)		
			State Game Land	**State Parks**	**Federal**
Little Mahoning Creek	73045	92.3	6.0	0.0	1.6
Little Yellow Creek	33651	90.5	1.5	8.0	0.0

Little Mahoning Creek LCA

Little Mahoning Creek LCA includes the whole watershed of Little Mahoning Creek. The lower portion of Little Mahoning Creek is in the flood zone for the Mahoning Creek Lake flood control project, and is occasionally inundated. Upstream of this area, Little Mahoning Creek is free-flowing. This LCA includes the following BDAs:

Little Mahoning Creek - Lower BDA (page 181)
Little Mahoning Creek - Upper BDA (page 153)
Little Mahoning Creek at Nashville BDA (page 139)
Mahoning Creek BDA, in part (page 182)
Mudlick Run BDA (page 154)
Nashville Swamp BDA (page 105)
Rochester Mills BDA (page 106)

Little Yellow Creek LCA

Little Yellow Creek LCA includes the watershed of Little Yellow Creek, and the watershed of Yellow Creek above the dam at Yellow Creek Lake. This LCA includes the following BDAs:

Dragonfly Pond BDA (page 86)
Little Yellow Creek BDA (page 86)
Suncliff BDA (page 86)
Yellow Creek BDA (page 117)
Yellow Creek State Park – Fields BDA (page 89)
Yellow Creek State Park – Woods BDA (page 118)
Yellow Creek State Park Lake BDA (page 89)
Yellow Creek State Park Uplands BDA (page 89)

Threats and Stresses for Watershed-based Landscape Conservation Areas

Maintaining suitable stream habitat is essential in order to protect all aquatic species occurring within aquatic Landscape Conservation Areas. Their success depends upon high water quality, the regulation of water temperature provided by forest cover, and the input of detritus and other organic material from the surrounding forest. If forest cover is substantially reduced within the watershed, water quality is likely to

decline from increased sediment loads. Removal of forest cover on steep slopes is especially problematic because of the potential for increased runoff and erosion following storm events.

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 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. The necessary increases in infrastructure related to increased development could catch municipalities unprepared.

Conservation Recommendations for Watershed-based Landscape Conservation Areas

Long-term, comprehensive planning in watersheds should take place to protect these resources. Incentives and educational programs to encourage all land owners to provide riparian buffers and adopt best management practices (BMPs) has the potential to greatly reduce inputs of nutrients and other contaminants into the aquatic system.

Watershed Conservation Plans

With funding from the DCNR, Watershed Conservation Plans (also known as 'Rivers Conservation Plans') are almost complete for all of Indiana County. Specific plans are listed below:

- Cowanshannock Creek Watershed Rivers Conservation Plan – a small portion of the headwaters of this creek is located with the county.
- Kiski-Conemaugh River Basin Conservation Plan – completed by Kiski-Conemaugh River Basin Alliance
- Lower Mahoning Creek Regional Watershed Conservation Plan – currently being developed by the Western Pennsylvania Conservancy.
- Mahoning Creek Watershed Conservation Plan – completed in 1998 by Jefferson County
- Upper Crooked Creek Watershed Conservation Plan – completed by Mackin Engineering in 2001, this plan covers a small portion of the county.
- Upper West Branch Susquehanna River Conservation Plan – completed in 2001 by the Cambria County Conservation and Recreation Authority, it includes the northeast portion of Indiana County.

More information about these plans can be found at: http://www.dcnr.state.pa.us/brc/rivers/riversconservation/

The county and its municipalities need to incorporate protection strategies into comprehensive plans and regulations. Careful monitoring and enforcement of regulations for activities on waterways and their tributary streams will be important to the protection and recovery of stream ecosystems throughout the county. Watershed conservation plans are being developed by private and public organizations. Local and county government should work with residents to develop a vision that protects water quality while meeting the needs of people living within the watershed.

Invasive species should also be controlled within LCAs. Control methods can range from hand pulling, to mechanical methods (e.g. mowing) to herbicides and pesticides. Chemical control should only be performed by individuals with proper training and licensing by 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. Each invasive species present on a site may require a different technique or suite of techniques for effective control. Specific control methods are detailed by many organizations, some can be found at: http://www.invasive.org/eastern/.

Important Bird Areas of Indiana 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: where large concentrations of birds congregate, sites utilized by special concern, threatened, or endangered birds, habitats which are unique or representative, or lands where long-term avian research occurs. Planning for these areas should consider how best to maintain their value as bird habitat. The value of some large scale IBAs may be due to the forest interior habitat contained within them, while natural communities that have a particular habitat value for birds (such as wetlands) are typically the basis for small scale IBAs. A high degree of protection should be given to these sites, and conservation plans are in the process of being completed for all IBAs in the state. More information on the IBA program is available from the Pennsylvania Chapter of the National Audubon Society (717-213-6880; http://pa.audubon.org/iba/).

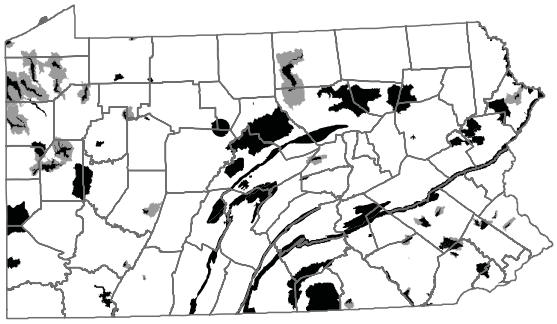


Figure 10: Important Bird Areas in Pennsylvania. Areas denoted in gray indicate conservation areas that are important for bird conservation.

Indiana County contains the Yellow Creek State Park IBA in Brush Valley and Cherryhill Townships; features described below pertain to the entire IBA and are not necessarily confined to the county.

Note: the following information is adapted from the Audubon Society of Pennsylvania IBA site descriptions (Audubon, 2008).

Yellow Creek State Park

Yellow Creek State Park is located in east-central Indiana County. At the heart of Yellow Creek State Park is Yellow Creek Lake, a 720-acre recreational lake. There is marsh habitat along the lake and the forested areas surrounding it are mixed woodlands with dense understory. The park is much like others in the Pennsylvania State Park system. Recreational opportunities are available including boating, swimming, picnicking, fishing, and hiking.

Several areas of the park are nesting areas for solitary vireo, Louisiana waterthrush, and hooded warbler. Other species observed at this site include: American coot, Canada goose, American wigeon, bufflehead, horned grebe, ring-necked duck, redhead, hooded merganser, black duck, Canada warbler, American bittern, Virginia rail, sora, common moorhen, common goldeneye, tree swallow, belted kingfisher, marsh wren, horned lark, American pipit, swamp sparrow, green heron and brown creeper.

The Todd Bird Club has kept records for this site and has recorded over 243 species of birds, including 28 species of waterfowl, 35 warblers, and numerous shore birds. The club also leads frequent bird hikes in the park. A large bird-blind is located for viewing of waterfowl. Yellow Creek State Park operates a nature center that is open from Memorial Day to Labor Day.

Important Mammal Areas of Indiana 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 mammal species of conservation concern. This process begins with the nomination of a site that is then reviewed by the Mammal Technical Committee of the Pennsylvania Biological Survey (http://www.pawildlife.org/imap.htm) to determine if there is a need to protect the habitat for mammals. Areas nominated must fulfill at least one of five criteria developed by the Mammal Technical Committee. Criteria are similar to those used for IBAs, and include areas utilized by special concern, threatened, or endangered mammals, habitats which are unique, or lands important for public education. 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. Planning for these areas should consider how best to maintain their value as mammal habitat. Stewardship plans are in the process of being completed for all IMAs in the state.

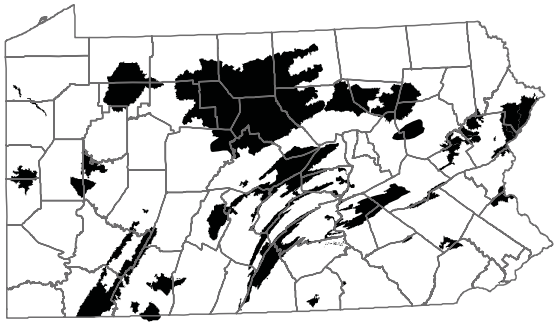


Figure 11: Important Mammal Areas in Pennsylvania. Areas denoted in gray indicate conservation areas that are important for mammal conservation.

Indiana County contains the Yellow Creek State Park IMA and part of the Chestnut Ridge / Laurel Ridge IMA. The descriptions below features described below pertain to the entire IBA and are not necessarily confined to the county.

Note: the following information is adapted from the IMA site descriptions (Mammal Technical Committee, 2011).

Yellow Creek State Park IMA

This area qualifies as an IMA for two reasons: (1) it includes wild populations of mammals that can be viewed in their natural habitat, and (2) it is a natural area with an established environmental education program that interprets natural history of resident mammals.

Located along SR 422 in Indiana County, this site includes a lake surrounded by abandoned farmlands, rolling hills, and a steep-sided valley that encompass substantial habitat diversity. Dominated by deciduous, coniferous, and mixed woodlands, it includes old fields, mature forest, marsh, hemlock-rhododendron streamside vegetation, and some swampy areas.

A variety of common mammals inhabit the Park, as well as some that are uncommon or with restricted distributions in the region (e.g. northern myotis, southern bog lemming, fox squirrel). Long-term studies of small mammals have been ongoing since 1984. Although the Park mammal list includes the Allegheny woodrat, this species has not been recorded and is unlikely to occur. The site is designated as an IMA for its educational programs on native mammals.

Park lands are managed to maintain some early successional habitats. Yellow Creek Lake is a major wintering area for migratory waterfowl and the Park has IBA designation (IBA #23). Among special concern bird species recorded are American bittern, osprey, great egret, and sedge wren. Although

surrounded by a conservation zone that provides a buffer against development adjoining Park boundaries, owners of mineral rights within this zone can challenge restrictions on mining.

Chestnut Ridge / Laurel Ridge IMA

This area qualifies as an IMA for the following reasons: (1) it supports significant populations of species or subspecies with specific habitat requirements, (2) it sustains a confirmed viable local population of a Species of Greatest Conservation Need and the species or subspecies regularly occurs at the site during one or more seasons, (3) it includes wild populations of mammals that can be viewed in their natural habitat, and (4) the site is a natural area associated with an established educational program that interprets natural history of resident mammals

These ridges are the dominant features of the Laurel Highlands Area of southwestern PA. Steep and heavily forested by deciduous trees, this area includes a variety of other general riparian and upland habitats, as well as caves and rocky areas. Focal sites within this IMA are Carnegie Museum of Natural History's Powdermill Biological Station, Roaring Run area of Forbes State Forest, Ohiopyle State Park, and Strangford Cave area along the Conemaugh River. Several state game lands and state parks are located within the area.

Unusual or special concern mammals known to occur on this IMA include the least shrew, pygmy shrew, West Virginia water shrew, long-tailed shrew, eastern small-footed myotis, northern myotis, Indiana myotis, Appalachian cottontail, Allegheny woodrat, northern river otter, bobcat, and least weasel. The Youghiogheny River has been a northern river otter reintroduction site. These ridges both support fairly well-connected Allegheny woodrat populations. The area includes Powdermill Biological Station, which provides ongoing educational programs on mammals as well as being a long-term monitoring site for small mammals.

Excessive logging in the past has left lasting detrimental effects, although recovery is underway. Although parts of the area are fully protected, ongoing habitat threats include encroachment due to development extending up from the adjoining valleys and increasing numbers of vacation homes in this public-private lands mosaic.

Outstanding Scenic Geologic Features

Outstanding Scenic Geologic Features include unique or exemplary outcrops, scenic views, or other geologically significant features that together represent the geologic diversity of the Commonwealth. The DCNR Bureau of Topographic and Geologic Survey maintains an inventory of unique geologic features of significance within the Commonwealth (Geyer and Bolles, 1979; Geyer and Bolles, 1987). In Indiana County, these features are erosional remnants. These features, Conemaugh Gorge, Conemaugh Water Gap, and Suncliff, are discussed within their respective townships.

RESULTS BY MUNICIPALITY: BIOLOGICAL DIVERSITY AREAS

An overview map of Indiana County's Natural Heritage Areas is presented in Figure 1 (page v) a table of the Natural Heritage Areas, organized by significance level, follows (Table 1, page vii). Detailed maps and descriptions of Indiana County's Natural Heritage Areas are presented here, organized by township. For each township, a map, a summary table, and a full report are provided. Biological Diversity Areas (BDAs), Landscape Conservation Areas (LCAs), and Managed Lands are indicated on the municipality maps. Managed Lands are public properties typically established and managed to a large extent for natural resources in order to maintain or enhance important ecological assets. Examples include state game lands (SGL), state forests, and state parks. Townships are arranged alphabetically; boroughs are included with the appropriate township due to their small size.

Biological Diversity Areas (BDAs) are areas containing plants or animals of conservation 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, and are mapped according to their sensitivity to human activities. Each BDA includes the following specific information:

- A categorical designation of a site's relative significance is listed after the site name. Definitions of the significance categories are presented in Table 15 (page 54).
- Listed under each site name are any 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 (such as collection or poaching) are referred to only as *species of concern* rather than by their species name. These species are designated as sensitive by the jurisdictional agency that oversees their conservation (see the introductory paragraph at the beginning of the *Results* section above for a more thorough discussion of jurisdictional agencies in PA). In some cases species are not mapped because of their sensitivity to habitat disturbance. This is to ensure the protection of the plant or animal from illegal or destructive collecting or abuse.
  - The rarity ranks and current legal status are listed for each community and species (for a detailed rank discussion see Appendix II, pg. 223).
  - See Terrestrial and Palustrine Plant Communities of Pennsylvania (Fike, 1999) for more information on Natural Communities recognized in Pennsylvania. This book can be downloaded from: http://www.naturalheritage.state.pa.us/fikebook.aspx.
- The text that follows each table discusses the natural qualities of the site and includes descriptions, potential threats, and recommendations for protection.

Armstrong Township and Shelocta Borough

	Taxa[1]	PNHP Rank[2] Global	State	Legal Status[2] State (Proposed)	Last Seen	Quality[2]
NATURAL HERITAGE AREAS:						
Anthony Run BDA			*Notable Significance*			
species of concern[3]	-	-	-	-	2007	E
Curry Run BDA			*Notable Significance*			
species of concern[3]	-	-	-	-	2007	E
Porter Floodplain BDA			*Local Significance*			

LANDSCAPE CONSERVATION AREAS: None

PUBLICLY MANAGED LAND: None

OTHER CONSERVATION AREAS: None known

GEOLOGIC FEATURES: None

[1] A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionid (Mussel)
[2] Please refer to Appendix II (pg. 223) for an explanation of PNHP ranks and legal status
[3] This species is not named by request of the jurisdictional agency

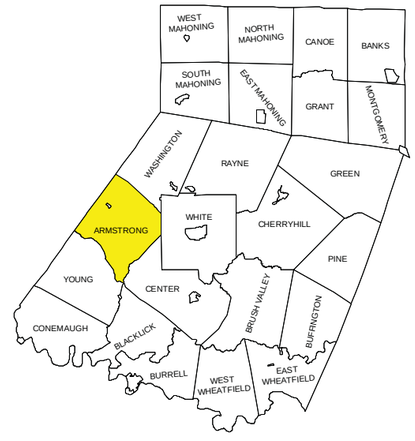
Indiana County
Natural Heritage Inventory

ArmstrongTownship
& Shelocta Borough

Biological Diversity Areas
Anthony Run BDA
Curry Run BDA
Porter Floodplain BDA

Landscape Conservation Areas
None Currently Identified

State Public Land
None



Elderton
Creekside
Fulton Run
Idaho
Shelocta
Curry Run BDA
Porter Floodplain BDA
Anthony Run BDA
Crooked Creek
Cheese Run
Mitchell Run
Curry Run
Wolf Run
South Bend
Gobblers Run
Parkwood
Claypoole Heights
WEST PIKE RD
Getty Heights
Shado-Wood Village
Muddy Run
Blacklegs Creek
West Lebanon
J M Junction
Crete
Reeds Run
Trail Run
Edgewood
Elders Ridge
McIntyre
Aultman
Iselin
Coal Run
422
156
1000
1200
1400
1600

0 0.5 1 2 Kilometers
0 0.5 1 2 Miles

N

Legend

Biological Diversity Area (BDA)
- Core
- Supporting Landscape

Landscape Conservation Area (LCA)

- **PA Bureau of Forestry**
- **PA Game Commission**
- **National Wetland Inventory**
- **Streams**
- **40 Ft. Contour Line**

PNHP
Pennsylvania Natural Heritage Program

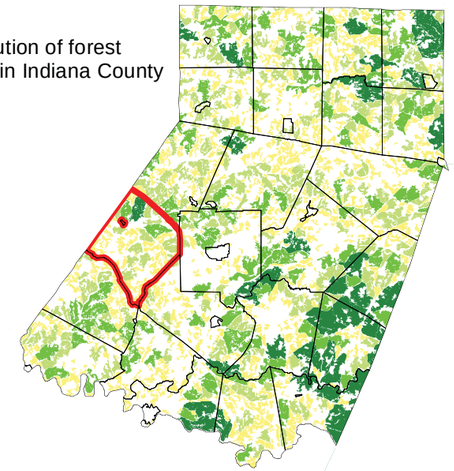
Indiana County
Natural Heritage Inventory

ArmstrongTownship
& Shelocta Borough

Much of the native biodiversity of the township can be maintained by providing undisturbed forested buffers along streams, and avoiding fragmentation of the largest forest blocks with additional roads or utility infrastructure. These general landscape features help provide the habitat necessary to keep common species common. In addition, reforestation of creek and stream banks can help link larger forested blocks together, contributing to their utility as natural wildlife corridors while significantly improving regional water quality.

Riparian buffers through forested areas should be considered priorities for conservation. Riparian buffers through non-forested habitatsshould be considered priorities for restoration.

Distribution of forest blocks in Indiana County



Legend

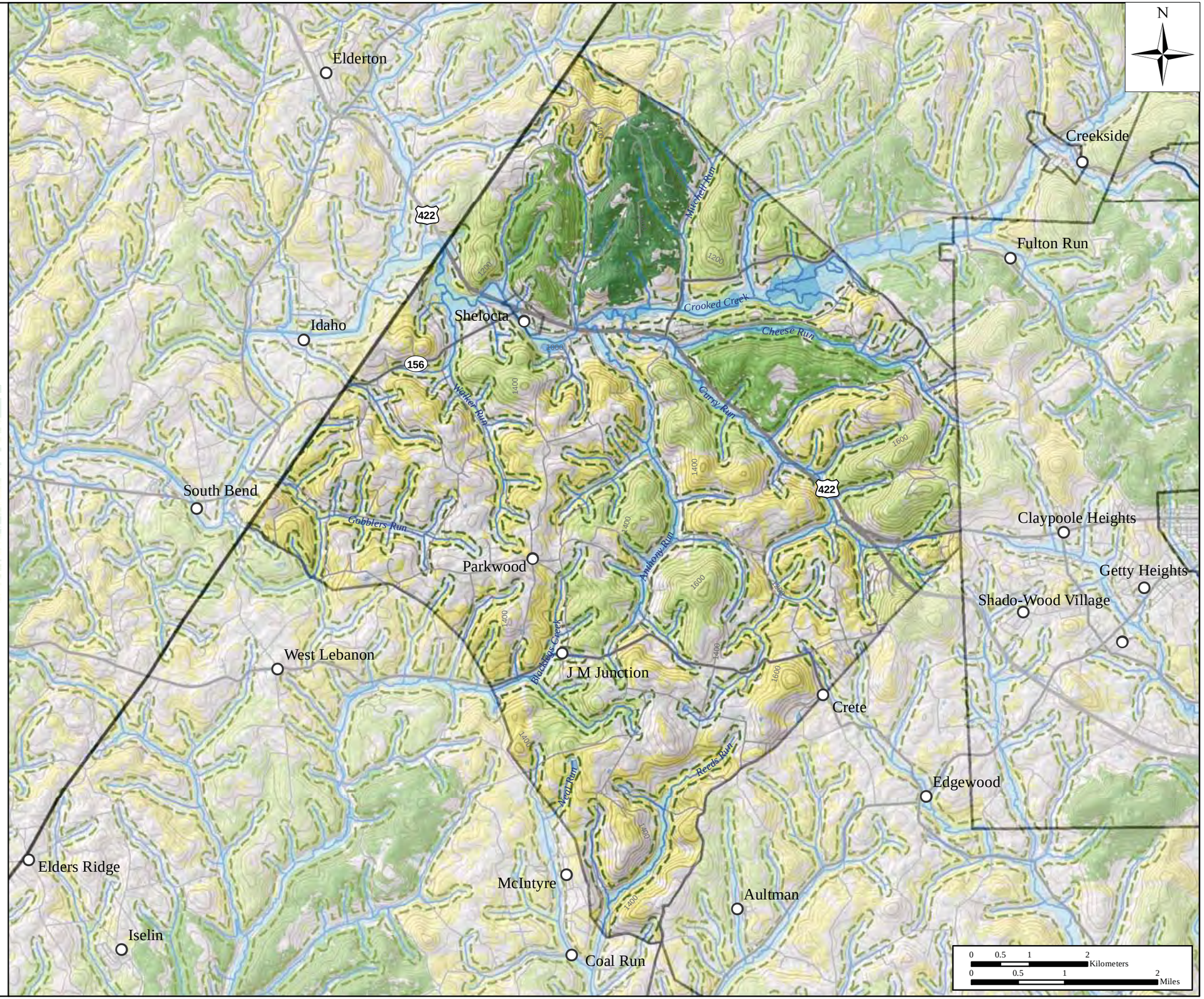
- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre

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

- PA Bureau of Forestry
- PA Game Lands
- 40 Ft. Contour Line

Pennsylvania Natural Heritage Program



Armstrong Township and Shelocta Borough

Armstrong Township is located along the western boundary of Indiana County and borders with Armstrong County. The township is part of the Pittsburgh Low Plateau Section of the Appalachian Plateau Province with a bedrock geology made up of shale and sandstone. Forested areas make up 73 percent of the land use while 26 percent is agricultural. The largest forest blocks are in the northern and northeastern portions of the township. Crooked Creek and its tributaries are the major waterways flowing through the township. Unfortunately much of Crooked Creek lacks a riparian buffer and is affected by abandoned mine drainage.

SHELOCTA BOROUGH

Shelocta is the only borough within the township. Approximately half (52 percent) of the borough is forested, 32 percent is developed, and 16 percent is in agriculture.

Anthony Run BDA

This site supports a population of **a species of concern**, which is not named at the request of the jurisdictional agency overseeing its protection. It relies on clean, clear creeks of small to moderate size, with both sandy/pebbly stretches with flowing water as well as still, muddy backwaters.

Threats and Stresses

The primary threat to this species is the degradation of the aquatic habitat that supports it through detrimental land use choices. Land use choices that change water temperature, increase inputs of sediments and nutrients, or modify the timing and amount of river flow are likely to adversely affect the species of concern.

Conservation Recommendations

To maintain this site a watershed-wide approach is necessary. Throughout the watershed a 100 meter no-cut buffer should be implemented on all streams to minimize nutrient and sediment inputs, maintain the shade to minimize thermal loading (sun heating of the water), and provide for the natural yearly input of leaves that maintain the food chain. Additionally, special care should be given to prevent the input of chemicals from abandoned mine drainage and other mining operations

Curry Run BDA

This site supports a population of **a species of concern**, which is not named at the request of the jurisdictional agency overseeing its protection. It relies on clean, clear creeks of small to moderate size, with both sandy/pebbly stretches with flowing water as well as still, muddy backwaters.

Threats and Stresses

The primary threat to this species is the degradation of the aquatic habitat that supports it through detrimental land use choices. Land use choices that change water temperature, increase inputs of sediments and nutrients, or modify the timing and amount of river flow are likely to adversely affect the species of concern.

Conservation Recommendations

To maintain this site a watershed-wide approach is necessary. Throughout the watershed a 100 meter no-cut buffer should be implemented on all streams to minimize nutrient and sediment inputs, maintain the shade to minimize thermal loading (sun heating of the water), and provide for the natural yearly input of leaves that maintain the food chain. Additionally, special care should be given to prevent the input of chemicals from abandoned mine drainage and other mining operations.

Porter Floodplain BDA

This site is designated along a forested floodplain of Crooked Creek south of a seldom-used railroad line. Dominant tree species include black maple (*Acer nigrum*), American sycamore (*Platanus occidentalis*) and silver maple (*Acer saccharinum*). Several temporary pools are scattered throughout the floodplain. While no species of special concern were noted within this BDA, high quality examples of this community type are relatively uncommon in Pennsylvania.

Threats and Stresses

As with many sites located along streams and rivers, invasive species are a significant risk. Many of these species are transported by flood events along the creek.

Conservation Recommendations

The majority of the Commonwealth's forested floodplains (of all types and sizes) have been farmed, flooded, or developed so the few remaining examples have become critically important pieces of the landscape.

Banks Township and Glen Campbell Borough

	Taxa[1]	PNHP Rank[2] Global	PNHP Rank[2] State	Legal Status[2] State (Proposed)	Last Seen	Quality[2]
NATURAL HERITAGE AREAS:						
Bear Run BDA			*Notable Significance*			
northern pygmy clubtail (*Lanthus parvulus*)	O	G4	S3S4	N	2007	E
ocellated darner (*Boyeria grafiana*)	O	G5	S3	N	2007	E
Glen Campbell BDA			*Notable Significance*			
species of concern[3]	-	-	-	-	2004	E
Johnsonburg BDA						
species of concern[3]	-	-	-	-	2007	E

LANDSCAPE CONSERVATION AREAS: Little Mahoning Creek

PUBLICLY MANAGED LAND: Hemlock Lake County Park
State Game Land #174

OTHER CONSERVATION AREAS: None known

GEOLOGIC FEATURES: None

[1] A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionid (Mussel)
[2] Please refer to Appendix II (pg. 223) for an explanation of PNHP ranks and legal status
[3] This species is not named by request of the jurisdictional agency

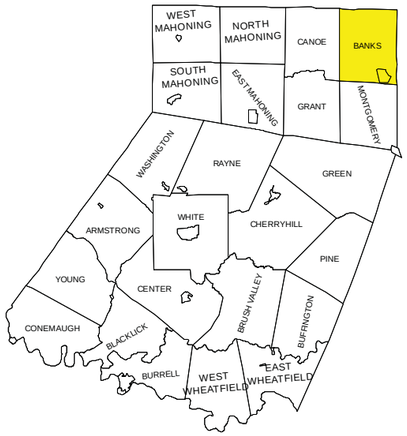
Indiana County
Natural Heritage Inventory

Banks Township
& Glen Campbell Borough

Biological Diversity Areas
Bear Run BDA
Glen Campbell BDA

Landscape Conservation Areas
Little Mahoning Creek LCA

State Public Land
State Game Land #174
State Game Land #262



Legend

Biological Diversity Area (BDA)
- Core
- Supporting Landscape

Landscape Conservation Area (LCA)

- **PA Bureau of Forestry**
- **PA Game Commission**
- **National Wetland Inventory**
- **Streams**
- **40 Ft. Contour Line**

Pennsylvania Natural Heritage Program

0 0.25 0.5 1 1.5 Kilometers
0 0.25 0.5 1 1.5 Miles

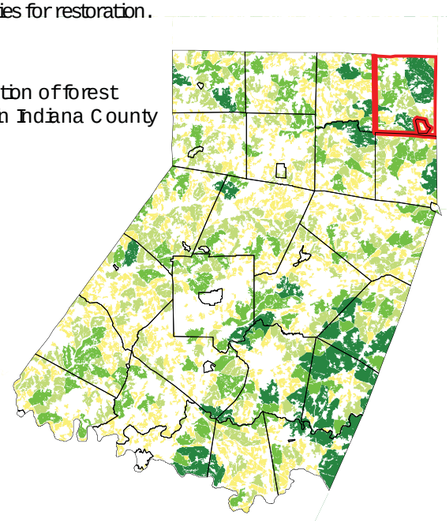
Indiana County Natural Heritage Inventory

Banks Township & Glen Campbell Borough

Much of the native biodiversity of the township can be maintained by providing undisturbed forested buffers along streams, and avoiding fragmentation of the largest forest blocks with additional roads or utility infrastructure. These general landscape features help provide the habitat necessary to keep common species common. In addition, reforestation of creek and stream banks can help link larger forested blocks together, contributing to their utility as natural wildlife corridors while significantly improving regional water quality.

Riparian buffers through forested areas should be considered priorities for conservation. Riparian buffers through non-forested habitats should be considered priorities for restoration.

Distribution of forest blocks in Indiana County



Legend

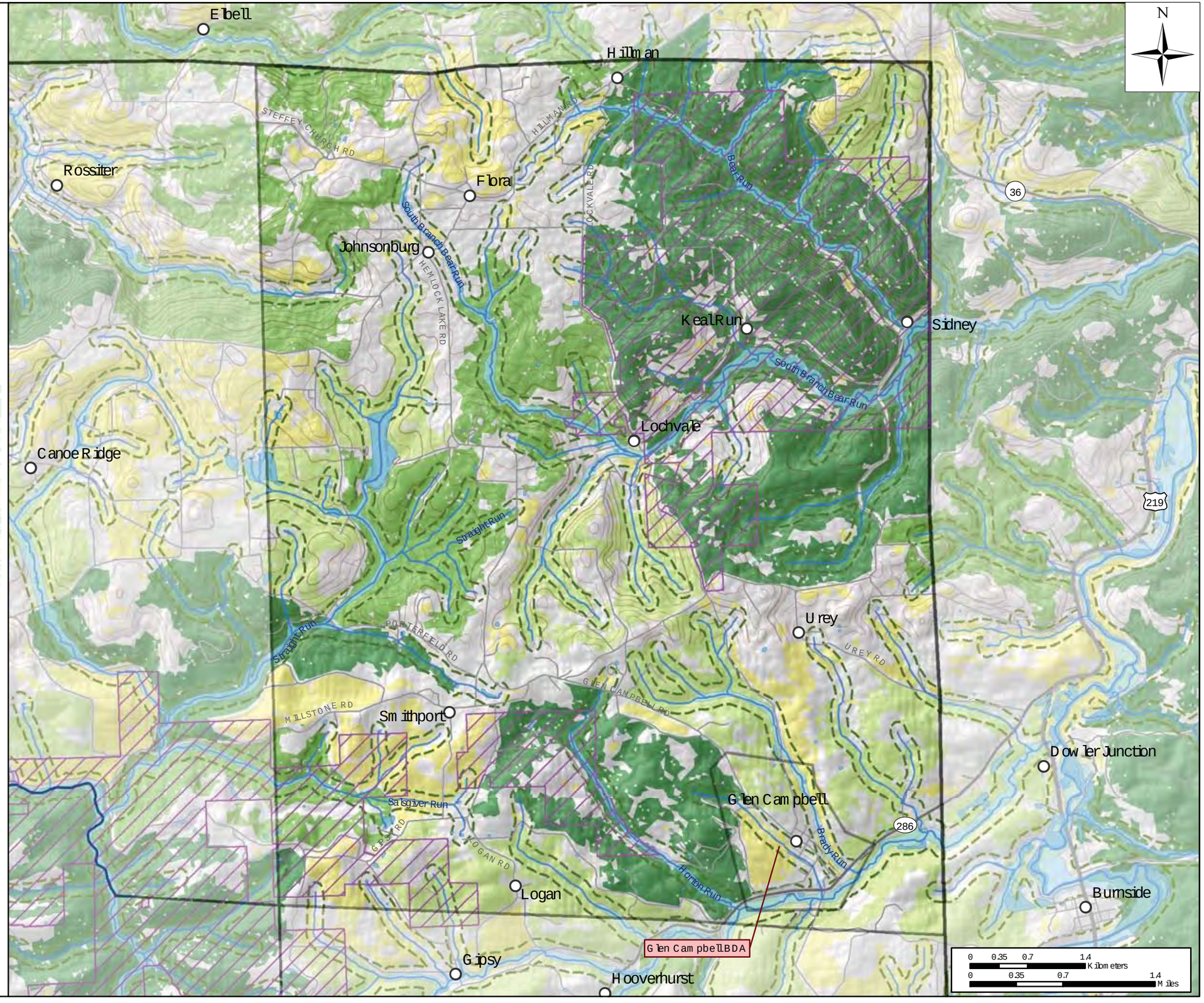
PNHP
Pennsylvania Natural Heritage Program

- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre

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

- PA Bureau of Forestry
- PA Game Lands
- 40 Ft. Contour Line



Banks Township and Glen Campbell Borough

Banks Township is in the northeastern corner of Indiana County sharing a border with Jefferson County to the north and Clearfield County to the east. Both the township and the borough are part of the Pittsburgh Low Plateau Section of the Appalachian Plateau Province with a bedrock geology made up of sandstone and shale. Banks Township is 80 percent forested with agriculture constituting 15 percent of the land use. State Game Land #174 in the northeast contains the largest forested blocks within the township. Another large forest block is located to the west of Glen Campbell Borough. In the eastern half of the township, Bear Run and its tributaries flow east from Banks Township into Clearfield County. Cush Creek also drains eastward and eventually flows into the West Branch of the Susquehanna River. A major divide occurs within the township with waters from the eastern half of the township flowing into the Susquehanna drainage while those in the western portion flow into the Ohio drainage.

GLEN CAMPBELL BOROUGH

The Borough of Glen Campbell is in the southeastern section of the township. Glen Campbell Borough has the highest percent forest cover of any borough in the county. It is 88 percent forested, with 6 percent residential and 4 percent agricultural.

Bear Run BDA

The headwaters of Bear Run originate in the southeastern corner of Jefferson County, flowing southward into Indiana County before it joins with the West Branch of the Susquehanna River in Clearfield County. Two dragonfly species of concern, the **ocellated darner** *(Boyeria grafiana)*, and the **northern pygmy clubtail** (*Lanthus parvulus*), use the northern section of Bear Run as habitat. These three species are considered to be vulnerable in Pennsylvania. At least three other species of dragonflies were found to be breeding in the stream.

Note: This site also appears in the Jefferson County Natural Heritage Inventory (2011).

Betsy Leppo, PNHP

ocellated darner (*Boyeria grafiana*)

Threats and Stresses

These dragonfly species depend upon high water quality, the regulation of water temperature levels provided by forest cover, and the seasonal input of detritus and other organic material supplied from the forest. Excess input of nutrients from human activities in the watershed causes bacterial growth that reduces the oxygen content of the water. Timber harvesting may increase erosion and siltation, and cause a decrease in dissolved oxygen as canopy cover is removed and water temperature rises (Dunkle 2000, NatureServe 2009).

The South Branch of Bear Run is heavily influenced by abandoned mine drainage (AMD) and the water quality of the stream highly degrades where the north branch joins with this section. It is unlikely that either of these dragonflies or much other aquatic life will be found downstream of this point until remediation is completed. Additionally, many gas wells exist within this watershed, which may cause impacts from sedimentation and pollution.

Conservation Recommendations

Ecologists do not completely understand the habitat needs of many of these stream-dwelling dragonflies, especially in regard to the protection of upstream water quality. Therefore, the supporting landscape delineated in this report should be used as a minimum guide; in practice, as much of the aquatic habitat should be protected as possible.

Remediation of the AMD influenced streams downstream of this site and subsequent improvement of the water quality could expand habitat for these and other aquatic species including fish. Best management practices should be used to prevent negative impacts of sedimentation and other effects of roads and gas well development.

Glen Campbell BDA

This site supports **a species of concern,** which is not named at the request of the jurisdictional agency overseeing its protection. This cryptic species is very often missed or overlooked during surveys and is likely somewhat more common on the landscape than indicated by observation alone. However, surveys over the last decade indicate that this species is becoming less common as its preferred habitat, early successional grasslands and shrublands, mature into forestland. Additionally, this species once utilized pasture and hayfields, but changes in agricultural practices have made this habitat less favorable and less available.

Threats and Stresses

Activities that reduce the prey base and available habitat for this species of concern present a challenge to this species. This includes the application of general pesticides and herbicides that reduce populations of insects such as crickets, grasshoppers, and spiders and destroy the vegetative structure that supports this species. Mowing at the wrong time of year may also directly kill this species which does not actively avoid mowing operations.

Conservation Recommendations

Maintaining early succession grassland and shrubland habitat is necessary to maintain this species. However, management activities should only be mechanical in manner and should only be conducted from late fall to early spring when there is the least chance of directly impacting this species.

Johnsonburg BDA

This area of upland forest and fields supports breeding for **a species of concern,** which is not named at the request of the jurisdictional agency overseeing its protection. This species, generally associated with deep forest, actually requires a combination of forested and grassland/scrubland habitats to successfully breed.

Threats and Stresses

This species is susceptible to disturbance, both intentional and unintentional, during the breeding season. Additionally, it requires mature forest next to grassland/shrubland habitat, and if this mix of habitats becomes unavailable it will vacate the area.

Conservation Recommendations

Maintaining a buffer from disturbance during the breeding season is necessary to maintain this species. Additionally, if the mix of mature forest next to grassland and shrubland is lost to logging or succession the species will be lost from the area. Intensification of agriculture in the area could make the habitat unsuitable.

Black Lick Township

	Taxa[1]	PNHP Rank[2] Global	State	Legal Status[2] State (Proposed)	Last Seen	Quality[2]
NATURAL HERITAGE AREAS:						
Aultmans Run BDA			*Notable Significance*			
species of concern[3]	-	-	-	-	2004	E

LANDSCAPE CONSERVATION AREAS: None

PUBLICLY MANAGED LAND: None

OTHER CONSERVATION AREAS: None known

GEOLOGIC FEATURES: None

[1] A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionid (Mussel)
[2] Please refer to Appendix II (pg. 223) for an explanation of PNHP ranks and legal status
[3] This species is not named by request of the jurisdictional agency

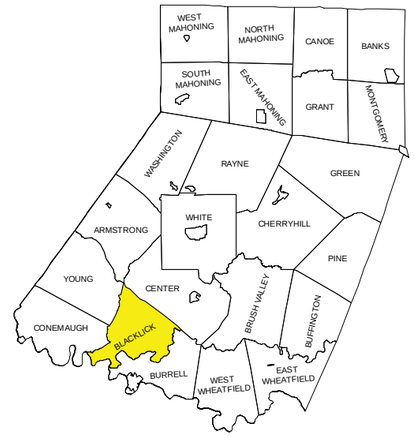
Indiana County
Natural Heritage Inventory

Blacklick Township
& Glen Campbell Borough

Biological Diversity Areas
Aultmans Run BDA

Landscape Conservation Areas
None Currently Identified

State & Federal Public Land
Conemaugh River Lake (USACE)



Aultman
Coal Run
Jacksonville
Smathers
Lewisville
Graceton
Coral
Black Lick
Josephine
Grafton
Palmertown
Campbells Mill
Fairfield Heights
Marshall Heights
Fillmore
Livermore
Smith
Snyder
Aultmans Run BDA
Conemaugh River Lake
286
217
119
CUNKLEMAN RD
GRANGE RD
HILL RD
BLACKLICK RD
THOMPSON RD
Muddy Run
Aultmans Run
Greys Run
Stewart Run
Blacklick Creek
Conemaugh River Lake
1400
1200
1000
N
0 0.25 0.5 1 1.5 Kilometers
0 0.25 0.5 1 1.5 Miles

Legend

Biological Diversity Area (BDA)
- Core
- Supporting Landscape

Landscape Conservation Area (LCA)
- **US Army Corps of Engineers**
- **PA Game Commission**
- **National Wetland Inventory**
- **Streams**
- **40 Ft. Contour Line**

PNHP
Pennsylvania Natural Heritage Program

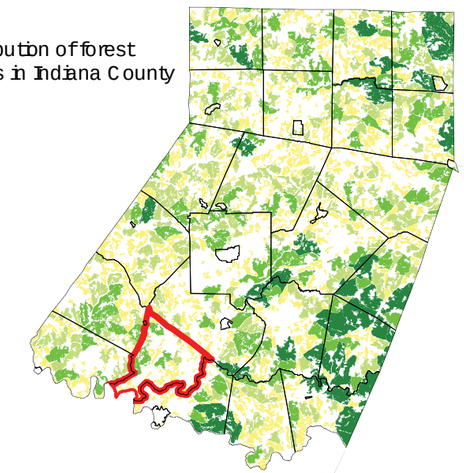
Indiana County
Natural Heritage Inventory

Blacklick Township
& Glen Campbell Borough

Much of the native biodiversity of the township can be maintained by providing undisturbed forested buffers along streams, and avoiding fragmentation of the largest forest blocks with additional roads or utility infrastructure. These general landscape features help provide the habitat necessary to keep common species common. In addition, reforestation of creek and stream banks can help link larger forested blocks together, contributing to their utility as natural wildlife corridors while significantly improving regional water quality.

Riparian buffers through forested areas should be considered priorities for conservation. Riparian buffers through non-forested habitats should be considered priorities for restoration.

Distribution of forest blocks in Indiana County



Legend

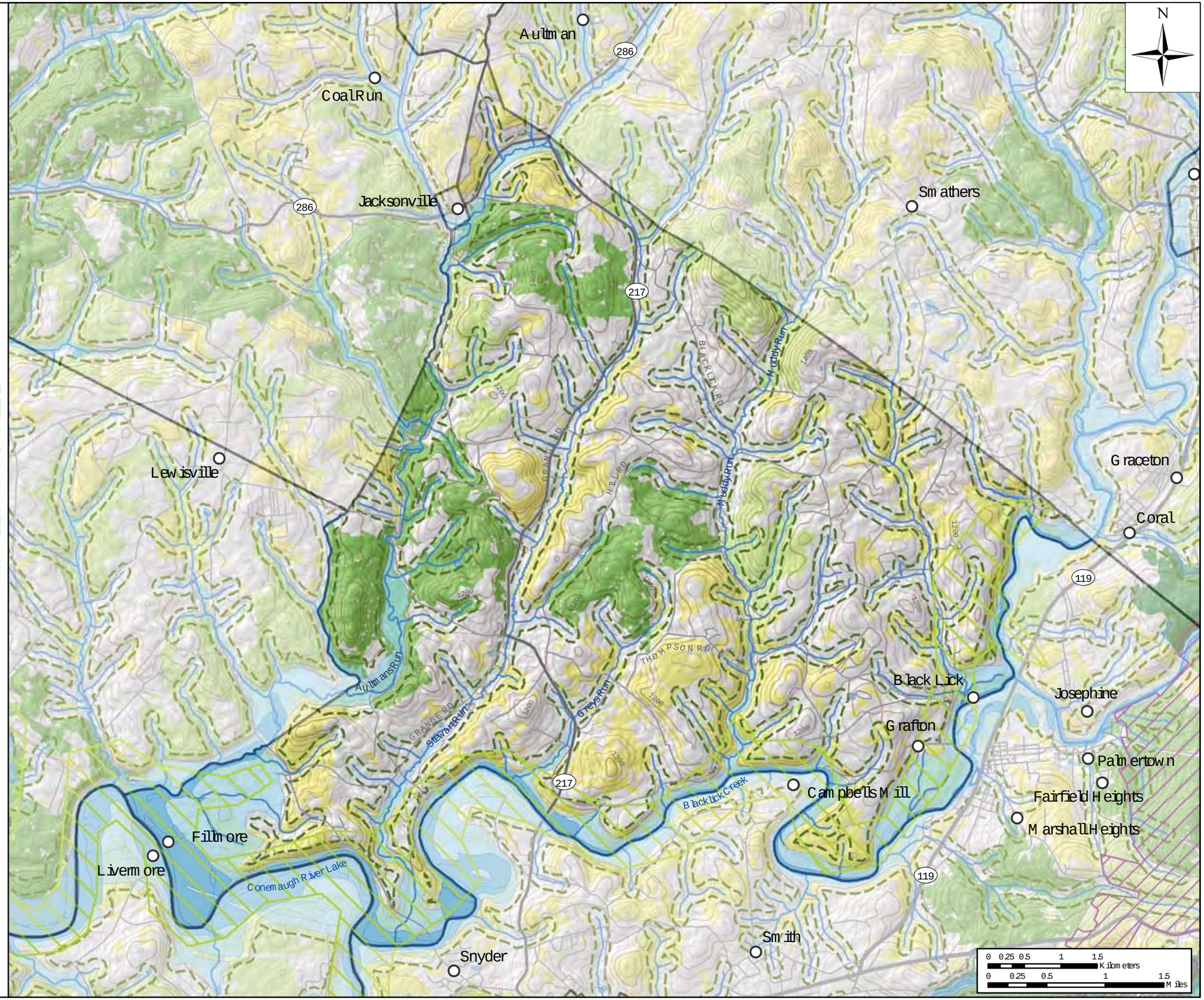
Pennsylvania Natural Heritage Program

- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre

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

- USACE
- PA Bureau of Forestry
- PA Game Lands
- 40 Ft. Contour Line



Black Lick Township

Black Lick Township is one of the southern townships within Indiana County. The Conemaugh River marks its border with Westmoreland County. Black Lick Creek and a short section of Two Lick Creek form the remainder of the southern and eastern boundaries with Burrell Township. Black Lick Township is part of the Pittsburgh Low Plateau Section of the Appalachian Plateau Province with a bedrock geology made up primarily of shale, sandstone, and siltstone. Forested areas comprise 57 percent of the total land use; agriculture makes up 39 percent of the land use. This makes Black Lick Township one of three townships with over a third of the land use devoted to agriculture. The largest forest blocks are along the boundary with Conemaugh and Young Townships. None of them exceeds 600 acres. Three other blocks ranging from 300 to 600 acres can be found in the center of the township. The Conemaugh River and the tributaries that flow into it, would benefit if riparian buffers were established where they are currently absent.

Aultmans Run BDA

This wide, flat floodplain provides important habitat for **a species of concern,** which is not named at the request of the jurisdictional agency overseeing its protection. This species, once common throughout Pennsylvania, has shown a marked decrease in population density. This species favors intact forested riparian habitat with a diverse mix of native vegetation and wetland types.

Threats and Stresses

This species is adversely affected by habitat fragmentation, such as the building of roads, levees, and other development, that results in a barrier of uninhabitable or dangerous habitat between patches of quality habitat. An additional threat posed by habitat fragmentation is that it increases the ease of access for species such as raccoons, skunks, and opossums, which are effective and efficient predators on the young of this species.

Conservation Recommendations

Maintaining a large, intact, undeveloped, and unfragmented forested floodplain with native vegetation is critical for this species. The majority of the Commonwealth's forested floodplains (of all types and sizes) have been farmed, flooded, or developed so the few remaining examples have become critically important pieces of the landscape for this species.

Brush Valley Township

	Taxa[1]	PNHP Rank[2] Global	PNHP Rank[2] State	Legal Status[2] State (Proposed)	Last Seen	Quality[2]
NATURAL HERITAGE AREAS:						
Brush Creek at Brush Creek Road BDA			*High Significance*			
spine-crowned clubtail (*Gomphus abbreviatus*)	O	G3G4	S2	N	2007	E
northern pygmy clubtail (*Lanthus parvulus*)	O	G5	S3	N	2007	E
Dragonfly Pond BDA			*Local Significance*			
paper pondshell (*Utterbackia imbecillis*)	U	G5	S3S4	CU	2006	A
Little Yellow Creek BDA			*High Significance*			
sable clubtail (*Gomphus rogersi*)	O	G4	S1	N	2007	E
species of concern[3]	-	-	-	-	199?	E
species of concern[3]	-	-	-	-	2003	E
species of concern[3]	-	-	-	-	2005	E
Suncliff BDA			*High Significance*			
West Virginia white (*Pieris virginiensis*)	L	G3G4	S2S3	N	2007	E
species of concern[3]	-	-	-	-	2008	D
Yellow Creek at Route 422 BDA			*Notable Significance*			
ocellated darner (*Boyeria grafiana*)	O	G5	S3	N	2007	E
harpoon clubtail (*Gomphus descriptus*)	O	G4	S1S2	N	2007	E
species of concern[3]	-	-	-	-	2008	E
Yellow Creek State Park BDA - Lake			*High Significance*			
least bittern (*Ixobrychus exilis*)	B	G5	S1B	PE	1985	E
sora (*Porzana carolina*)	B	G5	S3B	CR	2005	E
Virginia rail (*Rallus limicola*)	B	G5	S3B	N	1985	E
Yellow Creek State Park BDA - Uplands			*Notable Significance*			
species of concern[3]	-	-	-	-	1997	E
Yellow Creek State Park – Nature Trail Fields BDA			*Notable Significance*			
featherbells (*Stenanthium gramineum*)	P	G4G5	S1S2	N(TU)	2008	B

LANDSCAPE CONSERVATION AREAS: Little Yellow Creek Watershed

PUBLICLY MANAGED LAND:
State Game Lands #79
State Game Lands #273
State Game Lands #276
Yellow Creek State Park

OTHER CONSERVATION AREAS: None known

GEOLOGIC FEATURES: Suncliff

[1] A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionid (Mussel)
[2] Please refer to Appendix II (pg. 223) for an explanation of PNHP ranks and legal status
[3] This species is not named by request of the jurisdictional agency

Indiana County
Natural Heritage Inventory

Brush Valley Township

Biological Diversity Areas

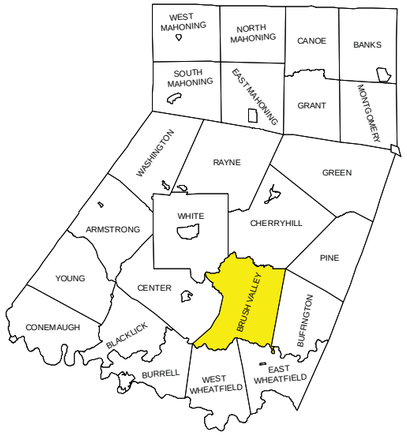
- Brush Creek at Brush Creek Road BDA
- Claghorn BDA
- Dragonfly Pond BDA
- Little Yellow Creek BDA
- Suncliff BDA
- Yellow Creek at Route 422 BDA
- Yellow Creek State Park - Lake BDA
- Yellow Creek State Park - Nature Trail Field BDA
- Yellow Creek State Park - Uplands BDA

Landscape Conservation Areas

- Little Yellow Creek Watershed LCA

State Public Land

- State Game Land #79
- State Game Land #273
- State Game Land #276
- Yellow Creek State Park



Legend

Biological Diversity Area (BDA)

- Core
- Supporting Landscape

Landscape Conservation Area (LCA)

- **PA Bureau of Forestry**
- **PA Game Commission**
- **National Wetland Inventory**
- **Streams**
- **40 Ft. Contour Line**

Pennsylvania Natural Heritage Program

N

0 0.5 1 2 Kilometers

0 0.5 1 2 Miles

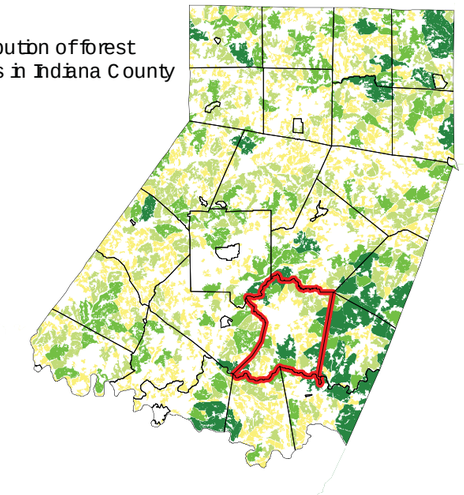
Indiana County Natural Heritage Inventory

Brush Valley Township

Much of the native biodiversity of the township can be maintained by providing undisturbed forested buffers along streams, and avoiding fragmentation of the largest forest blocks with additional roads or utility infrastructure. These general landscape features help provide the habitat necessary to keep common species common. In addition, reforestation of creek and stream banks can help link larger forested blocks together, contributing to their utility as natural wildlife corridors while significantly improving regional water quality.

Riparian buffers through forested areas should be considered priorities for conservation. Riparian buffers through non-forested habitats should be considered priorities for restoration.

Distribution of forest blocks in Indiana County



Legend

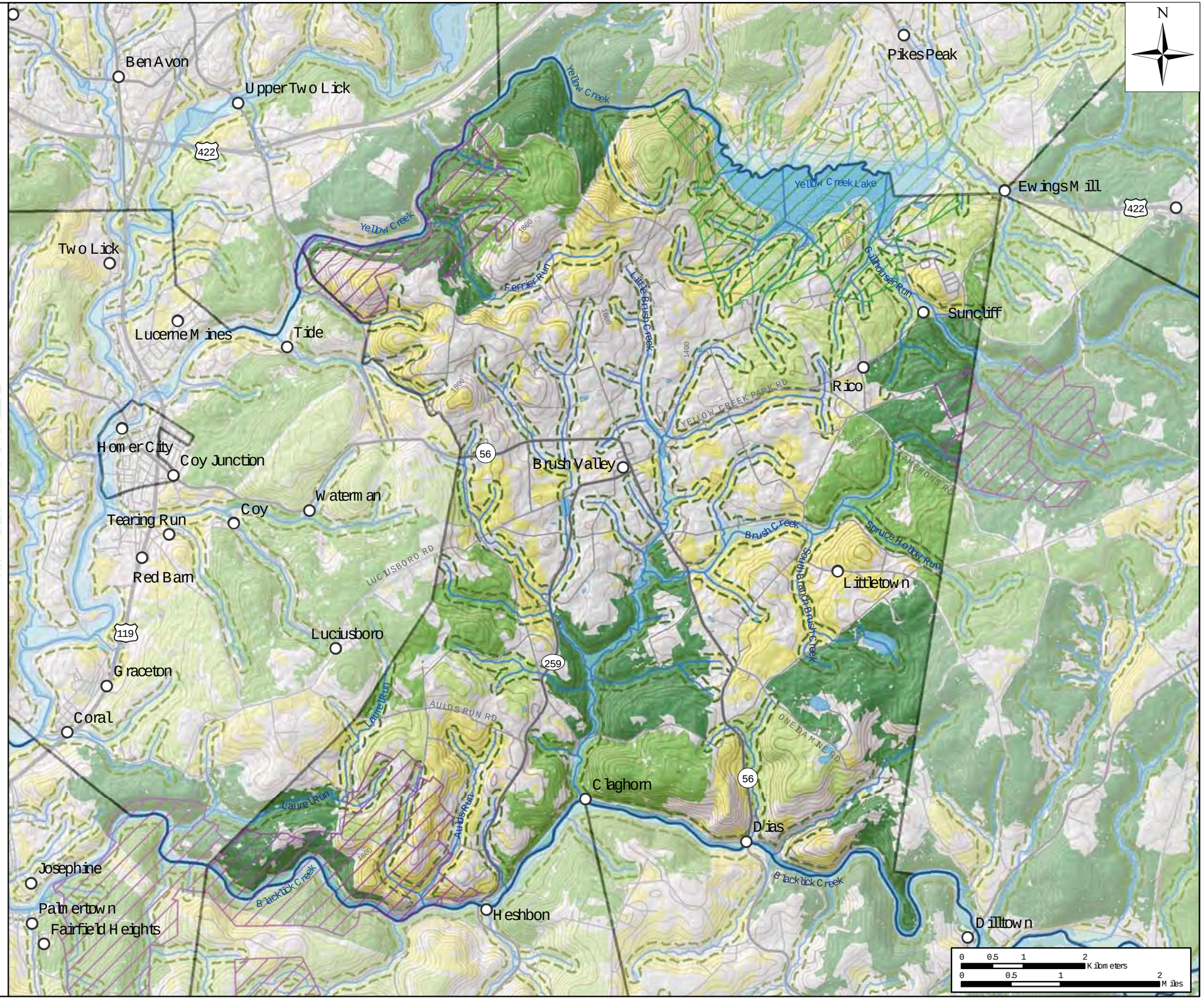
Pennsylvania Natural Heritage Program

- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre

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

- PA Bureau of Forestry
- PA Game Lands
- 40 Ft. Contour Line



Brush Valley Township

Brush Valley Township is part of the Allegheny Mountain Section of the Appalachian Plateau Province with a bedrock geology made up of shale and some sandstone. It is located in the southern half of the county. Forested land use exists in 71 percent of the township. Agricultural areas are in the center of the township and account for 21 percent of the land use; quarries represent an additional 5 percent. Brush Creek and its tributaries drain most of the township. Unfortunately, most of the streams that flow through the agricultural areas do not have riparian buffers. Two state game lands and a state park are in Brush Valley Township. State Game Land (SGL) #273 is in the northwest. SGL #276 is in the southwest corner and extends into parts of Burrell and West Wheatfield Townships. SGL #276 contains the largest forest block in the township. Yellow Creek State Park covers over 3,000 acres of land that straddles the township border with Cherry Hill Township. Yellow Creek State Park is an Important Mammal Area (IMA) as well as an Important Bird Area (IBA). Records exist for over 243 species of birds at this site.

Brush Creek at Brush Creek Road BDA

This section of Brush Creek near its headwaters supports two dragonfly species of concern. The **spine-crowned clubtail** (*Gomphus abbreviatus*) is a globally rare dragonfly of the Appalachians and coastal plains that is at the western edge of its range here. It is found is clean streams and rivers, with sandy, silty, or rocky bottoms. The **northern pygmy clubtail** (*Lanthus parvulus*) is a Pennsylvania-vulnerable species whose larvae live in spring runs and small creeks. At the southern edge of its range in Pennsylvania, it relies on cold, clear water and needs the shade of a canopy to keep water cool.

Ben Coulter

northern pygmy clubtail (*Lanthus parvulus*)

Threats and Stresses

These dragonfly species depends upon high water quality, the regulation of water temperature levels provided by forest cover, and the seasonal input of detritus and other organic material supplied from the forest. Excess input of nutrients from human activities in the watershed causes bacterial growth that reduces the oxygen content of the water. Timber harvesting may increase erosion and siltation, and cause a decrease in dissolved oxygen as canopy cover is removed and water temperature rises (Dunkle 2000, NatureServe 2009).

Conservation Recommendations

Ecologists do not completely understand the habitat needs of many of these stream-dwelling dragonflies, especially in regard to the protection of upstream water quality. Therefore, the supporting landscape delineated in this report should be used as a minimum guide; in practice, as much of the aquatic habitat should be protected as possible.

Dragonfly Pond BDA

This manmade pond supports a population of the **paper pondshell** (*Utterbackia imbecillis*) mussel. Yellow Creek State Park's Environmental Learning Classroom is located to the west of the pond and this site is used for educational efforts.


Alan Cressler
paper pondshell (*Utterbackia imbecillis*)

Threats and Stresses

Potential threats to this site are limited because of its location within protected land. However, improper forestry practices in the area surrounding the pond could result in degraded water quality. Additionally, runoff from the adjacent parking lots, work yard, and maintenance buildings could introduce detrimental compounds to the pond and adversely affect the mussels and other aquatic life.

Conservation Recommendations

As this site is entirely contained within Yellow Creek State Park, it is largely protected from land use conversion. However, any runoff from associated park facilities and other paved surfaces should be mitigated and properly treated before they enter the pond. This will reduce the chances of adversely affecting the aquatic species that the pond supports.

Little Yellow Creek BDA

*The full description of the **Little Yellow Creek BDA** is presented in the Pine Township section on page 159.*

This site supports four species of concern. These species depend on maintaining clear, clean, cold, free-flowing water within the site. This can only be achieved by maintaining an adequate forested buffer along the entirety of the upstream watershed.

Suncliff BDA

This site is based around a large calcareous cliff and floodplain along Little Yellow Creek. Suncliff is a 100-200 foot cliff of alternating shale, sandstone, limestone, minor coals, and clay of the Casselman and Glenshaw formations and is listed as an **outstanding geologic feature** in Pennsylvania (Geyer and Bolles, 1979). The slope beneath the cliff is covered with a loose talus that has eroded from the cliff and slopes down onto the forested floodplain of the Little Yellow Creek.

A sugar maple-basswood forest has developed on the slope beneath the cliff. The most common tree species in this forest is sugar maple (*Acer saccharum*) with scattered individuals of basswood *(Tilia americana*) and red oak (*Quercus rubra*). A diverse layer of wildflowers including blue cohosh (*Caulophyllum thalictroides*), red trillium (*Trillium erectum*), wild geranium (*Geranium maculatum*), liverleaf (*Hepatica nobilis* var*. acuta*), wild ginger (*Asarum canadense)* and spring beauty (*Claytonia virginiana*) is present. The floodplain at the

base of the hill is typical of many intact forested floodplains in western Pennsylvania. Hemlock (*Tsuga canadensis*) and sugar maple are the dominant tree species found here.


PNHP
Suncliff, a large calcareous cliff.

A large population of the **West Virginia white** (*Pieris virginiensis*) butterfly can be found in the rich floodplain. This floodplain forest and the adjacent slope provides habitat for the West Virginia white's two host plants–the two-leaf toothwort (*Cardamine diphylla*) and cut-leaved toothwort (*Cardamine concatenata*). The butterfly eggs are laid on these species and the larva feed upon the leaves of the plants as they develop into adults. Adults can be observed flying from early April to May. The forest is chiefly composed of hemlock (*Tsuga canadensis*), tulip poplar (*Liriodendron tulipifera*), and yellow birch (*Betula alleghaniensis*); a dense herbaceous layer of many spring wildflowers is present. The West Virginia white is considered imperiled in Pennsylvania and is globally vulnerable. Its range extends from Quebec and Wisconsin, and generally south to Alabama. Records exist for this species in most western Pennsylvania counties; it is absent from most of the central and southeastern portions of Pennsylvania.

An additional **species of concern,** which is not named at the request of the jurisdictional agency overseeing its protection, occurs, on the floodplains and lower slopes.

Threats and Stresses


Pete Woods, PNHP
a West Virginia white (*Pieris virginiana*) nectaring on marsh marigold

During the survey, the majority of this site was noted to be free of invasive species, except for the floodplain which was heavily invaded by Japanese stiltgrass (*Microstegium vimineum*). Additionally, there are several patches of other invasives such as Japanese knotweed and garlic mustard that may be invading the site from along Route 259.

One of the primary stresses to the West Virginia white is the decline in its host plants, the two-leaf toothwort and cut-leaved toothwort (NatureServe 2009). Browsing by overabundant deer populations are reducing the numbers of these plants and a host of other native plant species. The other species of concern at this site is also very vulnerable to deer browsing. Additionally, invasion of non-native garlic mustard (*Alliaria petiolata*) into Pennsylvania's forests is choking out toothworts through competition for space. Garlic mustard may also interfere with the ability of this butterfly to successfully lay its eggs on the proper host plants. No garlic mustard was identified on site, but it could become a factor as this site is located near several roads and buildings where its introduction may be likely.

Fragmentation of the forest is an immediate threat to this species since it will not cross open areas, including utility rights-of-way and sunny roads. This species is also sensitive to insecticides, such as those used for

gypsy moth control. This butterfly often does not re-colonize an area after being disturbed through timbering and pesticides impacts.

Large amounts of trash (eg. beverage containers) have been deposited on the forested slope from recreational activities at the top of the slope. While there appears to be limited direct effects on the biodiversity of the site from this, further dumping should be discouraged as it reduces the aesthetics of the site.

Conservation Recommendations

Invasive species control and prevention is the top management recommendation for this site. Preventing further invasion of Japanese knotweed and garlic mustard from the roadside will also protect this site from further degradation. Management of this area should focus on preventing invasion of garlic mustard and other invasive plants, as well as maintaining deer populations at sustainable levels or completely excluding them from the site. Limiting disturbance to the forested area is of primary concern to maintain this population of the West Virginia white. Spraying for gypsy moths within and around this area should be avoided when the larvae and adults are actively using the site.

Any cleanup of the dump site should be conducted outside the growing season to minimize disturbance to the native plant species growing here. This site is a strong candidate for permanent protection.

Yellow Creek at Route 422 BDA

*The full description of the **Yellow Creek at Route 422 BDA** is presented in the White Township section on page 194.*

This site supports **ocellated darner** (*Boyeria grafiana*) and **harpoon clubtail** (*Gomphus descriptus*), two dragonfly species of concern, and one other **species of concern.** These species depends on maintaining the water quality at the site.

Yellow Creek State Park – Lake BDA

The southern shore of the Yellow Creek State Park impoundment provides an extensive area of emergent aquatic vegetation, which supports nesting habitat for three different wetland bird species of concern: **least bittern** (*Ixobrychus exilis*), **sora** (*Porzana carolina*), and **Virginia rail** (*Rallus limicola*). Each of these species utilizes a different portion of the emergent wetland habitat and forages on a different component of the aquatic life supported by the wetland. While it has been a significant period of time since these species were directly observed within these wetlands, this is not surprising given that these birds do not frequent portions of the wetlands where they are easily observable and generally avoid contact with humans.

Threats and Stresses

These bird species are generally disturbance sensitive and become especially so during the breeding season. They are also "area sensitive" in that if the wetland they occupy becomes too small through either succession or hydrologic modification they will abandon it. A final concern is maintaining an acceptably large prey base to support breeding within these wetlands. This may require management of invasive plant species within the wetland to maintain sufficient native biodiversity.

Conservation Recommendations

During the breeding season access to these wetlands should be restricted including access from both the shore and the water. A "no go" buffer of at least 50 meters should be established around the wetland edge to reduce both noise and wake from motorboats and other recreational watercraft that use the impoundment during the summer. Any control of invasive non-native plant species within the wetland should be done, ideally, outside of the breeding season for these species. If management is mandatory during the breeding season it should be done as quickly and strategically as possible by the smallest number of individuals possible.

Mike Baird, bairdphotos.com

a sora (*Porzana carolina*), one of the marsh-nesting birds at this site.

Yellow Creek State Park – Uplands BDA

This patch of upland forest and scrubland supports breeding for a **species of concern,** which is not named at the request of the jurisdictional agency overseeing its protection. This species, generally associated with deep forest, actually requires a combination of forested and scrubland habitats to successfully breed.

Threats and Stresses

This species is susceptible to disturbance, both intentional and unintentional, during the breeding season. Additionally, it requires mature forest next to grassland/shrubland habitat, and if this mix of habitats becomes unavailable it will vacate the area.

Conservation Recommendations

Maintaining a buffer from disturbance during the breeding season is necessary to maintain this species within the park. Additionally, if the mix of mature forest next to grassland and shrubland is lost to logging or succession the species will be lost from the park.

Yellow Creek State Park – Nature Trail Fields BDA

This site is designated around a population of **featherbells** (*Stenanthium gramineum*), a plant species of concern. Featherbells rely on an early successional habitat in moist meadows with reduced grazing pressure from deer and reduced competition from non-native invasive plants.

Threats and Stresses

The species of concern would be especially susceptible to forestry practices within the core habitat. The featherbells are susceptible to grazing from deer, succession to a closed canopy, and competition from non-native invasive plants.

Conservation Recommendations

The site should be monitored for the presence of non-native invasive plants and these should be controlled if they become a problem.

Buffington Township

	Taxa[1]	PNHP Rank[2] Global	State	Legal Status[2] State (Proposed)	Last Seen	Quality[2]
NATURAL HERITAGE AREAS:						
Little Yellow Creek BDA			*High Significance*			
sable clubtail (*Gomphus rogersi*)	O	G4	S1	N	2007	E
species of concern[3]	-	-	-	-	199?	E
species of concern[3]	-	-	-	-	2003	E
species of concern[3]	-	-	-	-	2005	E
Suncliff BDA			*High Significance*			
West Virginia white (*Pieris virginiensis*)	L	G3G4	S2S3	N	2007	E
species of concern[3]	-	-	-	-	2008	D

LANDSCAPE CONSERVATION AREAS: Little Yellow Creek Watershed

PUBLICLY MANAGED LAND: State Game Land #79

OTHER CONSERVATION AREAS: None known

GEOLOGIC FEATURES: Suncliff

[1] A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionid (Mussel)
[2] Please refer to Appendix II (pg. 223) for an explanation of PNHP ranks and legal status
[3] This species is not named by request of the jurisdictional agency

Indiana County
Natural Heritage Inventory

Buffington Township

Biological Diversity Areas

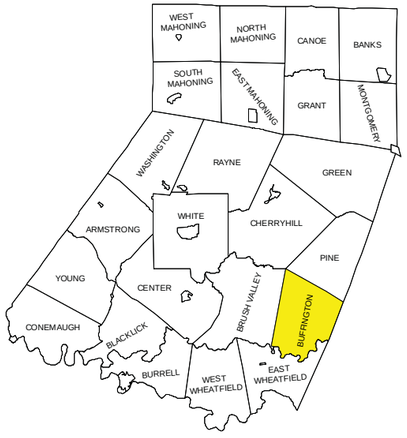
Little Yellow Creek BDA

Landscape Conservation Areas

Little Yellow Creek Watershed LCA

State Public Land

State Game Land #79



Legend

Biological Diversity Area (BDA)

- Core
- Supporting Landscape

Landscape Conservation Area (LCA)

- **PA Bureau of Forestry**
- **PA Game Commission**
- **National Wetland Inventory**
- **Streams**
- **40 Ft. Contour Line**

Pennsylvania Natural Heritage Program

0 0.25 0.5 1 1.5 Kilometers

0 0.25 0.5 1 1.5 Miles

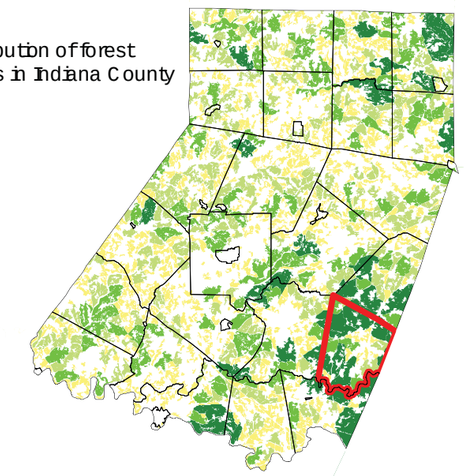
Indiana County Natural Heritage Inventory

Buffington Township

Much of the native biodiversity of the township can be maintained by providing undisturbed forested buffers along streams, and avoiding fragmentation of the largest forest blocks with additional roads or utility infrastructure. These general landscape features help provide the habitat necessary to keep common species common. In addition, reforestation of creek and stream banks can help link larger forested blocks together, contributing to their utility as natural wildlife corridors while significantly improving regional water quality.

Riparian buffers through forested areas should be considered priorities for conservation. Riparian buffers through non-forested habitats should be considered priorities for restoration.

Distribution of forest blocks in Indiana County



Legend

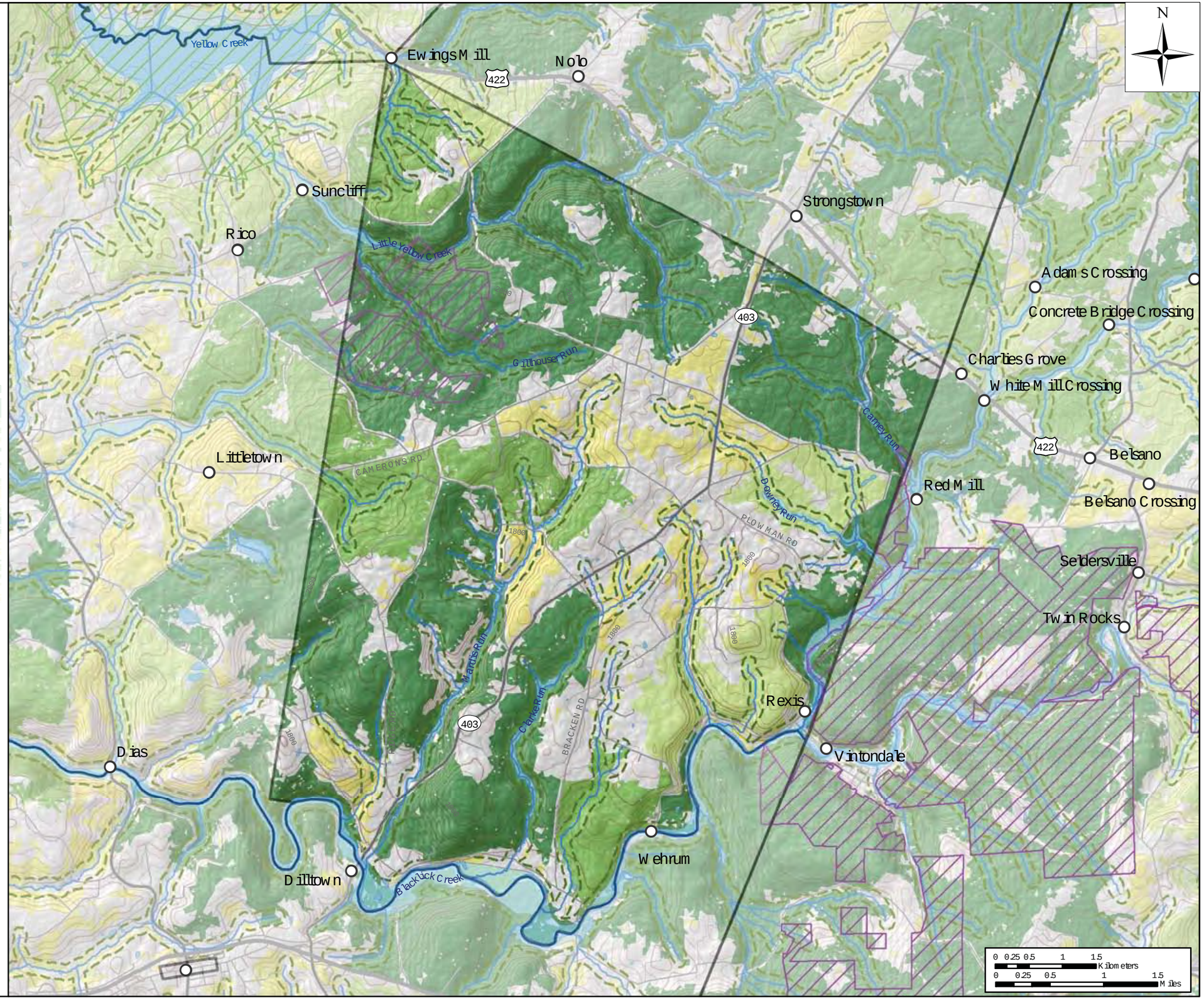
Pennsylvania Natural Heritage Program

- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre

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

- PA Bureau of Forestry
- PA Game Lands
- 40 Ft. Contour Line



Buffington Township

Buffington Township is in the southeastern part of the county and shares a border with Cambria County. Black Lick Creek forms the boundary between Buffington and East Wheatfield Townships. The township is part of the Allegheny Mountain Section of the Appalachian Plateau Province. Shale and sandstone dominate the bedrock. Forests make up 85 percent of the land use. Buffington Township is the second most heavily forested township in the county. Only 13 percent of the township is agricultural. Black Lick Creek and Yellow Creek are the major streams that flow through Buffington Township.

Suncliff BDA

*The full description of the **Suncliff BDA** is presented in the Brush Valley Township section on page 86.*

This site is an outstanding geologic feature and supports two species of concern in addition to a diverse native flora.

Little Yellow Creek BDA

*The full description of the **Little Yellow Creek BDA** is presented in the Pine Township section on page 159.*

This site supports four species of concern. These species depend on maintaining clear, clean, cold, free-flowing water within the site. This can only be achieved by maintaining an adequate forested buffer along the entirety of the upstream watershed.

Burrell Township and Blairsville Borough

	Taxa[1]	PNHP Rank[2] Global	PNHP Rank[2] State	Legal Status[2] State (Proposed)	Last Seen	Quality[2]
NATURAL HERITAGE AREAS:						
Blairsville Borough BDA			*Notable Significance*			
four-toed salamander	A	G5	S4	N	2004	E
species of concern[3]	-	-	-	-	2004	E
Chestnut Ridge – Penn View Mountain BDA			*High Significance*			
Allegheny woodrat (*Neotoma magister*)	M	G3G4	S3	PT	2000	E
thick-leaved meadow-rue (*Thalictrum coriaceum*)	P	G4	S2	PT	2008	A
Pine Ridge County Park BDA			*Local Significance*			
species of concern[3]	-	-	-	-	2007	AB
Strangford Cave BDA			*Exceptional Significance*			
Allegheny woodrat (*Neotoma magister*)	M	G3G4	S3	PT	2000	E
Allegheny cave amphipod (*Stygobromus allegheniensis*)	other	G5	S2S3	N	1995	E
Franz's cave isopod (*Caecidotea franzi*)	other	G2G4	S1	N	1999	E
An isopod (*Caecidotea kenki*)	other	G3	S1	N	1950	E
limestone solutional cave	other	GNR	SNR	N		
geologic feature – drainage pattern	other	GNR	SNR	N		

LANDSCAPE CONSERVATION AREAS: None

PUBLICLY MANAGED LAND: Pine Ridge County Park
State Game Land #153
State Game Land #276

OTHER CONSERVATION AREAS: None known

GEOLOGIC FEATURES: Conemaugh Water Gap

[1] A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionid (Mussel)
[2] Please refer to Appendix II (pg. 223) for an explanation of PNHP ranks and legal status
[3] This species is not named by request of the jurisdictional agency

Indiana County
Natural Heritage Inventory

Burrell Township
& Blairsville Borough

Biological Diversity Areas

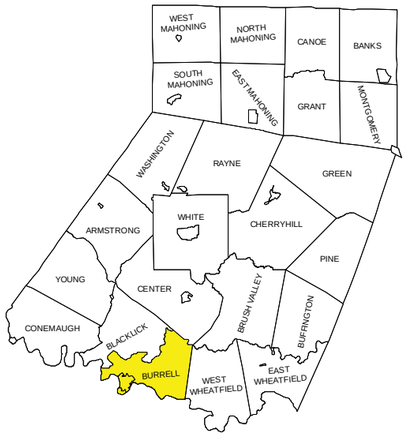
Blairsville Borough BDA
Chestnut Ridge/Penn View Mountain - North BDA
Pine Ridge County Park BDA
Strangford Cave BDA

Landscape Conservation Areas

None Currently Identified

State & Federal Public Land

Conemaugh River Lake (USACE)
State Game Land #153
State Game Land #276



Legend

Biological Diversity Area (BDA)
- Core
- Supporting Landscape

Landscape Conservation Area (LCA)
- **US Army Corps of Engineers**
- **PA Game Commission**
- **National Wetland Inventory**
- **Streams**
- **40 Ft. Contour Line**

Pennsylvania Natural Heritage Program

0 0.25 0.5 1 1.5 Kilometers
0 0.25 0.5 1 1.5 Miles

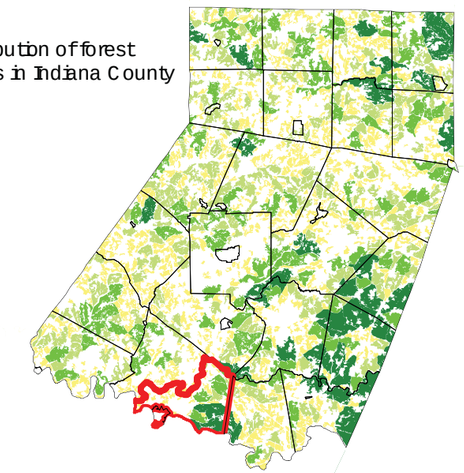
Indiana County Natural Heritage Inventory

Burrell Township & Blairsville Borough

Much of the native biodiversity of the township can be maintained by providing undisturbed forested buffers along streams, and avoiding fragmentation of the largest forest blocks with additional roads or utility infrastructure. These general landscape features help provide the habitat necessary to keep common species common. In addition, reforestation of creek and stream banks can help link larger forested blocks together, contributing to their utility as natural wildlife corridors while significantly improving regional water quality.

Riparian buffers through forested areas should be considered priorities for conservation. Riparian buffers through non-forested habitats should be considered priorities for restoration.

Distribution of forest blocks in Indiana County



Legend

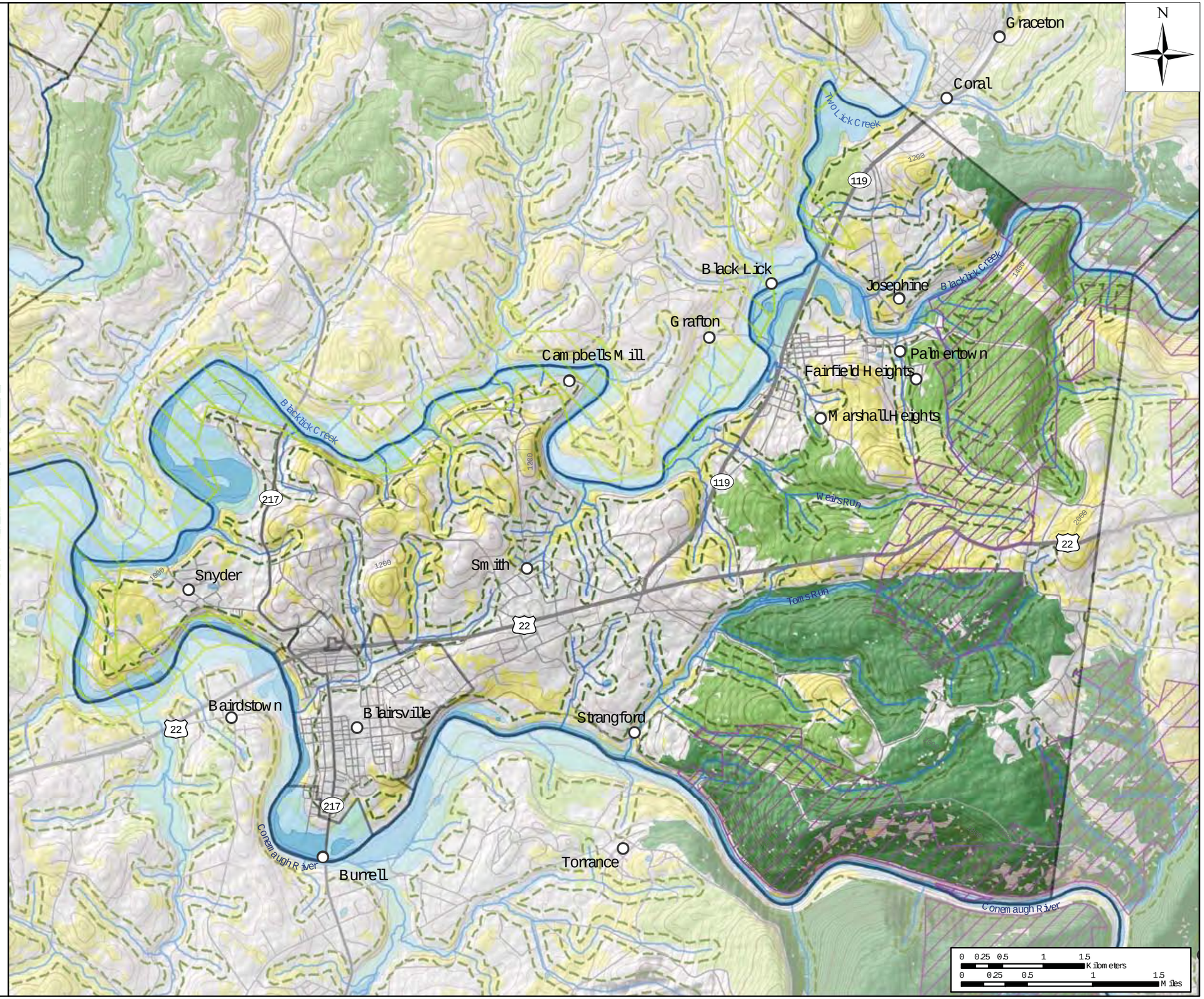
Pennsylvania Natural Heritage Program

- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre

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

- USACE
- PA Bureau of Forestry
- PA Game Lands
- 40 Ft. Contour Line



Burrell Township and Blairsville Borough

Burrell Township is located on the southern edge of Indiana County. The Conemaugh River forms the boundary between the township and Westmoreland County. Shale and limestone make up the bedrock geology within the township. Agriculture represents 21 percent of the land usage and forested areas make up 72 percent of the township, including several large tracts in the western half. State Game Land #276, State Game Land #153, and Pine Ridge County Park contain much of this forest. Streams within the township either drain directly into the Conemaugh or flow into Black Lick Creek and then to the Conemaugh. Abandoned mine drainage has caused water quality problems in the Conemaugh.

BLAIRSVILLE BOROUGH

Blairsville Borough and the western half of Burrell Township are part of the Pittsburgh Low Plateau Section of the Appalachian Plateau Province while the eastern half is in the Allegheny Mountain Section of the Appalachian Plateau Province. Blairsville Borough is located within a large bend of the Conemaugh River. Almost half of the borough is residential (47 percent), while forested areas make up 31 percent of the land cover.

Blairsville Borough BDA

An occurrence of a **species of concern,** which is not named at the request of the jurisdictional agency overseeing its protection, was found along this stretch of the Conemaugh River. 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. This site also supports the **four-toed salamander**, (*Hemidactylium scutatum*) an uncommon species which breeds in pools on the floodplain. This species lays its eggs in sphagnum moss overhanging the pools, and outside the breeding season it lives in the surrounding upland forest.

Threats and stresses

Riparian vegetation is important to the species of concern 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. Four-toed salamanders depend on an intact forest adjacent to the breeding habitat, therefore fragmentation of the remaining forest should be avoided.

Conservation Recommendations

Restoration of an intact upland forest that supplies clean water to this site is necessary to maintain this population of species of concern. To accomplish this goal, landowners should be proactively engaged and educated about the value their property provides to clean water in an effort to maintain the entire Conemaugh River watershed. Additionally, the wetland and forested riparian corridor needs to be fully restored within the core of this site to ensure adequate habitat for this species.

Chestnut Ridge – Penn View Mountain BDA

This site description is adapted from the 1998 Westmoreland County Natural Heritage Inventory site description for the Chestnut Ridge BDA.

This section of Chestnut Ridge is forested mostly with chestnut and red oak (*Quercus prinus, Q. rubra*) dominating what would be considered a highly disturbed Dry-Mesic Acidic Central Forest on the ridgetop. Many of the oaks on the ridgetop and higher elevations are dead as a result of gypsy moth (*Lymantria dispar*) defoliation thus resulting in a dense shrub layer of blackberry briar (*Rubus allegheniensis*) and a dense ground cover of hay-scented fern (*Dennstaedtia punctilobula*). The oak forest is more intact on the upper slopes. Black birch (*Betula lenta*) appears to be succeeding the oak forest on the ridgetop and at lower elevations chestnut oak drops out and red maple (*Acer rubrum*), sweet gum (*Nyssa sylvatica*), and tulip poplar (*Liriodendron tulipifera*) become more common in the canopy. The middle slopes have an understory of mountain laurel (*Kalmia latifolia*), deerberry (*Vaccinium stamineum*), and blueberry (*Vaccinium pallidum*).

Steve Grund, PNHP

thick-leaved meadow rue (*Thalictrum coriaceum*)

Outcrops of Loyalhanna limestone create conditions that support **thick-leaved meadow-rue** (*Thalictrum coriaceum*), a Pennsylvania Rare plant, and provide deep crevices that are habitat for **Allegheny woodrat** (*Neotoma magister*), a Pennsylvania Threatened species.

This BDA is contiguous with Strangford Cave BDA (p. 99) and Chestnut Ridge BDA in Westmoreland County, and it is possible that the BDA supports undocumented populations of the species known from those BDAs.

Threats and Stresses

The Allegheny woodrat faces numerous threats, including raccoon roundworm, reduced food supply as a result of the of loss of American chestnut from chestnut blight and the loss of many mature oaks from gypsy moth damage, and fragmentation of the forest leading to increased predation and isolation from nearby populations.

The aquatic species of concern in Strangford Cave could be impacted by any change in groundwater quality, and most of the recharge area for the cave stream may be within this BDA. Any geologic disturbance or use of chemicals within this BDA could be detrimental to the cave system.

Conservation Recommendations

Maintaining groundwater quality is of critical importance to the aquatic species of concern. Any geologic disturbance, chemical use or intensive land use within the recharge area of the cave should be avoided. Further fragmentation of the forest on this part of Chestnut Ridge should be avoided to maintain the viability of the Allegheny woodrat populations.

Pine Ridge County Park BDA

This site is designated around the floodplain and upland forest surrounding Tom's Run. Large, older growth tulip poplars (*Liriodendron tulipifera*) can be found here as they took hold after the decline of the American chestnut in the early part of the twentieth century. A large population of a **species of concern** can be found on this site. This species lives in rich, mesic forests.

The supporting landscape extends to the upper reaches of Tom's Run. Much of the supporting landscape is forested but residential development and agriculture are encroaching along the eastern boundary of the BDA.

Threats and Stresses

Much of the area within Pine Ridge County Park was noted to be free of invasive and exotic species. However, Japanese stiltgrass (*Microstegium vimineum*) was observed to be spreading along the lower, wetter sections of the Lodge Trail.

Conservation Recommendations

The control of exotic and invasive species such as Japanese stiltgrass is of primary concern here.

The park's timber management plan avoids disturbing the core of this BDA, but continued care should be taken to maintain ecologically-value forest cover within the park.

Strangford Cave BDA

Strangford Cave is a **limestone solutional cave**, created by groundwater flowing through the Loyalhanna limestone, a thick layer of limestone that reaches its northernmost extent here, where it is exposed along the Conemaugh Gorge. The cave entrance is within an abandoned quarry, and was exposed by quarrying operations. The cave's 1400 feet (430 meters) of passages were formed by a subterranean stream (Christenson, 1998), and the clear, cold water continues to shape the cavern, which can be seen in the sculpted pothole formations in the stream bed. This stream supports several aquatic invertebrate species of concern, including the globally rare **Franz's cave isopod** (*Caecidotea franzi*) and **Kenk's isopod** (*Caecidotea kenki*), as well as the state-imperiled **Allegheny cave amphipod** (*Stygobromus allegheniensis*). The extent of these populations is unknown, and these species could potentially exist in other nearby undocumented subterranean streams within the Loyalhanna limestone of Chestnut Ridge.

The entrance of the cave supports the **Allegheny woodrat** (*Neotoma magister*), a species which also occurs in the adjacent Chestnut Ridge / PennView Mountain BDA and further south on Chestnut Ridge.

Threats and Stresses

Formerly this cave was known as a party spot, and the resulting vandalism and litter marred the aesthetics of the cave and may have impacted the fragile subterranean ecosystem. The cave is now gated to protect the species living in the cave, and access is controlled by the Game Commission.

The aquatic species of concern could be impacted by any change in groundwater quality. The recharge area of the cave may be mostly protected within SGL #276.

The Allegheny woodrat faces numerous threats, including raccoon roundworm, reduced food supply as a result of the of loss of American chestnut from chestnut blight and the loss of many mature oaks from gypsy moth damage, and fragmentation of the forest leading to increased predation and isolation from nearby populations.

Conservation Recommendations

Maintaining groundwater quality is of critical importance to the aquatic species of concern. Any chemical use or intensive land use within the recharge area of the cave should be carefully considered.

Further fragmentation of the forest on this part of Chestnut Ridge should be avoided to maintain the viability of the Allegheny woodrat populations.

Jess Miller

an Allegheny woodrat (*Neotoma magister*)

Canoe Township

	Taxa[1]	PNHP Rank[2] Global	PNHP Rank[2] State	Legal Status[2] State (Proposed)	Last Seen	Quality[2]
NATURAL HERITAGE AREAS:						
Nashville Swamp BDA			*Notable Significance*			
northern pygmy clubtail (*Lanthus parvulus*)	O	G5	S3S4	N	2007	E
hemlock palustrine forest	C	GNR	S3	N	2007	E
Rochester Mills BDA			*Notable Significance*			
old growth hemlock forest	C	GNR	SNR	N	-	-

LANDSCAPE CONSERVATION AREAS: Little Mahoning Creek

PUBLICLY MANAGED LAND: None

OTHER CONSERVATION AREAS: None known

GEOLOGIC FEATURES: None

[1] A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionid (Mussel)
[2] Please refer to Appendix II (pg. 223) for an explanation of PNHP ranks and legal status
[3] This species is not named by request of the jurisdictional agency

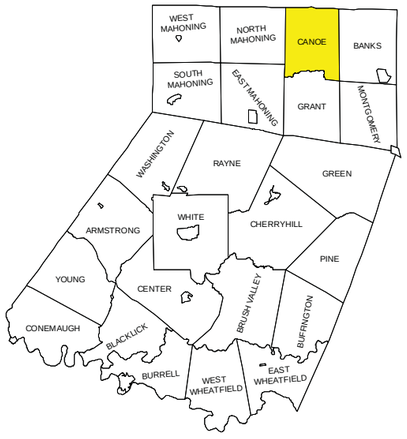
Indiana County
Natural Heritage Inventory

Canoe Township

Biological Diversity Areas
Nashville Swamp BDA
Rochester Mills BDA

Landscape Conservation Areas
Little Mahoning Creek LCA

State Public Land
State Game Land #262



Legend

Biological Diversity Area (BDA)
- Core
- Supporting Landscape

Landscape Conservation Area (LCA)

- **PA Bureau of Forestry**
- **PA Game Commission**
- **National Wetland Inventory**
- **Streams**
- **40 Ft. Contour Line**

Pennsylvania Natural Heritage Program

N

0 0.25 0.5 1 1.5 Kilometers
0 0.25 0.5 1 1.5 Miles

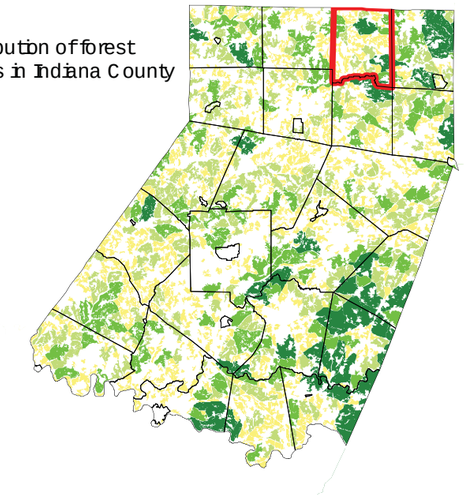
Indiana County Natural Heritage Inventory

Canoe Township

Much of the native biodiversity of the township can be maintained by providing undisturbed forested buffers along streams, and avoiding fragmentation of the largest forest blocks with additional roads or utility infrastructure. These general landscape features help provide the habitat necessary to keep common species common. In addition, reforestation of creek and stream banks can help link larger forested blocks together, contributing to their utility as natural wildlife corridors while significantly improving regional water quality.

Riparian buffers through forested areas should be considered priorities for conservation. Riparian buffers through non-forested habitats should be considered priorities for restoration.

Distribution of forest blocks in Indiana County



Legend

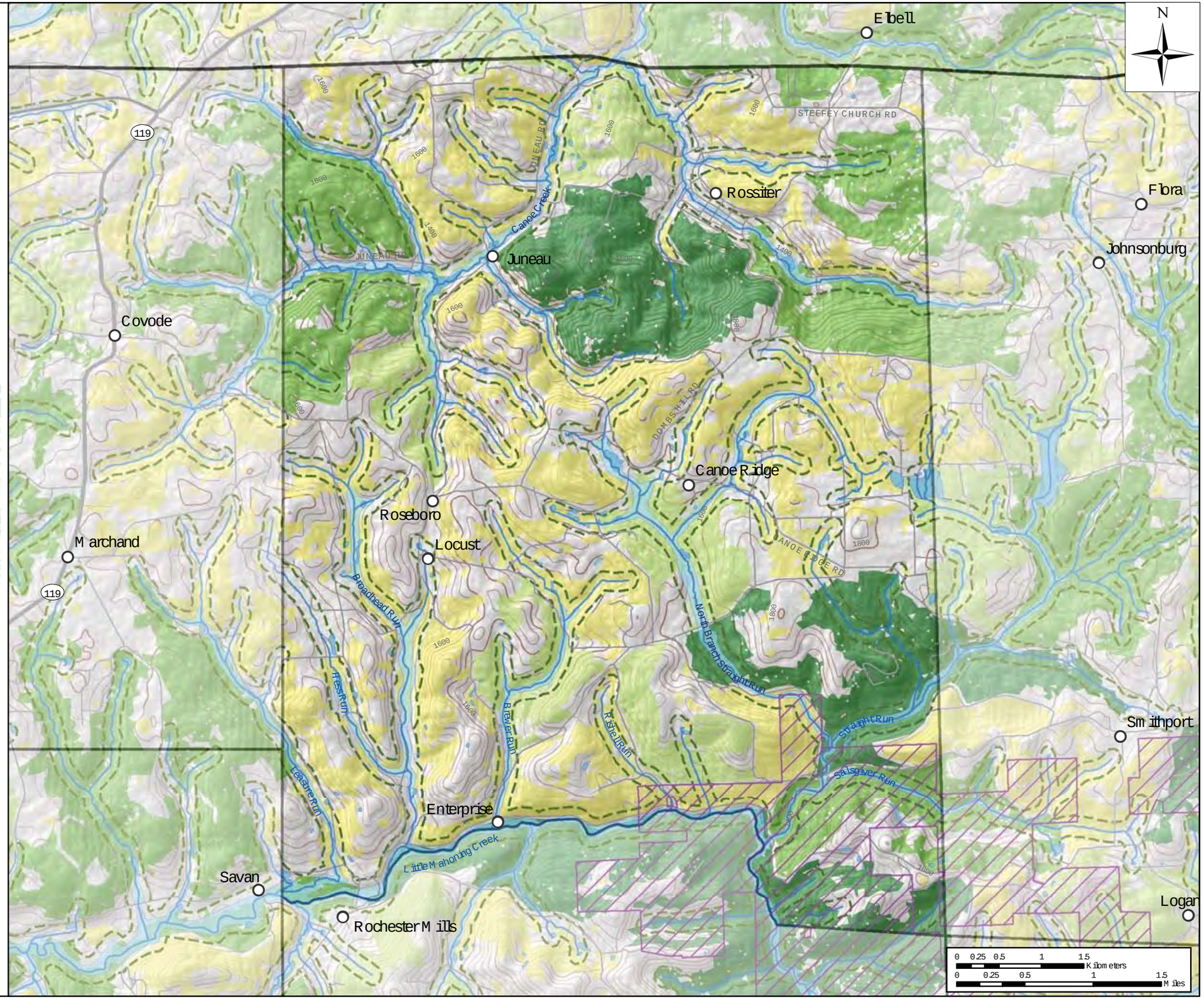
Pennsylvania Natural Heritage Program

- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre

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

- PA Bureau of Forestry
- PA Game Lands
- 40 Ft. Contour Line



Canoe Township

The township line runs along the border with Jefferson County. Canoe Township is part of the Pittsburgh Low Plateau Section of the Appalachian Plateau Province. The bedrock is primarily composed of shale and sandstone. Land use is 79 percent forested and 20 percent agricultural. There are two large blocks of forest, one in the north central part of the township, and the other in the southeast section. There are no public lands managed primarily for natural resources within the township. Canoe Creek drains the northern parts of Canoe Township while the Little Mahoning Creek forms a portion of the southern border with Grant Township. Brewer Run and the North Branch of the Little Mahoning Creek are both impacted by abandoned mine drainage and contribute to the water quality problems of the Little Mahoning.

Nashville Swamp BDA

A small **hemlock palustrine forest** occupies the center of the drainage divide. This swamp forest is characterized by a "drunken" stand of hemlock (*Tsuga canadensis*) and yellow birch (*Betula alleghaniensis*) that tilt and lean, exposing roots on raised mounds of sphagnum moss. A rich diversity of wetland plants occupies the mucky understory, colonizing openings created by fallen trees that have grown too tall to be supported by the saturated substrate. This swamp also supports a population of **northern pygmy clubtail** (*Lanthus parvulus*), a dragonfly species whose larvae live in spring runs and small creeks.

Threats and Stresses

The westward invasion of the hemlock woolly adelgid (*Adelges tsugae*), currently documented in all but 16 counties in Pennsylvania (PA Bureau of Forestry 2010), poses a potential threat to the hemlock trees in the region. The hemlock woolly adelgid, native to Asia, is a sap-feeding insect that attacks both the eastern hemlock and the Carolina hemlock (*Tsuga caroliniana*). This insect pest can result in high levels of hemlock mortality, opening up the forest canopy and illuminating the forest floor to full sunlight. Loss of the adjacent hemlock forest would impact the hydrologic regime of the wetland.

The northern pygmy clubtail depends upon high water quality, the regulation of water temperature levels provided by forest cover, and the seasonal input of detritus and other organic material supplied from the forest. Excess input of nutrients from human activities in the watershed causes bacterial growth that reduces the oxygen content of the water. Timber harvesting may increase erosion and siltation, and cause a decrease in dissolved oxygen as canopy cover is removed and water temperature rises (Dunkle 2000, NatureServe 2009).

Conservation Recommendations

Within the wetland, activities of greater intensity than occasional foot traffic should be avoided due to the sensitivity of the habitat. Forest canopy removal operations should be avoided within a 400 meter (~1350 foot) buffer zone surrounding the wetland in order to avoid detrimentally impacting the wetland and to help maintain water quality and the natural microclimate conditions in the wetland. Timber harvesting and road construction should be limited on the slopes overlooking the wetland complex.

Management of the forests in this area should include periodic monitoring for the hemlock woolly adelgid and other non-native forest pests. Any proposed treatments for insect outbreaks should take into consideration impacts to aquatic and other forest organisms.

Ecologists do not completely understand the habitat needs of many of stream-dwelling dragonflies, especially in regard to the protection of upstream water quality. Therefore, the supporting landscape delineated in this report should be used as a minimum guide; in practice, as much of the aquatic habitat should be protected as possible.

Rochester Mills BDA

This site is designated around a small patch of old growth hemlock forest containing many large hemlock (*Tsuga canadensis*) and beech (*Fagus grandifolia*) trees. Surveys of this site indicate that the core of the forest has not been cut in at least 150 years.

Christopher Tracey, PNHP

A canopy opening in a old-growth remnant of a hemlock forest

Threats and Stresses

The westward invasion of the hemlock woolly adelgid (*Adelges tsugae*), currently documented in all but 16 counties in Pennsylvania (PA Bureau of Forestry 2010), poses a potential threat to the hemlock trees in the region. The hemlock woolly adelgid, native to Asia, is a sap-feeding insect that attacks both the eastern hemlock and the Carolina hemlock (*Tsuga caroliniana*). This insect pest can result in high levels of hemlock mortality, opening up the forest canopy and illuminating the forest floor to full sunlight.

Conservation Recommendations

Preventing or reducing the risk of invasion by the hemlock wooly adelgid is of primary concern at this site. Management of the forests in this area should include periodic monitoring for the hemlock woolly adelgid and other non-native forest pests. Any proposed treatments for insect outbreaks should take into consideration impacts to aquatic and other forest organisms.

Within the wetland, activities of greater intensity than occasional foot traffic should be avoided due to the sensitivity of the habitat. Timber harvesting and road construction should be limited on the slopes overlooking the wetland complex.

Center Township and Homer City Borough

	Taxa[1]	PNHP Rank[2] Global	State	Legal Status[2] State (Proposed)	Last Seen	Quality[2]
NATURAL HERITAGE AREAS:						
Cherry Run North BDA			*Notable Significance*			
species of concern[3]	-	-	-	-	2007	E
Cherry Run Reservoir BDA			*Notable Significance*			
paper pondshell (*Utterbackia imbecillis*)	U	G5	S3S4	CU	2007	E
Two Lick Creek BDA			*Notable Significance*			
species of concern[3]	-	-	-	-	2007	E
Yellow Creek at Route 422 BDA			*Notable Significance*			
ocellated darner (*Boyeria grafiana*)	O	G5	S3	N	2007	E
harpoon clubtail (*Gomphus descriptus*)	O	G4	S1S2	N	2007	E
species of concern[3]	-	-	-	-	2008	E

LANDSCAPE CONSERVATION AREAS: None

PUBLICLY MANAGED LAND: State Game Lands #273
State Game Lands #276

OTHER CONSERVATION AREAS: None known

GEOLOGIC FEATURES: None

[1] A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionid (Mussel)
[2] Please refer to Appendix II (pg. 223) for an explanation of PNHP ranks and legal status
[3] This species is not named by request of the jurisdictional agency

Indiana County
Natural Heritage Inventory

Center Township
& Homer City Borough

Biological Diversity Areas

Cherry Run North BDA
Cherry Run Reservoir BDA
Two Lick Creek BDA
Yellow Creek at Route 422 BDA

Landscape Conservation Areas

None Currently Identified

State & Federal Public Land

State Game Land #273
State Game Land #276

Legend

Biological Diversity Area (BDA)
- Core
- Supporting Landscape

Landscape Conservation Area (LCA)

- **US Army Corps of Engineers**
- **PA Game Commission**
- **National Wetland Inventory**
- **Streams**
- **40 Ft. Contour Line**

Pennsylvania Natural Heritage Program

N

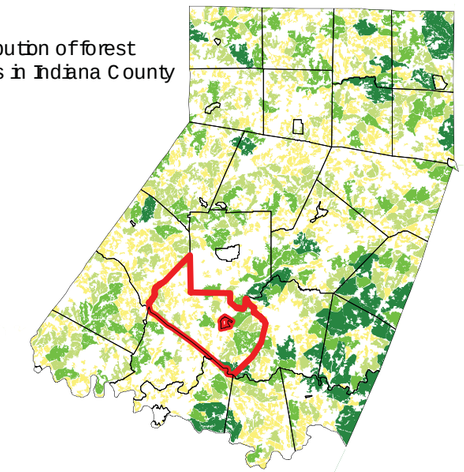
0 0.5 1 2 Kilometers
0 0.5 1 2 Miles

Indiana County
Natural Heritage Inventory
Center Township
& Homer City Borough

Much of the native biodiversity of the township can be maintained by providing undisturbed forested buffers along streams, and avoiding fragmentation of the largest forest blocks with additional roads or utility infrastructure. These general landscape features help provide the habitat necessary to keep common species common. In addition, reforestation of creek and stream banks can help link larger forested blocks together, contributing to their utility as natural wildlife corridors while significantly improving regional water quality.

Riparian buffers through forested areas should be considered priorities for conservation. Riparian buffers through non-forested habitats should be considered priorities for restoration.

Distribution of forest blocks in Indiana County



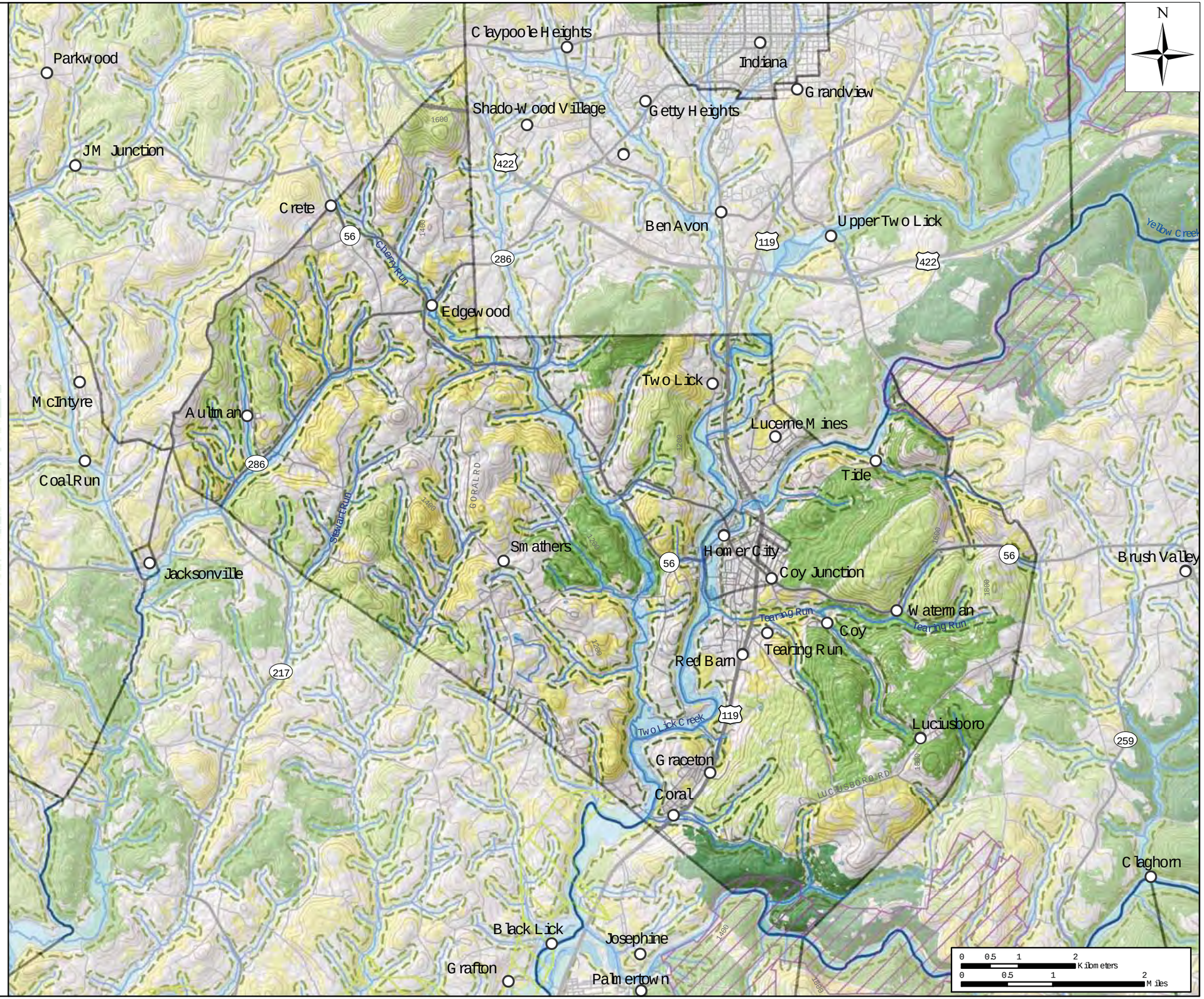
Legend

PNHP
Pennsylvania Natural Heritage Program

- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre
- < 250
- 251 - 500
- 501 - 1000
- > 1000

- USACE
- PA Bureau of Forestry
- PA Game Lands
- 40 Ft. Contour Line



Center Township and Homer City Borough

Center Township may be centrally located between the eastern and western borders of the county, but it is located much nearer to the southern county line than it is to the northern edge. The western portion of Center Township and Homer City Borough are part of the Pittsburgh Low Plateau Section of the Appalachian Plateau Province; the eastern third belongs to the Allegheny Mountain Section of the Appalachian Plateau. The bedrock geology across the township consists of shale, sandstone, and siltstone. Some of the largest forest blocks occur in the eastern third of the township, which also has a number of coal mining operations. Quarries represent 5 percent of the land use in the township and agriculture 23 percent. Forested areas represent 63 percent of the land use, but much of it is highly fragmented. Numerous streams in the township drain south across the township line into Black Lick Creek. Two Lick and Yellow Creek flow through mined areas and have been impacted by abandoned mine drainage. The only public lands in Center Township are a small piece of SGL #276 in the southeastern corner of the township and a small section of SGL #273 at the northern edge.

HOMER CITY BOROUGH

Homer City is 68 percent residential with 23 percent of the borough forested.

Cherry Run North BDA

An occurrence of a **species of concern,** which is not named at the request of the jurisdictional agency overseeing its protection, was found along this stretch of Cherry Run. These are heavily forested sections of creek, which provide 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 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

Preservation of the intact upland forest that supplies clean water to this site is necessary to maintain this population of species of concern. To accomplish this goal, landowners should be proactively engaged and educated about the value their property provides to clean water in an effort to maintain the entire Cherry Run and Two Lick watersheds. Additionally, the wetlands and forested riparian corridor present within the core of this site should be left undisturbed.

Cherry Run Reservoir BDA

This reservoir supports a population of **paper pondshell** ***(Utterbackia imbecillis)***, a mussel species of concern in Pennsylvania. This mussel has a wide distribution throughout the eastern United States from Florida northward to southern Canada, possibly the result of stocking bass. Though never densely populated, paper pondshells seem able to colonize most aquatic systems as long as there is a fine-particle substrate available (such as in backchannels, reservoirs, and deep river pools). This species also utilizes a wide range of host fish, but may also reproduce without the use of a host fish (Watters, 1994).


Alan Cressler

paper pondshell (*Utterbackia imbecillis*)

Threats and Stresses

This site is threatened by development further upstream in the watershed, especially from the development of the southwestern suburbs of Indiana. Improper management of stormwater within this area will have a direct adverse effect on the mussel beds. Additionally, the possibility of chemical spills and road salt from the Route 422 corridor could modify water chemistry within Cherry Run in ways that could eliminate the paper pondshell from the system altogether.

Conservation Recommendations

Proper management of stormwater runoff throughout the upstream portion of this site is necessary to maintain the paper pondshell within this system. This includes maintaining a forested riparian buffer at least 100 m wide on all upstream portions of this site, eliminating point-source pollution, and reducing non-point source pollution through proactive engagement and education of landowners about how their individual actions directly affect the communal resource.

Two Lick Creek BDA

An occurrence of a **species of concern,** which is not named at the request of the jurisdictional agency overseeing its protection, was found along this stretch of waterway. These are heavily forested sections of creek which provide 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 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

Preservation of the intact upland forest that supplies clean water to this site is necessary to maintain this population of species of concern. To accomplish this goal, landowners should be proactively engaged and educated about the value their property provides to clean water in an effort to maintain the entire Cherry Run and Two Lick watersheds. Additionally, the wetlands and forested riparian corridor present within the core of this site should be left undisturbed.

Yellow Creek at Route 422 BDA

*The full description of the **Yellow Creek at Route 422 BDA** is presented in the White Township section on page194.*

This site supports **ocellated darner** (*Boyeria grafiana*) and **harpoon clubtail** (*Gomphus descriptus*), dragonfly species of concern, as well as one other **species of concern**. These species depends on maintaining the water quality at the site.

Cherryhill Township and Clymer Borough

	Taxa[1]	PNHP Rank[2] Global	PNHP Rank[2] State	Legal Status[2] State (Proposed)	Last Seen	Quality[2]
NATURAL HERITAGE AREAS:						
Onberg BDA			*Notable Significance*			
species of concern[3]	-	-	-	-	2003	E
South Branch Two Lick Creek BDA			*High Significance*			
species of concern[3]	-	-	-	-	2005	E
species of concern[3]	-	-	-	-	2007	E
species of concern[3]	-	-	-	-	2007	E
species of concern[3]	-	-	-	-	2008	D
Yellow Creek BDA			*Notable Significance*			
species of concern[3]	-	-	-	-	2007	E
Yellow Creek State Park – Nature Trail Fields BDA			*Notable Significance*			
featherbells (*Stenanthium gramineum*)	P	G4G5	S1S2	N(TU)	2008	B
Yellow Creek State Park – Nature Trail Woods BDA			*Notable Significance*			
West Virginia white (*Pieris virginiensis*)	L	G3G4	S2S3	N	2006	E

LANDSCAPE CONSERVATION AREAS: Little Yellow Creek Watershed

PUBLICLY MANAGED LAND: State Game Land #248
Yellow Creek State Park

OTHER CONSERVATION AREAS: None known

GEOLOGIC FEATURES: None

[1] A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionid (Mussel)
[2] Please refer to Appendix II (pg. 223) for an explanation of PNHP ranks and legal status
[3] This species is not named by request of the jurisdictional agency

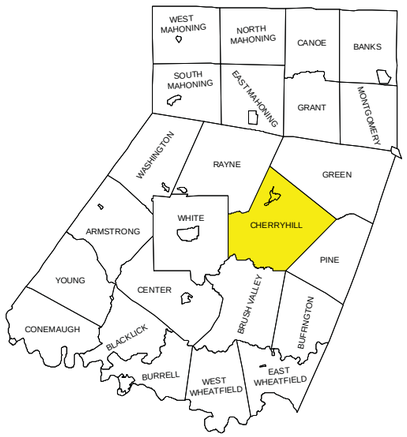
Indiana County
Natural Heritage Inventory

Cherryhill Township
& Clymer Borough

Biological Diversity Areas
- Onberg BDA
- South Branch Two Lick Creek BDA
- Yellow Creek BDA
- Yellow Creek State Park - Nature Trail Fields BDA
- Yellow Creek State Park - Nature Trail Woods BDA

Landscape Conservation Areas
- Little Yellow Creek Watershed LCA

State Public Land
- Gallitzin State Forest
- State Game Land #248
- Yellow Creek State Park



Legend

Biological Diversity Area (BDA)
- Core
- Supporting Landscape

Landscape Conservation Area (LCA)

- PA Bureau of Forestry
- PA Game Commission
- National Wetland Inventory
- Streams
- 40 Ft. Contour Line

Pennsylvania Natural Heritage Program

0 0.5 1 2 Kilometers
0 0.5 1 2 Miles

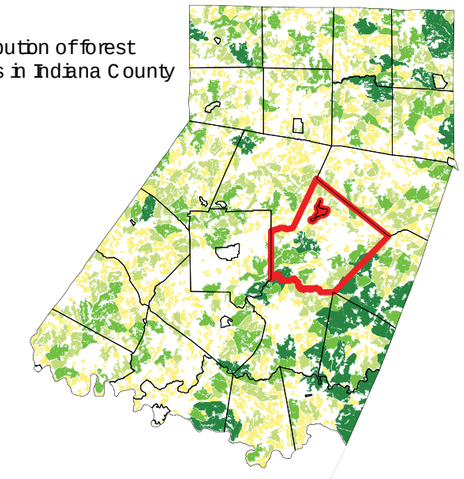
Indiana County
Natural Heritage Inventory

Cherryhill Township
& Clymer Borough

Much of the native biodiversity of the township can be maintained by providing undisturbed forested buffers along streams, and avoiding fragmentation of the largest forest blocks with additional roads or utility infrastructure. These general landscape features help provide the habitat necessary to keep common species common. In addition, reforestation of creek and stream banks can help link larger forested blocks together, contributing to their utility as natural wildlife corridors while significantly improving regional water quality.

Riparian buffers through forested areas should be considered priorities for conservation. Riparian buffers through non-forested habitats should be considered priorities for restoration.

Distribution of forest blocks in Indiana County



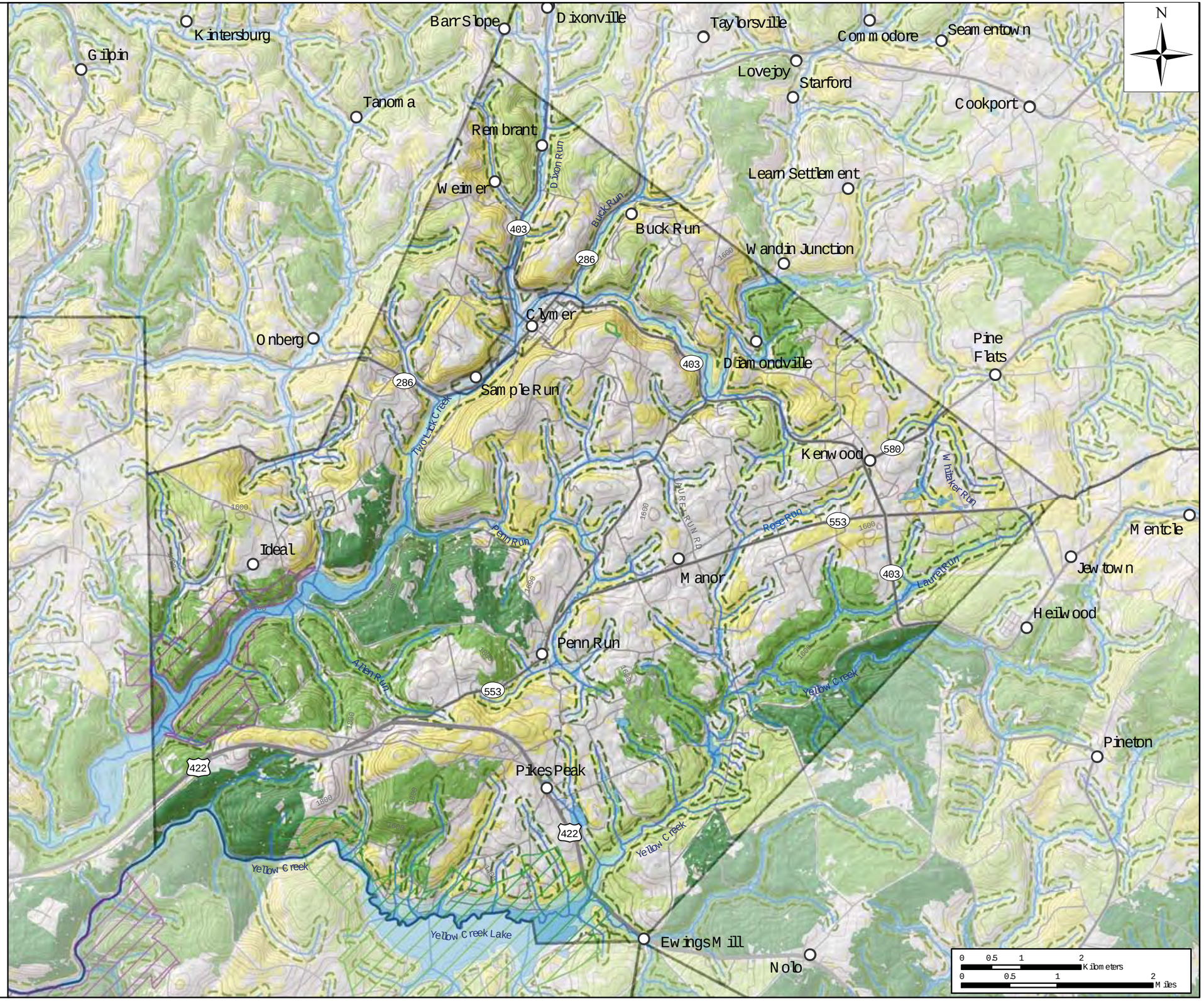
Legend

PNHP
Pennsylvania Natural Heritage Program

- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre
- < 250
- 251 - 500
- 501 - 1000
- > 1000

- PA Bureau of Forestry
- PA Game Lands
- 40 Ft. Contour Line



Cherryhill Township and Clymer Borough

Cherryhill Township is the second largest township in the county. Over half of Cherryhill Township plus Clymer Borough is in the Pittsburgh Low Plateau Section of the Appalachian Plateau Province. A smaller portion of the township is in the Allegheny Mountain Section of the Appalachian Plateau Province. The bedrock geology is mostly sandstone and shale. The largest forest blocks are in the southwest sector including that found in SGL #248 and Yellow Creek State Park. Yellow Creek State Park crosses over into Brush Valley Township. Yellow Creek State Park is an Important Mammal Area (IMA) as well as an Important Bird Area (IBA). Records exist for 243 species of birds at this site. Other forested areas occur along the eastern border with Pine Township. Forests make up 71 percent of total land use; agricultural practices make up 25 percent. Yellow Creek and Two Lick Creek are the primary streams that drain the township. Abandoned mine drainage has affected Penn Run, a tributary to Two Lick Creek.

CLYMER BOROUGH

Clymer Borough is in the northwest section of the township. Residential areas make up 43 percent of the borough; forested areas account for 49 percent of total land use.

Onberg BDA

*The full description of the **Onberg BDA** is presented in the Rayne Township section on page 165.*

This site supports a **species of concern** which depends on maintaining the water quality at the site.

South Branch Two Lick Creek BDA

*The full description of the **South Branch Two Lick Creek BDA** is presented in the Green Township section on page 143.*

This site supports populations of **four species of concern,** which are not named at the request of the jurisdictional agencies overseeing their protection. Maintaining the forested riparian habitat and water quality of the site is necessary to maintain these species at this site.

Yellow Creek BDA

This site supports a population of a **species of concern,** which is not named at the request of the jurisdictional agency overseeing its protection. It relies on clean, clear creeks of small to moderate size, with both sandy/pebbly stretches with flowing water as well as still, muddy backwaters.

Threats and Stresses

The primary threat to this species is the degradation of the aquatic habitat that supports it through detrimental land use choices. Land use choices that change water temperature, increase inputs of sediments and nutrients, or modify the timing and amount of river flow are likely to adversely affect the species of concern.

Conservation Recommendations

To maintain this site a watershed-wide approach is necessary. Throughout the watershed a 100 meter no-cut buffer should be implemented on all streams to minimize nutrient and sediment inputs, maintain the shade to minimize thermal loading (sun heating of the water), and provide for the natural yearly input of leaves that maintain the food chain. Additionally, special care should be given to prevent the input of chemicals from abandoned mine drainage and other mining operations.

Yellow Creek State Park – Nature Trail Woods BDA

A population of the **West Virginia white** (*Pieris virginiensis*) butterfly can be found in the rich floodplain. This floodplain forest and the adjacent slope provide habitat for the West Virginia white's two host plants–the two-leaf toothwort (*Cardamine diphylla*) and cut-leaved toothwort (*Cardamine concatenata*). The butterfly eggs are laid on these species and the larva feed upon the leaves of the plants as they develop into adults. Adults can be observed flying from early April to May.

Pete Woods, PNHP

a West Virginia white (*Pieris virginiensis*)

Threats and Stresses

One of the primary stresses to the West Virginia white is the decline in its host plants, the two-leaf toothwort and cut-leaved toothwort (NatureServe 2009). Browsing by overabundant deer populations are reducing the numbers of these plants and a host of other native plant species. Additionally, invasion of non-native garlic mustard (*Alliaria petiolata*) into Pennsylvania's forests is choking out these toothworts through competition for space. Garlic mustard may also interfere with the ability of this butterfly to successfully lay its eggs on the proper host plants. No garlic mustard was identified on site, but it could become a factor as this site is located near several roads and buildings where its introduction may be likely.

Conservation Recommendations

Invasive species control and prevention is the top management recommendation for this site. Preventing further invasion of garlic mustard will help protect this site from further degradation. Management of this area should focus on preventing invasion of garlic mustard and other invasive plants, as well as maintaining deer populations at sustainable levels or completely excluding them from the site. Limiting disturbance to the forested area is of primary concern to maintain this population of the West Virginia white. Spraying for gypsy moths within and around this area should be avoided when the larvae and adults are actively using the site.

Yellow Creek State Park – Nature Trail Fields BDA

This site is designated around a population of **featherbells** (*Stenanthium gramineum*), a plant species of concern. Featherbells rely on an early successional habitat in moist meadows with reduced grazing pressure from deer and reduced competition from non-native invasive plants.

Threats and Stresses

The species of concern would be especially susceptible to forestry practices within the core habitat. The featherbells are susceptible to grazing from deer, succession to a closed canopy, and competition from non-native invasive plants.

Conservation Recommendations

The species of concern requires the continued presence of a large patch of undisturbed forest near a healthy river. The existing disturbance at this site should be mitigated to buffer the forest from further disturbance. The site should be monitored for the presence of non-native invasive plants and these should be controlled if they become a problem.

Pete Woods, PNHP

a closeup view of featherbells (*Stenanthium gramineum*) flowers

Conemaugh Township and Saltsburg Borough

	Taxa[1]	PNHP Rank[2] Global	PNHP Rank[2] State	Legal Status[2] State (Proposed)	Last Seen	Quality[2]
NATURAL HERITAGE AREAS:						
Aultmans Run BDA			*Notable Significance*			
species of concern[3]	-	-	-	-	2004	E
Conemaugh Reservoir BDA			*Notable Significance*			
osprey (*Pandion haliaetus*)	B	G5	S2B	PT	2004	E
species of concern[3]	-	-	-	-	2010	E

LANDSCAPE CONSERVATION AREAS: None

PUBLICLY MANAGED LAND: State Game Land #328

OTHER CONSERVATION AREAS: None known

GEOLOGIC FEATURES: None

[1] A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionid (Mussel)
[2] Please refer to Appendix II (pg. 223) for an explanation of PNHP ranks and legal status
[3] This species is not named by request of the jurisdictional agency

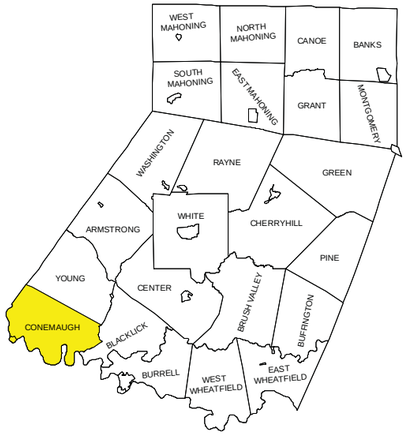
Indiana County
Natural Heritage Inventory

Conemaugh Township
& Saltsburg Borough

Biological Diversity Areas
Aultmans Run BDA
Conemaugh Reservoir BDA

Landscape Conservation Areas
None Currently Identified

State & Federal Public Land
State Game Land #328
Conemaugh River Lake (USACE)



Legend

Biological Diversity Area (BDA)
- Core
- Supporting Landscape

Landscape Conservation Area (LCA)

- **US Army Corps of Engineers**
- **PA Game Commission**
- **National Wetland Inventory**
- **Streams**
- **40 Ft. Contour Line**

Pennsylvania Natural Heritage Program

N

Iselin
Hicksville
Avonmore
Foster
Nowrytown
Clarksburg
Lewisville
Saltsburg
Moween
White
Tunnelton
Bow
Livermore
Fillmore
Big Run
Sulphur Run
Blacklegs Creek
Marshall Run
Kiskiminetas River
Elders Run
Roaring Run
Miller Run
Aultmans Run
Conemaugh River
SALTSBURG RD
CLARKSBURG RD
HILL RD
156
286
981
1200
1000
1400

State Game Land #328
Aultmans Run BDA
Conemaugh Reservoir BDA
Conemaugh River Lake

0 0.25 0.5 1 1.5 Kilometers
0 0.25 0.5 1 1.5 Miles

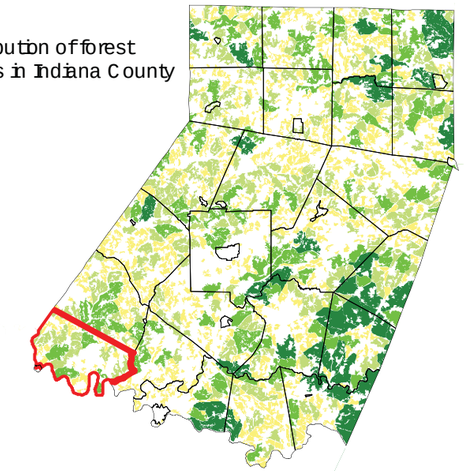
Indiana County Natural Heritage Inventory

Conemaugh Township & Saltsburg Borough

Much of the native biodiversity of the township can be maintained by providing undisturbed forested buffers along streams, and avoiding fragmentation of the largest forest blocks with additional roads or utility infrastructure. These general landscape features help provide the habitat necessary to keep common species common. In addition, reforestation of creek and stream banks can help link larger forested blocks together, contributing to their utility as natural wildlife corridors while significantly improving regional water quality.

Riparian buffers through forested areas should be considered priorities for conservation. Riparian buffers through non-forested habitats should be considered priorities for restoration.

Distribution of forest blocks in Indiana County



Legend

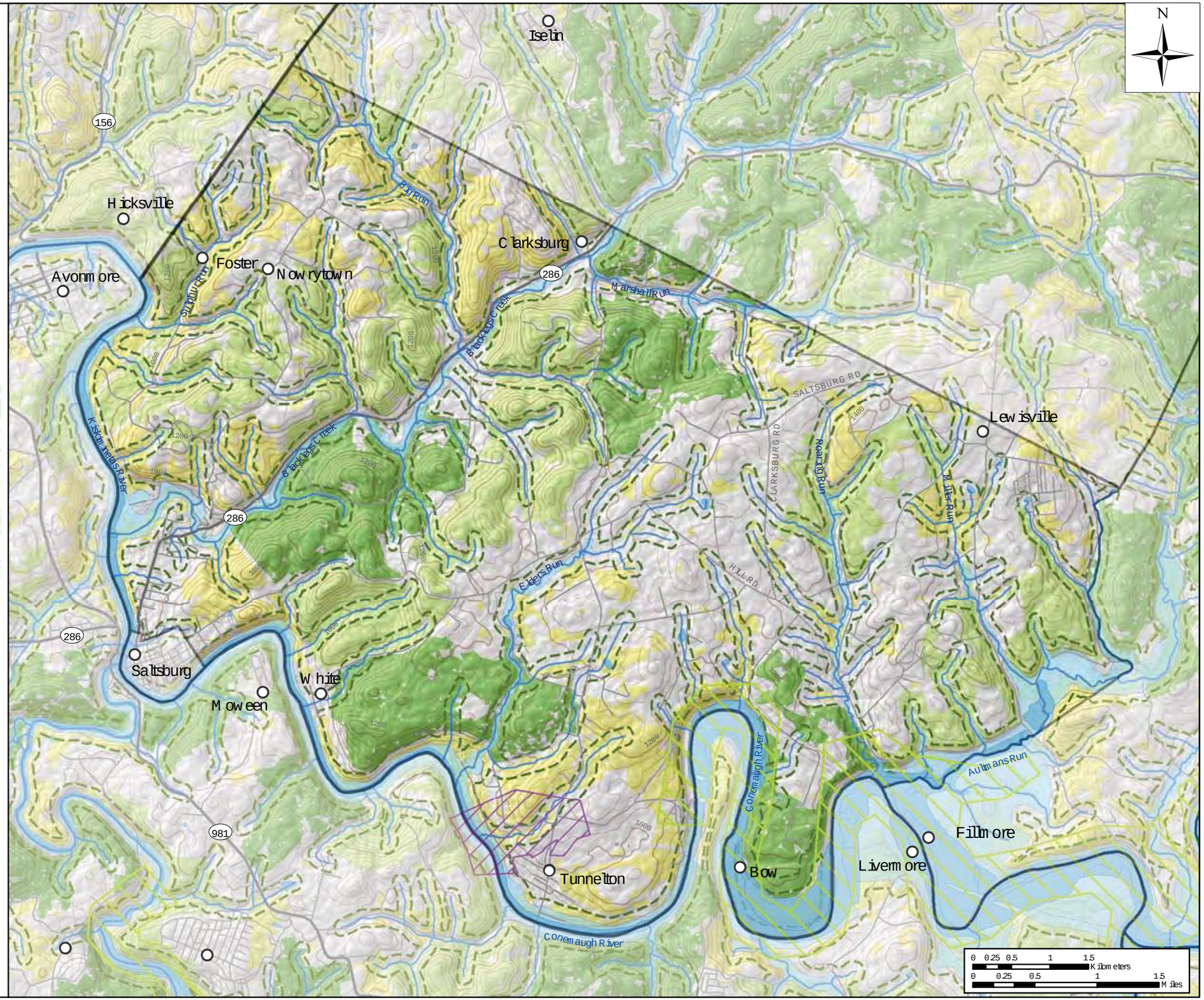
PNHP
Pennsylvania Natural Heritage Program

- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre

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

- USACE
- PA Bureau of Forestry
- PA Game Lands
- 40 Ft. Contour Line



Conemaugh Township and Saltsburg Borough

Conemaugh Township occupies the southeastern corner of Indiana County, and takes it name from the river that forms its southern border. Conemaugh Township shares its western border with Armstrong County. Conemaugh Township and Saltsburg Borough are in the Pittsburgh Low Plateau Section of the Appalachian Plateau Province with bedrock geology of shale, sandstone, and limestone. Primary land cover is forest, which constitutes 69 percent of the township; agriculture represents 27 percent of the land usage. Coal mining operations have been concentrated in the western part of the township. Most of the waterways in this same area are affected by abandoned mine drainage. All streams within the township drain into the Kiskiminetas River.

SALTSBURG BOROUGH

The Borough of Saltsburg sits along the north bank of the Conemaugh River, where it becomes the Kiskiminetas River. Land use is split evenly between residential and forestland. Developed land use areas (45 percent) and forested areas (47 percent) are nearly equal within the borough.

Aultmans Run BDA

*The full description of the **Aultmans Run BDA** is presented in the Black Lick Township section on page 81.*

This broad rich floodplain supports a **species of concern,** which is not named at the request of the jurisdictional agency overseeing its protection. Protection of the floodplain from permanent inundation, further hydrologic modification, improper forestry practices, and development are necessary to preserve this species at this site.

Conemaugh Reservoir BDA

This site supports nesting and foraging habitat for a pair of **osprey** (*Pandion haliaetus*) and supports another **species of concern,** which is not named at the request of the jurisdictional agency overseeing its protection. This large bend in the Conemaugh River provides the isolation that osprey prefer, and is directly adjacent to ideal foraging grounds within the mainstem of the Conemaugh River.

Len Blumin

an osprey (*Pandion haliaetus*) perching with a fish that it has just caught.

Threats and Stresses

The primary threat to this nesting pair of osprey is disturbance. While intentional disturbance is still an unfortunate reality for osprey, unintentional disturbance from ATV/ORV users, recreational boaters, and even well-meaning birders can result in nesting failure.

Conservation Recommendations

Providing an adequate buffer from disturbance is necessary to preserve this nesting pair of osprey, and the other species of concern, on the Conemaugh River. Repeated nest failure may drive the nesting osprey from the site, potentially permanently.

East Mahoning Township and Marion Center Borough

	Taxa[1]	PNHP Rank[2] Global	PNHP Rank[2] State	Legal Status[2] State (Proposed)	Last Seen	Quality[2]
NATURAL HERITAGE AREAS:						
Dixon Run BDA			*Dixon Significance*			
featherbells (*Stenanthium gramineum*)	P	G4G5	S1S2	TU	2007	AB
Little Mahoning Creek – Upper BDA			*Exceptional Significance*			
round pigtoe (*Pleurobema sintoxia*)	U	G4G5	S2	PE	2007	E
wavy-rayed lampmussel (*Lampsilis fasciola*)	U	G5	S4	N	2007	B
species of concern[3]	-	-	-	-	2007	E
elktoe (*Alasmidonta marginata*)	U	G4	S4	N	-	H
rainbow mussel (*Villosa iris*)	U	G5Q	S1	PE	-	H

LANDSCAPE CONSERVATION AREAS: Little Mahoning Creek Watershed

PUBLICLY MANAGED LAND: None

OTHER CONSERVATION AREAS: None known

GEOLOGIC FEATURES: None

[1] A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionid (Mussel)
[2] Please refer to Appendix II (pg. 223) for an explanation of PNHP ranks and legal status
[3] This species is not named by request of the jurisdictional agency

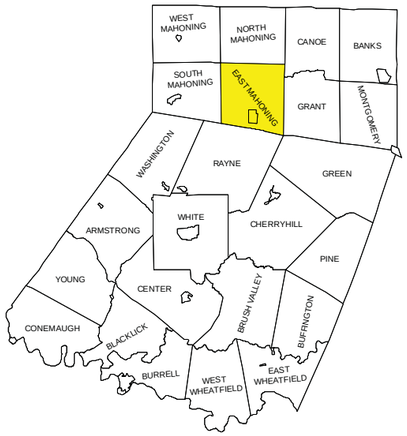
Indiana County
Natural Heritage Inventory

East Mahoning Township
& Marion Center Borough

Biological Diversity Areas
Dixon Run BDA
Little Mahoning Creek - Upper BDA

Landscape Conservation Areas
Little Mahoning Creek LCA

State Public Land
None



Legend

Biological Diversity Area (BDA)
- Core
- Supporting Landscape

Landscape Conservation Area (LCA)

- **PA Bureau of Forestry**
- **PA Game Commission**
- **National Wetland Inventory**
- **Streams**
- **40 Ft. Contour Line**

Pennsylvania Natural Heritage Program

N

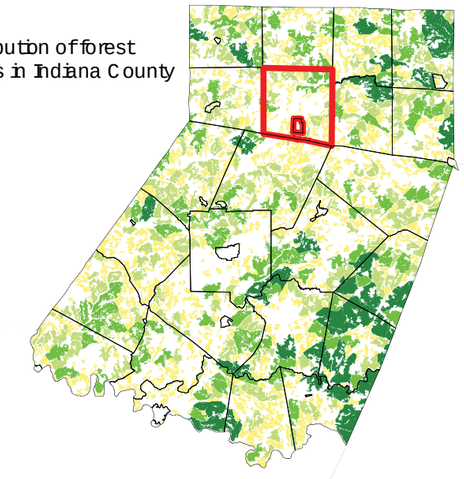
0 0.25 0.5 1 1.5 Kilometers
0 0.25 0.5 1 1.5 Miles

Indiana County
Natural Heritage Inventory
East Mahoning Township
& Marion Center Borough

Much of the native biodiversity of the township can be maintained by providing undisturbed forested buffers along streams, and avoiding fragmentation of the largest forest blocks with additional roads or utility infrastructure. These general landscape features help provide the habitat necessary to keep common species common. In addition, reforestation of creek and stream banks can help link larger forested blocks together, contributing to their utility as natural wildlife corridors while significantly improving regional water quality.

Riparian buffers through forested areas should be considered priorities for conservation. Riparian buffers through non-forested habitats should be considered priorities for restoration.

Distribution of forest blocks in Indiana County



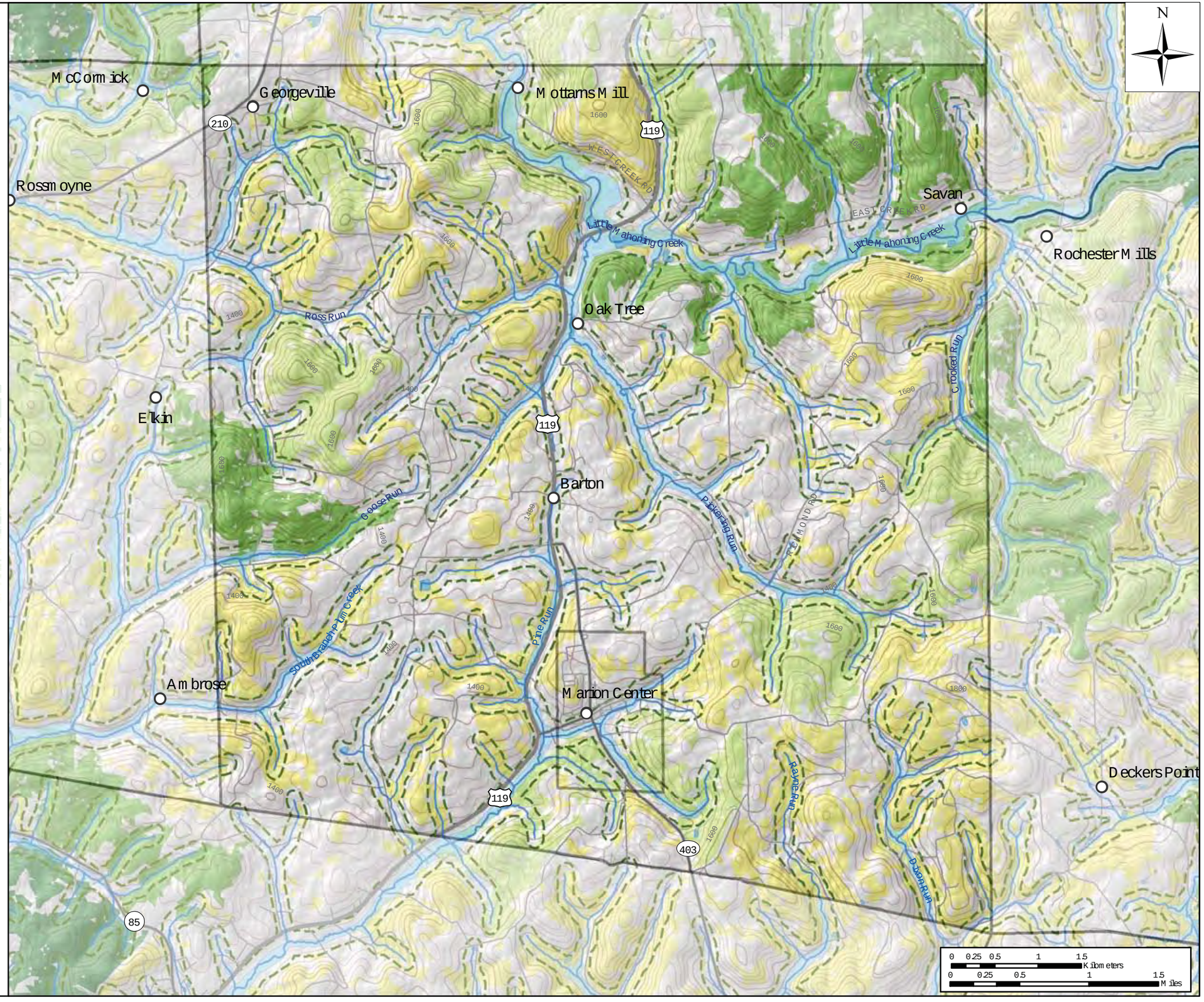
Legend

PNHP
Pennsylvania Natural Heritage Program

- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre
- < 250
- 251 - 500
- 501 - 1000
- > 1000

- PA Bureau of Forestry
- PA Game Lands
- 40 Ft. Contour Line



East Mahoning Township and Marion Center Borough

East Mahoning Township and Marion Center Borough are in the Pittsburgh Low Plateau Section of the Appalachian Plateau Province. The bedrock geology consists of shale and sandstone. Agriculture accounts for 39 percent of the land use; 30 percent of the land use is either pasture or hay fields. Only South Mahoning Township has a higher percentage of land in agricultural use (43 percent). Forests make up 59 percent of the land cover in East Mahoning. Most of the forest blocks in the township are 500 acres or less. The Little Mahoning Creek and its tributaries drain the northern two-thirds of the township, while Pine Run drains most of the southern portion. Abandoned mine drainage affects the Little Mahoning. East Mahoning Township and Marion Center Borough have the second highest percentages of land in agriculture within Indiana County.

MARION CENTER BOROUGH

Marion Center Borough is 53 percent forested, 38 percent agricultural, and only 6 percent residential. The tributary to Pine Run that flows through Marion Center Borough has problems with on site wastewater and organic enrichment.

Dixon Run BDA

This site is designated around a population of **featherbells** (*Stenanthium gramineum*), a plant species of concern. Featherbells rely on an early successional habitat in moist meadows with reduced grazing pressure from deer and reduced competition from non-native invasive plants.

Chuck Williams, WPC

featherbells (*Stenanthium gramineum*)

Threats and Stresses

The species of would be especially susceptible to forestry practices within the core habitat. The featherbells are susceptible to grazing from deer, succession to a closed canopy, and competition from non-native invasive plants.

Conservation Recommendations

The species of concern requires the continued presence of a large patch of undisturbed forest near a healthy river. The existing disturbance at this site should be mitigated to buffer the forest from further disturbance. The site should be monitored for the presence of non-native invasive plants and these should be controlled if they become a problem.

Little Mahoning Creek – Upper BDA

*The full description of the **Little Mahoning Creek – Upper BDA** is presented in the North Mahoning Township section on page 153.*

This BDA supports numerous aquatic species of concern, which depend on maintaining the quality of the creek's water.

East Wheatfield Township and Armagh Borough

	Taxa[1]	PNHP Rank[2] Global	PNHP Rank[2] State	Legal Status[2] State (Proposed)	Last Seen	Quality[2]
NATURAL HERITAGE AREAS:						
Blacklick Valley Floodplain and Natural Area BDA			*Local Significance*			
Conemaugh Gorge BDA			*High Significance*			
Allegheny woodrat (*Neotoma magister*)	M	G3G4	S3	PT	1993	E
mountain bugbane (*Cimicifuga americana*)	P	G4	S3	PR	2007	C
geologic feature – gorge	other	GNR	SNR	N	N/A	N/A
species of concern[3]	-	-	-	-	2007	C
Claghorn BDA			*Notable Significance*			
golden club (*Orontium aquaticum*)	P	G5	S4	WATCH	2008	C
mountain bugbane (*Cimicifuga americana*)	P	G4	S3	PR	2007	B
Robindale BDA			*Notable Significance*			
shining ladies'-tresses (*Spiranthes lucida*)	P	G5	S3	PT	1999	E
species of concern[3]	-	-	-	-	1997	E

LANDSCAPE CONSERVATION AREAS: Laurel Ridge LCA

PUBLICLY MANAGED LAND: Charles F. Lewis Natural Area
Gallitzin State Forest
State Game Lands #79

OTHER CONSERVATION AREAS: None known

OTHER GEOLOGIC FEATURES: None

[1] A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionid (Mussel)
[2] Please refer to Appendix II (pg. 223) for an explanation of PNHP ranks and legal status
[3] This species is not named by request of the jurisdictional agency

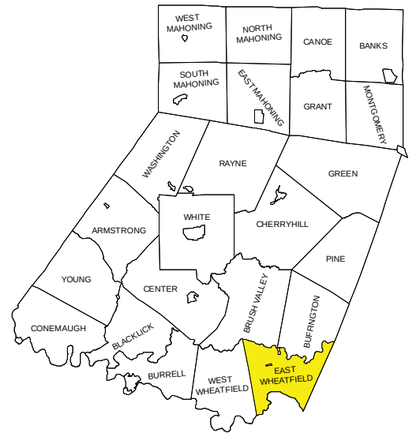
Indiana County
Natural Heritage Inventory

East Wheatfield Township
& Armagh Borough

Biological Diversity Areas
- Black Lick Creek Floodplain and Natural Area BDA
- Claghorn BDA
- Conemaugh Gorge BDA
- Robindale BDA

Landscape Conservation Areas
- None Currently Identified

State Public Land
- Charles F. Lewis Natural Area
- Gallitzin State Forest
- State Game Land #79



Legend

Biological Diversity Area (BDA)
- Core
- Supporting Landscape

Landscape Conservation Area (LCA)

- **PA Bureau of Forestry**
- **PA Game Commission**
- **National Wetland Inventory**
- **Streams**
- **40 Ft. Contour Line**

Pennsylvania Natural Heritage Program

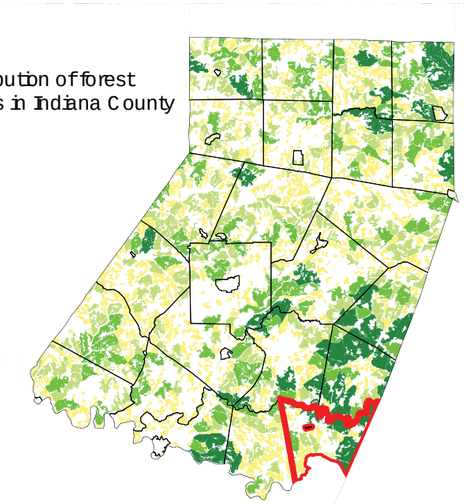
0 0.25 0.5 1 1.5 Kilometers
0 0.25 0.5 1 1.5 Miles

Indiana County
Natural Heritage Inventory
East Wheatfield Township
& Armagh Borough

Much of the native biodiversity of the township can be maintained by providing undisturbed forested buffers along streams, and avoiding fragmentation of the largest forest blocks with additional roads or utility infrastructure. These general landscape features help provide the habitat necessary to keep common species common. In addition, reforestation of creek and stream banks can help link larger forested blocks together, contributing to their utility as natural wildlife corridors while significantly improving regional water quality.

Riparian buffers through forested areas should be considered priorities for conservation. Riparian buffers through non-forested habitats should be considered priorities for restoration.

Distribution of forest blocks in Indiana County



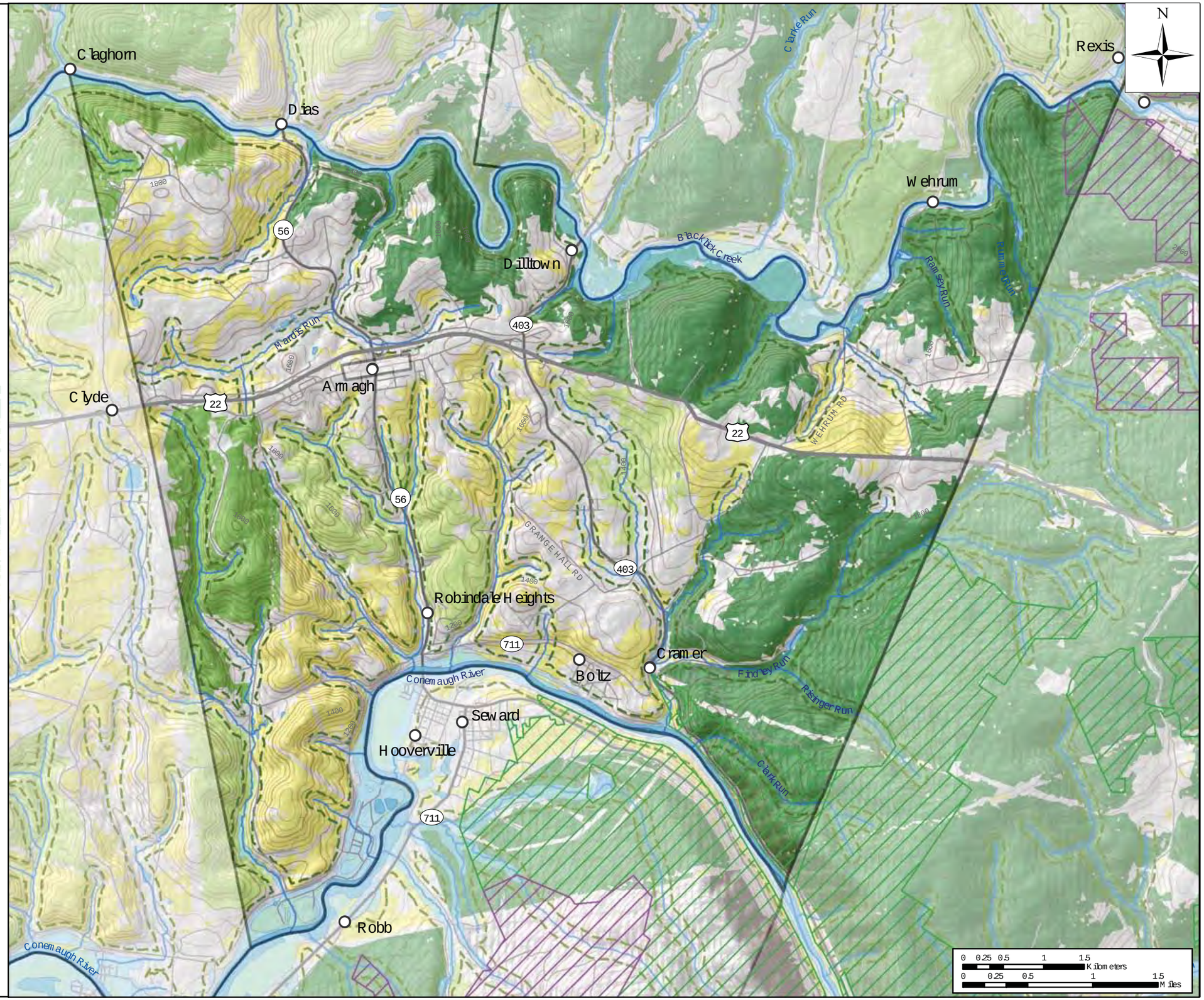
Legend

PNHP
Pennsylvania Natural Heritage Program

- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre
- < 250
- 251 - 500
- 501 - 1000
- > 1000

- PA Bureau of Forestry
- PA Game Lands
- 40 Ft. Contour Line



East Wheatfield Township and Armagh Borough

East Wheatfield Township is in the southeastern corner of the county along the border with Cambria County. Both the northern and southern township borders are marked by streams. Black Lick Creek forms the northern border and the Conemaugh River forms the southern boundary between Indiana and Westmoreland Counties. East Wheatfield Township and Armagh Borough are a part of the Allegheny Mountain Section of the Appalachian Plateau Province. The bedrock geology is comprised of shale and sandstone. Forests make up 81 percent of total land use and agricultural practices occupy 16 percent of the land use within the township. The streams in the southern two-thirds of the township flow into the Conemaugh River. Streams in the northern third of the township also flow into the Conemaugh River but do so after a circuitous route via Black Lick Creek. Abandoned mine drainage has adversely affected the Conemaugh River. East Wheatfield Township and Cambria County share the Charles F. Lewis Natural Area. The township portion is on the north bank of the Conemaugh River.

ARMAGH BOROUGH

Armagh Borough is 50 percent residential, 14 percent forested, and 18 percent agricultural.

Blacklick Valley Floodplain and Natural Area BDA

This site is designated around a series of natural habitats surrounding the Blacklick Valley Natural Area, maintained by Indiana County Parks and Trails. Along the southern edge of Black Lick Creek, a floodplain supports a great diversity of plants. Numerous channel scars and oxbow scars that hold water during flood events and provide habitat for amphibians and reptiles. The forest here is regenerating as it was once cleared for agriculture. Common species include silver maple (*Acer saccharinum*) and American sycamore (*Platanus occidentalis*). Some portions of the floodplain are shrub swamps consisting of various alder and dogwood species.

The upland forests in the area on both sides of the creek tend to support a rich herbaceous flora. The forests in the northern portion of the site tend to be richer and dominated by sugar maple (*Acer saccharum*), while the forests along the southern portion are typically more oak (*Quercus* spp.) dominated.

Additional information about this area can be found in *Great Natural Areas in Western Pennsylvania* by Steven Ostrander (2000).

Threats and Stresses

Invasive species are a major threat to the site. Japanese stiltgrass (*Microstegium vimineum*) is abundant in some areas of the floodplain forest. Overbrowsing by deer is another threat to the plant diversity at this site.

Conservation Recommendations

Control of Japanese stiltgrass should be a priority for maintaining diversity at this site. Additional surveys for species of concern should be conducted in the uplands of this site.

Conemaugh Gorge BDA

This large forest block and state natural area supports a population of **Allegheny woodrat** (*Neotoma magister*) and a **species of concern,** which is not named at the request of the jurisdictional agency overseeing its protection. This natural area is part of several thousand acres of nearly contiguous forest that stretches from the **Conemaugh River Gorge**, a state recognized geologic feature, north and south along most of Laurel Ridge. The Conemaugh River Gorge offers a spectacular vista down into the river and upward to the gorge rim that rests over 1,400 feet (>1/4 mile) above the river. The intact forestland and exposed rock outcrops combined with the relatively undisturbed habitat are what provide habitat for the species of concern found at this site. Clark Run, a side valley of the Conemaugh Gorge, supports a population of **mountain bugbane** (*Cimicifuga americana*). Exposures of the Loyalhanna limestone along the valley enrich the soils here with calcium, and along the lower, moist, shaded slopes of the valley conditions are suitable for mountain bugbane.

Threats and Stresses

With the greatest majority of the site within either Gallitzin State Forest or the Charles F. Lewis Natural Area, it is primarily protected from development. However, because of several utility rights of way and numerous roads that traverse the area, it needs to be monitored for non-native invasive species spreading along these corridors. This population of mountain bugbane is threatened by deer overbrowsing. Individuals on the steepest slopes of the valley appear to be protected from deer, but upstream from this area the valley widens and most of the mountain bugbane plants were heavily browsed by deer. Japanese knotweed (*Fallopia japonica*) is also a threat here. It is spreading along the trail and along the creek, and in 2007 it had reached the mountain bugbane population and was beginning to crowd it out.

Conservation Recommendations

Further effort should be made to secure additional protection along Laurel Ridge to the north to enhance habitat connectivity to assure that this forested corridor does not become a dead end for migratory animals.

Emily Falk

Conemaugh Gorge

Claghorn BDA

This steep, north facing hillside above Black Lick Creek supports a population of **mountain bugbane** (*Cimicifuga americana*), a Pennsylvania rare plant species. Approximately 200 individuals were identified in this area.

A small population of **golden club** (*Orontium aquaticum*) can be found in the flat open bottom slope of a drainage that enters Black Lick Creek. While this species used to be tracked, it is now considered common enough to be a "watch list" species. Associated plants found here include *Juncus* sp., *Ludwigia* sp., and *Rhododendron maximum*.

Additionally, scattered individuals of bushy bluestem (*Andropogon glomeratus*), a species of grass considered rare in Pennsylvania may be found along the riverbanks and disturbed mine lands in the area. However, populations in western Pennsylvania appear to have originated from seed mix used on reclaimed abandoned mine land and are thus not considered native occurrences and not monitored at these locations.

Threats and Stresses

Japanese knotweed (*Fallopia japonica*) is present in portions of the site and if left uncontrolled it may become the dominant plant along the waterway to the exclusion of all other species.

Conservation Recommendations

The golden club that is found on this site should be conserved to prevent relisting of this species if populations are lost.

golden club (*Orontium aquaticum*) in flower

Robindale BDA

This site provides habitat for a **species of concern,** which is not named at the request of the jurisdictional agency overseeing its protection, and **shining ladies'-tresses** (*Spiranthes lucida*). These species are generally associated with wet-meadow habitats and open wet woods.

Threats and Stresses

These species are threatened by deer browse, development, succession of woods into closed-canopy forest, and activities that might modify the local hydrology.

Conservation Recommendations

Maintaining the hydrology at this site is necessary if these species are to maintain their place on the landscape. Additionally, a reduction in deer browse would ease pressure on these populations.

Pete Woods, PNHP

shining ladies' tresses (*Spiranthes lucida*)

Grant Township

	Taxa[1]	PNHP Rank[2] Global	PNHP Rank[2] State	Legal Status[2] State (Proposed)	Last Seen	Quality[2]
NATURAL HERITAGE AREAS:						
Nashville Swamp BDA			*Notable Significance*			
hemlock palustrine forest	C	GNR	S3	N	2007	E
Little Mahoning Creek at Nashville BDA			*Notable Significance*			
northern pygmy clubtail (*Lanthus parvulus*)	O	G4	S3S4	N	2006	E
ocellated darner (*Boyeria grafiana*)	O	G5	S3	N	2006	E

LANDSCAPE CONSERVATION AREAS: Little Mahoning Creek Watershed

PUBLICLY MANAGED LAND: State Game Land #262

OTHER CONSERVATION AREAS: None known

GEOLOGIC FEATURES: None

[1] A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionid (Mussel)
[2] Please refer to Appendix II (pg. 223) for an explanation of PNHP ranks and legal status
[3] This species is not named by request of the jurisdictional agency

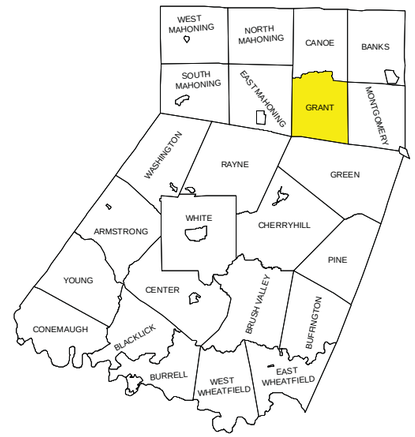
Indiana County
Natural Heritage Inventory

Grant Township

Biological Diversity Areas
Little Mahoning Creek at Nashville BDA
Nashville Swamp BDA

Landscape Conservation Areas
Little Mahoning Creek LCA

State Public Land
State Game Land #262



Legend

Biological Diversity Area (BDA)
- Core
- Supporting Landscape

Landscape Conservation Area (LCA)

- **PA Bureau of Forestry**
- **PA Game Commission**
- **National Wetland Inventory**
- **Streams**
- **40 Ft. Contour Line**

Pennsylvania Natural Heritage Program

Nashville Swamp BDA
State Game Land #262
Little Mahoning Creek at Nashville BDA
Little Mahoning Creek LCA
Enterprise
Savan
Rochester Mills
Logan
Gipsy
Nashville
Gorman Summit
Wilgus
Deckers Point
East Run
Hillsdale
Rayne
Purchase Line
Little Mahoning Creek
Beech Run
Barrett Run
Crooked Run
Pine Run
Rairigh Run
East Run
403
286
N
0 0.25 0.5 1 1.5 Kilometers
0 0.25 0.5 1 1.5 Miles

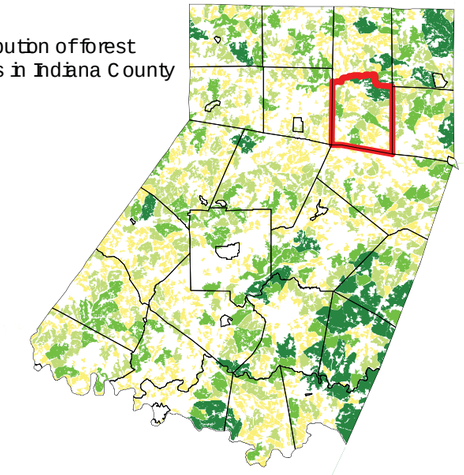
Indiana County Natural Heritage Inventory

Grant Township

Much of the native biodiversity of the township can be maintained by providing undisturbed forested buffers along streams, and avoiding fragmentation of the largest forest blocks with additional roads or utility infrastructure. These general landscape features help provide the habitat necessary to keep common species common. In addition, reforestation of creek and stream banks can help link larger forested blocks together, contributing to their utility as natural wildlife corridors while significantly improving regional water quality.

Riparian buffers through forested areas should be considered priorities for conservation. Riparian buffers through non-forested habitats should be considered priorities for restoration.

Distribution of forest blocks in Indiana County



Legend

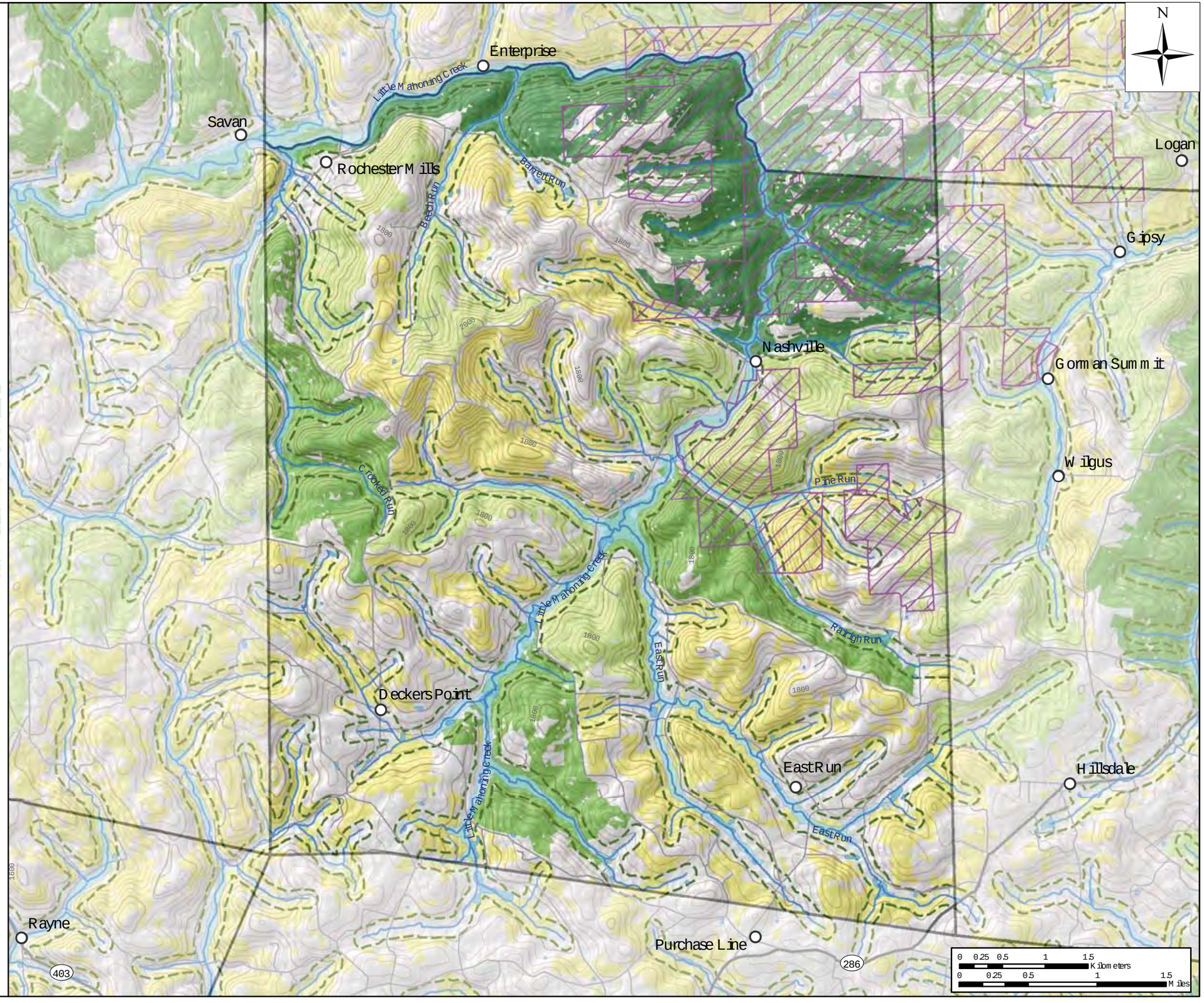
Pennsylvania Natural Heritage Program

- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre

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

- PA Bureau of Forestry
- PA Game Lands
- 40 Ft. Contour Line



Grant Township

Grant Township is part of the Pittsburgh Low Plateau Section of the Appalachian Plateau Province with bedrock geology of sandstone and shale. It is located in the northern portion of Indiana County. Forests cover more than 83 percent of this township. SGL #262 makes up a portion of the forested area. Agricultural practices represent 16 percent with most of it as pasture or hay fields. The Little Mahoning Creek is the major stream flowing through Grant Township. It serves as much of the boundary between Grant and Canoe Townships. Abandoned mine drainage has adversely affected this stream, but significant restoration efforts in the creek are improving its condition.

Nashville Swamp BDA

*The full description of the **Nashville Swamp BDA** is presented in the Canoe Township section on page 105.*

This site supports a **hemlock palustrine forest**. Maintaining the upstream hydrology that supports this site is critical to supporting this natural community of concern.

Little Mahoning Creek at Nashville BDA

Two dragonfly species, the **ocellated darner** (*Boyeria grafiana*) and the **northern pygmy clubtail** (*Lanthus parvulus*), were observed along Mahoning Creek adjacent to State Game Land #262. These two species are considered to be vulnerable in Pennsylvania.


Rick Koval

ocellated darner (*Boyeria grafiana*)

Threats and Stresses

These dragonfly species depend upon high water quality, the regulation of water temperature levels provided by forest cover, and the seasonal input of detritus and other organic material supplied from the forest. Excess input of nutrients from human activities in the watershed causes bacterial growth that reduces the oxygen content of the water. Timber harvesting may increase erosion and siltation, and cause a decrease in dissolved oxygen as canopy cover is removed and water temperature rises (Dunkle 2000, NatureServe 2009).

Conservation Recommendations

Ecologists do not completely understand the habitat needs of many of these stream-dwelling dragonflies, especially in regard to the protection of upstream water quality. Therefore, the supporting landscape delineated in this report should be used as a minimum guide; in practice, as much of the aquatic and riparian habitat should be protected as possible.

Green Township

	Taxa[1]	PNHP Rank[2] Global	PNHP Rank[2] State	Legal Status[2] State (Proposed)	Last Seen	Quality[2]
NATURAL HERITAGE AREAS:						
South Branch Two Lick Creek BDA			*High Significance*			
species of concern[3]	-	-	-	-	2008	D
species of concern[3]	-	-	-	-	2005	E
species of concern[3]	-	-	-	-	2007	E
species of concern[3]	-	-	-	-	2007	E
State Game Land #185			*Notable Significance*			
hemlock palustrine forest	C	GNR	S3	N	2007	E

LANDSCAPE CONSERVATION AREAS: Little Mahoning Creek Watershed
Little Yellow Creek Watershed

PUBLICLY MANAGED LAND: State Game Lands #185

OTHER CONSERVATION AREAS: None known

GEOLOGIC FEATURES: None

[1] A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionid (Mussel)
[2] Please refer to Appendix II (pg. 223) for an explanation of PNHP ranks and legal status
[3] This species is not named by request of the jurisdictional agency

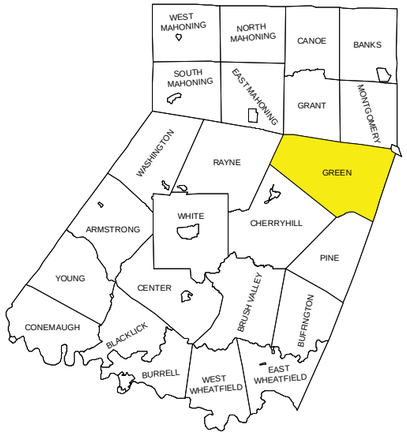
Indiana County
Natural Heritage Inventory

Green Township

Biological Diversity Areas
SGL #185 BDA
South Branch Two Lick Creek BDA

Landscape Conservation Areas
Little Mahoning Creek LCA
Little Yellow Creek Watershed LCA

State Public Land
State Game Land #185



Deckers Point
Bowdertown
East Run
Hillsdale
Little Mahoning Creek LCA
Purchase Line
North Branch Two Lick Creek
Idamar
Bencetown
Fleming Summit
Palmers Run
Cherry Tree
Cush Cushion Crossing
Hazlet Run
McKeages Crossing
Cush Cushion Creek
Barr Slope
Dixonville
ALLISON RD
Commodore
Seamentown
Isenberg Run
Taylorsville
Uniontown
Lovejoy
Starford
Pompey Run
Cookport
Peg Run
Bakers Run
DEATH VALLEY RD
SGL #185 BDA
Rembrant
Weimer
Learn Settlement
Rock Run
Greenwich
Douglas Run
Garmantown
Buck Run
Spruce
Wandin Junction
South Branch Two Lick Creek
State Game Land #185
Clymer
Repine Run
Long Run
Diamondville
Pine Flats
Long Run
South Branch Two Lick Creek BDA
Sample Run
Marsteller
Grisemore
Sides Run
Martintown
Kenwood
Little Yellow Creek Watershed LCA
Mentcle
Manor
Jewtown
Alverda
Heilwood
Penn Run

0 0.5 1 2 Kilometers
0 0.5 1 2 Miles

Legend

Biological Diversity Area (BDA)
- Core
- Supporting Landscape

Landscape Conservation Area (LCA)

- **PA Bureau of Forestry**
- **PA Game Commission**
- **National Wetland Inventory**
- **Streams**
- **40 Ft. Contour Line**

Pennsylvania Natural Heritage Program

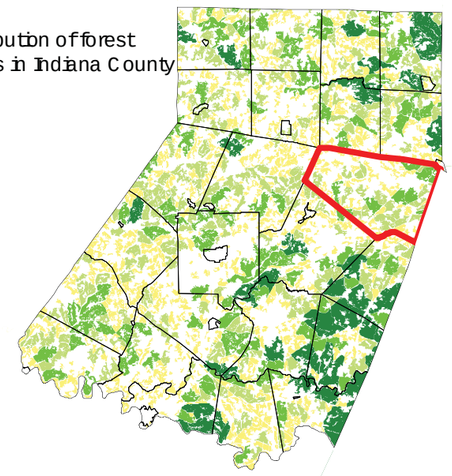
Indiana County
Natural Heritage Inventory

Green Township

Much of the native biodiversity of the township can be maintained by providing undisturbed forested buffers along streams, and avoiding fragmentation of the largest forest blocks with additional roads or utility infrastructure. These general landscape features help provide the habitat necessary to keep common species common. In addition, reforestation of creek and stream banks can help link larger forested blocks together, contributing to their utility as natural wildlife corridors while significantly improving regional water quality.

Riparian buffers through forested areas should be considered priorities for conservation. Riparian buffers through non-forested habitats should be considered priorities for restoration.

Distribution of forest blocks in Indiana County



Legend

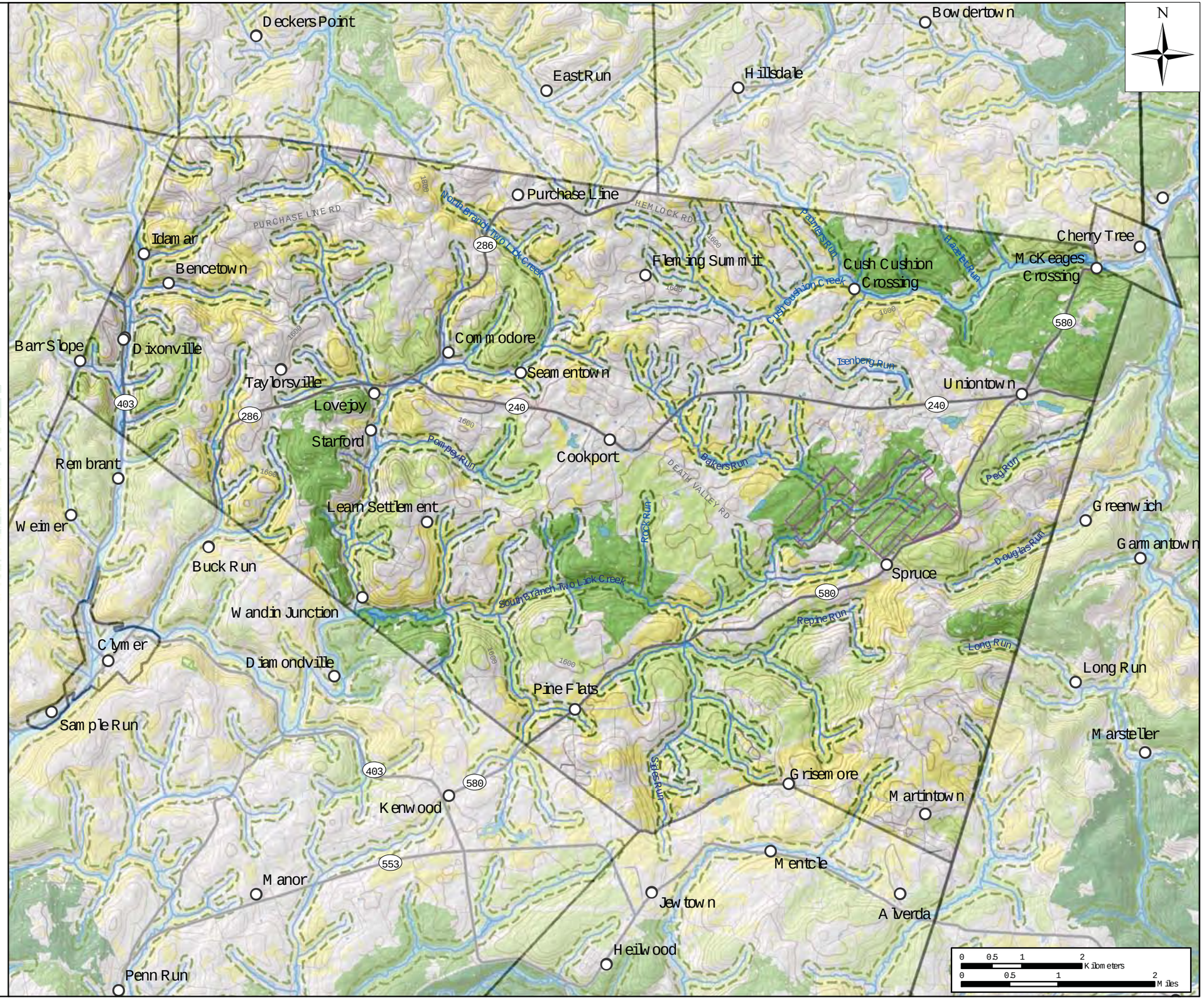
Pennsylvania Natural Heritage Program

- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre

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

- PA Bureau of Forestry
- PA Game Lands
- 40 Ft. Contour Line



Green Township

Green Township is the largest township in the county and shares a border with Cambria County. It is in the Pittsburgh Low Plateau Section of the Appalachian Plateau Province. The bedrock geology is comprised mostly of shale and sandstone. Agriculture makes up 29 percent of the total land use, with 70 percent of the land use being forest. The North and South Branches of Two Lick Creek plus Cush Cushion Creek are the major streams within the township. The divide between the Ohio and Susquehanna drainages occurs in the township with Cush Cushion Creek flowing into the Susquehanna drainage and the remainder of the township into the Ohio drainage basin. SGL #185 is located within Green Township and contributes to the forested areas. All forest blocks within the township are less than 700 acres in size.

South Branch Two Lick Creek BDA

This site supports **four species of concern**, which are not named in this report at the request of the jurisdictional agencies overseeing their protection. The species of concern depend on an intact forested riparian corridor composed of native vegetation, and on good water quality. This provides adequate habitat for these species, ensures clean and cold water within the local watershed, and allows easier and safer dispersal.

Threats and Stresses

The primary threat to these species is the degradation of the riparian and aquatic habitat that supports them through detrimental land use choices. Land use choices that change water temperature, increase inputs of sediments and nutrients, modify the timing and amount of river flow, or reduce or remove the riparian buffer stand to adversely affect these species.

Conservation Recommendations

To maintain this site a watershed-wide approach is necessary. Throughout the watershed a 100 meter no-cut buffer should be implemented and maintained on the main channel and on all tributaries to minimize nutrient and sediment inputs, maintain the shade to minimize thermal loading (sun heating of the water), and provide for the natural yearly input of leaves that maintain the food chain. Additionally, special care should be given to prevent the input of chemicals from abandoned mine drainage and other mining operations.

State Game Land #185 BDA

This site contains a **hemlock palustrine forest**, considered Vulnerable in Pennsylvania. The heavy shade from the canopy of hemlocks produces a cool microclimate which, combined with seasonal flooding, results in a habitat that supports a distinctive set of species.

Threats and Stresses

The westward invasion of the hemlock woolly adelgid (*Adelges tsugae*), currently documented in all but 16 counties in Pennsylvania (PA Bureau of Forestry 2010), poses a potential threat to the hemlock trees in the region. The hemlock woolly adelgid, native to Asia, is a sap-feeding insect that attacks both the eastern

hemlock (*Tsuga canadensis*) and the Carolina hemlock (*Tsuga caroliniana*). This insect pest can result in high levels of hemlock mortality, opening up the forest canopy and illuminating the forest floor to full sunlight. Loss of the adjacent hemlock forest would impact the hydrologic regime of the wetland.

Conservation Recommendations

Within the wetland, activities of greater intensity than occasional foot traffic should be avoided due to the sensitivity of the habitat. Forest canopy removal operations should be avoided within a 400 meter (~1350 foot) buffer zone surrounding the wetland in order to avoid detrimentally impacting the wetland and to help maintain water quality and the natural microclimate conditions in the wetland. Timber harvesting and road construction should be limited on the slopes overlooking the wetland complex.

Management of the forests in this area should include periodic monitoring for the hemlock woolly adelgid and other non-native forest pests. If hemlock dieback occurs, care should be taken to ensure that invasive plants do not become established.

Montgomery Township and Cherry Tree Borough

		PNHP Rank[2]		Legal Status[2]		
	Taxa[1]	Global	State	State (Proposed)	Last Seen	Quality[2]
NATURAL HERITAGE AREAS:						
Kilns Run BDA			*Notable Significance*			
species of concern[3]	-	-	-	-	2004	E

LANDSCAPE CONSERVATION AREAS: Little Mahoning Creek

PUBLICLY MANAGED LAND: None

OTHER CONSERVATION AREAS: None known

GEOLOGIC FEATURES: None

[1] A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionid (Mussel)
[2] Please refer to Appendix II (pg. 223) for an explanation of PNHP ranks and legal status
[3] This species is not named by request of the jurisdictional agency

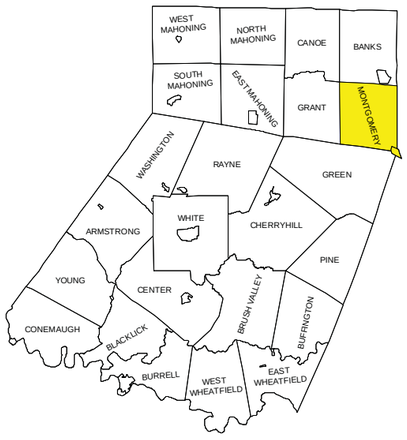
Indiana County
Natural Heritage Inventory

Montgomery Township
& Cherry Tree Borough

Biological Diversity Areas
Kilns Run BDA

Landscape Conservation Areas
Little Mahoning Creek LCA

State Public Land
State Game Land #262



Legend

Biological Diversity Area (BDA)
- Core
- Supporting Landscape

Landscape Conservation Area (LCA)

- PA Bureau of Forestry
- PA Game Commission
- National Wetland Inventory
- Streams
- 40 Ft. Contour Line

Pennsylvania Natural Heritage Program

Logan
Burnside
Gipsy
Hooverhurst
Nashville
Gorman Summit
Wilgus
Arcadia
Patchinville
Cush Creek
Bowdertown
East Run
Hillsdale
Stifflertown
Purchase Line
Cherry Tree
McKeages Crossing
State Game Land #262
Kilns Run BDA
Little Mahoning Creek LCA
West Branch Cush Creek
South Branch Cush Creek
Rock Run
Boiling Spring Run
Shryock Run
Powell Run
Kilns Run
Painters Run
Hazelet Run
GIPSY RD
ARCADIA RD
STIFFLER RD
HILLSDALE RD
PIONEER LAKE RD
CHERRY TREE RD
286
219
1800
1600
1400

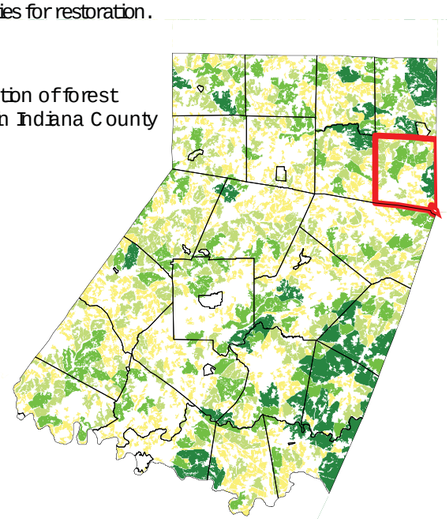
0 0.25 0.5 1 1.5 Kilometers
0 0.25 0.5 1 1.5 Miles

Indiana County
Natural Heritage Inventory
Montgomery Township
& Cherry Tree Borough

Much of the native biodiversity of the township can be maintained by providing undisturbed forested buffers along streams, and avoiding fragmentation of the largest forest blocks with additional roads or utility infrastructure. These general landscape features help provide the habitat necessary to keep common species common. In addition, reforestation of creek and stream banks can help link larger forested blocks together, contributing to their utility as natural wildlife corridors while significantly improving regional water quality.

Riparian buffers through forested areas should be considered priorities for conservation. Riparian buffers through non-forested habitats should be considered priorities for restoration.

Distribution of forest blocks in Indiana County



Legend

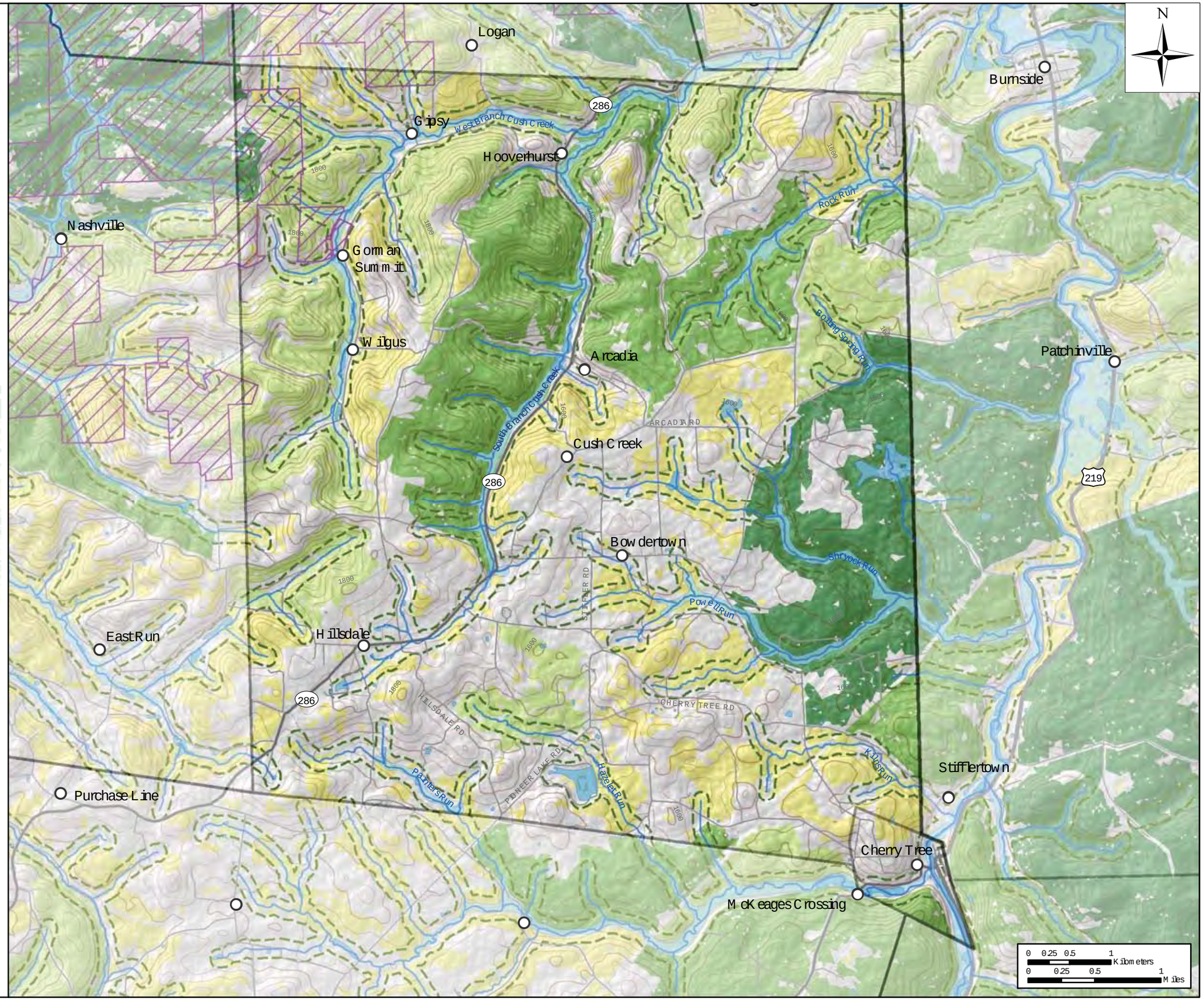
Pennsylvania Natural Heritage Program

- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre

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

- PA Bureau of Forestry
- PA Game Lands
- 40 Ft. Contour Line



Montgomery Township and Cherry Tree Borough

Montgomery Township is located in the northeastern sector of the county and borders with Clearfield County. Montgomery Township and Cherry Tree Borough are in the Pittsburgh Low Plateau Section of the Appalachian Plateau Province. The bedrock geology is primarily shale and sandstone. Forests make up 74 percent of the total land use with most forest blocks between 400 and 800 acres in size, while a quarter of the land use is agriculture. Cush Creek and its tributaries drain much of the township along with Shyrock Run and Rock Run in the eastern part. Montgomery Township, Banks Township and parts of Green Township, are unique in that they are a part of the Susquehanna drainage basin, while the rest of Indiana County belongs to the Ohio drainage basin.

CHERRY TREE BOROUGH

Cherry Tree Borough is the only borough within the township and is located at the intersection of Indiana, Clearfield, and Cambria Counties.

Kilns Run BDA

An occurrence of a **species of concern,** which is not named at the request of the jurisdictional agency overseeing its protection, was found along this creek. This is a heavily forested section of 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.

Conservation Recommendations

Preservation of the intact upland forest that supplies clean water to this site is necessary to maintain this population of species of concern. To accomplish this goal, landowners should be proactively engaged and educated about the value their property provides to clean water in an effort to maintain the entire Kilns Run watershed. Additionally, the wetlands and forested riparian corridor present within the core of this site should be left undisturbed.

North Mahoning Township

	Taxa[1]	PNHP Rank[2] Global	PNHP Rank[2] State	Legal Status[2] State (Proposed)	Last Seen	Quality[2]
NATURAL HERITAGE AREAS:						
Little Mahoning Creek – Upper BDA			*High Significance*			
round pigtoe (*Pleurobema sintoxia*)	U	G4G5	S2	PE	2007	E
wavy-rayed lampmussel (*Lampsilis fasciola*)	U	G5	S4	N	2007	B
species of concern[3]	-	-	-	-	2007	E
elktoe (*Alasmidonta marginata*)	U	G4	S4	N	-	H
rainbow mussel (*Villosa iris*)	U	G5Q	S1	PE	-	H
Mudlick Run BDA			*Notable Significance*			
featherbells (*Stenanthium gramineum*)	P	G4G5	S1S2	N(TU)	2007	A

LANDSCAPE CONSERVATION AREAS: Little Mahoning Creek Watershed

PUBLICLY MANAGED LAND: None

OTHER CONSERVATION AREAS: None known

GEOLOGIC FEATURES: None

[1] A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionid (Mussel)
[2] Please refer to Appendix II (pg. 223) for an explanation of PNHP ranks and legal status
[3] This species is not named by request of the jurisdictional agency

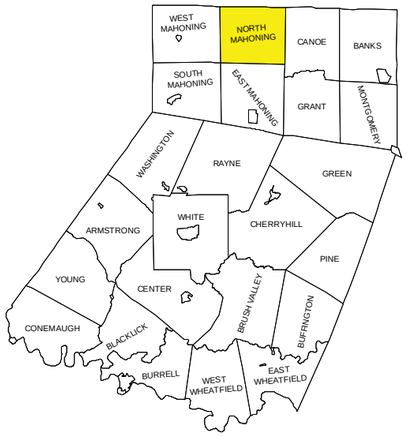
Indiana County
Natural Heritage Inventory

North Mahoning Township

Biological Diversity Areas
Little Mahoning Creek - Upper BDA
Mudlick Run BDA

Landscape Conservation Areas
Little Mahoning Creek LCA

State & Federal Public Land
Mahoning Creek Lake (USACE)



Legend

Biological Diversity Area (BDA)
- Core
- Supporting Landscape

Landscape Conservation Area (LCA)
- **PA Bureau of Forestry**
- **PA Game Commission**
- **US Army Corps of Engineers**
- **National Wetland Inventory**
- **Streams**
- **40 Ft. Contour Line**

PNHP
Pennsylvania Natural Heritage Program

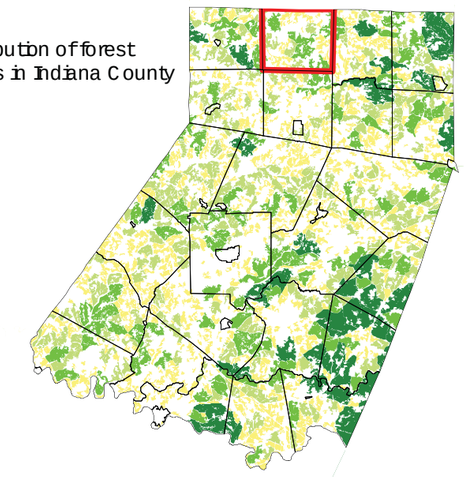
Indiana County
Natural Heritage Inventory

North Mahoning Township

Much of the native biodiversity of the township can be maintained by providing undisturbed forested buffers along streams, and avoiding fragmentation of the largest forest blocks with additional roads or utility infrastructure. These general landscape features help provide the habitat necessary to keep common species common. In addition, reforestation of creek and stream banks can help link larger forested blocks together, contributing to their utility as natural wildlife corridors while significantly improving regional water quality.

Riparian buffers through forested areas should be considered priorities for conservation. Riparian buffers through non-forested habitats should be considered priorities for restoration.

Distribution of forest blocks in Indiana County



Legend

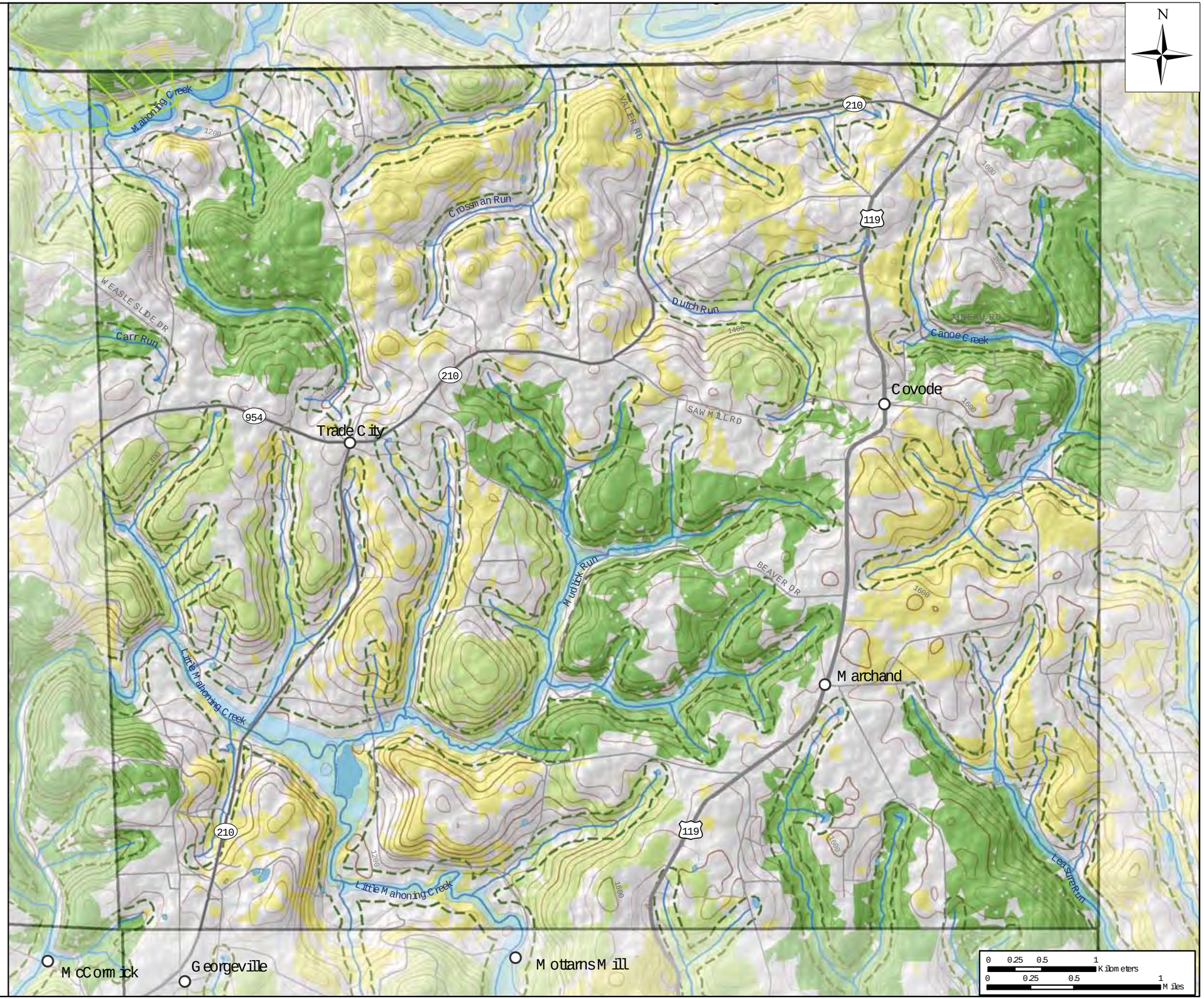
PNHP
Pennsylvania Natural Heritage Program

- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre

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

- USACE
- PA Bureau of Forestry
- PA Game Lands
- 40 Ft. Contour Line



North Mahoning Township

North Mahoning Township is located in northern Indiana County and shares a border with Jefferson County. It is a part of the Pittsburgh Low Plateau Section of the Appalachian Plateau Province with bedrock geology of shale and sandstone. Forested areas make up sixty-two percent of the municipality, but roads and agriculture fragment much of the landscape. Agricultural areas account for 37 percent of the land use. This is one of the highest percentages in the county. Mudlick Run and Little Mahoning are the major streams draining the township.

Little Mahoning Creek – Upper BDA

This section of Little Mahoning Creek provides ideal habitat for a wealth of aquatic species because of high water quality and limited historical impacts on aquatic species. Among the listed species found at this site are **round pigtoe** (*Pleurobema sintoxia*), **wavy-rayed lampmussel** (*Lampsilis fasciola*), and a **species of concern,** which is not named at the request of the jurisdictional agency overseeing its protection.

Lance Merry

a wavy-rayed lampmussel (*Lampsilis fasciola*)

Historically, this site also supported two other mussel species of concern, **elktoe** (*Alasmidonta marginata*) and **rainbow mussel** (*Villosa iris*). These species continue to live farther downstream, in Little Mahoning Creek – Lower BDA. They may still exist here, or may be able to recolonize from the lower populations.

Threats and Stresses

This entire system is threatened by various sources of water pollution. Because it is underlain by the Marcellus shale formation, natural gas extraction is a realistic possibility within this system. The input of any waste products resulting from Marcellus shale fracturing will cause significant long-term negative impacts on the aquatic life in the creek, as it has on several other high-quality waterways in the Commonwealth.

Other inputs from improper farming and forestry within the watershed could be just as damaging to the aquatic life in the creek. Excess nutrients and sediments can smother or bury the aquatic life in the stream.

Development within the floodplain will result in additional inputs of nutrients and sediments by removing the riparian buffer. This development will also reduce flood storage capacity for the stream by decreasing the size of the floodplain.

Existing dams on Little Mahoning Creek are increasing "thermal pollution" by allowing the water to heat up in the sun. They are also acting as dispersal barriers for aquatic life with no listed species found upstream of the dam in East Mahoning Township just upstream from the Baltimore and Ohio railroad bridge.

Conservation Recommendations

Creation and maintenance of a 100 meter forested riparian buffer throughout the entire Little Mahoning Creek watershed, including all the tributaries, is necessary for the protection of water quality within this site. This buffer will help to mitigate existing nutrient and sediment inputs and help to reduce thermal pollution within the site. It will also provide the natural, seasonal input of leaves that support the food chain within this creek.

Any Marcellus shale drilling that occurs within the watershed, if it is allowed at all, should be closely monitored and held to the highest safety standards. A failure to adhere to strict standards aimed at protecting aquatic ecosystems will invite an environmental disaster like the massive kill-off of aquatic life in Dunkard Creek in the fall of 2009.

PNHP

elktoe (*Alasmidonta marginata*)

Finally, an effort should be made to remove all manmade barriers to fish passage within the Little Mahoning Creek watershed. These barriers are increasing thermal pollution and providing habitat for fish species such as common carp (*Cyprinus carpio*) and are a general detriment to the watershed.

Mudlick Run BDA

This site is designated around a population of **featherbells** (*Stenanthium gramineum*), a plant species of concern. Featherbells rely on an early successional habitat in moist meadows with reduced grazing pressure from deer and reduced competition from non-native invasive plants.

Threats and Stresses

The species of concern would be especially susceptible to forestry practices within the core habitat. The featherbells are susceptible to grazing from deer, succession to a closed canopy, and competition from non-native invasive plants.

Conservation Recommendations

The species of concern requires the continued presence of a large patch of undisturbed forest near a healthy river. The existing disturbance at this site should be mitigated to buffer the forest from further disturbance. The site should be monitored for the presence of non-native invasive plants and these should be controlled if they become a problem.

Pete Woods, PNHP

featherbells (*Stenanthium gramineum*) sprouts, in the early spring

Pine Township

	Taxa[1]	PNHP Rank[2] Global	PNHP Rank[2] State	Legal Status[2] State (Proposed)	Last Seen	Quality[2]
NATURAL HERITAGE AREAS:						
Little Yellow Creek BDA			*High Significance*			
sable clubtail (*Gomphus rogersi*)	O	G4	S1	N	2007	E
species of concern[3]	-	-	-	-	199?	E
species of concern[3]	-	-	-	-	2003	E
species of concern[3]	-	-	-	-	2005	E
South Branch Two Lick Creek BDA			*High Significance*			
species of concern[3]	-	-		-	2008	D
species of concern[3]	-	-	-	-	2005	E
species of concern[3]	-	-	-	-	2007	E
species of concern[3]	-	-	-	-	2007	E

LANDSCAPE CONSERVATION AREAS: Little Yellow Creek Watershed

PUBLICLY MANAGED LAND: None

OTHER CONSERVATION AREAS: None known

GEOLOGIC FEATURES: None

[1] A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionid (Mussel)
[2] Please refer to Appendix II (pg. 223) for an explanation of PNHP ranks and legal status
[3] This species is not named by request of the jurisdictional agency

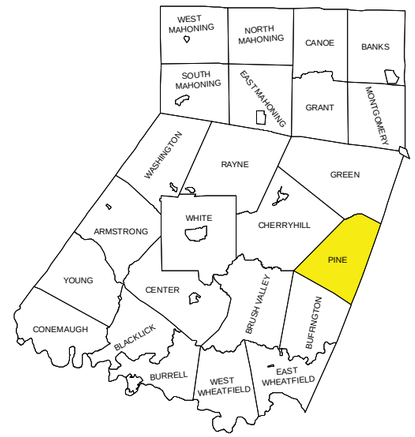
Indiana County
Natural Heritage Inventory

Pine Township

Biological Diversity Areas
Little Yellow Creek BDA
South Branch Two Lick Creek BDA

Landscape Conservation Areas
Little Yellow Creek Watershed

State Public Land
None



Legend

Biological Diversity Area (BDA)
- Core
- Supporting Landscape

Landscape Conservation Area (LCA)

- **PA Bureau of Forestry**
- **PA Game Commission**
- **National Wetland Inventory**
- **Streams**
- **40 Ft. Contour Line**

Pennsylvania Natural Heritage Program

0 0.5 1 2 Kilometers
0 0.5 1 2 Miles

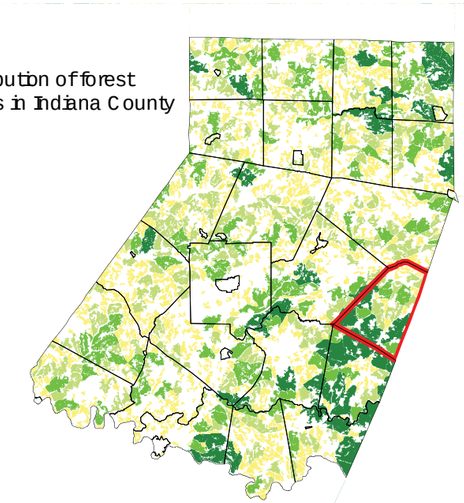
Indiana County Natural Heritage Inventory

Pine Township

Much of the native biodiversity of the township can be maintained by providing undisturbed forested buffers along streams, and avoiding fragmentation of the largest forest blocks with additional roads or utility infrastructure. These general landscape features help provide the habitat necessary to keep common species common. In addition, reforestation of creek and stream banks can help link larger forested blocks together, contributing to their utility as natural wildlife corridors while significantly improving regional water quality.

Riparian buffers through forested areas should be considered priorities for conservation. Riparian buffers through non-forested habitats should be considered priorities for restoration.

Distribution of forest blocks in Indiana County



Legend

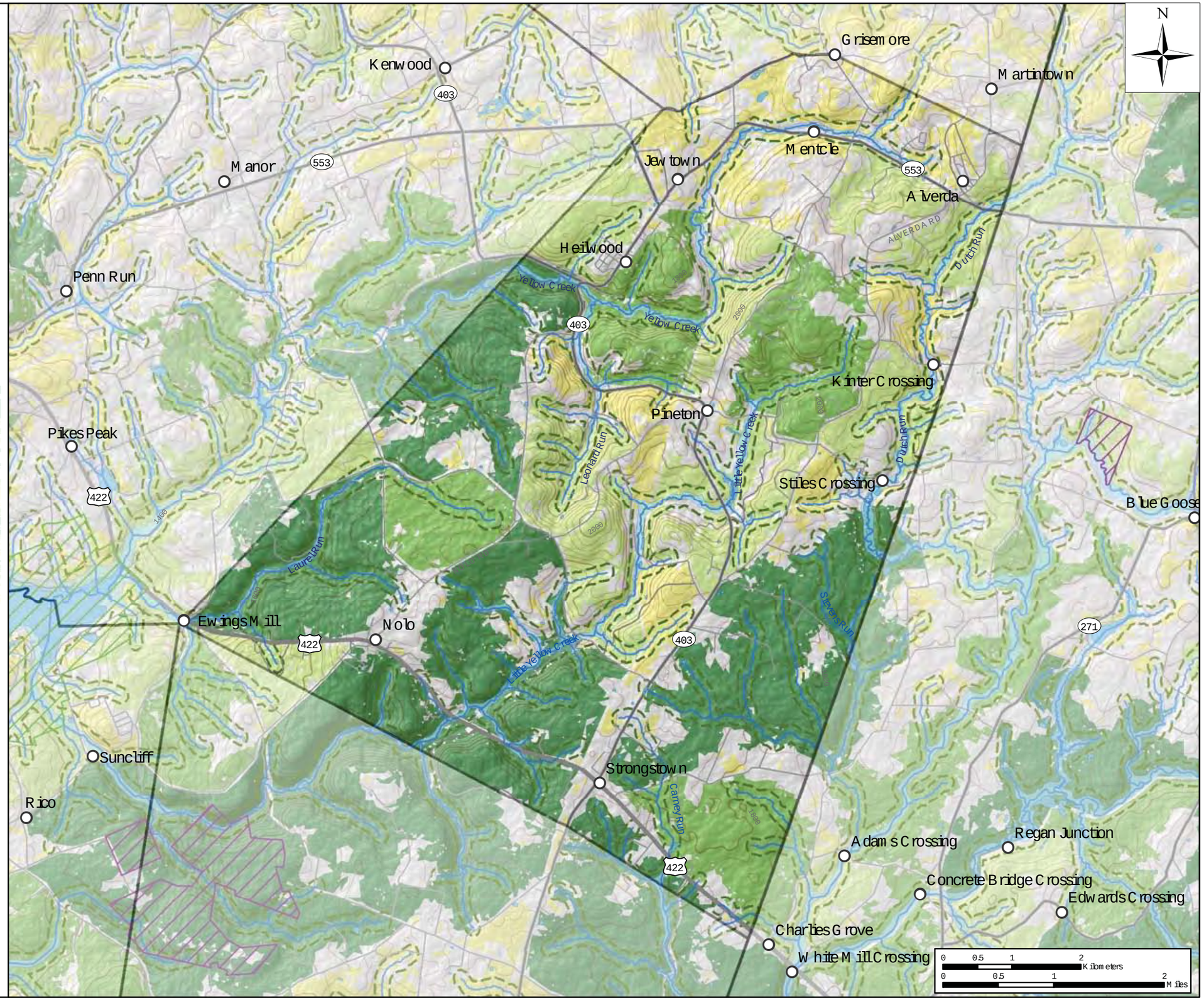
Pennsylvania Natural Heritage Program

- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre

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

- PA Bureau of Forestry
- PA Game Lands
- 40 Ft. Contour Line



Pine Township

Pine Township is located along the eastern edge of the county; it shares a border with Cambria County. It is located primarily in the Allegheny Mountain Section of the Appalachian Plateau Province with just a small portion at the northern end of the township in the Pittsburgh Low Plateau Section of the Appalachian Plateau Province. The bedrock geology is composed of shale and sandstone. Pine Township is aptly named; evergreens make up 12 percent of its total forested area, the highest percent of evergreen forest in the county. Altogether, 85 percent of total land use occurs as forest in Pine Township, this is the highest percentage of forest for any township in Indiana County. The largest forest blocks occur in the southern half of the township. Agricultural land use is at a low of 13 percent. US 422 cuts through this forested area near the southern boundary. Yellow Creek, Little Yellow Creek, and Dutch Creek are the major streams flowing through Pine Township.

Little Yellow Creek BDA

This site supports a population of a dragonfly species of concern, **sable clubtail** (*Gomphus rogersi*).

Ben Coulter

sable clubtail (*Gomphus rogersi*)

The sable clubtail is a dragonfly species that prefers forested clear-water streams of a moderate size with a decent current and a rocky bottom. The larvae of this species are most often found below a log jam or other significant pile of in-stream course woody debris. Adults are active from mid-April through July and can be seen occasionally patrolling the waterway, though they often forage well into the canopy of the surrounding forest.

This site also supports **three additional species of concern,** which are not named at the request of the jurisdictional agencies overseeing their protection, all require clean, clear, cold, free-flowing streams with a healthy population of aquatic macroinvertebrates.

Threats and Stresses

The primary threat to these species is the degradation of the aquatic habitat that supports them through detrimental land use choices. Land use choices that change water temperature, increase inputs of sediments and nutrients, or modify the chemical composition, timing, and amount of river flow stand to adversely affect these species.

Conservation Recommendations

To maintain this site a watershed-wide approach is necessary. Throughout the watershed a 100 meter no-cut buffer should be implemented on all streams to minimize nutrient and sediment inputs, maintain the shade to minimize thermal loading (sun heating of the water), and provide for the natural yearly input of leaves that maintain the food webs. Additionally, special care should be given to prevent the input of chemicals from abandoned mine drainage and other mining operations. As a note, active mining operations have already encroached to less than 30 meters (~98 feet) of the edge of Little Yellow Creek within the core habitat of this site.

Pete Woods, PNHP

southern pygmy clubtail (*Lanthus vernalis*), an uncommon dragonfly found at this site

South Branch Two Lick Creek BDA

*The full description of the **South Branch Two Lick Creek BDA** is presented in the Green Township section on page 143.*

This site supports populations of **four species of concern,** which are not named at the request of the jurisdictional agencies overseeing their protection. Maintaining the forested riparian habitat and water quality of the site is necessary to maintain these species at this site.

Rayne Township and Ernest Borough

	Taxa[1]	PNHP Rank[2] Global	State	Legal Status[2] State (Proposed)	Last Seen	Quality[2]
NATURAL HERITAGE AREAS:						
Onberg BDA			*Notable Significance*			
species of concern[3]	-	-	-	-	2003	E

LANDSCAPE CONSERVATION AREAS: None

PUBLICLY MANAGED LAND: Blue Spruce Park

OTHER CONSERVATION AREAS: None known

GEOLOGIC FEATURES: None

[1] A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionid (Mussel)
[2] Please refer to Appendix II (pg. 223) for an explanation of PNHP ranks and legal status
[3] This species is not named by request of the jurisdictional agency

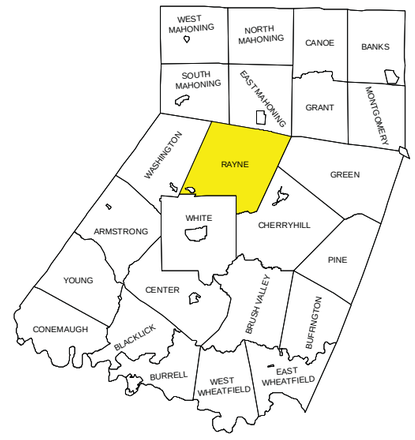
Indiana County
Natural Heritage Inventory

Rayne Township
& Ernst Borough

Biological Diversity Areas
Onberg BDA

Landscape Conservation Areas
None Currently Identified

State Public Land
None



Legend

Biological Diversity Area (BDA)
- Core
- Supporting Landscape

Landscape Conservation Area (LCA)
- **PA Bureau of Forestry**
- **PA Game Commission**
- **National Wetland Inventory**
- **Streams**
- **40 Ft. Contour Line**

Pennsylvania Natural Heritage Program

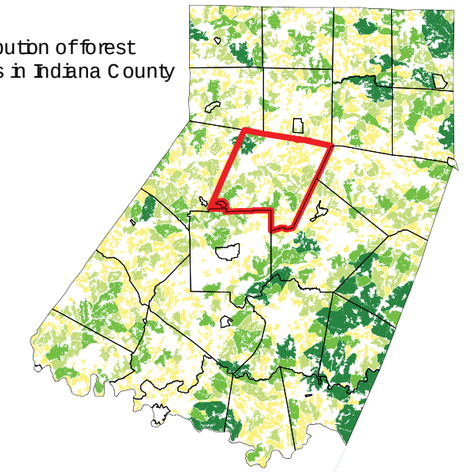
0 0.5 1 2 Kilometers
0 0.5 1 2 Miles

Indiana County
Natural Heritage Inventory
Rayne Township
& Ernst Borough

Much of the native biodiversity of the township can be maintained by providing undisturbed forested buffers along streams, and avoiding fragmentation of the largest forest blocks with additional roads or utility infrastructure. These general landscape features help provide the habitat necessary to keep common species common. In addition, reforestation of creek and stream banks can help link larger forested blocks together, contributing to their utility as natural wildlife corridors while significantly improving regional water quality.

Riparian buffers through forested areas should be considered priorities for conservation. Riparian buffers through non-forested habitats should be considered priorities for restoration.

Distribution of forest blocks in Indiana County



Legend

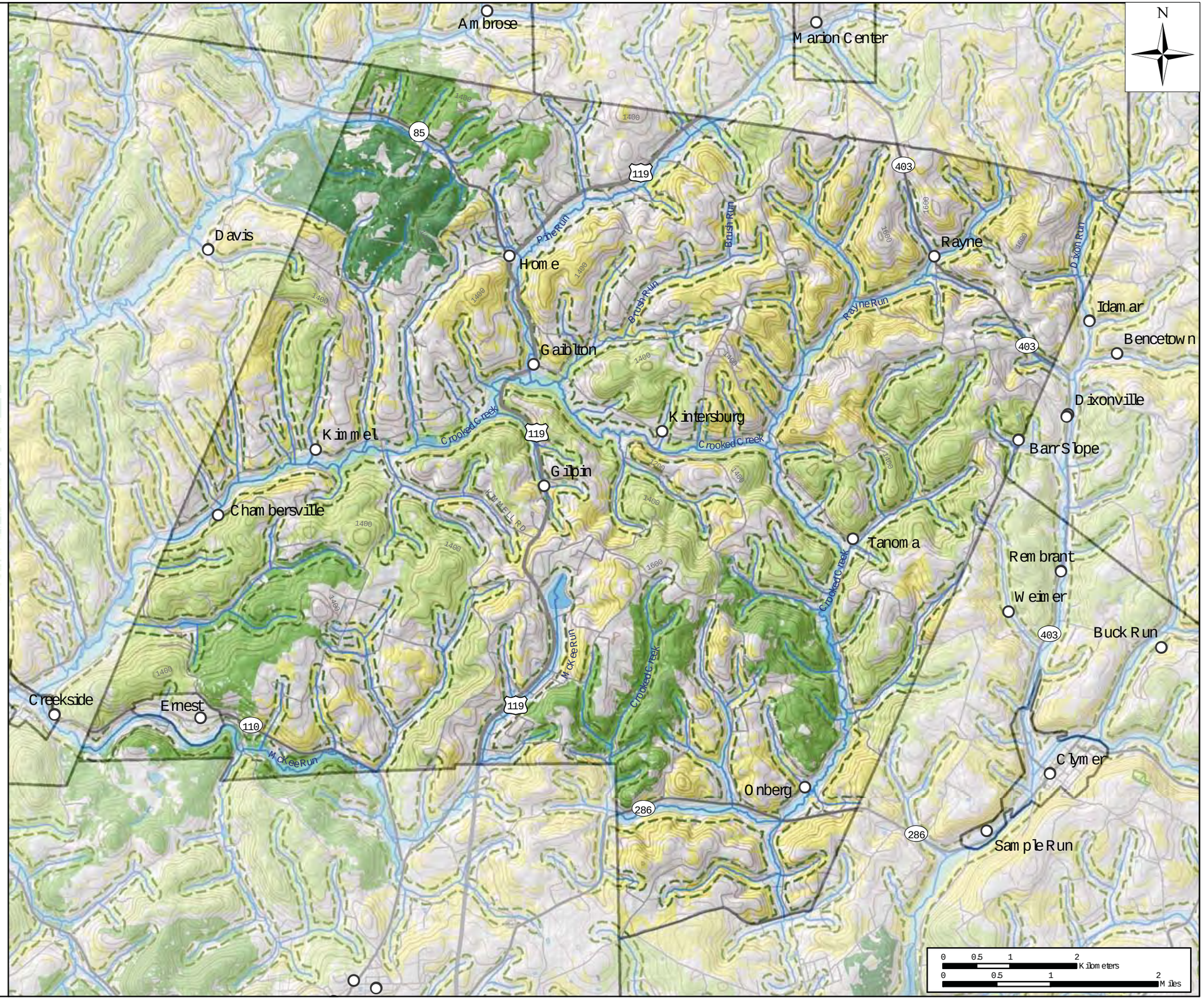
Pennsylvania Natural Heritage Program

- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre

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

- PA Bureau of Forestry
- PA Game Lands
- 40 Ft. Contour Line



Rayne Township and Ernest Borough

Rayne Township is located in central Indiana County, within the Pittsburgh Low Plateau Section of the Appalachian Plateau Province. Shale and sandstone are the main components of the bedrock geology. Rayne Township is 68 percent forested but roads and agriculture fragment much of it. Agriculture makes up 30 percent of the total land use. Crooked Creek and its tributaries drain most of the township. Blue Spruce Park is a county park located in the southwest corner of the township, just north of Ernest Borough.

ERNEST BOROUGH

Ernest Borough is in the southwest corner of Rayne Township. The borough is 29 percent developed; 65 percent forested and only 6 percent is agricultural.

Onberg BDA

This site supports a population of a **species of concern,** which is not named at the request of the jurisdictional agency overseeing its protection. It relies on clean, clear creeks of small to moderate size, with both sandy/pebbly stretches with flowing water as well as still, muddy backwaters.

Threats and Stresses

The primary threat to this species is the degradation of the aquatic habitat that supports it through detrimental land use choices. Land use choices that change water temperature, increase inputs of sediments and nutrients, or modify the timing and amount of river flow are likely to adversely affect the species of concern.

Conservation Recommendations

To maintain this site a watershed-wide approach is necessary. Throughout the watershed a 100 meter no-cut buffer should be implemented on all streams to minimize nutrient and sediment inputs, maintain the shade to minimize thermal loading (sun heating of the water), and provide for the natural yearly input of leaves that maintain the food chain. Additionally, special care should be given to prevent the input of chemicals from abandoned mine drainage and other mining operations.

South Mahoning Township and Plumville Borough

	Taxa[1]	PNHP Rank[2] Global	PNHP Rank[2] State	Legal Status[2] State (Proposed)	Last Seen	Quality[2]
NATURAL HERITAGE AREAS:						
Little Mahoning Creek – Lower BDA			*Exceptional Significance*			
mustached clubtail (*Gomphus adelphus*)	O	G4	S3S4	N	2006	E
rapids clubtail (*Gomphus quadricolor*)	O	G3G4	S1S2	N	2007	E
elktoe (*Alasmidonta marginata*)	U	G4	S4	N	2007	E
rainbow mussel (*Villosa iris*)	U	G5Q	S1	PE	2007	E
round pigtoe (*Pleurobema sintoxia*)	U	G4G5	S2	PE	2007	E
wavy-rayed lampmussel (*Lampsilis fasciola*)	U	G5	S4	N	2007	B
species of concern[3]	-	-	-	-	2005	E
species of concern[3]	-	-	-	-	2007	E
species of concern[3]	-	-	-	-	1991	E
North Branch Plum Creek BDA			*Notable Significance*			
species of concern[3]	-	-	-	-	2007	E

LANDSCAPE CONSERVATION AREAS: Little Mahoning Creek Watershed

PUBLICLY MANAGED LAND: None

OTHER CONSERVATION AREAS: None known

GEOLOGIC FEATURES: None

[1] A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionid (Mussel)
[2] Please refer to Appendix II (pg. 223) for an explanation of PNHP ranks and legal status
[3] This species is not named by request of the jurisdictional agency

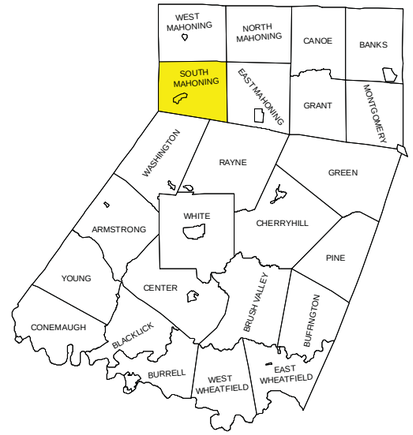
Indiana County
Natural Heritage Inventory

South Mahoning Township
& Plumville Borough

Biological Diversity Areas
Little Mahoning Creek - Lower BDA
North Branch Plum Creek BDA

Landscape Conservation Areas
Little Mahoning Creek

State Public Land
None



Legend

Biological Diversity Area (BDA)
- Core
- Supporting Landscape

Landscape Conservation Area (LCA)

- **PA Bureau of Forestry**
- **PA Game Commission**
- **National Wetland Inventory**
- **Streams**
- **40 Ft. Contour Line**

Pennsylvania Natural Heritage Program

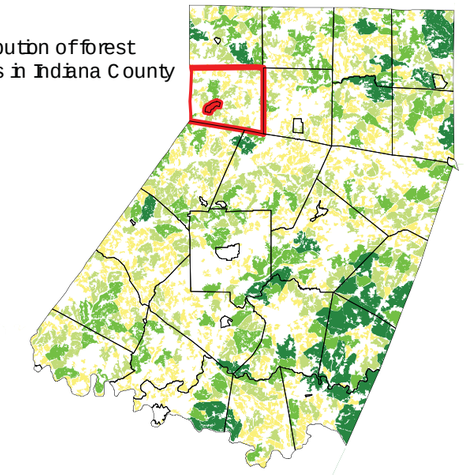
0 0.25 0.5 1 1.5 Kilometers
0 0.25 0.5 1 1.5 Miles

Indiana County
Natural Heritage Inventory
South Mahoning Township
& Plumville Borough

Much of the native biodiversity of the township can be maintained by providing undisturbed forested buffers along streams, and avoiding fragmentation of the largest forest blocks with additional roads or utility infrastructure. These general landscape features help provide the habitat necessary to keep common species common. In addition, reforestation of creek and stream banks can help link larger forested blocks together, contributing to their utility as natural wildlife corridors while significantly improving regional water quality.

Riparian buffers through forested areas should be considered priorities for conservation. Riparian buffers through non-forested habitats should be considered priorities for restoration.

Distribution of forest blocks in Indiana County



Legend

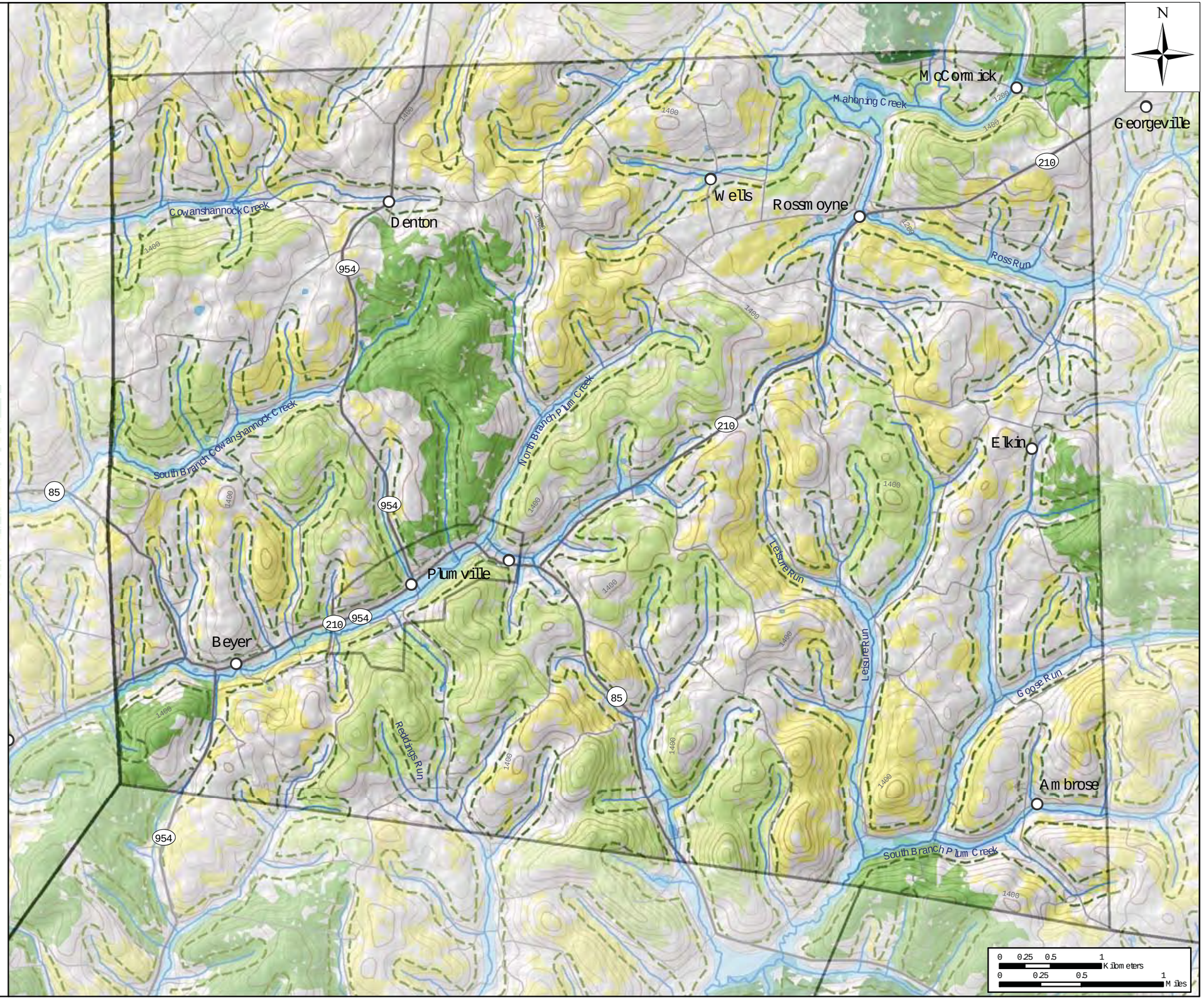
Pennsylvania Natural Heritage Program

- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre

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

- PA Bureau of Forestry
- PA Game Lands
- 40 Ft. Contour Line



South Mahoning Township and Plumville Borough

South Mahoning Township is located along the western edge of Indiana County and makes up part of the border with Armstrong County. South Mahoning Township and Plumville Borough are in the Pittsburgh Low Plateau Section of the Appalachian Plateau Province. Like much of the county, the bedrock geology is composed of shale and sandstone. Forested areas make up 57 percent of the total land use, which is less than nearly any other township in the county. Conversely, agriculture represents 43 percent of the total land use, which is the highest percentage for any township in Indiana County. Most of the forest blocks are less than 500 acres in size with the exception of one 700 acre block. The North and South Branches of Plum Creek drain most of the township. Ross Run and the Cowanshannock Creek respectively cover smaller drainages in the northeast and northwest corners of the township. Many miles of streams flow through agricultural areas. Trees should be planted along the banks of these streams to buffer them from sediment, fertilizers, and pesticides that otherwise can enter the streams.

PLUMVILLE BOROUGH

Only 5 percent of Plumville Borough is developed.

Little Mahoning Creek – Lower BDA

*The full description of the **Little Mahoning Creek – Lower BDA** is presented in the West Mahoning Township section on page 181.*

This section of Little Mahoning Creek provides habitat for numerous aquatic species, but faces impacts from impoundments and the threat of Marcellus shale gas extraction.

North Branch Plum Creek BDA

This site supports a population of a **species of concern,** which is not named at the request of the jurisdictional agency overseeing its protection. It relies on clean, clear creeks of small to moderate size, with both sandy/pebbly stretches with flowing water as well as still, muddy backwaters.

This site shares a Supporting Landscape with **Keystone Lake BDA**, which is downstream in Armstrong County. Keystone Lake is a High Significance BDA that supports marsh-nesting birds including **sora** (*Porzana carolina*), and **Virginia rail** (*Rallus limicola*), as well as **paper pondshell** (*Utterbackia imbecillis*), and another **species of concern,** which is not named at the request of the jurisdictional agency overseeing its protection.

Threats and Stresses

The primary threat to this species is the degradation of the aquatic habitat that supports it through detrimental land use choices. Land use choices that change water temperature, increase inputs of sediments and nutrients, or modify the timing and amount of river flow are likely to adversely affect the species of concern.

Conservation Recommendations

To maintain this site a watershed-wide approach is necessary. Throughout the watershed a 100 meter no-cut buffer should be implemented on all streams to minimize nutrient and sediment inputs, maintain the shade to minimize thermal loading (sun heating of the water), and provide for the natural yearly input of leaves that maintain the food chain. Additionally, special care should be given to prevent the input of chemicals from abandoned mine drainage and other mining operations.

David Spier

Virginia rail (*Rallus limicola*) adult with chick

Washington Township and Creekside Borough

	Taxa[1]	PNHP Rank[2] Global	PNHP Rank[2] State	Legal Status[2] State (Proposed)	Last Seen	Quality[2]
NATURAL HERITAGE AREAS:						
Creekside BDA			*Notable Significance*			
featherbells (*Stenanthium gramineum*)	P	G4G5	S1S2	TU	2008	A
species of concern[3]	-	-	-	-	2007	E
South Branch Plum Creek BDA			*Notable Significance*			
Wabash pigtoe (*Fusconaia flava*)	U	G5	S2	PE	2007	D
species of concern[3]	-	-	-	-	2007	E

LANDSCAPE CONSERVATION AREAS: None

PUBLICLY MANAGED LAND: None

OTHER CONSERVATION AREAS: None known

GEOLOGIC FEATURES: None

[1] A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionid (Mussel)
[2] Please refer to Appendix II (pg. 223) for an explanation of PNHP ranks and legal status
[3] This species is not named by request of the jurisdictional agency

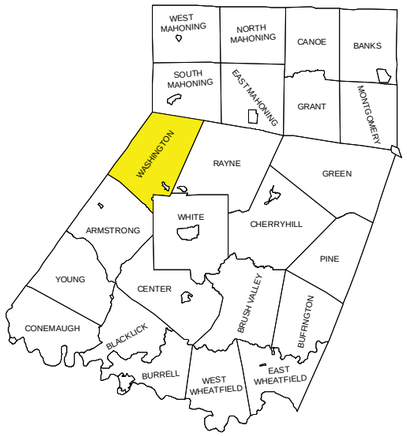
Indiana County
Natural Heritage Inventory

Washington Township
& Creekside Borough

Biological Diversity Areas
Creekside BDA
South Branch Plum Creek BDA

Landscape Conservation Areas
None Currently Identified

State Public Land
None



Legend

Biological Diversity Area (BDA)
- Core
- Supporting Landscape

Landscape Conservation Area (LCA)
- **PA Bureau of Forestry**
- **PA Game Commission**
- **National Wetland Inventory**
- **Streams**
- **40 Ft. Contour Line**

Pennsylvania Natural Heritage Program

0 0.5 1 2 Kilometers
0 0.5 1 2 Miles

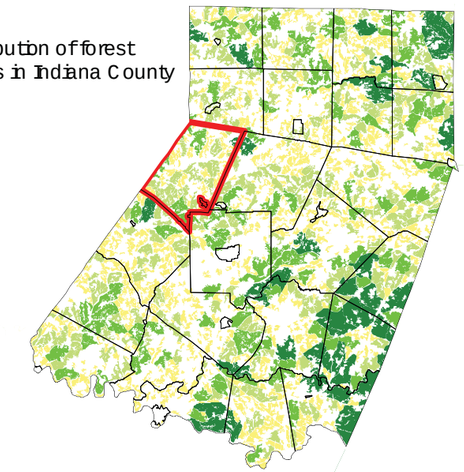
Indiana County
Natural Heritage Inventory

Washington Township
& Creekside Borough

Much of the native biodiversity of the township can be maintained by providing undisturbed forested buffers along streams, and avoiding fragmentation of the largest forest blocks with additional roads or utility infrastructure. These general landscape features help provide the habitat necessary to keep common species common. In addition, reforestation of creek and stream banks can help link larger forested blocks together, contributing to their utility as natural wildlife corridors while significantly improving regional water quality.

Riparian buffers through forested areas should be considered priorities for conservation. Riparian buffers through non-forested habitats should be considered priorities for restoration.

Distribution of forest blocks in Indiana County



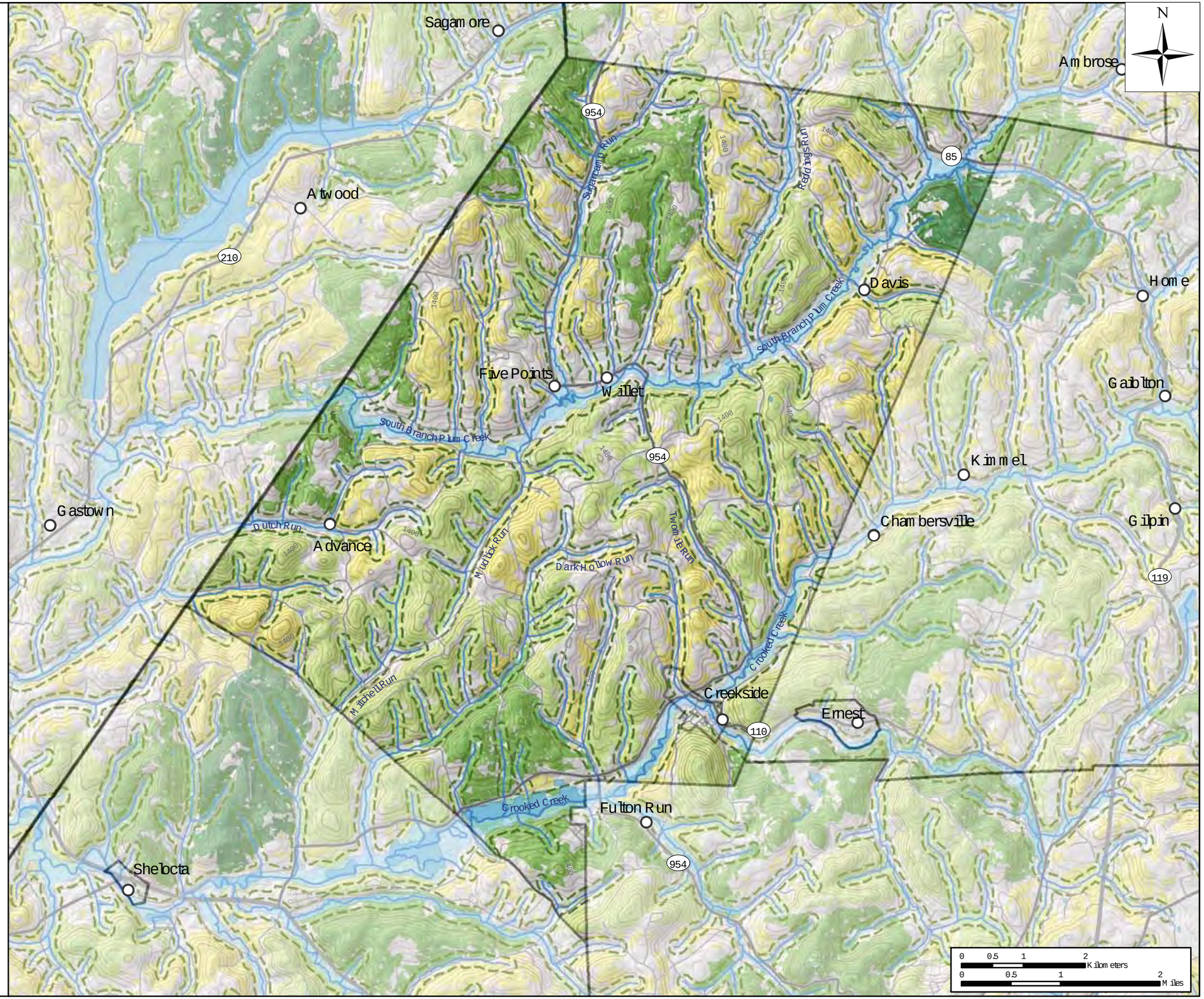
Legend

PNHP
Pennsylvania Natural Heritage Program

- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre
- < 250
- 251 - 500
- 501 - 1000
- > 1000

- PA Bureau of Forestry
- PA Game Lands
- 40 Ft. Contour Line



Washington Township and Creekside Borough

Washington Township is located along the western edge of the county and makes up part of the border with Armstrong County. Washington Township and Creekside Borough are in the Pittsburgh Low Plateau Section of the Appalachian Plateau Province. Shale and sandstone make up the bedrock geology. Forests cover three-fourths of the land within the township. Most of the forest blocks are less than 500 acres with only two greater than that. The largest forest block contains 810 acres. Agriculture accounts for 25 percent of the total land use. The South Branch of Plum Creek drains over half of the township. The creek flows through agricultural areas and is impaired due to problems associated with runoff from fields. Reforestation along the banks of the creek would provide a buffer against the pollutants that currently enter the stream. Crooked Creek and its tributaries flow through the southeastern portion of the township. Abandoned mine drainage has adversely affected some sections of this creek.

CREEKSIDE BOROUGH

Crooked Creek flows through Creekside Borough. Creekside is 29 percent developed, 42 percent forested, and 28 percent agriculture.

Creekside BDA

This site is designated around a population of **featherbells** (*Stenanthium gramineum*) and an additional **species of concern,** which is not named at the request of the jurisdictional agency overseeing its protection. The featherbells rely on an early successional habitat in moist meadows with reduced grazing pressure from deer and reduced competition from non-native invasive plants. The other species of concern relies on the close proximity of forest habitat near open water.

Rocky Gleason, PNHP

featherbells (*Stenanthium gramineum*) in bloom

Threats and Stresses

The species of concern would be especially susceptible to forestry practices within the core habitat. The featherbells are susceptible to grazing from deer, succession to a closed canopy, and competition from non-native invasive plants.

Conservation Recommendations

The species of concern requires the continued presence of a large patch of undisturbed forest near a healthy river. The existing disturbance at this site should be mitigated to buffer the forest from further disturbance. The site should be monitored for the presence of non-native invasive plants and these should be controlled if they become a problem.

South Branch Plum Creek BDA

This site supports **Wabash pigtoe** (*Fusconaia flava*), a Pennsylvania-Endangered mussel, as well as a **species of concern,** which is not named at the request of the jurisdictional agency overseeing its protection. These species both rely on clean, clear creeks and rivers.


PNHP
Wabash pigtoe (*Fusconaia flava*)

Threats and Stresses

The primary threat to these species is the degradation of the aquatic habitat that supports them through detrimental land use choices. Land use choices that change water temperature, increase inputs of sediments and nutrients, or modify the timing and amount of river flow are likely to adversely affect the species of concern.

Conservation Recommendations

To maintain this site a watershed-wide approach is necessary. Throughout the watershed a 100 meter no-cut buffer should be implemented on all streams to minimize nutrient and sediment inputs, maintain the shade to minimize thermal loading (sun heating of the water), and provide for the natural yearly input of leaves that maintain the food chain. Additionally, special care should be given to prevent the input of chemicals from abandoned mine drainage and other mining operations.

West Mahoning Township and Smicksburg Borough

	Taxa[1]	PNHP Rank[2] Global	PNHP Rank[2] State	Legal Status[2] State (Proposed)	Last Seen	Quality[2]
NATURAL HERITAGE AREAS:						
Little Mahoning Creek – Lower BDA			*Exceptional Significance*			
mustached clubtail (*Gomphus adelphus*)	O	G4	S3S4	N	2006	E
rapids clubtail (*Gomphus quadricolor*)	O	G3G4	S1S2	N	2007	E
elktoe (*Alasmidonta marginata*)	U	G4	S4	N	2007	E
rainbow mussel (*Villosa iris*)	U	G5Q	S1	PE	2007	E
round pigtoe (*Pleurobema sintoxia*)	U	G4G5	S2	PE	2007	E
wavy-rayed lampmussel (*Lampsilis fasciola*)	U	G5	S4	N	2007	B
species of concern[3]	-	-	-	-	2005	E
species of concern[3]	-	-	-	-	2007	E
species of concern[3]	-	-	-	-	1991	E
Little Mahoning Creek – Upper BDA			*High Significance*			
round pigtoe (*Pleurobema sintoxia*)	U	G4G5	S2	PE	2007	E
wavy-rayed lampmussel (*Lampsilis fasciola*)	U	G5	S4	N	2007	B
species of concern[3]	-	-	-	-	2007	E
elktoe (*Alasmidonta marginata*)	U	G4	S4	N	-	H
rainbow mussel (*Villosa iris*)	U	G5Q	S1	PE	-	H
Mahoning Creek BDA			*High Significance*			
Mountain bugbane (*Cimicifuga americana*)	P	G4G	S3	PR(PT)	2008	AB
Elktoe (*Alasmidonta marginata*)	U	G4	S4	N	2007	E
rainbow mussel (*Villosa iris*)	U	G5Q	S1	PE	2007	E
round pigtoe (*Pleurobema sintoxia*)	U	G4G5	S2	PE	2007	E
wavy-rayed lampmussel (*Lampsilis fasciola*)	U	G5	S4	N	2007	B
species of concern[3]	-	-	-	-	2005	E
species of concern[3]	-	-	-	-	2007	E
species of concern[3]	-	-	-	-	2005	E

LANDSCAPE CONSERVATION AREAS: Little Mahoning Creek Watershed

PUBLICLY MANAGED LAND: None

OTHER CONSERVATION AREAS: None known

GEOLOGIC FEATURES: None

[1] A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionid (Mussel)
[2] Please refer to Appendix II (pg. 223) for an explanation of PNHP ranks and legal status
[3] This species is not named by request of the jurisdictional agency

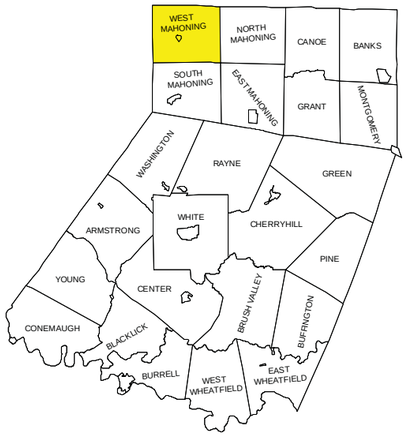
Indiana County
Natural Heritage Inventory

West Mahoning Township
& Smicksburg Borough

Biological Diversity Areas
- Little Mahoning Creek - Lower BDA
- Little Mahoning Creek - Upper BDA
- Mahoning Creek BDA

Landscape Conservation Areas
- Little Mahoning Creek LCA

State & Federal Public Land
- Mahoning Creek lake (USACE)



Milton
Mahoning Creek Lake
Sugarcamp Run
Hamilton Run
North Point
Loop
Mahoning Creek
Mahoning Creek BDA
Carr Run
Little Mahoning Creek LCA
954
Smicksburg
DAYTON RD
Little Mahoning Creek - Upper BDA
Little Mahoning Creek - Lower BDA
SMICKSBURG CEMETARY RD
MCCORMICK RD
Glade Run
Little Mahoning Creek
1400
1600
1200

0 0.25 0.5 1 1.5 Kilometers
0 0.25 0.5 1 1.5 Miles

Legend

Biological Diversity Area (BDA)
- Core
- Supporting Landscape

Landscape Conservation Area (LCA)
- PA Bureau of Forestry
- PA Game Commission
- US Army Corps of Engineers
- National Wetland Inventory
- Streams
- 40 Ft. Contour Line

Pennsylvania Natural Heritage Program

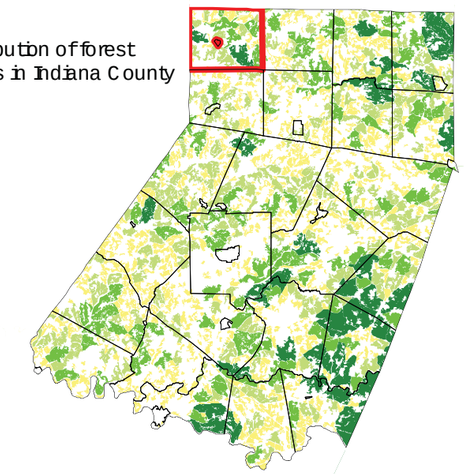
Indiana County
Natural Heritage Inventory

West Mahoning Township
& Smicksburg Borough

Much of the native biodiversity of the township can be maintained by providing undisturbed forested buffers along streams, and avoiding fragmentation of the largest forest blocks with additional roads or utility infrastructure. These general landscape features help provide the habitat necessary to keep common species common. In addition, reforestation of creek and stream banks can help link larger forested blocks together, contributing to their utility as natural wildlife corridors while significantly improving regional water quality.

Riparian buffers through forested areas should be considered priorities for conservation. Riparian buffers through non-forested habitats should be considered priorities for restoration.

Distribution of forest blocks in Indiana County



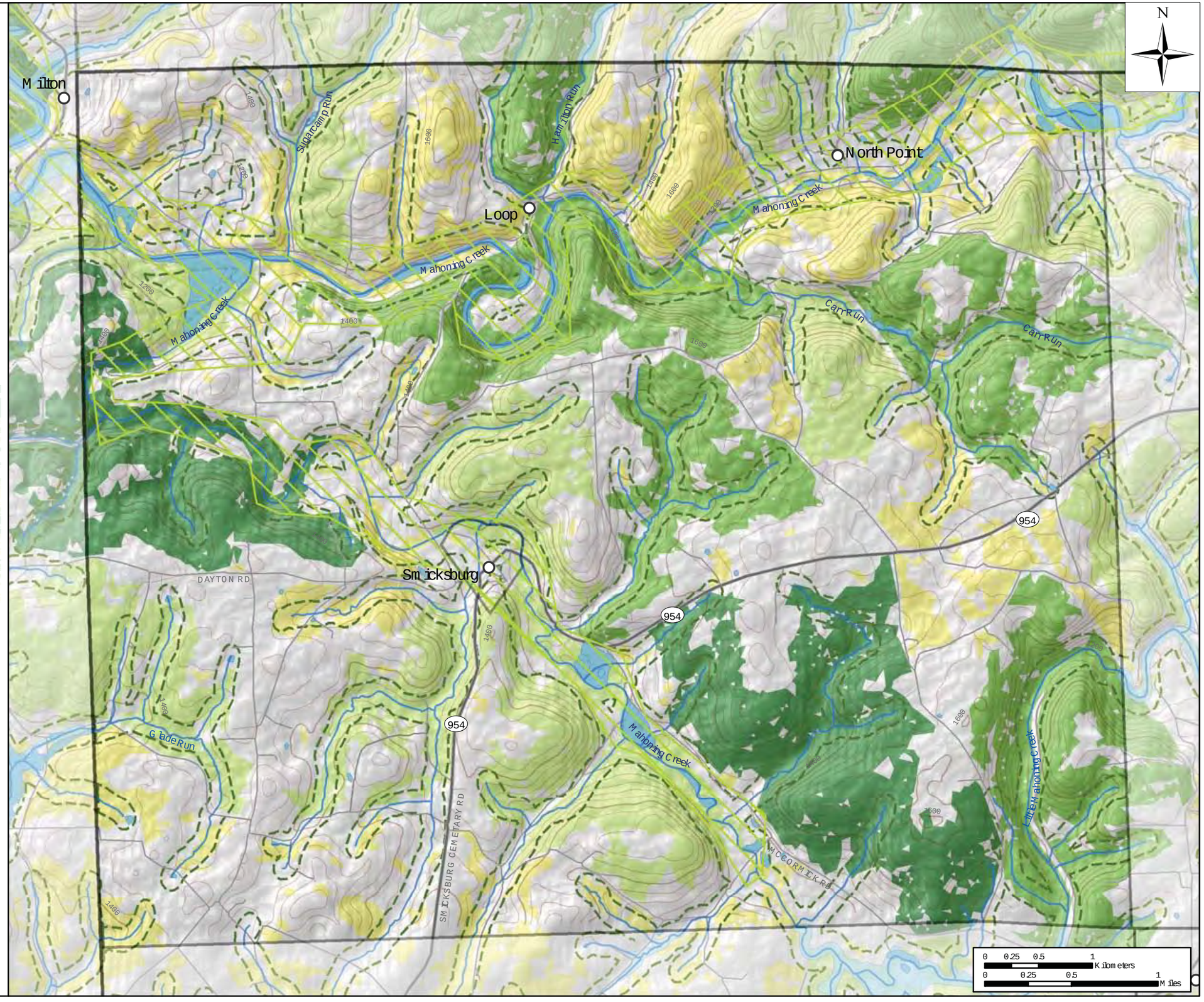
Legend

PNHP
Pennsylvania Natural Heritage Program

- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre
- < 250
- 251 - 500
- 501 - 1000
- > 1000

- USACE
- PA Bureau of Forestry
- PA Game Lands
- 40 Ft. Contour Line



West Mahoning Township and Smicksburg Borough

West Mahoning Township is located in the northwestern corner of the county and shares borders with Armstrong County to the west and Jefferson County to the north. West Mahoning Township and Smicksburg Borough are in the Pittsburgh Low Plateau Section of the Appalachian Plateau Province with bedrock geology of shale and sandstone. Forests make up 71 percent of the total land use in the township and agricultural practices account for 28 percent of the total land use. The major streams flowing through West Mahoning Township are the Little Mahoning and Mahoning Creeks.

SMICKSBURG BOROUGH

Smicksburg is located in the central part of the township. Development has occurred in only 10 percent of the borough; the remainder of the land is forested (69 percent) or is in agricultural (21 percent).

Little Mahoning Creek – Lower BDA

This section of Little Mahoning Creek provides ideal habitat for a wealth of aquatic species because of high water quality and limited historical impacts on aquatic species. Among the species of concern found at this site are: **elktoe** (*Alasmidonta marginata*), **mustached clubtail** (*Gomphus adelphus*), **rainbow mussel** (*Villosa iris*), **rapids clubtail** (*Gomphus quadricolor*), **round pigtoe** (*Pleurobema sintoxia*), **wavy-rayed lampmussel** *(Lampsilis fasciola)*, and **three additional species of concern,** which are not named at the request of the jurisdictional agencies overseeing their protection**.** This plethora of species of concern is a representation of the historical biodiversity that once populated the streams of Western Pennsylvania. This wealth of species has been greatly reduced through mining, improper forestry activities, pollution, and development on the landscape (Ortmann 1909). Today, only a handful of isolated sites within the Commonwealth have a similar number of aquatic species of concern, making this a key location for proactive steps to maintain its quality.

Pete Woods, PNHP

2 male rapids clubtails (*Gomphus quadricolor*)

Threats and Stresses

This entire system is threatened by various sources of water pollution. Because it is underlain by the Marcellus shale formation, natural gas extraction is a realistic possibility within this system. The input of any waste products resulting from Marcellus shale fracturing will cause significant long-term negative impacts on the aquatic life in the creek, as it has on several other high-quality waterways in the Commonwealth.

Other inputs from improper farming and forestry within the watershed could be just as damaging to the aquatic life in the creek. Excess nutrients and sediments can smother or bury the aquatic life in the stream.

Development within the floodplain will result in additional inputs of nutrients and sediments by removing the riparian buffer. This development will also reduce flood storage capacity for the stream by decreasing the size of the floodplain.

Existing dams on Little Mahoning Creek are increasing "thermal pollution" by allowing time for the water to heat up in the sun. They are also acting as dispersal barriers for aquatic life with no species of concern found upstream of the dam in East Mahoning Township just upstream from the Baltimore and Ohio railroad bridge.

Conservation Recommendations

Creation and maintenance of a 100 meter forested riparian buffer throughout the entire Little Mahoning Creek watershed, including all the tributaries, is important for the protection of water quality within this site. This buffer will help to mitigate existing nutrient and sediment inputs and help to reduce thermal pollution within the site. It will also provide the natural, seasonal input of leaves that support the food chain within this creek.

Any Marcellus shale drilling that occurs within the watershed, if it is allowed at all, should be closely monitored and held to the highest safety standards. A failure to adhere to strict standards aimed at protecting aquatic ecosystems will invite an environmental disaster like the massive kill-off of aquatic life in Dunkard Creek in the fall of 2009.

Finally, an effort should be made to remove all manmade barriers to fish passage within the Little Mahoning Creek watershed. These barriers are increasing thermal pollution and providing habitat for fish species such as common carp (*Cyprinus carpio*) and are a general detriment to the watershed.

Little Mahoning Creek – Upper BDA

*The full description of the **Little Mahoning Creek – Upper BDA** is presented in the North Mahoning Township section on page 153.*

This section of Little Mahoning Creek provides habitat for numerous aquatic species, but faces impacts from impoundments and the threat of Marcellus shale gas extraction.

Mahoning Creek BDA

This section of Mahoning Creek provides habitat for a wealth of terrestrial and aquatic species because of the largely intact floodplain, good water quality, and proximity to areas with little historical impacts on aquatic species. Among the species of concern found at this site are: **elktoe** (*Alasmidonta marginata*), **rainbow mussel** (*Villosa iris*), **round pigtoe** (*Pleurobema sintoxia*), **wavy-rayed lampmussel** (*Lampsilis fasciola*), and **three additional species of concern,** which are not named at the request of the jurisdictional agencies overseeing their protection. This plethora of species of concern is a representation of the historical biodiversity that once populated the streams of western Pennsylvania (Ortmann 1909). This wealth of species has been greatly reduced through mining, improper forestry activities, pollution, and development on the landscape. Today, only a handful of isolated sites within the Commonwealth have a similar number of aquatic species of concern making this a key location for proactive steps to maintain its quality. The terrestrial species present within this site depend on the continued presence of a wide, forested, and undisturbed floodplain to provide them with the habitat they need. This will also help protect water quality, mitigate the impacts of flooding events, and maintain the beauty of the river corridor.

Slopes above the creek support a population of **mountain bugbane** (*Cimicifuga americana*), a Pennsylvania-rare plant that lives in shaded, moist, limey soils.

Lance Merry

A wavy-rayed lampmussel (*Lampsilis fasciola*), displaying its lure to attract fish. When a fish bites, the mussel will spit out its larvae. If the fish is of the right species, the larvae will hitch a ride on its gills for a few days or weeks.

Threats and Stresses

This entire system is threatened by various sources of water pollution. Because it is underlain by the Marcellus shale formation, natural gas extraction is a realistic possibility within this system. The input of any waste products resulting from Marcellus shale fracturing will cause significant long-term negative impacts on the aquatic life in the creek, as it has on several other high-quality waterways in the Commonwealth.

There are significant areas of abandoned mine lands within the Mahoning Creek watershed. These areas blight the landscape and offer little economic or ecologic value and need to be restored. They are a source of pollution to Mahoning Creek through acid and mineral drainage, which changes the water chemistry and degrades its value to aquatic species and recreational users.

Other inputs from improper farming and forestry within the watershed could be just as damaging to the aquatic life in the creek. Excess nutrients and sediments can smother or bury the aquatic life in the stream

Development within the floodplain will result in additional inputs of nutrients and sediments by removing the riparian buffer. This development will also reduce flood storage capacity for the stream by decreasing the size of the floodplain.

Conservation Recommendations

Creation and maintenance of a 100 meter forested riparian buffer throughout the entire Mahoning Creek watershed, including all the tributaries, is important for the protection of water quality within this site. While a significant proportion of the site already maintains this type of buffer, several areas have little or no forested riparian buffer. This buffer will help to mitigate existing nutrient and sediment inputs and help to reduce thermal pollution within the site. It will also provide the natural, seasonal input of leaves that support the food chain within this creek.

The abandoned mine lands within the watershed need to be reclaimed. This process will allow these blighted properties to return some value back to the community and the watershed. Once restored, forests can be regrown and drainage from the site can be reduced, treated, or eliminated altogether.

Any Marcellus shale drilling or other mining that occurs within the watershed, if it is allowed at all, should be closely monitored and held to the highest safety standards. A failure to adhere to strict standards aimed at protecting aquatic ecosystems will invite an environmental disaster like the massive kill-off of aquatic life in Dunkard Creek in the fall of 2009.

West Wheatfield Township

	Taxa[1]	PNHP Rank[2] Global	PNHP Rank[2] State	Legal Status[2] State (Proposed)	Last Seen	Quality[2]
NATURAL HERITAGE AREAS:						
Buttermilk Falls Natural Area BDA			*Local Significance*			
Chestnut Ridge – Penn View Mountain BDA			*High Significance*			
Allegheny woodrat (*Neotoma magister*)	M	G3G4	S3	PT	2000	E
thick-leaved meadow-rue (*Thalictrum coriaceum*)	P	G4	S2	PT	2008	A
Claghorn BDA			*Notable Significance*			
golden club (*Orontium aquaticum*)	P	G5	S4	WATCH	2008	C
mountain bugbane (*Cimicifuga americana*)	P	G4	S3	PR	2007	B
Robindale BDA			*Notable Significance*			
species of concern[3]	-	-	-	-	1997	E
shining ladies'-tresses (*Spiranthes lucida*)	P	G5	S3	PT	1999	E

LANDSCAPE CONSERVATION AREAS: None

PUBLICLY MANAGED LAND: State Game Land #153
State Game Land #276

OTHER CONSERVATION AREAS: None known

GEOLOGIC FEATURES: None

[1] A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionid (Mussel)
[2] Please refer to Appendix II (pg. 223) for an explanation of PNHP ranks and legal status
[3] This species is not named by request of the jurisdictional agency

Indiana County
Natural Heritage Inventory

West Wheatfield Township

Biological Diversity Areas

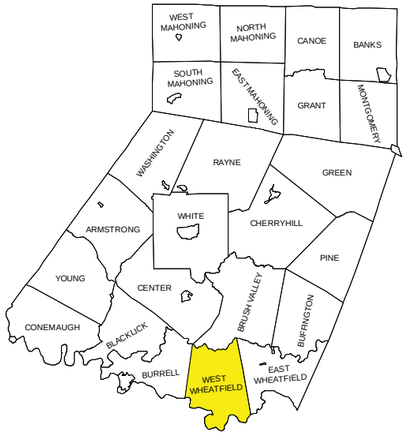
Buttermilk Falls Natural Area BDA
Chestnut Ridge/Penn View Mountain - North BDA
Claghorn BDA
Robindale BDA

Landscape Conservation Areas

None Currently Identified

State Public Land

State Game Land #153
State Game Land #276



Legend

Biological Diversity Area (BDA)
- Core
- Supporting Landscape

Landscape Conservation Area (LCA)

- **PA Bureau of Forestry**
- **PA Game Commission**
- **National Wetland Inventory**
- **Streams**
- **40 Ft. Contour Line**

Pennsylvania Natural Heritage Program

0 0.5 1 2 Kilometers
0 0.5 1 2 Miles

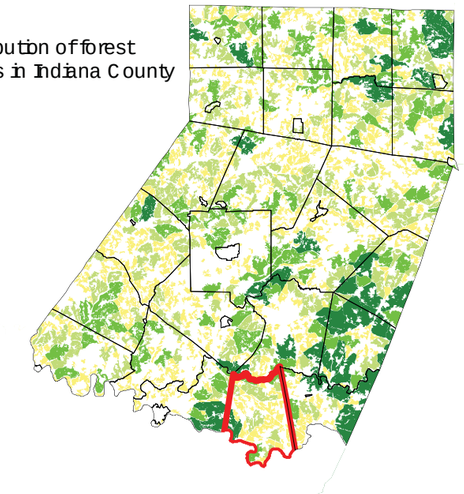
Indiana County
Natural Heritage Inventory

West Wheatfield Township

Much of the native biodiversity of the township can be maintained by providing undisturbed forested buffers along streams, and avoiding fragmentation of the largest forest blocks with additional roads or utility infrastructure. These general landscape features help provide the habitat necessary to keep common species common. In addition, reforestation of creek and stream banks can help link larger forested blocks together, contributing to their utility as natural wildlife corridors while significantly improving regional water quality.

Riparian buffers through forested areas should be considered priorities for conservation. Riparian buffers through non-forested habitats should be considered priorities for restoration.

Distribution of forest blocks in Indiana County



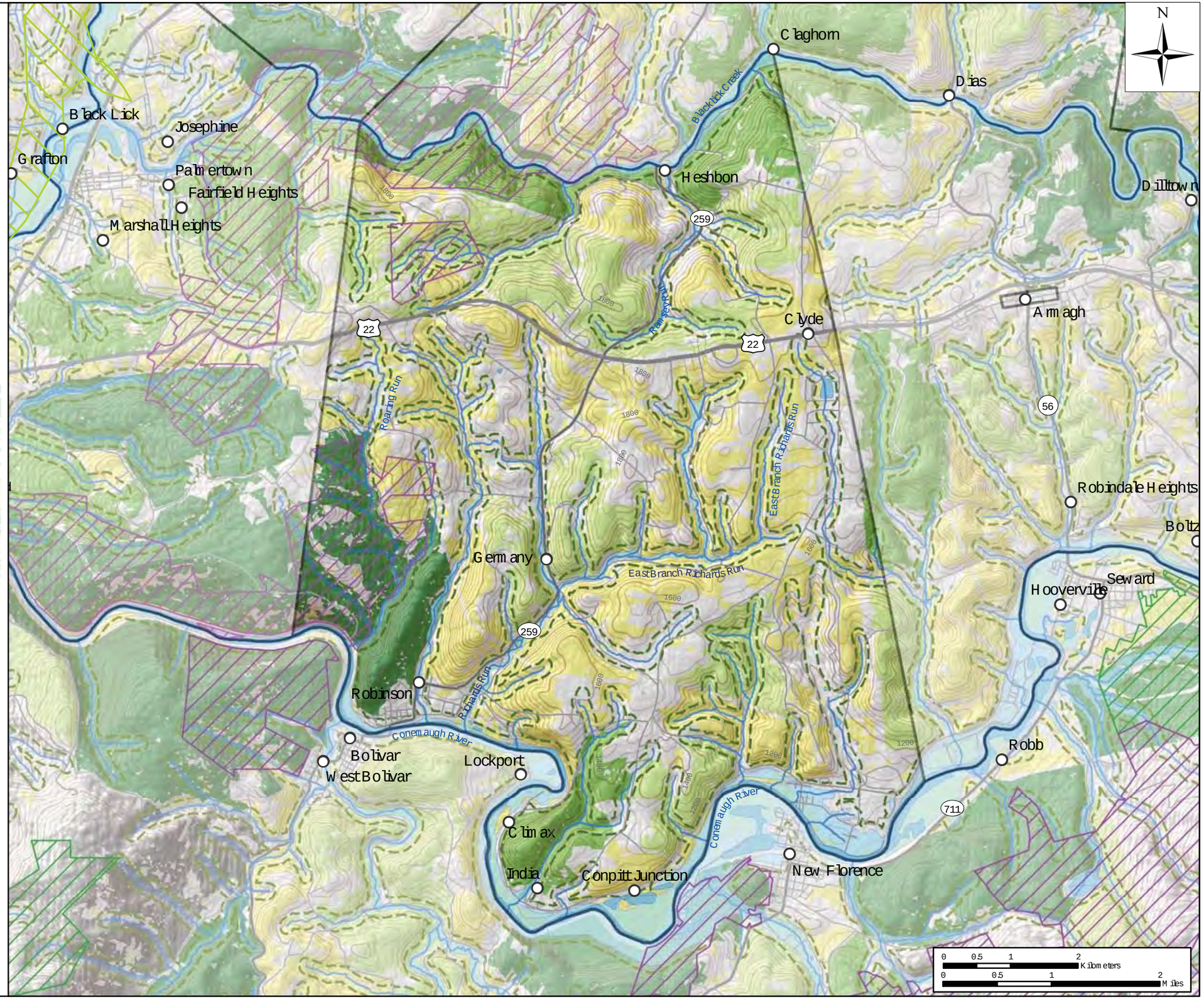
Legend

PNHP
Pennsylvania Natural Heritage Program

- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre
- < 250
- 251 - 500
- 501 - 1000
- > 1000

- USACE
- PA Bureau of Forestry
- PA Game Lands
- 40 Ft. Contour Line



West Wheatfield Township

West Wheatfield is one of the southern townships. It is located along the Conemaugh River and forms the boundary between Indiana and Westmoreland Counties. West Wheatfield Township is part of the Allegheny Mountain Section of the Appalachian Plateau Province. The bedrock geology is comprised of shale and sandstone. SGL #153 is located in the southwest corner and overlaps into Westmoreland County. Likewise, SGL #276 crosses the northern township line with Brush Valley. Most of the northern township boundary runs through SGL #276. Another separate tract of SGL #276 is in the northwest portion of the township. Forests make up 81 percent of the land use; agriculture consists of 15 percent of total land usage.

Buttermilk Falls Natural Area BDA

Buttermilk Falls is a 45-foot high waterfall located along Hires Run. This waterfall was created by a resistant layer of sandstone which is underlain by the more easily erodible shale. In addition to this geologic feature and plant community, historic remains of previous settlement can be found on site. The supporting landscape extends from the waterfall upstream to the dam at Holiday Lake.

Christopher Tracey, PNHP

Buttermilk Falls is a 45-foot high waterfall located along Hires Run.

Threats and Stresses

The effects of the Holiday Lake dam on Buttermilk Fall's hydrology are unknown, but there could be impacts on the amount of water flowing over the falls. This site is highly fragmented, located between two power line right-of-ways and residential development. Several invasive species such as garlic mustard (*Alliaria petiolata*), Japanese honeysuckle (*Lonicera japonica*), and Japanese knotweed (*Fallopia japonica*) were observed in the immediate area.

Conservation Recommendations

Maintain appropriate hydrology at the falls. Increasing forest connectivity between the patches would benefit wider-ranging animal species that may use the site.

Chestnut Ridge – Penn View Mountain BDA

*The full description of the **Chestnut Ridge – Penn View Mountain BDA** is presented in the Burrell Township section on page 98.*

This large BDA provides habitat for a large number of species of concern and offers a large contiguous block of forest habitat. The Conemaugh River water gap also provides some of the most scenic vistas in the county.

Claghorn BDA

*The full description of the **Claghorn BDA** is presented in the East Wheatfield Township section on page 133.*

This site is designated around the steep, north facing hillside above Black Lick Creek and supports a population of **mountain bugbane** (*Cimicifuga americana*), a Pennsylvania rare plant species.

Robindale BDA

*The full description of the **Robindale BDA** is presented in the East Wheatfield Township section on page 134.*

This site provides habitat for a **species of concern,** which is not named at the request of the jurisdictional agency overseeing its protection, and **shining ladies'-tresses** *(Spiranthes lucida)*. These species are generally associated with wet-meadow habitat and open wet woods.

White Township and Indiana Borough

	Taxa[1]	PNHP Rank[2] Global	PNHP Rank[2] State	Legal Status[2] State (Proposed)	Last Seen	Quality[2]
NATURAL HERITAGE AREAS:						
East Pike BDA			*Local Significance*			
small wood sunflower (*Helianthus microcephalus*)	P	G5	S4	N(SP)	2007	C
White's Woods BDA			*Local Significance*			
Yellow Creek at Route 422 BDA			*Notable Significance*			
ocellated darner (*Boyeria grafiana*)	O	G5	S3	N	2007	E
harpoon clubtail (*Gomphus descriptus*)	O	G4	S1S2	N	2007	E
species of concern[3]	-	-	-	-	2008	E

LANDSCAPE CONSERVATION AREAS: None

PUBLICLY MANAGED LAND: State Game Land #248

OTHER CONSERVATION AREAS: None known

GEOLOGIC FEATURES: None

[1] A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionid (Mussel)
[2] Please refer to Appendix II (pg. 223) for an explanation of PNHP ranks and legal status
[3] This species is not named by request of the jurisdictional agency

Indiana County
Natural Heritage Inventory

White Township
& Indiana Borough

Biological Diversity Areas

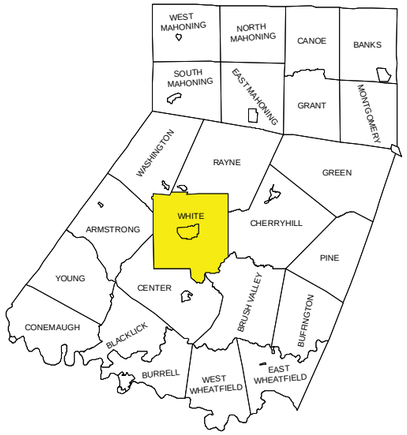
East Pike BDA
White's Woods BDA
Yellow Creek at Route 422 BDA

Landscape Conservation Areas

None Currently Identified

State Public Land

State Game Land #248



Legend

Biological Diversity Area (BDA)
- Core
- Supporting Landscape

Landscape Conservation Area (LCA)

- **PA Bureau of Forestry**
- **PA Game Commission**
- **National Wetland Inventory**
- **Streams**
- **40 Ft. Contour Line**

Pennsylvania Natural Heritage Program

N

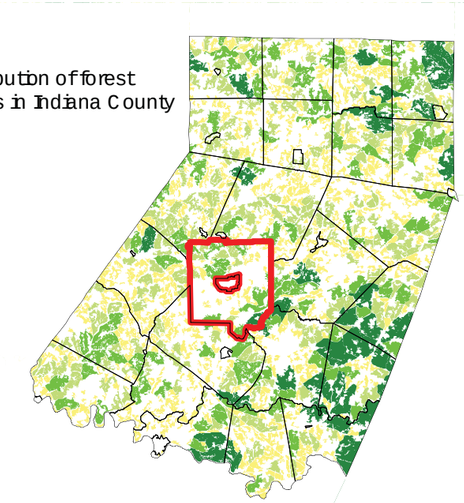
0 0.5 1 2 Kilometers
0 0.5 1 2 Miles

Indiana County
Natural Heritage Inventory
White Township
& Indiana Borough

Much of the native biodiversity of the township can be maintained by providing undisturbed forested buffers along streams, and avoiding fragmentation of the largest forest blocks with additional roads or utility infrastructure. These general landscape features help provide the habitat necessary to keep common species common. In addition, reforestation of creek and stream banks can help link larger forested blocks together, contributing to their utility as natural wildlife corridors while significantly improving regional water quality.

Riparian buffers through forested areas should be considered priorities for conservation. Riparian buffers through non-forested habitats should be considered priorities for restoration.

Distribution of forest blocks in Indiana County



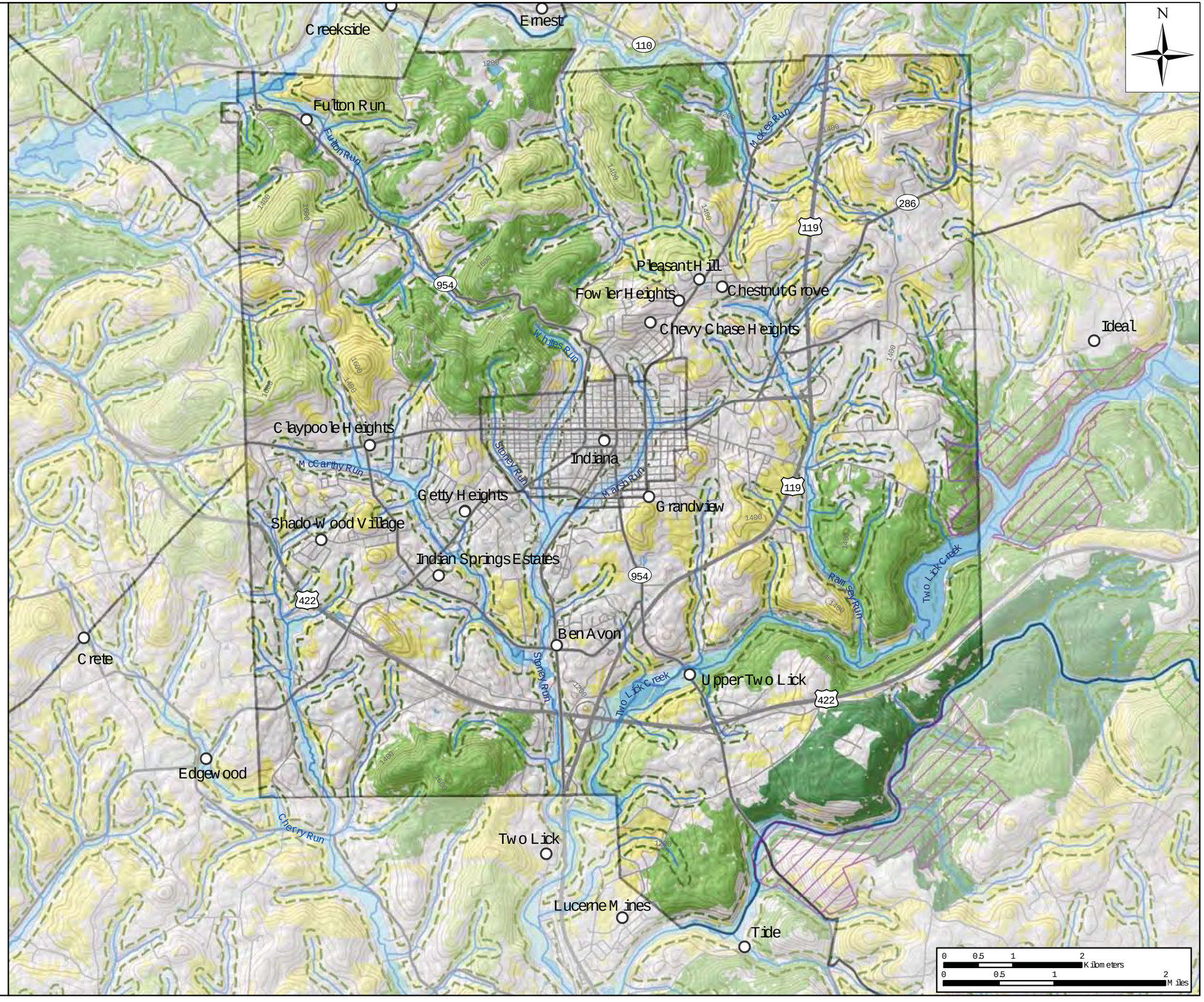
Legend

PNHP
Pennsylvania Natural Heritage Program

- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre
- < 250
- 251 - 500
- 501 - 1000
- > 1000

- PA Bureau of Forestry
- PA Game Lands
- 40 Ft. Contour Line



White Township and Indiana Borough

White Township and Indiana Borough are primarily in the Pittsburgh Low Plateau Section of the Appalachian Plateau Province with the southeastern corner of the township falling within the Allegheny Mountain Section of the Appalachian Plateau Province. The bedrock geology is of shale and sandstone. Streams in the northern portion of the township flow out of the township into Crooked Creek. These streams are in better condition than those to the south. Two Lick Creek and its tributaries drain the southern two-thirds of the township. To the east, agricultural practices and urban runoff have downgraded Ramsey Run, while abandoned mine drainage has affected Two Lick Creek. Agriculture makes up 32 percent of the total land use, mostly found in a wide swath between the northeast and southwest corners of the township. 58 percent of the township is forest. A small portion of SGL #248 falls along the eastern border of the township.

INDIANA BOROUGH

Indiana Borough is the largest borough in the county and serves as the county seat. It is also home to Indiana University of Pennsylvania. Urban runoff and storm sewers adversely affect Stoney Run and its tributaries as they travel through Indiana Borough. Development has occurred in 79 percent of the borough.

East Pike BDA

This BDA is designated around a roadside population of **small wood sunflower** (*Helianthus microcephalus*). This small population is located in a power line right-of-way, where the open canopy creates good conditions in terms of light and dry soil for this species to grow. Additional plants may likely be found in the right-of-way to the east, but lack of landowner permission precluded a survey of that area. This species was recently changed from "Pennsylvania Endangered" to "Watch List" status as many more populations have been discovered throughout its range in Pennsylvania in recent years.

PNHP

small wood sunflower (*Helianthus microcephalus*)

Threats and Stresses

As with many roadside populations of plants, they are subject to road management activities such as mowing, herbicide application, and salt application.

Conservation Recommendations

Additional surveys along the right-of-way and other openings for this species could be conducted with landowner permission. Road management activities should be conducted with the needs of this species in mind.

White's Woods BDA

This site is designated around a highly diverse stream valley located within White's Woods Nature Center. The presence of several of the herbaceous plant species here indicate that portions of this area have been minimally disturbed. The forest in this section is predominately composed of red oak (*Quercus rubra*), tulip poplar (*Liriodendron tulipifera*), black cherry (*Prunus serotina*), and sugar maple (*Acer saccharum*). Three uncommon plants that are under threat of over-collection by people can be found here.

Threats and Stresses

Invasive species are a major threat to this site. As with many urban parks, species such as Japanese honeysuckle (*Lonicera japonica*), Morrow's honeysuckle (*Lonicera morrowii*), garlic mustard (*Alliaria petiolata*), Japanese barberry (*Berberis thunbergii*) and oriental bittersweet (*Celastrus orbiculata*) are distributed throughout the site.

White's Woods Nature Center is currently the subject of a debate over a selective timber harvest. Much of the area identified in this BDA is within the "Natural Area" as described in the proposed forest management plan for the site (Babyak Forestry Services, 2007) and may not be negatively affected by logging of other areas of the park.

Conservation Recommendations

Invasive species should be controlled in order to maintain the diverse native flora of the site. Additional study should be conducted to see what the potential effects of logging may have on the core of this site.

Christopher Tracey, PNHP

A small stream cuts through a wildflower-rich valley within White's Woods.

Yellow Creek at Route 422 BDA

This reach of Yellow Creek supports two dragonfly species of concern. The **harpoon clubtail** (*Gomphus descriptus*) is considered imperiled in Pennsylvania, while the **ocellated darner** (*Boyeria grafiana*) is considered to be vulnerable in Pennsylvania.

Threats and Stresses

These dragonfly species both depend upon high water quality, the regulation of water temperature levels provided by forest cover, and the seasonal input of detritus and other organic material supplied from the forest. Excess input of nutrients from human activities in the watershed causes bacterial growth that reduces the oxygen content of the water. Timber harvesting may increase erosion and siltation, and cause a decrease in dissolved oxygen as canopy cover is removed and water temperature rises (Dunkle 2000, NatureServe 2009).

This site also supports a **species of concern,** which is not named at the request of the jurisdictional agency overseeing its protection.

Conservation Recommendations

Ecologists do not completely understand the habitat needs of many of these stream-dwelling dragonflies, especially in regard to the protection of upstream water quality. Therefore, the supporting landscape delineated in this report should be used as a minimum guide; in practice, as much of the aquatic habitat should be protected as possible.

Young Township

	Taxa[1]	PNHP Rank[2] Global	State	Legal Status[2] State (Proposed)	Last Seen	Quality[2]
NATURAL HERITAGE AREAS:	None identified					
LANDSCAPE CONSERVATION AREAS:	None					
PUBLICLY MANAGED LAND:	None					
OTHER CONSERVATION AREAS:	None known					
GEOLOGIC FEATURES:	None					

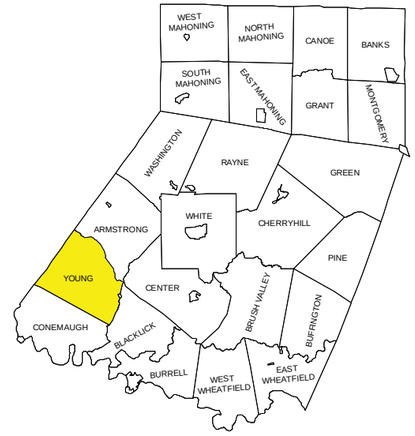
[1] A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionid (Mussel)
[2] Please refer to Appendix II (pg. 223) for an explanation of PNHP ranks and legal status
[3] This species is not named by request of the jurisdictional agency

Indiana County
Natural Heritage Inventory
Young Township

Biological Diversity Areas
None Currently Identified

Landscape Conservation Areas
None Currently Identified

State Public Land
State Game Land #248



Legend

Biological Diversity Area (BDA)
- Core
- Supporting Landscape

Landscape Conservation Area (LCA)

- **PA Bureau of Forestry**
- **PA Game Commission**
- **National Wetland Inventory**
- **Streams**
- **40 Ft. Contour Line**

Pennsylvania Natural Heritage Program

N

0 0.5 1 2 Kilometers
0 0.5 1 2 Miles

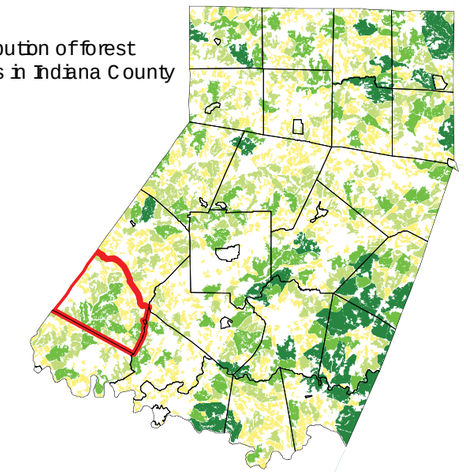
Indiana County
Natural Heritage Inventory

Young Township

Much of the native biodiversity of the township can be maintained by providing undisturbed forested buffers along streams, and avoiding fragmentation of the largest forest blocks with additional roads or utility infrastructure. These general landscape features help provide the habitat necessary to keep common species common. In addition, reforestation of creek and stream banks can help link larger forested blocks together, contributing to their utility as natural wildlife corridors while significantly improving regional water quality.

Riparian buffers through forested areas should be considered priorities for conservation. Riparian buffers through non-forested habitats should be considered priorities for restoration.

Distribution of forest blocks in Indiana County



Legend

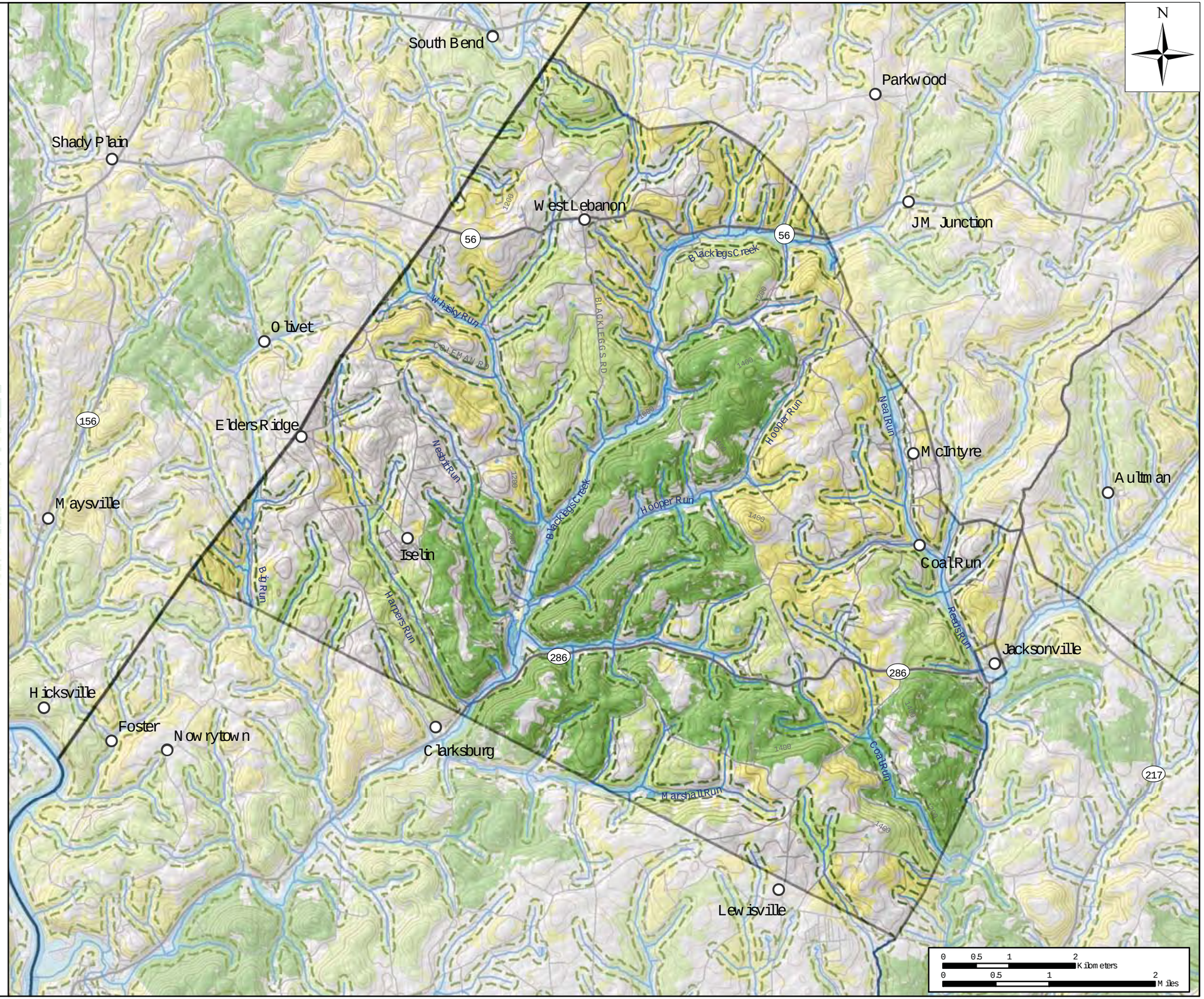
Pennsylvania Natural Heritage Program

- Streams
- National Wetland Inventory
- 100-year Floodplain
- Recommended Riparian Buffer

Forest Blocks by Acre

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

- PA Bureau of Forestry
- PA Game Lands
- 40 Ft. Contour Line



Young Township

Young Township is in the southwestern part of Indiana County and forms a portion of the border with Armstrong County. Shale and sandstone make up the bedrock geology in the eastern half of the township. Limestone is more prevalent in the western region along with the shale, sandstone. The township is a part of the Pittsburgh Low Plateau Section of the Appalachian Plateau Province. Agriculture makes up 32 percent of the total land use in the township. Forest makes up 76 percent with the largest forest blocks located in the central part of the township. Other forest blocks are to the east. Streams in the southwest sector of the township are impaired. Whiskey Run and its tributaries are damaged by abandoned mine drainage. Harpers Run is degraded by urban runoff and storm sewers. In the northeast corner, Reeds Run is degraded by abandoned mine drainage. Streams flowing through the central portion of the township are of a higher quality than other streams within the township.

No Biological Diversity Areas were identified in Young Township.

DISCUSSION AND GENERAL RECOMMENDATIONS

For this County Natural Heritage Report, the ecologists, zoologists, and botanists of the Pennsylvania Natural Heritage Program, and partner organizations, have explored the natural resources of Indiana 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 and endangered plants and animals, but also many common species, for which no formal records previously existed in museum and agency records.

Indiana County's contribution to biodiversity in Pennsylvania

Indiana County has 81 occurrences of species tracked by PNHP, including those listed as endangered, threatened, and rare species; it falls 52nd out of the Commonwealth's 67 counties. Figure 12 below shows the distribution of these species by municipality.

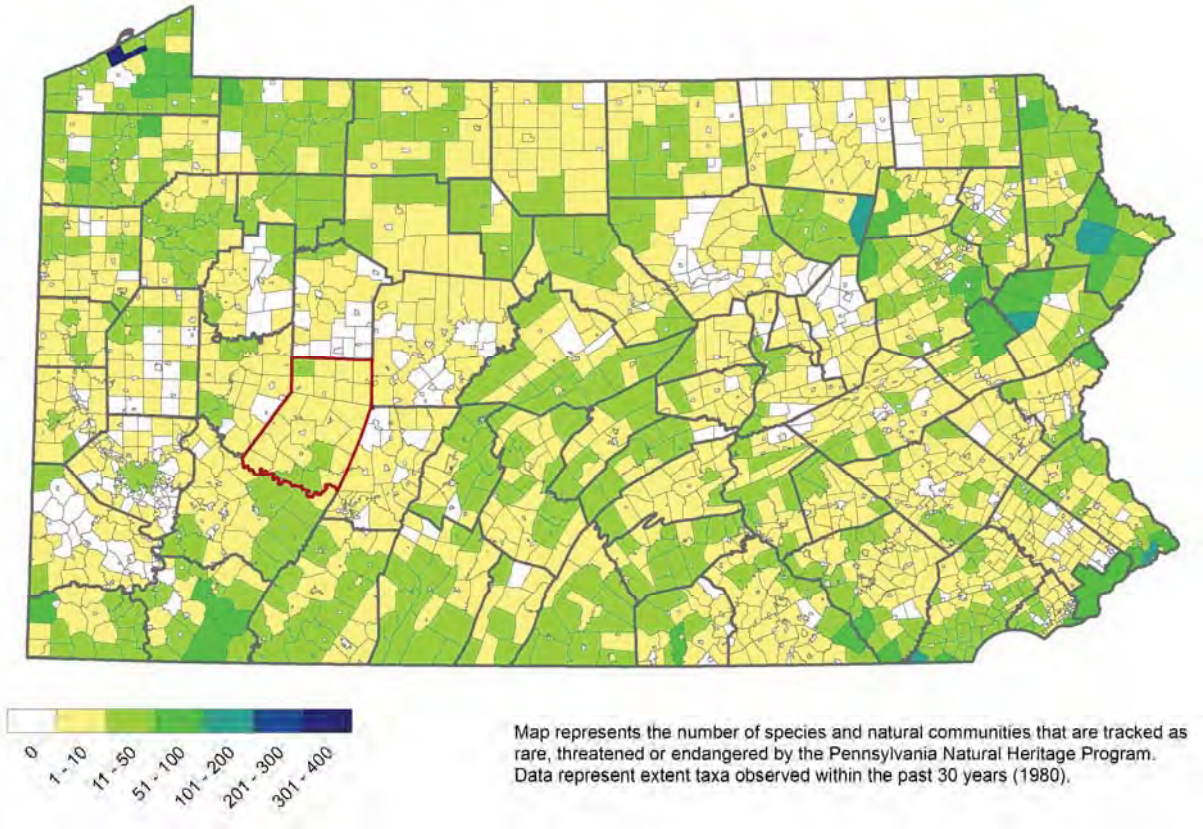


Figure 12: Distribution of endangered, threatened, and rare species by municipality. The darker the color, the more occurrences in a given municipality. Brush Valley Township maintains the highest number of rare species with 18 records as of 2011.

Although Indiana County is not in the top tier of biodiversity among Pennsylvania's counties, it contains a number of rare species and communities that are significant to western Pennsylvania. Many of these including hellbenders, several of dragonfly species, the West Virginia white butterfly and two species of isopod (*Caecidotea kenki* and *Caecidotea franzi*) are considered globally rare.

Future Research in Indiana County

Though many hours of field research over multiple years were undertaken for this inventory, this is not a comprehensive, final word on Indiana's natural resources. The data represented in this report represent a snapshot of Indiana County's natural resources at the time the report was written. Any further work in the county will likely yield additional records of rare species, exemplary natural communities, and sites of local significance. This is partially due to the fact that natural systems are dynamic – constantly changing due to natural and human pressures. Also, since sites were surveyed only when landowner permission was granted, access to some exemplary sites may have been restricted. Additional survey efforts are encouraged for these reasons. PNHP sees this report as a working document – a guide for conservation of known rare, threatened, and endangered species, their habitats, and other important resources of conservation importance in Indiana County.

Table 17. State status of species of conservation concern in Indiana County.

State Status	# of occurrences
PA Endangered (PE)	2
PA Threatened (PT)	7
PA Rare (PR) plants, or PA Concern (PC) animals	8
PV Vulnerable (PV) plants	2
Tentatively Undetermined (TU)	3
Tracked by PNHP, but without legal state status	48

Refer to Appendix II (pg. 223) for a description of the state status.

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 rare species such as Young Township, which has rare species 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. 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). Additionally, 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 (412-288-2777; http//www.naturalheritage.state.pa.us/).

A Final Note on Rare, Threatened, 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. If a species becomes extinct, or is lost from a portion of its native range as happens with extirpation, 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 more often than not the species is not replaceable in the system. This may be because the habitat has been altered to the point that the species and the ecosystem cycles upon which its survival depends are no longer intact. Rare species are often indicative of fragile ecosystems that may have become degraded - protection of rare species may help monitor the quality of Indiana County's ecosystems. A great example of a rare species acting as an indicator of environmental quality is the osprey - a bird species which indicated the deleterious effects of the pesticide DDT in our environment.

Submitting Additional Data

As the state repository for biodiversity data, the Pennsylvania Natural Heritage Program appreciates submissions of 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

A form is presented in Appendix I for the submission of rare species to the PNHP.

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 beauty and recreational value inherent 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, educational institutions, private organizations, and individuals. The following section outlines general recommendations to begin to protect the species outlined in this report.

The Indiana County Natural Heritage Inventory and Land Use Planning

One of the main roles of this document is to integrate ecological and conservation information into the planning process. Through early integration, costly conflicts with rare, threatened and endangered species can be avoided and these resources can be protected for future generations. Comprehensive land use planning and its related ordinances can be effective tools for the conservation of Indiana County's biological diversity. Land use planning establishes guidelines for the kinds of land uses that are suitable in an area and provides a basis for guiding public and private development to benefit communities, the local economy and the environment. Zoning and subdivision ordinances then set out rules that implement the land use plan. Planning, zoning and subdivision ordinances are not only valuable tools for urban and suburban areas where development pressures have already affected the use of open space and the integrity of the natural environment, but also for rural areas where current losses are less pronounced. These areas can apply planning to avoid the haphazard losses of valuable regional resources, while still achieving desirable levels of development. The following is a brief overview on land use tools available in Indiana County.

Indiana County is currently updating its comprehensive plan, initially completed in 1967. As much as possible, information from this inventory should be integrated into the process for the comprehensive plan, specifically sections that involve development, natural resources, recreation and open space. Biological Diversity Areas (BDAs) and Landscape Conservation Areas (LCAs) have been used to form the backbone of many plans for Greenway and Open Space networks in the Commonwealth. Draft BDAs from preliminary results of this project were provided to the consultants conducting the Greenway and Open Space Plan. This greenway plan should be examined and potentially updated with any additional findings from this Natural Heritage Inventory that were not identified in the draft data provided. The NHI should be further consulted for site-level planning and trail alignments as it can help decided the best compatibility of the resource with the designated use. Although many of the Natural Heritage Areas outlined in this report will be integrated into this greenway plan, additional planning and protection will ensure the viability of the conservation elements present at the site.

Planning for the land use decisions of today and those of the future is an important task and this Natural Heritage Inventory can serve as a useful tool. Pennsylvania Natural Heritage Program staff and expertise are available for additional technical assistance and planning for the conservation of these sites.

General Recommendations

The following are general recommendations for the protection of the Natural Heritage Areas (BDAs, LCAs, IBAs, IMAs, and Outstanding Geologic Features) within Indiana County. Approaches to protecting a natural heritage area are wide ranging, and factors such as land ownership, time constraints, and tools and resource availability 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. Keep in mind that 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.

1. **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 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 the landowner and the 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, watersheds, forested areas, or agricultural lands) with the land trust offering technical expertise.

   Land acquisition by a conservation 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. One strategy is to 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 are ideal. Private lands adjacent to public lands should be examined for acquisition when a natural heritage area is present on either property, and there is a need of 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. The Pennsylvania Land Trust Association website offers a search engine to find land trusts (http://conserveland.org). The Evergreen Conservancy is an example of a local land trust in Indiana County. They are located in Indiana, PA and can be contacted at 724-349-4333 (info@evergreenconservancy.org; http://evergreenconservancy.org/). The Western Pennsylvania

Conservancy is a regional land trust that can be contacted at 412-288-2777 (info@paconserve.org; http://www.waterlandlife.org).

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. Often it is overlooked that zoning can prevent municipal or county-wide development activities which are undesirable to the majority of the residents, and allow for planning that can meet the goals of the county residents. For example, the Indiana County Comprehensive Plan states that empty storefronts are a concern for many residents (Indiana County Planning Commission, 2005). Regulations which require that businesses concentrate development and restrict sprawl might be a step toward infill and revitalization of downtown business districts.

2. **Prepare management plans that address species of concern and natural communities.** Many of the natural heritage areas that are already protected are in need of additional management plans to ensure the continued existence of the associated natural elements. Site-specific recommendations should be added to existing management plans, new plans should be prepared. Recommendations may include: removal of invasive 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; 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.

3. **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 rare species, 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 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, developers, and residents can lessen the impact of development on watersheds.

4. **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 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 buffer zones

within riparian zones. 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.

5. **Reduce fragmentation of the landscape surrounding natural heritage areas.**
Encourage development in sites that have already seen past disturbances (especially mined and heavily timbered areas). 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 greatly reduced. 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 previously disturbed areas for commercial and industrial projects, also known as *brownfield development*, 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 (potentially even wind 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 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 preserved linking natural areas to each other. Preserving greenspace around development can provide ample recreation opportunities, and potentially increase nearby property value.

6. **Encourage the formation of 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, management, and stewardship of protected sites. 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 by disrupting the integrity of the ecosystems they occupy. Management for invasive species depends upon the extent of their establishment. Small infestations may be easily controlled or eliminated but larger, well established populations typically present difficult management 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 of 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 of 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 at http://www.invasivespeciesinfo.gov/

8. Incorporate natural heritage inventory information into planning efforts.

One of the main roles of this document is to integrate conservation information into the planning process. Over half of Indiana County residents identify with the need for a Planned Growth Option of development (Indiana County Planning Commission, 2005); a scenario that balances the need for jobs while also protecting the county's rural qualities. 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, park 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 Natural Heritage Inventory data and recommendations into county and municipal plans.

GLOSSARY

Acid or Abandoned Mine Drainage (AMDD**)**: Drainage flowing from or caused by surface mining, deep mining, or coal refuse piles that are typically highly acidic or basic with elevated levels of dissolved metals. Receiving waterways are typically adversely affected.

Anthropocentric: Human centered.

Anthropogenic: Human caused.

Apparently secure: A Pennsylvania state rank (S4) meaning that a species is uncommon but not rare, and usually widespread. Generally speaking, more than 100 occurrences are present in Pennsylvania.

ATV: All-terrain-vehicle.

Bedrock: The solid rock that underlies loose material, such as soil, sand, clay, or gravel.

Biological Diversity Area (BDA): An area containing (or important in the support of) plants or animals of special concern at state or federal levels, exemplary natural communities, or exceptional native diversity. *Core* areas delineate essential habitat (typically necessary for living and reproducing) that cannot absorb significant levels of activity without substantial impact to the elements of concern. *Supporting* areas maintain vital ecological processes or secondary habitat that may be able to accommodate some types of low impact activities.

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.

Brownfield development: The reclamation of previously disturbed areas for commercial and industrial projects. Revitalizing previously developed areas encourages economic growth while allowing ecologically sensitive areas to remain undisturbed.

Bt (*Bacillus thuringiensis*): An insecticide which is produced by the fermentation of a bacterium (Bt), and is used to control many caterpillar pests such as the gypsy moth.

Calcareous: Composed of, containing, or characteristic of calcium carbonate, calcium, or limestone; chalky. 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.

Calciphilic: Thriving in environments rich in calcium salts.

Co-dominant: Where several species together comprise the dominant layer (see "dominant" below).

Colluvium: Debris, often weathered rock and soil that has moved down a hill slope chiefly by gravity; includes talus and cliff debris.

Community: An assemblage of plant or animal populations sharing a common environment, and interacting with each other and the physical environment.

Connectivity: When blocks of habitat are connected by suitable travel corridors (see fragmentation).

Core habitat: Areas intended to identify the essential habitat of the species of concern or natural community. They can absorb very little activity or disturbance without substantial impact to the natural features, and the species of concern.

Critically imperiled: A Pennsylvania state rank (S1) meaning that a species is extremely vulnerable to extirpation due to its extreme rarity.

DCNR: The Pennsylvania Department of Conservation and Natural Resources. The Pennsylvania Bureau of Forestry is housed in the DCNR; it has jurisdiction over all plants.

DEP: The Pennsylvania Department of Environmental Protection is responsible for state permitting and the Environmental Review process.

Dominant: The species (usually plant) exerting the greatest influence on a given community either by abundance or influence on microclimate, soils, and other species.

Ecology: The study of relations between organisms and their natural (living and nonliving) environment.

Ecosystem: An ecological community comprised of the biotic (living) community and the abiotic (nonliving) environment functioning as a system.

Edge effects: Consequences arising from habitat fragmentation which typically include: increased light intensity, reduced depth of leaf-litter, increased erosion, increased severity of wind and weather, increased abundance of invasive species, and altered abundance and composition of plant and animal species, and can extend 1,000 feet (300 meters) into the remaining intact habitat (see connectivity and fragmentation).

Element: All-inclusive term for a species of concern or an exemplary natural community.

Endemic: A species or other taxonomic group that is restricted to a particular geographic region typically due to habitat isolation, or response to soil or climatic conditions.

Erosional remnant: Outstanding scenic geologic features, landforms, or outcrops produced by the erosion process.

Eutrophication: The process of nutrient enrichment (usually by nitrates and phosphates) in aquatic ecosystems. Nutrient addition occurs naturally over geologic time, but often is accelerated by human activities (failing septic systems, pet waste, combined sewer overflow, fertilizer, or agricultural run-off). When nutrients no longer limit growth in a system, algal blooms and excessive aquatic plant growth can have negative impacts on the waterway.

Exceptional Value Waters (EV): A DEP designation for a stream or watershed which constitutes an outstanding national, state, regional, or local resource. Often these are waters of national, state, or county parks or forests, waters which are used as a source of an unfiltered potable water supply, waters of wildlife refuges or State Game Lands, or other waters of substantial recreational or ecological significance.

Exotic: Used to describe plant or animal species that were introduced into new habitats by humans. Examples include: Japanese honeysuckle, purple loosestrife, emerald ash borer, and grass carp. Exotics present a problem because they may outcompete native species (see invasive, native, and non-native).

Extant: Currently in existence.

Extirpated: Species that have become locally extinct or are gone from a region such as the state of Pennsylvania (see also local or localized extinction).

Fen: Open-canopy peatland that has developed under the influence of basic, rich waters.

Floodplain: Flat, low-lying areas along streams and rivers subject to periodic flooding; a category of riparian area or zone.

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 the series of organisms that eat them and are then eaten. Only some of the many possible relationships can be shown in such a diagram, and typically only one or two carnivores are shown at the highest trophic levels.

Forb: Non-grass (non-graminoid) herbaceous plant such as goldenrod.

Forest interior species: Plant or animal species which require large blocks of intact core (contiguous) interior forest habitat (300 feet from an edge) in order to breed.

Fragmentation: When contiguous habitat (such as a forest) is split into small, isolated patches by fragmenting features such as roads, utility rights-of-way, trails (footpaths, snowmobile, ATV, etc.), railroads, or developed land. The remaining pieces may be too small to support the species present in the original tract of habitat (see connectivity).

Generalist: The numerous species occurring throughout the county that are able to survive in a wide range of habitat types. These generalist species are typically well represented throughout Pennsylvania; one example is the eastern chipmunk (*Tamias striatus*).

Geomorphic: Pertaining to the form of the earth, or of its surface features.

Glochidia: Larval mussels.

Graminoid: Grass or grass-like plant. Examples include: grasses (*Poaceae*), sedges (*Cyperaceae*), rushes (*Juncaceae*), arrow-grasses (*Juncaginaceae*), and quillworts (*Isoetes*).

Ground cover: Low shrubs, herbs, and mosses that are found at or close to the surface of the ground.

Herbaceous: Non-woody plant; stems typically die back each winter.

Herpetofauna: The group of reptiles and amphibians found in a particular region (see herpetologist and herptile).

Herpetologist: One who studies reptiles and amphibians; from the Greek *herpeto* – a creeping thing and *ology* – the science or study of (see herpetofauna and herptile).

Herptile: A reptile or amphibian. These species are studied by a herpetologist. Collectively, native reptiles and amphibians are known as herptiles or herpetofauna (see herpetofauna and herpetologist).

Hibernaculum: A location where animals hibernate.

Hibernation: The period of winter inactivity during which time normal physiological processes are reduced and a significant decrease in body temperature occurs. In Pennsylvania, true hibernation is exhibited by woodchucks, jumping mice, and bats.

High-Quality Coldwater Fisheries (HQ-CWF): A DEP designation (PA Code, Chapter 93) for a stream or watershed that has excellent quality waters and ecological or other features that require special water quality protection.

Hydric: Extremely wet, as opposed to a dry (xeric) or intermediate (mesic) environment.

Hydrology: Water system of an area including both surface water and ground water.

IBA (Important Bird Area): A site designated by the Pennsylvania Audubon Society due to its outstanding value to birds for conservation. Designations are based on criteria developed by the Ornithological Technical Committee of the Pennsylvania Biological Survey including areas where large concentrations of birds congregate, sites utilized by special concern, threatened, or endangered birds, habitats which are unique or representative, or lands where long-term avian research occurs.

IMA (Important Mammal Area): A site designated by the Important Mammal Areas Project (IMAP), a diverse alliance of sportsmen, conservation organizations, wildlife professionals, and scientists. Areas nominated must fulfill at least one of five criteria developed by the Mammal Technical Committee of the Pennsylvania Biological Survey including: areas utilized by special concern, threatened, or endangered mammals, habitats which are unique, or lands important for public education.

Imperiled: A Pennsylvania state rank (S2) meaning that a species is very vulnerable to extirpation because of its rarity.

Indicator species: A species whose presence or absence illustrates the environmental condition of a habitat. Often amphibians and macroinvertebrates are used as indicators of the water quality in aquatic habitats, since many are sensitive to environmental problems such as increased abandoned mine drainage, pollution, or serious acid rain inputs.

Invasives (Invasive species): Plants or animals that tend to spread rapidly, and alter the overall makeup and character of habitats they invade. These invasions are typically due to the introduction of an exotic species, and can often have negative effects on the natural community (see exotics and non-native).

Jurisdiction: The authority to regulate, enforce laws, and make decisions relevant to a geographic area or structural body.

Landscape Conservation Area (LCA): A large contiguous area that has not been heavily disturbed, and thus retains much of its natural character. LCAs are usually important because they are large, contain contiguous forest, maintain open space, are a mixture of important habitats, and/or include one or more Biological Diversity Areas.

Lepidoptera: Butterflies and moths. The name comes from the Greek words *lepido* - meaning scale and *ptera* - referring to the word wing.

Local or localized extinction (see also extirpated): Removal of a species from part of its natural/native range. If enough of these populations disappear from the landscape, or become so small that inbreeding reduces their genetic diversity, they may disappear from Pennsylvania entirely.

Locally significant: Areas that are significant on a county-wide scale, but cannot be deemed exemplary natural communities state-wide due to past disturbances. These locally significant sites represent good examples of habitats that are relatively rare in the county, support an uncommon diversity of plant species, and/or provide valuable wildlife habitat on a local level.

Macroinvertebrates: Include aquatic insects, worms, and crustaceans (like crayfish and scuds) which generally occupy the lower levels of food webs in aquatic systems.

Mast: A fruit, especially of beech, but also of oak, elm, and other forest trees, which is an important food source in forest ecosystems.

Mesic: Moist, not saturated. 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 fungus which has a close physical association with plant roots; both the fungus and the plant appear to benefit. A mycorrhizal root takes up nutrients more efficiently than does a root without the fungus. Some plants appear incapable of normal development in the absence of their mycorrhizal fungi.

Native: Not introduced by human activities; usually describes species that occurred in Pennsylvania (or any area of the U.S.) prior to European settlement.

Natural community: Organisms acting together, with their physical environment, and with the natural processes of their habitat. They are often defined by their dominant plant species or the geological features on which they depend.

Natural Heritage Areas or Natural Heritage Site: A site with either an exemplary natural community or species of concern; not to be confused with the State Forest Natural Areas which are specific management units designated by DCNR Bureau of Forestry. BDAs and LCAs are examples of natural heritage areas described in this report.

No take: A species for which there is no open hunting season, and a possession limit of 0 because they are thought to be declining.

Non-native: Introduced by humans into a habitat not within their natural range (see exotic and invasive).

Non-point source: Refers to diffuse sources of pollution such as storm water runoff contaminated with oil or pesticides; the specific source of the pollution cannot be easily determined (see point source).

Odonata or Odonates: Dragonflies and damselflies. The word Odonata comes from the Greek word odon - which means tooth.

Old-field ecosystem: Develops on abandoned farmland as the land gradually reverts to forest (see succession).

Palustrine: Describes wetlands; areas intermediate between aquatic and terrestrial habitats supporting predominately water-loving vegetation, where conditions are at least periodically wet enough during the growing season to produce anaerobic soil conditions and thereby influence plant growth.

PFBC: The Pennsylvania Fish and Boat Commission which has jurisdiction over all state and federally listed fish, reptiles, amphibians, and aquatic vertebrate and invertebrate animals.

PGC: The Pennsylvania Game Commission which has jurisdiction over all state and federally listed terrestrial vertebrate birds and mammals.

Physiographic province: A region of which all parts are similar in geologic structure and climate due in part to a unified geomorphic history; a region whose topographic features and landforms differ significantly from that of adjacent regions. Indiana County is mostly in the Pittsburgh Low Plateau and Allegheny Mountain physiographic provinces.

PNHP: The Pennsylvania Natural Heritage Program was established in 1981, and is currently a partnership between the DCNR, PFBC, PGC, and WPC.

Point source: Refers to specific sources of pollution such as contaminated outflow from a factory's pipe; the specific source of the pollution can be pinpointed (see non-point source).

Riparian area: Transition area between the aquatic and terrestrial environment; streamside; pertaining to or situated on the bank of a body of water, especially of a river.

Riparian buffer: Vegetated riparian buffers of streams are typically measured from the top of the slope to the edge of other land uses; man-made delineations between land uses.

Rock city: Weathered rock that contains passageways and tunnels that are interconnected like streets of a little city.

Rookery: The communal breeding ground of certain birds or animals, such as herons, penguins, and seals.

R-O-W (Right-of-way): Strip of land occupied or intended to be occupied by a street, crosswalk, railroad, electric transmission line, oil or gas pipeline, water main, sanitary or storm sewer line, or other special use.

Scenic geological feature: Unique or exemplary outcrops, scenic views, or other geologically significant features that together represent the geologic diversity of the Commonwealth.

Secure: A Pennsylvania state rank (S5) meaning that a species is widespread, abundant, and secure in the state.

Sedge: Grass-like herbaceous plant of the family Cyperaceae, especially members of the genus Carex.

Seep: Where water flows from the ground in a diffuse pattern and saturates the soil; lush herbaceous vegetation often grows in these wet areas, and many are used by amphibians.

Sensitive species of concern: Species perceived to be highly vulnerable to intentional disturbance (such as collection or poaching), and are identified as sensitive by the jurisdictional agency that oversees their conservation. This designation is to ensure the protection of the plant or animal from illegal or destructive collecting or abuse.

Shrub: A perennial, woody plant that typically differs from a tree in its short stature (less than five meters, 16.5 feet, in height) and multi-growth form (branched).

Special animals or special plants: Plants or animals with a rank of vulnerable, imperiled, or critically imperiled in Pennsylvania, and tracked by the Pennsylvania Natural Heritage Program.

Specialist: Species that have fairly restricted habitat needs are termed specialists; they are often restricted to grasslands, vernal pools, interior forest, upper elevation ridgelines or other habitats.

Stream reach: Referring to a specific stretch of a stream, creek, or river; i.e. the reach of Red Bank Creek between Brookville and Summerville.

Subcanopy: In a forest community, the tops and branches of the small trees and tall shrubs that form a distinct layer beneath the high tree canopy and above the shrub layer (if present).

Succession: Natural process of vegetation change through time; over time, the plant species of a site will change in composition and structure as light and soil conditions change (for example, a field that is left alone may, over time, be taken over by shrubs, then small trees, and eventually a woodland).

Supporting Natural Landscape: Areas surrounding or adjacent to Core Habitat that are not considered the primary habitat of the species of concern or natural community, but may serve as secondary habitat. These areas provide support by maintaining vital ecological processes as well as isolation from potential environmental degradation. Supporting Natural Landscape areas may be able to accommodate some types of activities without detriment to natural resources of concern. Each should be considered on a site by site and species by species basis.

Swamp: A wooded wetland, intermittently or permanently flooded.

Terrestrial: Land based.

Thermoregulate: Lying in the sun or moving into the shade to regulate body temperature.

TNC: The Nature Conservancy.

Tracked species: Species that are monitored, and considered to be of concern by PNHP (typically those that are vulnerable, imperiled, or critically imperiled in Pennsylvania).

Understory: Layer of shrubs and small trees between the herbaceous layer and the canopy.

Upland: Sites with well-drained dry to mesic soils.

Vernal: Occurring in the spring.

Vernal (or ephemeral or seasonal) Pools: Complexes of temporary/fluctuating natural pools which are important breeding areas for amphibians.

Vulnerable: A Pennsylvania state rank (S3) meaning that a species is vulnerable to extirpation because it is uncommon or found in restricted ranges.

Wetlands: Areas intermediate between aquatic and terrestrial habitats; characterized by a predominance of water-loving plants, where conditions are at least periodically wet enough during the growing season to produce anaerobic soil conditions and thereby influence plant growth. Examples include woody, emergent, palustrine, and scrub shrub wetlands. For more information see the National Wetlands Inventory (NWI) website: http://www.fws.gov/nwi/

WPC: The Western Pennsylvania Conservancy; a non-profit organization dedicated to conserving and restoring the diversity of western Pennsylvania.

Xeric: A dry, as opposed to a wet (hydric) or intermediate (mesic), environment.

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GIS DATA SOURCES

Note: Many diverse data sources were used in the creation of this report. Every attempt was made to ensure the accuracy of the data. The Pennsylvania Natural Heritage Program should not be held liable for any mapping errors resultant from use of these public data sources.

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Appendices

APPENDIX I: Species of Concern Report Form

(PLEASE INCLUDE A MAP – SEE MAPPING INSTRUCTIONS)

Species Name**:**	**SURVEYOR(S)**:(*Please include your address & phone #)*
Date of Visit:	Time spent at site**:**
USGS Quadrangle:	
Site Name and Directions to Site**:**	**GPS Coordinates**: Latitude:_____ Longitude:_____ **DATUM** (e.g. NAD27, NAD83)_____
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:
Landowner aware of the species of concern? **YES____ NO____** Landowner aware that data are submitted to PA Natural Diversity Inventory? **YES____ NO____** **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.e. found scat, heard song, animal crossing road, found plant in bog*)	
♣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.e. fresh adult butterfly; healthy mature plants - 50% flowering and with immature fruit*)	
♣Behavior (*animals*) (*i.e: nectaring insect, breeding birds, turtle basking*)	
♣If revisiting this site, compare the heath and size of the population to previous visits.	
♣Confidence level on Identification: ID Positive ID Somewhat Uncertain ID Unknown	
♣Voucher specimen or photo taken? (*Please include if possible*)	
♣Additional information:	

APPENDIX II: Federal and State Status, and Natural Heritage Ranks

FEDERAL STATUS

U.S. FISH AND WILDLIFE SERVICE CATEGORIES OF ENDANGERED
AND THREATENED PLANTS AND ANIMALS

The following definitions are extracted from the September 27, 1985 U.S. Fish and Wildlife Service notice in the 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 through all or a significant portion of their ranges.

PE - Proposed Endangered - Taxa proposed to be formally listed as endangered.

PT - Proposed Threatened - Taxa proposed to be formally listed as threatened.

C1 - Taxa for which the Service currently has on file substantial information on biological vulnerability and threat(s) to support the appropriateness of proposing to list them as endangered or threatened species.

C2 - Taxa for which information now in possession of the Service indicates that proposing to list them as endangered or threatened species is possibly appropriate, but for which substantial data on biological vulnerability and threats are not currently known or on file to support the immediate preparation of rules.

C3 - Taxa that are no longer being considered for listing as threatened or endangered species. Such taxa are further coded to indicate three categories, depending on the reason(s) for removal from consideration.

3A--Taxa for which the Service has persuasive evidence of extinction.

3B--Names that, on the basis of current taxonomic understanding, usually as represented in published revisions and monographs, do not represent taxa meeting the Act's definition of "species".

3C--Taxa that have proven to be more abundant or widespread than was previously believed and/or those that are not subject to any identifiable threat.

N - Taxa not currently listed by the U.S. Fish and Wildlife Service

STATE STATUS-NATIVE PLANT SPECIES

Legislative Authority: Title 25, Chapter 82, Conservation of Native Wild Plants, amended June 18, 1993, 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 have been 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 further decline in this Commonwealth, or if the species is greatly exploited by man.

PR - Pennsylvania Rare - Plant species which are uncommon within this Commonwealth. All species of native wild plants classified as Disjunct, Endemic, Limit of Range, and Restricted are included within the Pennsylvania Rare classification.

PX - Pennsylvania Extirpated - Plant species believed by the Department to be extinct within this Commonwealth. These plant species may or may not be in existence outside this Commonwealth. If plant species classified as Pennsylvania Extirpated are found to exist, the species automatically will be considered to be classified as Pennsylvania Endangered.

PV - Pennsylvania Vulnerable - Plant species which are in danger of population decline within Pennsylvania 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 - 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.

N - None - Plant species which are believed to be endangered, rare, or threatened, but which are being considered by the required regulatory review processes for future listing

APPENDIX II (continued)

STATE STATUS-ANIMALS

The following state statuses are used by the Pennsylvania Game Commission for (1990, Title 34, Chapter 133 pertaining to wild birds and mammals) and by the Pennsylvania Fish and Boat Commission (1991, Title 30, Chapter 75 pertaining to fish, amphibians, reptiles, and aquatic organisms):

PE - Pennsylvania Endangered - Game Commission - 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 has been 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 have been 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 and Boat Commission - Endangered Species are all species and subspecies: (1) declared by 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) declared by the Executive Director (PaFC) to be threatened with extinction and appear on the Pennsylvania Endangered Species List published in the Pennsylvania Bulletin.

PT - Pennsylvania Threatened - Game Commission - Species that may become endangered within the foreseeable future throughout their range in Pennsylvania unless the causal factors affecting the organism are abated. These are: 1) species whose populations within the Commonwealth are decreasing or have been heavily depleted by adverse factors and while not actually endangered, are still in critical condition; or 2) species whose populations may be relatively abundant in the Commonwealth but are under severe threat from serious adverse factors that have been 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 and Boat Commission - Threatened Species are all species and subspecies: (1) declared by 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) have been declared by the Executive Director (PaFC) 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.

PC Pennsylvania Concern - Animals that could become endangered or threatened in the future. All of these are uncommon, have restricted distribution, or are at risk because of certain aspects of their biology.

CP Candidate Proposed - Species comprising taxa for which the Pennsylvania Biological Survey (PBS) currently has substantial information on hand to support the biological appropriateness of proposing to list as Endangered or Threatened.

CA Candidate at Risk - Species that although relatively abundant now are particularly vulnerable to certain types of exploitation or environmental modification.

CR Candidate Rare - Species which exist only in one of a few restricted geographic areas or habitats within Pennsylvania, or they occur in low numbers over a relatively broad area of the Commonwealth.

CU Condition Undetermined - Species for which there is insufficient data available to provide an adequate basis for their assignment to other classes or categories.

N None - No current legal status, but is under review for future listing.

NATURAL HERITAGE 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 = **Vulnerable** – 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 = **Secure** globally, though it may be quite rare in parts of its range, especially at the periphery.

GU = Possibly in peril range wide but status uncertain; need more information.

GNR = Global rank has yet to be assessed. This rank indicates neither commonness nor rarity.

Range ranks (for example, G2G4 or G3G4) indicate a range of uncertainty regarding a species rank.

APPENDIX II (continued)

NATURAL HERITAGE 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 very vulnerable to extirpation from the state.

S3 = **Vulnerable** -- rare in state (on the order of 21 to 100 occurrences).

S4 = **Apparently secure** – uncommon but not rare.

S5 = **Secure** – common, widespread, and abundant in the state.

B = Rank Qualifier - Basic rank refers to the breeding population of the element in the state.

N = Rank Qualifier - Basic rank refers to the non-breeding population of the element in the state.

SNR = State status has not yet been assessed. This rank indicates neither commonness nor rarity.

SU = Currently unrankable due to due to a lack of information

SH = Of historical occurrence in the state with the expectation that it may be rediscovered.

SX = Apparently extirpated from the state.

Range ranks (for example, S1S3 or S3S4) indicate a range of uncertainty regarding a species rank.

NATURAL HERITAGE ELEMENT OCCURRENCE QUALITY RANKS

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 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 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 species is in a clearly disturbed habitat, small in size and/or number, and possibly declining.
D	Small 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 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 or to conclude that the element was no longer present at the site.
H	Recent field information verifying the continued existence of the occurrence is lacking.

Range ranks (for example, AB or CD) indicate a range of uncertainty regarding a quality rank.

APPENDIX III: 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. For more information, go to http://www.cas.psu.edu/docs/casdept/forest/stewardship/1page.html 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
137 Penn Nursery Rd.
Spring Mills, PA 16875
(814) 364-5157
E-mail: jstiehler@state.pa.us

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.sfiofpa.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

Forest Landowner Associations provide information and educational programs to help members better manage their forest resources. There does not currently appear to be an active association in Indiana County as documented by the School for Forest Resources at Penn State University (http://paforeststewards.cas.psu.edu/associations.html)

The ***Forest Stewardship Volunteer Initiative Project*** has an excellent web site providing general information and links to publications on sustainable forestry. Available online: http://vip.cas.psu.edu/index.html.

Forest Certification Program Information

Forest certification programs are important tools in safeguarding the long-term ecological health of forest resources. These programs develop a set of criteria for sustainable forest management, and offer accreditation to forest managers and producers of forest products if they demonstrate that their operations are consistent with the standards. The companies can then market their products with the stamp of the certification agency. The Forest Stewardship Council (FSC**;** http://www.fsc.org/), an international stakeholder-owned network dedicated to promoting responsible management of the world's forests, offers a comprehensive certification program. Because the program's growing popularity is leading to requests for ecological information, and because there is a great deal of convergence between the regional FSC standards and the information provided in the Natural Heritage Inventory (NHI), we offer the following comparison of NHI information and FSC standards to facilitate the use of the NHI report as a tool in certification. FSC standards are developed individually by region by a local working group; Pennsylvania falls within the Appalachian Region.

The NHI report information is most applicable to principles 6, 7, and 9 of the FSC's Appalachian Regional Working Group standards (AWG-FSC 2005).

Principle 6: Environmental Impact

6.1 Assessment of environmental impacts:

The NHI report provides the following relevant information:
Sites hosting Vulnerable, Imperiled, and Critically Imperiled Plant Community Types (G1-G3, S1-S3 according to NatureServe and Natural Heritage Databases).
Threatened and Endangered species according to state and federal listings, as well as species ranked G1-G3 and S1-S3 according to NatureServe and Natural Heritage Databases
The LCA, IBA, and IMA designations are a resource to assess landscape-level ecological impacts.

6.2 Safeguards for unique species & their habitats.

The NHI report identifies the habitat requirements of species meeting the above-listed criteria through the Biological Diversity Area designations, and recommendations regarding the compatibility of some forest management operations in these habitats are included. The report does not identify connectivity needs between populations.

6.4 Protection of representative samples of existing ecosystems

The CAs and the natural communities described in the NHI report are a good reference for identifying representative samples of existing ecosystems. The report also provides context for understanding the conservation significance of these ecosystems. However, as the report focuses only on those sites of highest conservation concern in the county, it is not a comprehensive listing of all existing ecosystem types.

Principle 7: Management Plan

The information contain in the NHI report can serve as baseline ecological data for use in developing a management plan.

Principle 9: High Conservation Value Forests

The criteria recommended for the identification of High Conservation Value Forests (HCVF) are identical to the criteria used to identify Conservation Areas in the NHI report, with one exception. The FSC standards include roadless areas of 500 acres or greater as High Conservation Value Forests, while such areas receive no NHI designation.

APPENDIX IV: Species and Communities of Conservation Concern in Indiana County

Scientific Name	Common Name	Global Rank[1]	State Rank[1]	State Status[1]	Proposed Status[1]	fact sheet page no.
		Mammals				
Neotoma magister	Allegheny woodrat	G3G4	S3	PT	PT	235
		Birds				
Ardea herodias[2]	great blue heron[2]	G5	S3S4B,S4N	N	N	-
Asio otus[2]	long-eared owl[2]	G5	S2B,S2S3N	N	CU	-
Ixobrychus exilis	least bittern	G5	S1B	PE	PE	239
Pandion haliaetus	osprey	G5	S2B	PT	PT	242
Porzana carolina	sora	G5	S3B	N	CR	-
Rallus limicola	Virginia rail	G5	S3B	N	N	245
		Herptiles				
Crotalus horridus[2]	timber rattlesnake[2]	G4	S3S4	PC	CA	246
Cryptobranchus alleganiensis[2]	hellbender[2]	G3G4	S3	N	N	247
Glyptemys insculpta[2]	wood turtle[2]	G4	S3S4	N	N	-
Hemidactylium scutatum[2]	four-toed salamander[2]	G5	S4	N	N	-
Heterodon platirhinos[2,3]	eastern hognose snake[2,3]	G5	S3	N	N	-
Liochlorophis vernalis[2]	smooth green snake[2]	G5	S3S4	N	N	248
Necturus maculosus[2]	mudpuppy[2]	G5	S3S4	N	N	249
Regina septemvittata[2]	queen snake[2]	G5	S3	N	N	250
		Fish				
Lampetra aepyptera[2]	least brook lamprey[2]	G5	S3	PC	CR	251
		Mussels				
Alasmidonta marginata	elktoe	G4	S4	N	N	252
Epioblasma triquetra[2]	snuffbox[2]	G3	S1	PE	PE	-
Fusconaia flava	Wabash pigtoe	G5	S2	N	PE	-
Lampsilis fasciola	wavy-rayed lampmussel	G5	S4	N	N	253
Pleurobema sintoxia	round pigtoe	G4G5	S2	N	PE	254
Utterbackia imbecillis	paper pondshell	G5	S3S4	N	CU	255
Villosa iris	rainbow mussel	G5Q	S1	N	PE	256
		Invertebrates				
Boyeria grafiana	ocellated darner	G5	S3	N	N	-
Caecidotea franzi	Franz's cave isopod	G2G4	S1	N	N	-
Caecidotea kenki	an isopod	G3	S1	N	N	-
Gomphus abbreviatus	spine-crowned clubtail	G3G4	S2	N	N	-
Gomphus adelphus	mustached clubtail	G4	S3S4	N	N	258
Gomphus descriptus	harpoon clubtail	G4	S1S2	N	N	-
Gomphus quadricolor	rapids clubtail	G3G4	S1S2	N	N	-
Gomphus rogersi	sable clubtail	G4	S1	N	N	259
Lanthus parvulus	northern pygmy clubtail	G4	S3	N	N	-
Pieris virginiensis	West Virginia white	G3G4	S2S3	N	N	-
Stygobromus allegheniensis	Allegheny cave amphipod	G5	S2S3	N	N	

Plants						
Andropogon glomeratus	bushy bluestem	G5	S3	TU	PR	260
Cimicifuga americana	mountain bugbane	G4	S3	PT	PR	261
Hydrastis canadensis	golden-seal	G4	S4	PV	PV	-
Najas gracillima	bushy naiad	G5?	S4	PT	WATCH	-
Orontium aquaticum	golden club	G5	S4	PR	WATCH	262
Platanthera peramoena[2]	purple-fringeless orchid[2]	G5	S2	TU	PT	263
Spiranthes lucida	shining ladies'-tresses	G5	S3	N	PT	-
Stenanthium gramineum	featherbells	G4G5	S1S2	N	TU	-
Thalictrum coriaceum	thick-leaved meadow-rue	G4	S2	PE	PT	264
Trillium flexipes[2]	declined trillium[2]	G5	S2	TU	PT	
Natural Communities and Geologic Features						
cave, limestone solutional		GNR	SNR	N	N	
drainage pattern		GNR	SNR	N	N	
hemlock palustrine forest		GNR	S3	N	N	

1 = Please refer to Appendix II (pg. 223)for an explanation of PNHP ranks and legal status
2 = This species is not named at the site level by request of the jurisdictional agency
3 = This species is known historically from Indiana County, but has not been confirmed in recent years.

APPENDIX V: Facts Sheets for selected Species of Concern in Indiana County

The following fact sheets are presented to provide additional information and management guidelines for species of concern. Fact sheets have been developed for 24 of Indiana County's 47 species of conservation concern. Page numbers for fact sheets are listed in Appendix V. Copies of these fact sheets and others may be downloaded from the Pennsylvania Natural Heritage Program website at: http://www.naturalheritage.state.pa.us/.

Allegheny Woodrat

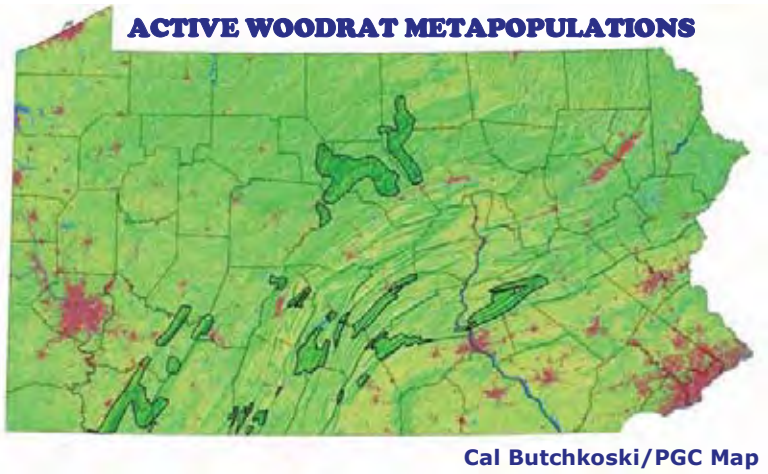
Neotoma magister

CURRENT STATUS: In Pennsylvania, the Allegheny woodrat is listed as threatened and protected under the Game and Wildlife Code. It is a Priority Species in the state Wildlife Action Plan. Considered vulnerable nationally, this species warrants federal prelisting consideration.

POPULATION STATUS: The Allegheny woodrat (*Neotoma magister*) was once considered a common resident of Pennsylvania's mountains. The species, first described from a specimen taken in a cave near Carlisle in 1858, has disappeared from the southeastern portion of the state and has declined in much of the rest of the state. The reason for the decline is not well-understood and likely results of a combination of factors. At present, sustainable populations remain in Pennsylvania's southwestern, south-central and north-central counties, with a few remnant populations in eastern counties. Our state has an important position in the biology of this species, holding both the diminishing northeastern range margin and a core of still-healthy populations. At one time, its range extended from southwestern Connecticut west to Indiana and south to northern Alabama. The Allegheny woodrat is now extirpated from Connecticut and New York, studies in remaining northern states document decline, and its status in southern states is unknown because of a shortage of recent surveys.

IDENTIFYING CHARACTERISTICS: The Allegheny woodrat is a relative of the better-known packrats of the West. Although this animal is referred to as a "rat" it is more mouse-like in appearance and has a bicolor, furred tail – unlike the naked tail of the Norway rat. It also is distinguished by noticeably larger ears and eyes, a larger, heavier head, and much longer whiskers. It is gray above with white underparts and paws. The average adult weighs less than a pound and is about 17 inches in total length, including an eight-inch tail.

BIOLOGY-NATURAL HISTORY: Allegheny woodrats are largely solitary, tolerating each other's presence briefly during the breeding season. Individual woodrats build a nest of plant material within a rock outcrop and may surround the nest with dry leaves and twigs, possibly as an alarm system. They emerge at dusk to forage for food, which includes a variety of leaves, fruit, nuts, seeds, fungi and twigs. Radio-telemetry studies indicate that woodrats may change den locations during summer, but after mid-autumn they retain one den for winter. Woodrats do not hibernate. Beginning in mid-summer, they store food for winter by stuffing leaves and other materials into rock crevices and protected ledges. They also collect non-food items such as wasp nests, bones, molted snakeskins, candy wrappers, and shotgun shells. Another distinctive behavior is their tendency to establish latrines for defecation, usually a flat rock surface protected by an overhang, separate from their living quarters. Reproductive success is difficult to measure because the Allegheny woodrat places its nests deep within rock outcrops. The most common litter size is probably two or three young. Some females may have two litters per year. This supposition is supported by captures of juvenile woodrats during each month from May to October in West Virginia. Variability in the length of the reproductive season may be influenced by variability in mast crops, severity of winter, and availability of secure cover. Predators of the Allegheny woodrat include the great horned owl, raccoon, coyote, weasel, fisher and black rat snake.

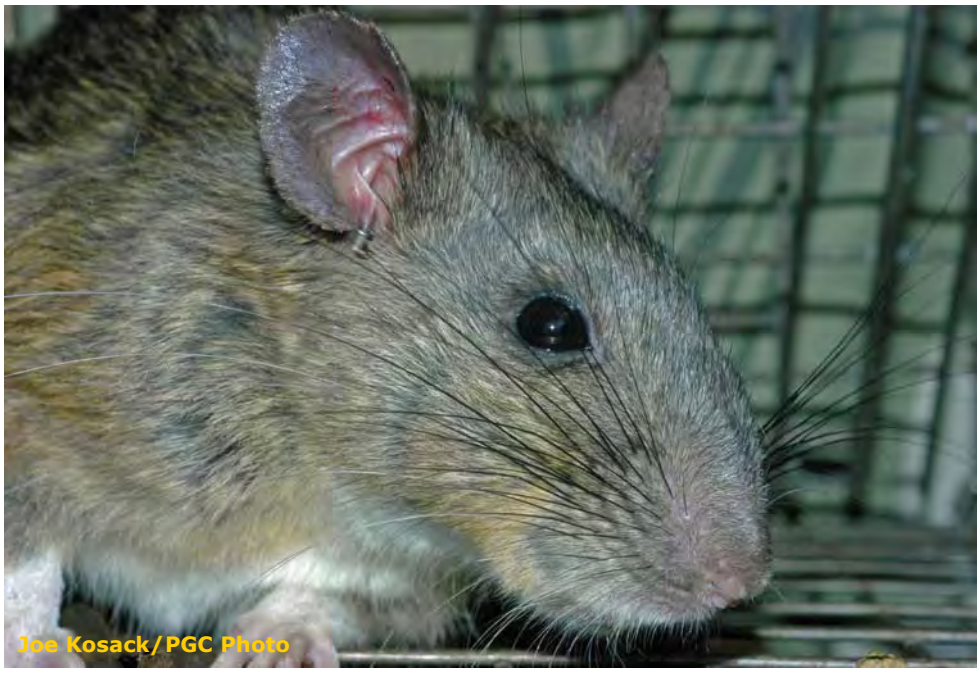


Cal Butchkoski/PGC Map

PREFERRED HABITAT: Ideal habitat for woodrats appears to be extensive expanses of abundant, closely-spaced surface rock surrounded by un-fragmented forest. Outcrops, cliffs, ledges, boulder fields, and caves are essential, providing protection and locations for nests and food caches. Vegetation may be deciduous, coniferous or mixed forest. Mast-producing trees are important; in some areas woodrats accumulate large nut caches. One study found that woodrats increased the size of their home range in years of poor mast production, which may increase their vulnerability to predators. In Pennsylvania, appropriate sandstone and limestone are typically distributed in patches interspersed with forest, where woodrats are usually found in population groups of fewer than 20 individuals, each centered on one rock patch.

REASONS FOR BEING THREATENED: No single factor has been identified to explain the decline of Allegheny woodrat populations. Instead, it's likely a wide variety of factors interact. While woodrats are general herbivores, they are not indiscriminate consumers. Reports from the early 1900s indicate that the American chestnut may have been an important food source - until chestnut blight removed all the mature trees of that species. Later, gypsy moth infestations that damaged oaks affected acorn production. The raccoon roundworm parasite affects a wide range of wildlife species; infected woodrats may die in a matter of weeks or succumb to predators as they become disabled. A study during the mid-1990s proposed that as the interface between forest and agricultural fields spread in Pennsylvania, the number of great horned owls increased, and this may have put woodrat populations under greater pressure. Porcupines, which also den in rock crevices and caves, are becoming more abundant and may preempt favorable den sites. Timbering, road building, utility lines, ridge-top telecommunications towers and wind farms, and conversion of land to agricultural or residential use have all affected forests surrounding rock habitat and created barriers that reduce the woodrat's ability to travel between rock patches, increasing isolation and reducing recolonization. Another mid-1990s study found that woodrat populations within one kilometer (0.62 mile) of forest edge were 15 times as likely to disappear as those more than two kilometers (1.24 miles) from forest edge.

MANAGEMENT PRACTICES: The conservation objective for Allegheny woodrats is to maintain viable breeding populations in three Pennsylvania regions: Appalachian Plateau, Ridge and Valley Province, and upper Susquehanna River drainage. To help achieve that goal, a series of three federal State Wildlife Grants Program projects produced an adaptive conservation-management plan; developed a model for predicting population viability, determined age-specific demographics, characterized habitat, and tested supplemental feeding; and funded training workshops for 92 biologists, foresters and land managers statewide. Implementation of management practices for the Allegheny woodrat will be tracked and evaluated. The Pennsylvania Game Commission's Wildlife Diversity Section is assisting a Purdue University


Joe Kosack/PGC Photo

study of genetic diversity of woodrat populations and captive breeding program. Research and survey priorities include continuing surveys for the presence of woodrats, assessment of the level of raccoon roundworm infestation, radio telemetry to gather additional data on population dynamics and specific habitat requirements, and studies to determine impacts of human encroachment and forest fragmentation.


Cal Butchkoski/PGC Photo

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By Eileen Butchkoski
Pennsylvania Game Commission
Connecting you with wildlife!

1/13/10

Great Blue Heron (*Ardea herodias*) Rookery

Pennsylvania Bird Species of Concern

State Rank: S3S4 (vulnerable/apparently secure), Global Rank: G4 (apparently secure)

Identification

A rookery is a colony of nesting birds. Great blue herons build their nests as high as 30 meters off the ground, in wooded areas isolated from human disturbance. Although they are wading birds, living on fish caught at the edges of rivers, in ponds, and in wetlands, Great blue heron rookeries may be located well away from water features; one colony found in Pennsylvania was as much as 17 miles from good fishing grounds. They may also nest in mixed-species rookeries with other heron species, other waterbirds, or even raptors such as owls and hawks.

Great Blue Heron (*Ardea herodias*) Rookery.

Habitat/Behavior

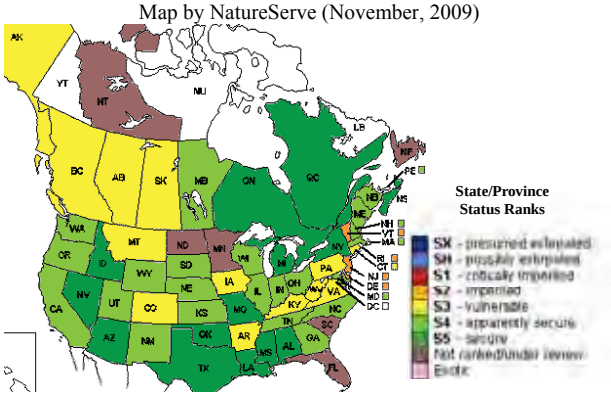
Great blue herons usually return to the same rookery site every year, starting in the spring when males arrive to scout the area and claim their nests, from which they court the later-arriving females. Nests are re-used and expanded year-to-year – they start as simple platforms of sticks but can eventually become saucers up to a meter deep. Each mated pair builds up the nest together, the male bringing new twigs and other materials to the female, who adds them to the structure.

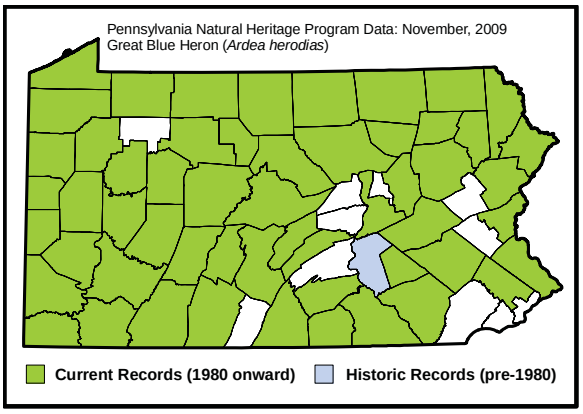
In Pennsylvania, the eggs are laid from mid-March to early June, after the female has had access to sufficient food for a period of about a week. Chicks hatch about a month later, usually a little less than two days apart, in the order in which their eggs were laid with brood contain two or three chicks. The parents share the tasks of incubating feeding, catching more than 20 percent of their own body weight in fish every day.

Great blue heron chicks are covered with a light gray down. Chicks require the most food between 26 and 41 days after hatching, when they may eat 0.6 pounds of fish each day. The chicks are ready to leave the nest by the end of the summer.

North American State/Province Conservation Status

Map by NatureServe (November, 2009)





Conservation

Protection of breeding grounds is one of the keys to conserving bird species. Great Blue Herons tolerate fewer disturbances to their breeding colonies than most waterbirds. It is recommended that human activity be excluded from a buffer zone of 300 meters (roughly 1000 feet) around heron rookeries to prevent people from scaring the herons off their nests. Severe or prolonged disturbance may cause the birds to abandon the nesting site, though they may re-colonize nearby if they find suitable habitat. Rookeries are also vulnerable to destruction of forest habitat and, when they are located in wetlands, changes to the flood regime that may kill trees.

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PNHP
Pennsylvania Natural Heritage Program

Least Bittern

Ixobrychus exilis

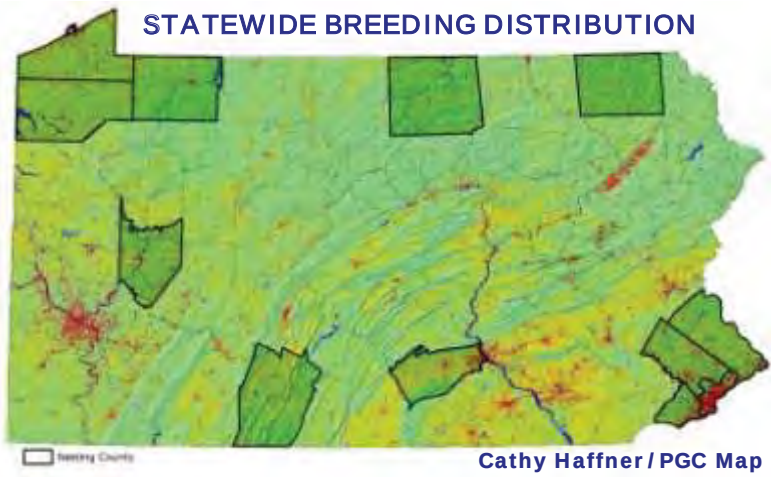
CURRENT STATUS: In Pennsylvania, the least bittern is listed as state endangered and protected under the Game and Wildlife Code. Although not list as endangered or threatened at the federal level, the least bittern is a species of high concern in the North American Waterbird Conservation Plan and is a U. S. Fish and Wildlife Service migratory bird of conservation concern in the Northeast. All migratory birds are protected under the Migratory Bird Treaty Act of 1918.

POPULATION TREND: Least bitterns (*Ixobrychus exilis*) are locally uncommon breeders in the Tinicum area in Philadelphia County; at Presque Isle State Park in Erie County; and in larger emergent wetlands in the state's northwestern counties. They are rare in suitable habitat elsewhere in the state. Only four confirmed breeding sites statewide were identified during the 2nd Pennsylvania Breeding Bird Atlas (2004 -2008). Least bitterns are declining in areas where their largest historical populations have been found. At Tinicum, only a few pairs have been nesting in recent years. In the late 1950s, however, as many as 27 nests were recorded there. Least bitterns were first designated as a threatened species in 1979. In 1997, the species was downgraded to endangered.

IDENTIFYING CHARACTERISTICS: The smallest member of the heron family, the least bittern is 11 to 14 inches in length and has a 16- to 18-inch wingspan. This primarily black and tan bird has a blackish-green cap and back, brown neck and underparts, and a white throat. The least bittern is most readily identified in flight by conspicuous, chestnut-colored wing patches. A rare, darker phase also exists. Males have a darker back than females. When disturbed, the least bittern is more likely to run than fly, and like its relative, the American bittern, it also has the habit of freezing with its bill pointed straight up when alarmed. To further camouflage itself, the bird will sway back and forth, seeming to act like a reed swaying in the wind. Despite their cryptic plumage and stealthy ways, least bitterns can be easily detected in spring migration and the nesting season by hearing their persistent vocalizations. The male's advertising song is a dove- or cuckoo-like repetitive, wooden cooing. Least bitterns also call with a ticking sound, perhaps a contact communication between members of a nesting pair. Occasionally they can be seen flying weakly over the wetland, showing off their brightly-colored buffy neck and wing patches.

BIOLOGY-NATURAL HISTORY: The least bittern nests in wetland areas throughout the eastern United States and along the Pacific coast. It spends the winter from our southern states south to Colombia, South America. This species is a regular migrant through the state, but it nests regularly in our northwest

and southeast corners only and possibly in a few other scattered locations, but not regularly or in significant numbers. The least bittern arrives in Pennsylvania in April and builds its platform nest of reeds and grasses near open water. Four or five pale blue or green eggs are laid in the six-inch nest in mid or late May. Both adults incubate eggs and care for young. The young hatch over a period of about three weeks (17-20 days). The chicks grow quickly and leave the nest to forage on their own at about two weeks of age. They will not fly, however, until they are four weeks old.



Cathy Haffner / PGC Map

PREFERRED HABITAT: Least bitterns thrive in dense marshland ecosystems containing cattails and reeds, along the coast and inland, where they feed primarily on small fish, amphibians, insects and small mammals. They visit and nest in brushy wetlands more frequently than their larger cousin, the American bittern. They will use their feet to cling to woody vegetation, rushes, or cattails, making them difficult to see.

REASONS FOR BEING ENDANGERED: Nesting opportunities for this species in Pennsylvania are limited and decreasing as the wetland habitat it needs has been extensively drained or impounded. Loss of tidal marshes along the Delaware River has been key to the bird's decline in Pennsylvania. Its future is largely dependent upon safeguarding the state's remaining large marshes. Least bitterns need stable wetlands where water levels do not vary considerably or become dry. They tend to be found in larger wetlands, so wetland size may be a limiting factor.

MANAGEMENT PROGRAMS: Areas where this species is known to nest should be uncompromisingly protected. Surveys to further determine where least bitterns nest are ongoing. Marshland habitats, when possible, should be managed to provide additional nesting habitat. For least bitterns and other species preferring dense vegetation and low to moderate water depth (2-4 inches), water should be drawn slowly in late spring to allow for seed germination and to create a mixture of mud flat, shallow emergent vegetation, and decaying plant matter (which is rich in aquatic invertebrates) in deeper areas. Re-flooding after germination would promote least bittern habitat. Maintaining high, stable water levels during the nesting season will enhance the species' breeding success. Also, removing invasive plant species (purple loosestrife, for example) and protecting wetlands from sediment and chemical pollution will benefit least bitterns and other wildlife. In general, larger wetlands and wetland complexes are more likely to sustain populations of this and other wetland-obligate species. Bigger is better, even for our smallest heron.


Bob Moul Photo

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By Cathy Haffner and Doug Gross
Pennsylvania Game Commission
Connecting you with wildlife!
10/7/09

Osprey

Pandion haliaetus

Jake Dingel/PGC Photo

CURRENT STATUS: In Pennsylvania, the osprey is listed as state threatened and protected under the Game and Wildlife Code. Nationally, they are not listed as an endangered or threatened species. All migratory birds are protected under the Migratory Bird Treaty Act of 1918.

POPULATION TREND: Pennsylvania's nesting osprey (*Pandion haliaetus)* population has been on the rise in recent years. During the 2nd Pennsylvania Breeding Bird Atlas (2004-2008), confirmed nests were reported in at least 90 atlas blocks, and were widely distributed across the Commonwealth. That represents a more than nine-fold increase in 20 years. Since many blocks probably represent multiple pairs, the state nesting population certainly exceeds 100 active nesting pairs. The 1st Pennsylvania Breeding Bird Atlas (1984-1989) recorded nine breeding pairs, restricted to the northeastern and southcentral counties. As recently as 1986, the state had one known nesting pair of ospreys. As a result of budget cuts, osprey nest monitoring was discontinued in recent years, so we lack precise population estimates. But the 2nd Pennsylvania Breeding Bird Atlas results indicate a much larger population than previously found. The osprey was listed as extirpated in Pennsylvania in 1979. Reintroduction attempts in the Poconos prompted a reclassification as endangered. In 1997, Ospreys were upgraded from endangered to threatened.

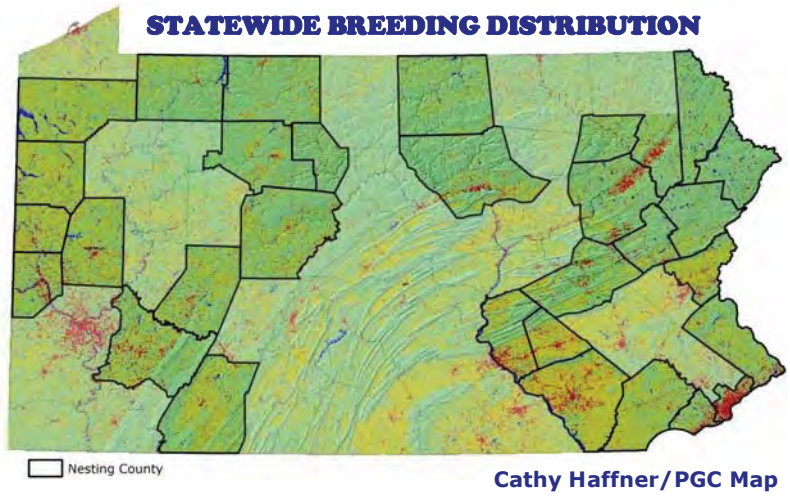
IDENTIFYING CHARACTERISTICS: Ospreys are large, striking, fish-eating birds of prey most often seen around water. They may exceed 24 inches in length and sport wingspans approaching six feet. Also referred to as "fish hawks," ospreys are dark brown above, bright white below, with some brown streaking on the breast. Key identification characteristics are the prominent dark eye stripes, black patches at the crooks of bent wings, and a characteristic silhouette. Unlike eagles, ospreys often hover over open water while fishing, thus making this large raptor easily identifiable from a distance.

Jake Dingel/PGC Photo

BIOLOGY-NATURAL HISTORY: The osprey is one of the world's most widely distributed birds. It is often called a "fish hawk" because of its feeding preferences. They are found along seacoasts and major waterways on every continent except Antarctica. They prey almost exclusively on fish. Ospreys start breeding at three years of age, or older. Until that age, immature birds stay on their southern wintering grounds of Central America and South America. Ospreys breed singly or in colonies. Their stick nests are large and usually built near water. A breeding pair adds sticks to the nest every year it is occupied and throughout the breeding season. They usually nest in large trees, but they may be found nesting on channel markers, telephone poles, billboards, cell towers, chimneys and manmade platforms built specifically for their use. In fact, in 2001, 80 percent of osprey nests

were found on manmade structures, often near large bodies of water. Usually three eggs are laid and will hatch in about 40 days. Both sexes incubate eggs, although females tend to spend more time incubating than males. Females brood young through three weeks of age. Young begin to fly about seven weeks after hatching.

PREFERRED HABITAT: Ospreys prefer lakes, ponds, rivers and marshes bordered by trees. They require open water containing adequate fishing opportunities. In recent years, ospreys have produced young near lakes and rivers across most of the state. During spring and summer, non-breeding sub-adults can be found throughout the state. The world's largest nesting population of ospreys – approaching 2,000 pairs – occurs in the Chesapeake Bay area each spring. Osprey pairs typically return to Pennsylvania in late March to early April to nest.



REASONS FOR BEING THREATENED: Historically, ospreys were never found in large numbers in Pennsylvania. In the early 1900s ospreys nested along the state's larger waterways, but habitat destruction and water pollution made these areas unsuitable. Illegal shootings also seemed to have played some role in the bird's decline. Osprey populations were further decimated through the effects of insecticides, such as DDT, on their reproductive capabilities. Use of DDT in the late 1940s unleashed what would become a slow, steady stranglehold on ospreys and other birds of prey. By eating contaminated prey, the birds ingested the insecticide that, in turn, induced them to lay eggs with extremely thin shells – shells often so fragile, they broke when sat upon. Unable to reproduce, ospreys soon disappeared.

MANAGEMENT PROGRAMS: Between 1980 and 1996, 265 ospreys – obtained as nestlings from Chesapeake Bay nests – were released in Pennsylvania. The reintroductions occurred in three geographic areas: the Poconos, Tioga County reservoirs and Moraine State Park (Butler County). Nest sites are tracked through the Wildlife Diversity Program and protected under the state Game and Wildlife Code and federal Migratory Bird Treaty Act.

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By Doug Gross
Pennsylvania Game Commission
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8/28/09

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.

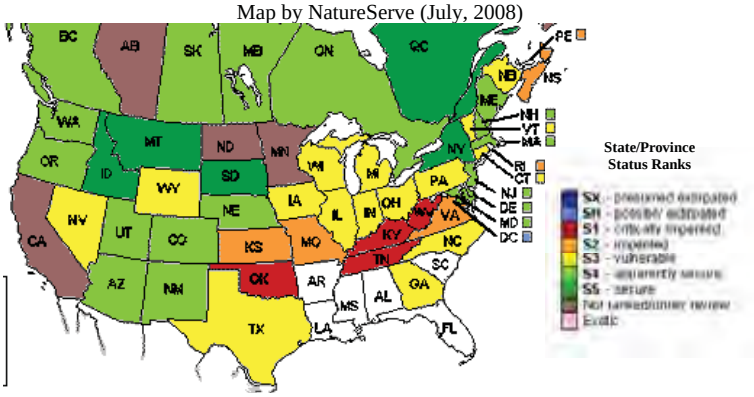
Migrating into Pennsylvania as wetlands re-green in the spring, nesting begins in May with the chicks hatching in June and fledging in July. Fall migration may begin as early as mid-August and generally most birds have left by mid-October, but individuals have been recorded in marshes until freezes force them south.

photo source: Denis Kania

Virginia Rail (*Rallus limicola*)

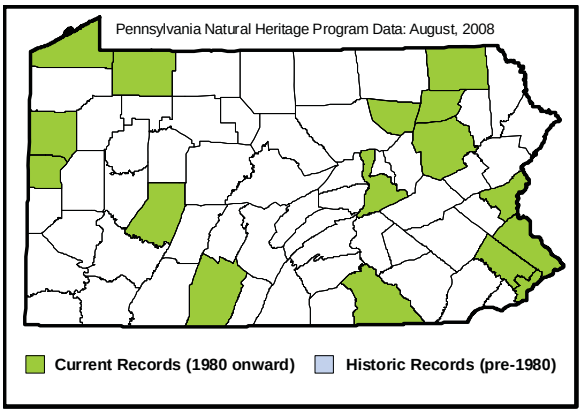
North American State/Province Conservation Status

Map by NatureServe (July, 2008)



Range

Found breeding in suitable habitat throughout northern North America with wintering grounds composed by wetlands along the Gulf Coast and into Mexico.



Habitat

Prefers early-successional marshlands with little standing-dead vegetation to impede movement and foraging. Nests in similar habitat over water in a woven nest concealed by marsh vegetation. Utilizes 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.

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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Timber Rattlesnake (*Crotalus horridus*)

Reptile Species of Concern

State Rank: S3S4 (vulnerable/apparently secure), Global Rank: G4 (apparently secure)

Identification

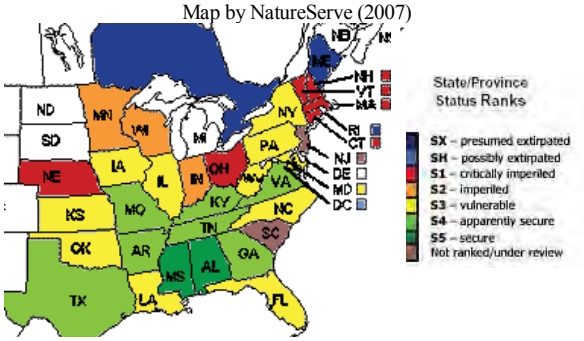
Timber rattlesnakes (*Crotalus horridus*) are easily distinguished from other snakes in Pennsylvania. Timber rattlesnakes are stout-bodied, large snakes reaching lengths of up to 5 feet. Color is extremely variable but usually consists of brown or black bands on bright yellow to black coloration. The head is triangular in shape and a rattle is present at the end of the black tail. This species may be confused with the less common eastern massasauga (*Sistrurus catenatus catenatus*) only present in the western portion of the state. The timber rattlesnake can be distinguished from the massasauga by the lack of white facial lines, the black tail forward of the rattle, and numerous small head-scales.

Habitat

Crotalus horridus is associated with deciduous forests and rocky outcrops. Hibernacula are usually found on south-facing rocky slopes with adequate crevices to provide shelter during the winter months. Males may travel far from the den site in the summer, moving into valleys and low-lying areas. Gravid females are far less mobile and tend to stay within a short distance of the den. Timber rattlesnakes are venomous, however are generally mild-mannered and not likely to strike.

North American State/Province Conservation Status

Map by NatureServe (2007)



Conservation/Status

Timber rattlesnake numbers have decreased significantly from historic records. This species was once widespread across the state. The remaining populations are usually found in remote, isolated areas. Collection and destruction of habitat are likely the main reasons for reductions in population size. Den sites have been targets for collection and should be the focus of conservation efforts for this species. The state status of the timber rattlesnake is candidate at risk (CA). Though this species is still relatively abundant across the state, it remains vulnerable to exploitation. Permits are now required to collect rattlesnakes and only one snake can be taken each year. Snake hunts still occur in the state but after capture, snakes must be marked and release and the site of capture. Biologists are gathering information from collectors and individual studies to determine the current status of this species in the state.

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Eastern Hellbender (*Cryptobranchus alleganiensis alleganiensis*)

Pennsylvania Amphibian Species of Concern
State Rank: S3 (vulnerable), Global Rank: G3G4 (vulnerable)

Identification

The eastern hellbender is the largest salamander species in the northeastern United States. Males are around 17 inches in length, while females are a bit larger, averaging 21 inches. With a wide head, white tipped toes and wrinkled body, the hellbender has a bizarre monster-like appearance. Despite its odd looks, the hellbender is completely harmless. The base color is brown, and blotched with darker spots, though some adults may vary from yellowish brown to nearly black. The hellbender is one of two aquatic salamanders in Pennsylvania. The other is the mudpuppy (*Necturus maculosus*) which has distinctive external gills through adulthood and is easily distinguished from the hellbender.

Photo source: Tim Maret

The Eastern Hellbender
(*Cryptobranchus alleganiensis alleganiensis*)

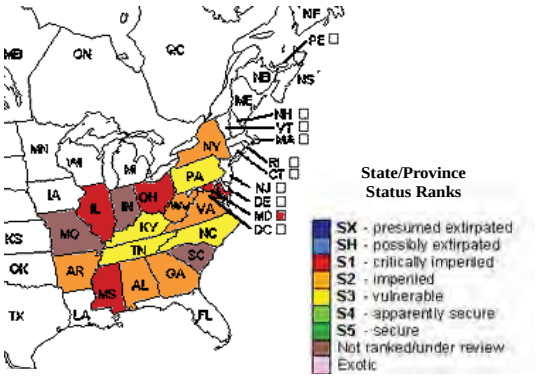
Habitat and Natural History

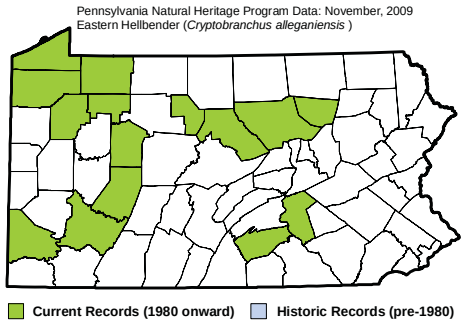
Inhabitants of swift-flowing, clean, clear waters, eastern hellbenders live in crevices under flat rocks on medium sized stream and river bottoms. Hellbenders feed almost exclusively on crayfish and pose no threat to game fish populations; however, they were once thought of as vicious predators of trout and other game fish and were consequently persecuted. Hellbenders are usually active at night, retreating under rocks during the daylight hours. Between late August through the end of September, adult hellbenders are seen more frequently moving about on the river bottoms in search of mates. Males construct nest chambers below rocks and lure females in for breeding. As the female deposits pearl-like strings of eggs, the male fertilizes them and guards the eggs until they hatch.

Conservation/Status

The eastern hellbender has declined in Pennsylvania for a number of reasons, but primarily due to decreases in water quality. Amphibians as a whole are particularly susceptible to chemical contamination given their permeable skin. Increased sedimentation due to soil erosion may choke out hellbender habitat, by filling in the gaps beneath rocks where they live. While some populations of hellbenders appear to be stable; many others seem to have vanished. Introductions of invasive exotic crayfish, such as the rusty crayfish (*Orconectes rusticus*) which are more aggressive than our native species, are thought to be the cause for some of these declines. Recent work has shown that predation by non-native game fish including walleye and brown trout may also lead to hellbender declines.

North American State/Province Conservation Status
Map by NatureServe 2009





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Pennsylvania Natural Heritage Program

Smooth Green Snake (*Liochlorophis vernalis*)

State Rank: S3S4 Global Rank: G5

Identification

The smooth green snake (*Liochlorophis vernalis*) is a long slender snake with a brightly green colored body and yellowish white underside. This snake can reach up to 2 feet in length. Females are longer than males in total body length, although tail length, the distance from the cloaca to the tip of the tail, is greater for males. The smooth green snake is similar in appearance to the rough green snake. They are distinguished by the nature of their scales; the smooth green snake lacks keeled scales whereas the scales of the rough green snake are keeled.

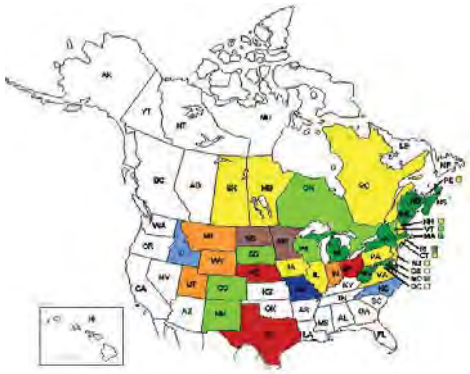
photo source: Charlie Eichelberger

Habitat/Behavior

This terrestrial species inhabits moist and upland habitats including fields, wet meadows, bog and marsh borders and forest clearings. They are primarily ground dwellers found in the open or among grass and vegetation, where their camouflage color makes them difficult to see. They will occasionally climb into low shrubs, and are also found under cover such as rocks and logs. This non-venomous, docile snake does not bite but, as a defensive behavior, will occassionally emit a musky secretion when handled or threatened. The smooth green snake feeds on insects, caterpillars, grasshoppers, and spiders. During the winter months, this snake hibernates communally underground in mammal burrows, gravel banks, and ant mounds and has been found close to 3 feet below ground. Predators include hawks, cats, and mammals.

Status

The smooth green snake ranges from eastern Nova Scotia and Manitoba, south to Virginia and West Virginia and west to southeastern Saskatchewan, Montana, Wyoming, Utah, and New Mexico. Isolated populations are known from southeastern Texas and Chihuahua, Mexico. This species is widely distributed throughout Pennsylvania except in the southeastern Coastal Plain and Piedmont regions, and the mountains of the southern Poconos where it is absent. The use of pesticides is the main threat to the smooth green snake as pesticide use can considerably reduce the numbers of insects and other invertebrates they prey upon. Loss of habitat also threatens their well-being and has contributed to their decline across their range.



Pennsylvania Natural Heritage Program

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Mudpuppy (*Necturus maculosus*)

Pennsylvania Amphibian Species of Concern
State Rank: S3S4 (vulnerable), Global Rank: G5 (secure)

Description

The mudpuppy is a large salamander that averages 8–13 inches in length. The head is flattened, the eyes are small and bushy gills are evident on either side of the head. Mudpuppies belong to a family of salamanders that retain external gills as adults. The body is gray-brown in color with dark blotches across the back.

Charlie Eichelberger (PNHP)

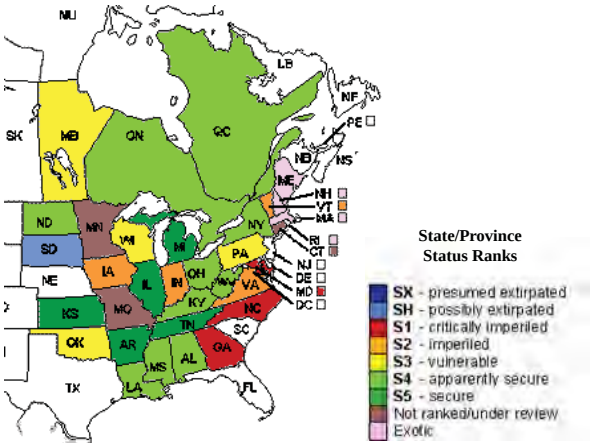
Occasionally caught by fishermen, the mudpuppy is completely harmless to humans, and serves an important role in the ecology of Pennsylvania's waterways.

Habitat and Natural History

The habitat of the mudpuppy is variable and includes lakes, ponds, and canals, as well as fast flowing streams and rivers. Found only in the western third of the state, mudpuppies are absent from the Delaware, Potomac, and Susquehanna drainages. They hide under rocks and logs during the day, and at night, forage and feed opportunistically on aquatic insects, mollusks, crustaceans, small fish and other salamanders. They in turn are prey for hellbenders, fish, snapping turtles, herons and crayfish.

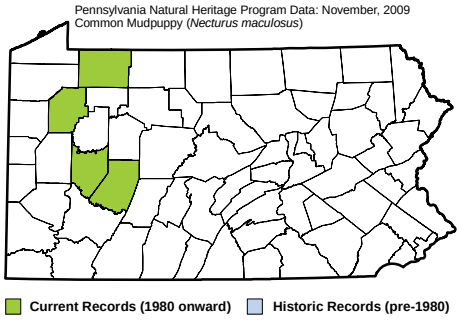
The mudpuppy reaches sexual maturity at about 5 years of age and may live for nearly 30 years. Breeding takes place in the fall and nesting occurs the following spring. The female excavates a depression under a log or rock and deposits eggs on the underside of these overhanging structures. She tends the eggs until they hatch some two months later. The young, which have alternating yellow and brown stripes, remain in the nest another six to 8 weeks until they have absorbed their attached yolk sac. Juveniles tend to favor pools with silt and organic debris or a rocky retreat not already occupied by an adult salamander or fish. Mudpuppies are active year round.

North American State/Province Conservation Status
Map by NatureServe (2009)



Conservation Status

While the mudpuppy occurs throughout much of eastern North America, it was recently added to the watch list in Pennsylvania. The Pennsylvania distribution map reflects the fact that this species is newly tracked. As additional data is collected, the distribution map will be updated. The fate of another Pennsylvania species of concern is closely tied to that of the mudpuppy. The mudpuppy serves as the only known host for the larva of the threatened salamander mussel, *Simpsonaias ambigua.*



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PNHP
Pennsylvania Natural Heritage Program

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)

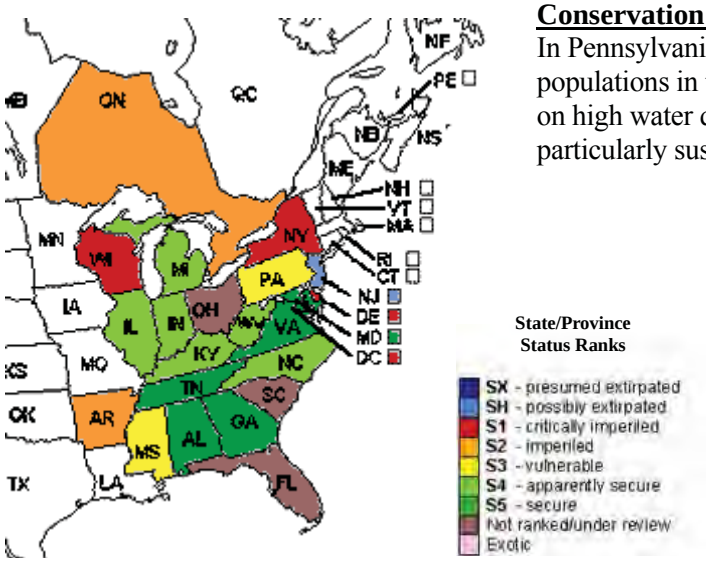
Queen Snake (*Regina septemvittata*)

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.

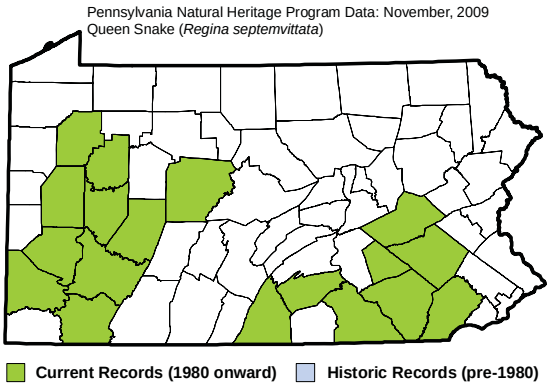
Females reach reproductive maturity in their third year while males mature in their second year. Queen snakes breed in the spring, with females birthing 4-15 live young in August.

Queen snakes are active from late April through October and then seek suitable overwintering sites such as a muskrat lodges, crayfish burrows or a crevices 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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PNHP
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LEAST BROOK LAMPREY (*Lampetra aepyptera*)

Freshwater Fish Species of Concern

State Rank: S3 (vulnerable) Global Rank: G4 (apparently secure)

Description

© Noel Burkhead. Natureserve.org

The least brook lamprey has an eel-shaped body with a deeply notched dorsal fin which separates it into two distinct fins. The mouth is disc-shaped and surrounded by teeth. Adults are dark and tan above and lighter below. During spawning, adults become blue-black in color (dnr.state.oh.us.). The least brook lamprey reaches a length of 18 cm and the maximum reported age is 8 years (fishbase.org)

Behavior

The least brook lamprey is a non-parasitic species that spawns in late winter or spring. Th
the larval stage lasts about 5-6 years. Larvae metamorphose in late summer. Adults over-winter, spawn, and then die. The brood is hidden in nests in gravely riffles and the eggs are not guarded (natureserve.org).

Diet

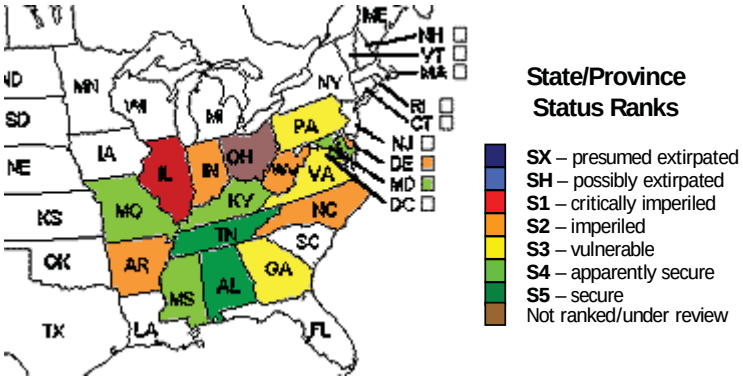
The least brook lamprey is herbivorous in its immature stages and feeds on minute drifting microscopic organic material. In its adult stage, the least brook lamprey does not feed (natureserve.org).

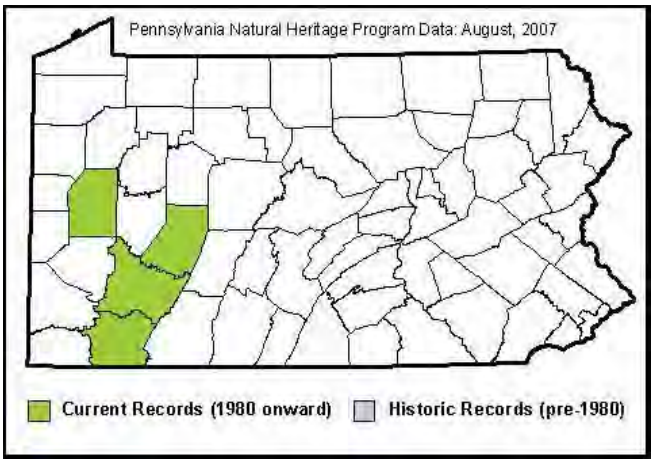
Threats and Protection Needs

The least brook lamprey is a Candidate Rare species in Pennsylvania. The species is restricted to the southern stretches of the Susquehanna watersheds and the Ohio watershed (naturalheritage.state.pa.us). Little available data is out on threats and protection needs for the least brook lamprey. Perhaps some of this is due to the sea lamprey and the intensive efforts to eradicate it from its non-native range. Unlike the least brook lamprey, the sea lamprey is a parasitic lamprey that devastates native fish populations and the similarity between the species

North American State/Province Conservation Status

Map by NatureServe (September 2007)





Habitat

The least brook lamprey prefers clean, clear gravel riffles and runs of creeks and small rivers. Larvae burrow in the bottom of quiet waters. They are found along the Atlantic Slope from the Susquehanna River drainage in southeastern Pennslyvania to North Carolina. In the Mississippi basin they are found from southwestern Pennsylvania to south-central Missouri and northern Arkansas, south to northern Alabama to Georgia, Alabama, and Mississippi.

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Pennsylvania Natural Heritage Program

Elktoe (Alasmidonta marginata)

Freshwater Mussel Species of Concern

State Rank: S4 (apparently secure), Global Rank: G4 (apparently secure)

Identification

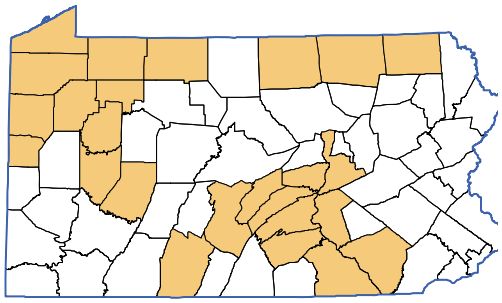
The Elktoe (*Alasmidonta marginata*) is a moderately sized mussel, commonly reaching 75 mm in length. The shell is trapezoidal or rhomboid shaped, inflated, and thin (Parmalee 1998, Strayer and Jirka 1997). The anterior margin is rounded, with a somewhat straight ventral margin. The ventral and posterior 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).

Photo: http://www.lwatrous.com/missouri_mollusks/mussels/images/a_marginata.jpg

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).

Pennsylvania Distribution by County



Pennsylvania Natural Heritage Program data 2007

Host Fish

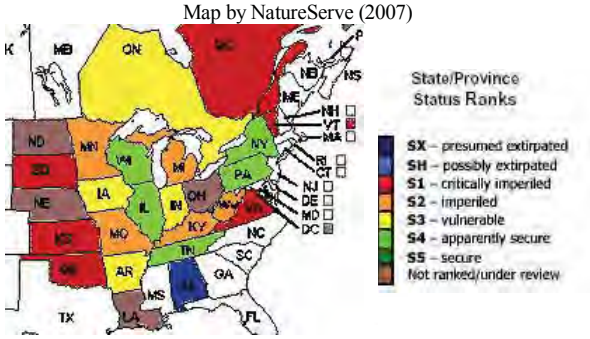
Hosts for Elktoe glochidia include the white sucker, northern hogsucker, shorthead redhorse, rockbass, and warmouth (Parmalee 1998; Strayer and Jirka 1997).

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.

North American State/Province Conservation Status

Map by NatureServe (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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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 (Bogan 1993; Strayer and Jirka 1997).

Photo source: PNHP

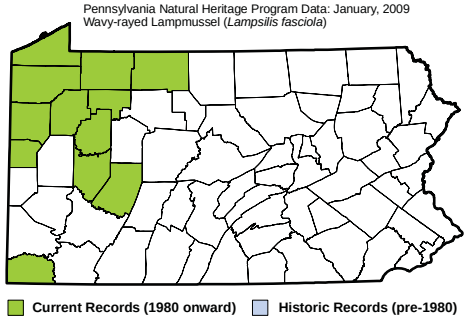
Habitat

The wavy-rayed lampmussel lives in the riffles of medium to large sized rivers and creeks in water that is clear (NatureServe 2008).

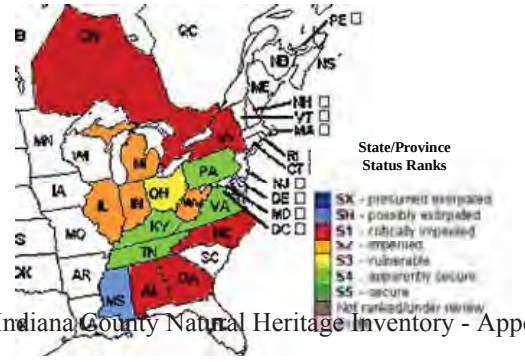
Host Fish

A host for this mussel is the smallmouth bass (*Micropterus dolomieui*) (Zale and Neves 1982, Strayer and Jirka 1997; Cummings and Watters 2009). 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: Tamara Smith, PNHP



North American State/Province Conservation Status
Map by NatureServe 2008



Status

The wavy-rayed lampmussel is found in the Great Lakes and Ohio-Mississippi drainages from Ontario, Canada south to Mississippi and eastward (NatureServe 2008). In Pennsylvania the *Lampsilis fasciola* is found in the Ohio and Lake Erie drainage basins (PNHP 2008). 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 (PNHP 2008). 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*) (Lydeard et al. 2004).

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Round Pigtoe (*Pleurobema sintoxia)*

Freshwater Mussel Species of Concern

State Rank: S2 (imperiled) **Global Rank: G4/G5** (apparently secure/secure)

Identification

The round pigtoe (*Pleurobema sintoxia*) has a variable shell. The shells of mussels in large rivers are inflated while those in smaller order streams are compressed (NatureServe 2008). 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 (Cummings and Mayer 1992).

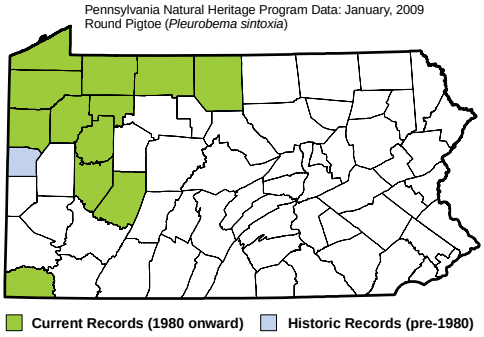
Photo source: Tam Smith

Habitat

This mussel is found in the mud, sand or gravel of large to medium rivers (NatureServe 2008).

Host Fish

In Pennsylvania, hosts for the larval glochidia include the: bluegill (*Lepomis macrochirus*), bluntnose minnow (*Pimephales notatus*), and creek chub (*Semotilus atromaculatus*) (Hove 1995; Watters, et al. 2005).

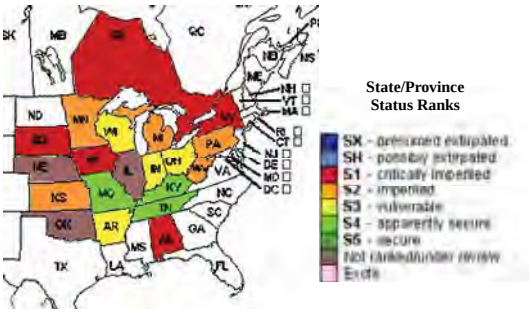


Status

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.

North American State/Province Conservation Status

Map by NatureServe 2008



In Pennsylvania the round pigtoe is restricted to the Ohio and Lake Erie drainages (PNHP 2008). 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.

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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).

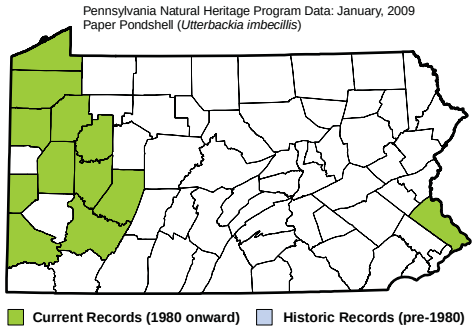
Photo source: Mary Walsh (PNHP)

Habitat

Typical habitat is the soft substrate of slow moving creeks, rivers, lakes, ponds and other impoundments (Strayer and Jirka 1997; Bogan 2002).

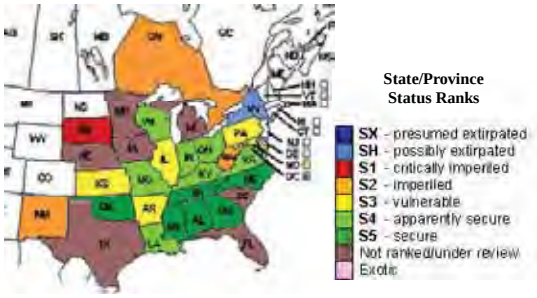
Host Fish

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 catesbeianus*) 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.

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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/pg07_WildlifeSpeciesCon/pg7b1a1_31.htm, 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/pg07_WildlifeSpeciesCon/pg7b1a1_31.htm, Parmalee 1998, Strayer and Jirka 1997).

Photo: 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).

Photo: PA Science Office TNC

Photo: PA Science Office TNC

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).

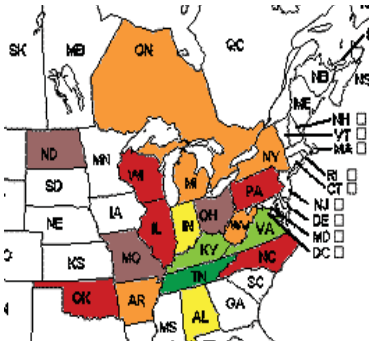
Status

The Rainbow mussel is widespread throughout the St. Lawrence, upper Mississippi, Ohio, Tennessee, and Cumberland River basins (www.ncwildlife.org/pg07_WildlifeSpeciesCon/pg7b1a1_31.htm, 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/invertebrates.aspx). 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.

North American State/Province Conservation Status

Map by NatureServe (2007)



State/Province Status Ranks

SX – presumed extirpated
SH – possibly extirpated
S1 – critically imperiled
S2 – imperiled
S3 – vulnerable
S4 – apparently secure
S5 – secure
Not ranked/under review

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Mustached Clubtail (*Gomphus adelphus*)

Pennsylvania Invertebrate Species of Concern

State Rank: S3S4 (vulnerable/apparently secure) Global Rank: G4 (apparently secure)

Identification

The mustached clubtail is a small (4.3 to 4.8 centimeters, or about two inches, long) dragonfly patterned in black and yellowish green. The upper surface of the head is black and the thorax yellow with black stripes, notably a black band running back to front on the upper surface which divides into two stripes towards a yellow collar at the front of the thorax. The abdomen is black.

Photo: David Westover (Kondratieff, 2000)

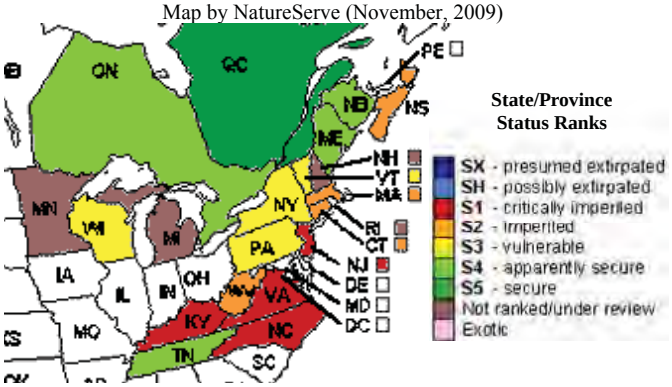
Mustached Clubtail (*Gomphus adelphus*)

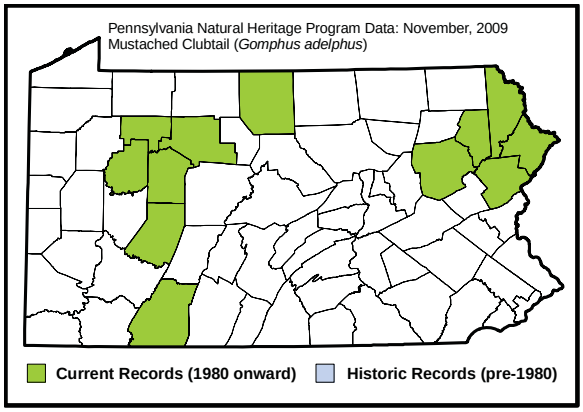
Habitat/Behavior

Mustached clubtail adults are found near riffles in clear streams and sometimes along lakeshores, where they often rest on low vegetation. The larvae are aquatic predators and hunt in streambeds below riffles. The species ranges from Quebec and Ontario south to North Carolina and Tennessee and west into Minesota.

North American State/Province Conservation Status

Map by NatureServe (November, 2009)





Reasons for Being Threatened

Because their life cycle involves both terrestrial and aquatic phases, dragonflies are particularly sensitive to disturbances of stream and lake habitats. Water pollution, flow regime changes, and modification to in-stream microhabitat can harm the larvae; clearing of stream and lake shore vegetation deprives the adults of foraging and resting habitat.

Conservation

Protection of the mustached clubtail will require preservation and restoration of both the terrestrial stream-side habitat of the adult and the aquatic habitat of the larvae. The species can benefit from reduction of fertilizer and pesticide runoff, as well as planting of vegetative buffers along streams.

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NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: November 6, 2009).

Needham, James G.; Minter J. Westfall, Jr.; and Michael L. May. 2000. Dragonflies of North America, Revised Edi-tion. Washington: Scientific Publishers. 340-1.

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Sable Clubtail (*Gomphus rogersi*)

Pennsylvania Invertebrate Species of Concern

State Rank: S1 (critically imperiled) Global Rank: G4 (apparently secure)

Identification

Sable clubtail, *Gomphus rogersi*, is a dark-colored dragonfly marked with tones of olive, slate, and extensive areas of black. The veins of this species' wings are black, as is the labrum, or upper lip; the frons, or facial plate, is a paler color. The sides of the thorax are also mostly pale. Adults grow to lengths of 47 to 50 millimeters.

Photo: Dan Czaplak

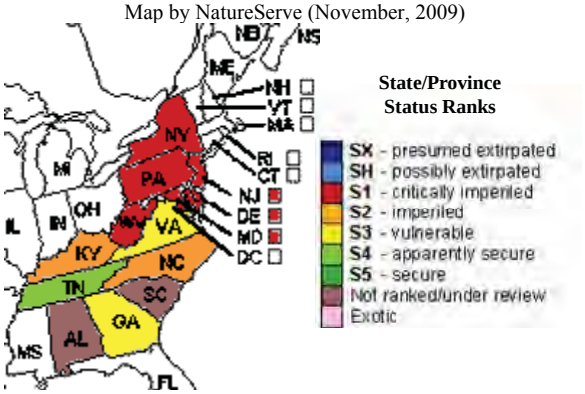
Sable clubtail (*Gomphus rogersi*)

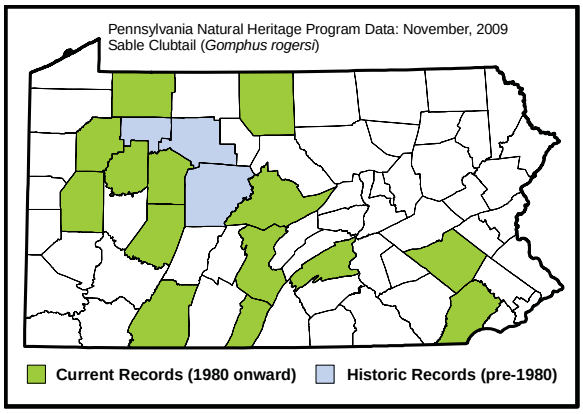
As with all dragonfly species, Sable clubtail larvae are aquatic predators. They resemble squat, wingless versions of the adult form, with hooks on their forelegs specialized for burrowing.

Sable clubtail is a member of the subgenus *Gomphurus*, one of three subdivisions of the large and diverse club-tail genus, *Gomphus*.

North American State/Province Conservation Status

Map by NatureServe (November, 2009)





Habitat/Behavior

Sable clubtail is documented from Vermont south to Alabama and Georgia. Its preferred habitat is along small, rocky streams.

Reasons for Being Threatened

Because their life cycle involves both terrestrial and aquatic phases, dragonflies are particularly sensitive to disturbances of stream and lake habitats. Water pollution can harm the larvae; clearing of stream- and lake-shore vegetation deprives the adults of habitat. Though its status is undecided in several states, it is imperiled or critically imperiled in most of the northern half of its range, including Pennsylvania.

Conservation

Protection of sable clubtail will require preservation and restoration of both the terrestrial stream-side habitat of the adult and the aquatic habitat of the larvae. The species can benefit from reduction of fertilizer and pesticide runoff, as well as planting of vegetative buffers along streams.

References

Czaplak D. 2005. "Dragonflies" [web page]. Available online at http://odolep.com. Accessed 28 April 2005.

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Needham JG, MJ Westfall, Jr, ML May. 2000. Dragonflies of North America. Washington: Scientific Publishers. 939 p.

New Jersey Odonata Survey. 2003. "NJODES: The Dragonflies and Damselflies of New Jersey" [web site]. Available at http://www.njodes.com/default.htm. Accessed 28 April 2005.

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Bushy Bluestem (*Andropogon glomeratus*)

Pennsylvania Plant Species of Concern
State Rank: S3 (vulnerable) Global Rank: G5 (secure)

Description

Bushy bluestem is an erect, tufted perennial grass that may grow to 3 feet (1 m) tall. The leaves have narrow, elongate blades approximately 3/8 of an inch (3-6 mm) wide, and tend to turn copper to orange in the fall. The individual flowers are minute and are grouped in small spikelets that are surrounded by fluffy, gray-white bristles. Numerous groupings of the spikelets are aggregated together to form a bushy terminal cluster, which give the plant its name.

photo source: Pete Woods, PNHP

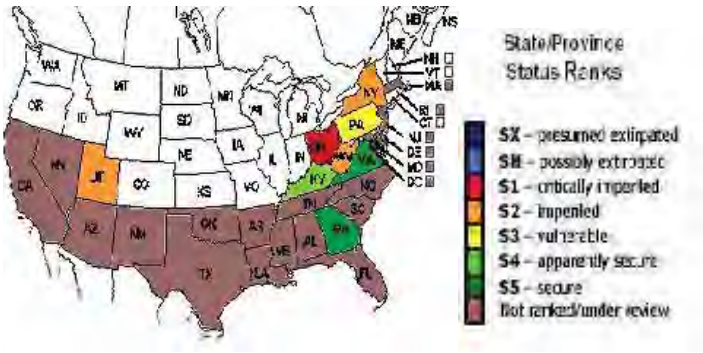
Distribution & Habitat

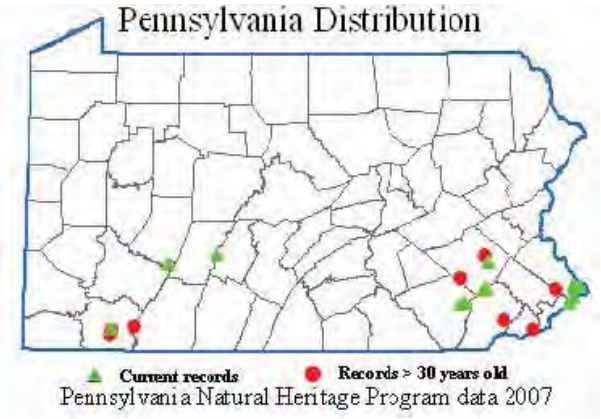
Bushy bluestem has a range across the continent in the southern states, with an extension northeastward into southern New England. In Pennsylvania, it has been documented historically in scattered locations, particularly in the southern counties. The bushy bluestem grows in a variety of damp to wet open places, clearings, and sometimes in human-created disturbed ground.

Status

The PA Biological Survey (PABS) considers bushy bluestem to be a species of special concern, based on the few occurrences that have been recently confirmed. It has a PA legal rarity status of Undetermined and has been assigned a suggested rarity status of Rare by PABS. About 15 populations are currently known from the state.

North American State/Province Conservation Status





Conservation Considerations

The populations of bushy bluestem in the state are threatened by human-related habitat loss, natural succession, invasive species, and the indiscriminate spraying of herbicides. Given the preference of the species for open habitats, active management – such as fire, mowing, or invasive species removal – is often required to maintain the proper successional stage at sites where it grows.

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.A. Block. 2007. The Plants of Pennsylvania: An Illustrated Manual. 2nd edition. University of Pennsylvania Press, Philadelphia.

*Mountain bugbane (*Cimicifuga americana*)*

Pennsylvania Threatened Plant Species
State Rank: S3 (vulnerable) Global Rank: G4 (apparently vulnerable)

What it looks like:

Mountain bugbane is a perennial herb that grows from one to one and a half meters tall.

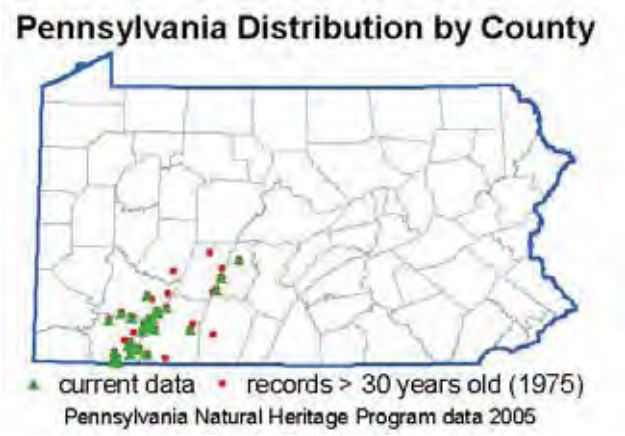
Leaves are compound, with terminal leaflets large, toothed, and deeply cleft; other leaflets oval to wedge-shaped with sharply defined teeth. All leaflets are less than 10 centimeters long.

Flowers: a slender raceme (up to 30 centimeters tall) of tiny white flowers; no petals; short-lived sepals; most conspicuous feature is the spray of many white stamens; strong foul odor attracts flies for pollination; flowers open from base upward on spike. Can be distinguished from the very similar looking species, black bugbane (*Cimicifuga racemosa*), because it has three or more carpels instead of one, and because of its stalked seed pods.

Rita Hawrot, Western Pennsylvania Conservancy

Where it is found:

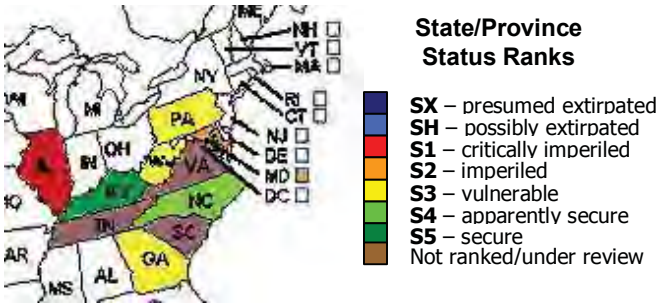
Mountain bugbane grows in rich hardwood forests, often in the same habitat as hemlock, on north-facing mountainsides or the wooded corridors that follow mountain streams. It is restricted to the central Appalachians, from Pennsylvania south to Georgia and as far west as Illinois.



Why it is rare:

Mountain bugbane is primarily endangered by development of its habitat, but populations have also suffered from harvesting pressure. Although mountain bugbane is not particularly valuable in itself, its similar-looking relative black bugbane is a highly sought-after medicinal herb. Between 300,000 and 500,000 pounds of black bugbane were collected from the wild for sale in 1999, and some of this was almost certainly mountain bugbane.

North American State/Province Conservation Status
Map by NatureServe



Conservation considerations:

Much is still unknown about where mountain bugbane grows and how secure its existing populations are. Information about how often it is collected with black bugbane would greatly aid conservation efforts. Given present information, habitat conservation is what this species needs most.

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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. 49.
- NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: September 4, 2007).
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Golden Club (*Orontium aquaticum*)

Pennsylvania Watch Listed Plant Species

State Rank: S4 (Apparently Secure) Global Rank: G5 (Secure)

Identification

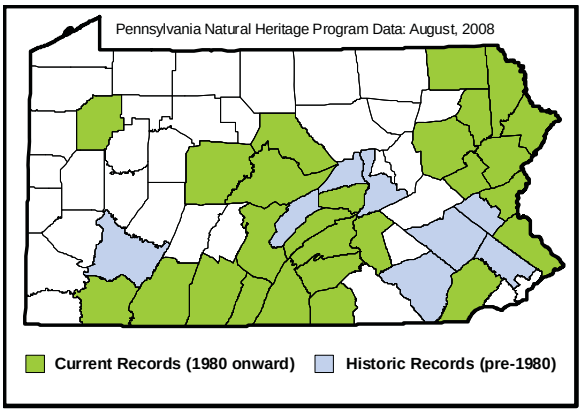
Golden club is a perennial herb that may grow up to 2 feet (about 2/3 meter) in height. This species belongs to the same family as Jack-in-the-Pulpit. The leaves are lance-shaped to oblong to elliptic, dark green, lack teeth on the margin, up to 12 inches (30 cm) in length, pointed at the tip and with a well-developed stalk at the base. The leaf surface causes water to bead up and so the leaves always appear dry. The individual flowers, appearing in April and May, are scattered on the golden-yellow tip of a club-shaped flowering stem, which is white in color directly below the flowers.

photo source: Sally Ray, PNHP

Golden club in bloom (*Orontium aquaticum*)

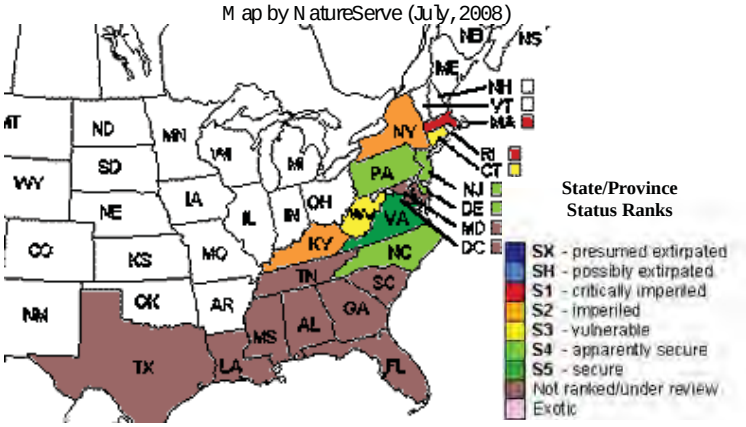
Distribution

Golden Club has a range from New York and Massachusetts south and west into Florida and Texas. In Pennsylvania, the species has been documented historically throughout most of the state.



North American State/Province Conservation Status

Map by NatureServe (July, 2008)



Habitat

Golden Club grows in shallow water of lakes and ponds, oxbow floodplains, slow-moving streams, and swamps.

State Status & Conservation

The PA Biological Survey (PABS) has assigned Golden Club to the Watch list, which indicates that the species appears to be frequent enough and secure enough not to require an official rarity status, but deserves to be monitored because of its localized distribution and in order to detect possible negative trends in the status of the species. Some populations of Golden Club are impacted by water pollution, excessive deer and waterfowl browsing, and exotic species.

References

- NatureServe. 2008. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.0. NatureServe, Arlington, Virginia. Available at http://www.natureserve.org/explorer.
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- Rhoads, A.F. and T.A. Block. 2007. The Plants of Pennsylvania: An Illustrated Manual, Second Edition. University of Pennsylvania Press, Philadelphia.

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Purple fringeless orchid (*Platanthera peramoena*)

Pennsylvania Plant Species of Concern

State Rank: S2 (imperiled), Global Rank: G5 (secure)

What it looks like:

The purple fringeless orchid is a short plant, 3-10 decimeters (about 12-39 inches) tall, bearing loose inflorescences (spikes) of violet to pink flowers. It is thought to be adapted for pollination by daylight-active lepidoptera (moths and butterflies).

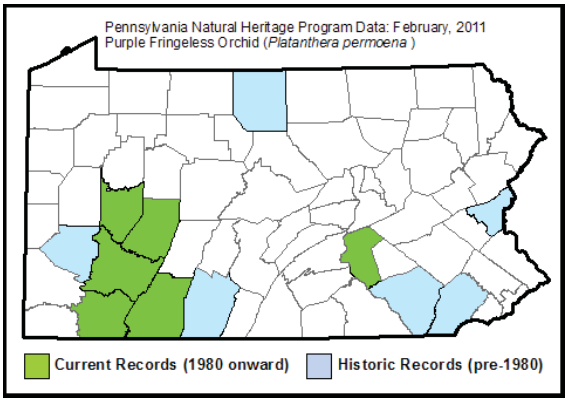
Flowers are bilaterally symmetrical, with prominent lower petals deeply divided into three wedge-shaped segments with finely toothed outer edges. The lowermost segment is partially split by a single, central notch. Flowering occurs in July and August.

Leaves are long and narrow, 10-20 cm (about 4-8 in) long at the bottom of the stem and shorter towards the inflorescence.

photo by Clifford Pelchat, from Digital Flora of Texas

Where it is found:

The purple fringeless orchid grows in open, swampy places – along roads, in forest openings and meadows, and near vernal pools, preferring acidic soil. It is found from Pennsylvania south to Mississippi and west to Arkansas.

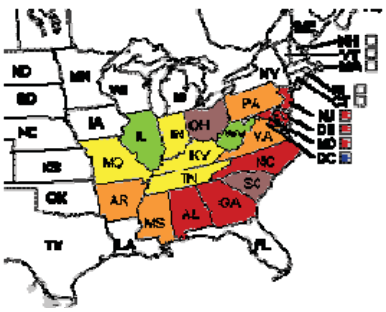


Why it is rare:

The orchid's restricted habitat has made it vulnerable to changing land use and forest harvesting or management practices. Changes to its forest habitat have contributed to the species' critically imperiled status across the eastern seaboard and into the southeast of the United States.

North American State/Province Conservation Status

Map by NatureServe, February 2011



State/Province Status Ranks

- **SX** – presumed extirpated
- **SH** – possibly extirpated
- **S1** – critically imperiled
- **S2** – imperiled
- **S3** – vulnerable
- **S4** – apparently secure
- **S5** – secure

Not ranked/under review

Conservation considerations:

The purple fringeless orchid will benefit most from habitat protection. Forest management strategies should avoid disturbing known populations of the orchid, and forest land containing marshes or vernal pools should be preserved against human interference.

Pennsylvania Natural Heritage Program

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Thick-leaved Meadow-rue (*Thalictrum coriaceum)*

Pennsylvania Endangered
State Rank: S2 (imperiled), Global Rank: G4 (apparently secure)

What it looks like:

Thick-leafed meadow rue, a member of the buttercup family (Ranunculaceae), grows up to one meter (three feet) tall from its low woody base, or caudex. Its roots are bright yellow. Individual plants bear only male or female flowers.

Flowers have no petals, but deciduous sepals are white to purple in color, and the filaments and stigma are maroon. Flowering occurs in late May through June.

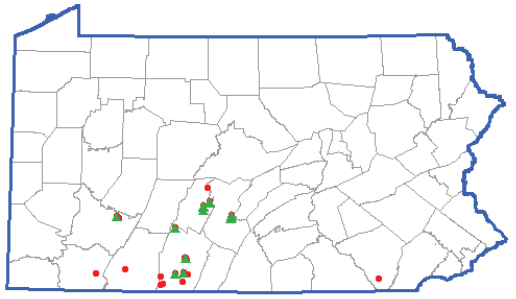
Leaves are compound, with up to four leaflets, which are kidney-shaped to round, with broad lobes or teeth along their outer margins.

USDA-NRCS PLANTS Database - from *Illustrated flora of the northern states and Canada.* (Britton, N.L., and A. Brown 1913.) Vol. 2: 119.

Where it is found:

Thick-leafed meadow rue grows in rocky, open wooded habitats and areas with rich, moist soil in mountain or Piedmont terrain. Its natural range is from Pennsylvania south to Tennessee and Georgia; while it is present in Kentucky, it may be exotic in that state.

Pennsylvania Distribution by County



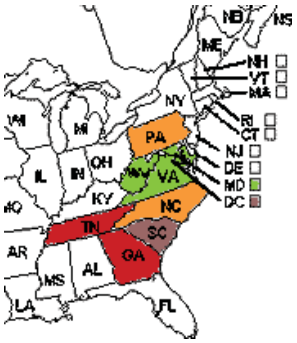
Pennsylvania Natural Heritage Program data 2005

Why it is rare:

This species is rare through much of its range, and because it requires particularly pristine forest habitat, it is very sensitive to human disturbance.

North American State/Province Conservation Status

Map by NatureServe (August 2007)



State/Province Status Ranks

- **SX** – presumed extirpated
- **SH** – possibly extirpated
- **S1** – critically imperiled
- **S2** – imperiled
- **S3** – vulnerable
- **S4** – apparently secure
- **S5** – secure
- Not ranked/under review
- Exotic

Conservation considerations:

Recovery of thick-leafed meadow rue in Pennsylvania will require preservation and protection of unaltered woodlands within the plant's historical range. Removal or management of invasive competitor species and reduction of deer populations to control overgrazing will also benefit this species.

References

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APPENDIX VI: PNHP Aquatic Community Classification (ACC) in Indiana County

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 Community 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 19 shows the aquatic communities that were identified within Indiana 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. Environmental and water quality habitats typically associated with the community type are also described.

1) Community Habitat - The environment of the stream where the community occurs is described by watershed and stream characteristics. Size of the stream and watershed, gradient (slope), and elevation are a few habitat characteristics that may be important to the community type. Local conditions are also mentioned.

2) Stream quality rating- Community locations are ranked as low, medium, or high quality based on known habitat, water quality, and sensitivity of organisms to pollution.

3) Threats and Disturbances - Pollution sources or other threats that may alter the natural state of the community are discussed, where known.

4) Conservation recommendations – 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.

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, acid 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 flowing 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 among 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 as discharges from sewage treatment plants, mines, and industrial sources.

***What is the relationship between Pennsylvania Aquatic Fish Community Classes and stream designations*?**
Pennsylvania protects aquatic life as a "designated use" of waters in the Commonwealth under the federal Clean Water Act. Enforced by PA DEP is the regulation that four types of aquatic life should be propagated and maintained based on their designation in Pennsylvania (PA Code 93.3; http://www.pacode.com/secure/data/025/chapter93/chap93toc.html, accessed 10/14/2009):

> **Cold Water Fishes (CWF):** Fishes and associated aquatic flora and fauna preferring colder waters (included in the cold water fishes are trout species).
>
> **Warm Water Fishes (WWF):** Fishes and associated aquatic flora and fauna preferring warmer waters.
>
> **Trout Stocked Fishes (TSF):** Stocked trout species (maintained from Feb 15 to July 31) and warm-water flora and fauna.
>
> **Migratory Fishes (MF):** Fishes (those having anadromous, catadromous, or similar life histories) which must migrate through flowing waters to their breeding habitats.

Additionally, some water bodies receive additional special protections as "Exception Value" or "High Quality" waters because they are especially valued for aquatic life, water quality, and/or recreation. Meeting relatively high water quality and other standards qualify the water bodies for additional protections from degradation beyond the aquatic life uses (PA Code 93.4b, http://www.pacode.com/secure/data/025/chapter93/chap93toc.html, accessed 10/14/2009).

The purpose and meanings differ between the classes defined in Pennsylvania aquatic life use/special protection designations and aquatic fish assemblages from the Pennsylvania Aquatic Community

Classification. In both cases it is meant to relatively define the organisms and aquatic habitats along a gradient of water temperatures (and associated stream size). The PA stream designations broadly encompass habitats occupied by several ACC fish assemblages (Table 18) and are used in water quality regulation.

Table 18: Pennsylvania aquatic life uses and special protection water designations and their occurrence with fish assemblages. (EV = Exceptional Value Waters, HQ = High Quality waters, CWF= Cold Water fishes, WWF= Warm Water Fishes, TSF= Trout Stocked Fishes, MF= Migratory Fishes).

Increasing watershed area	Fish Communities	EV	HQ	CWF	WWF	TSF	MF
	Coldwater	X	X	X			
	Coolwater		X	X	X	X	X
	Warmwater			X	X	X	X
	Large River				X		X

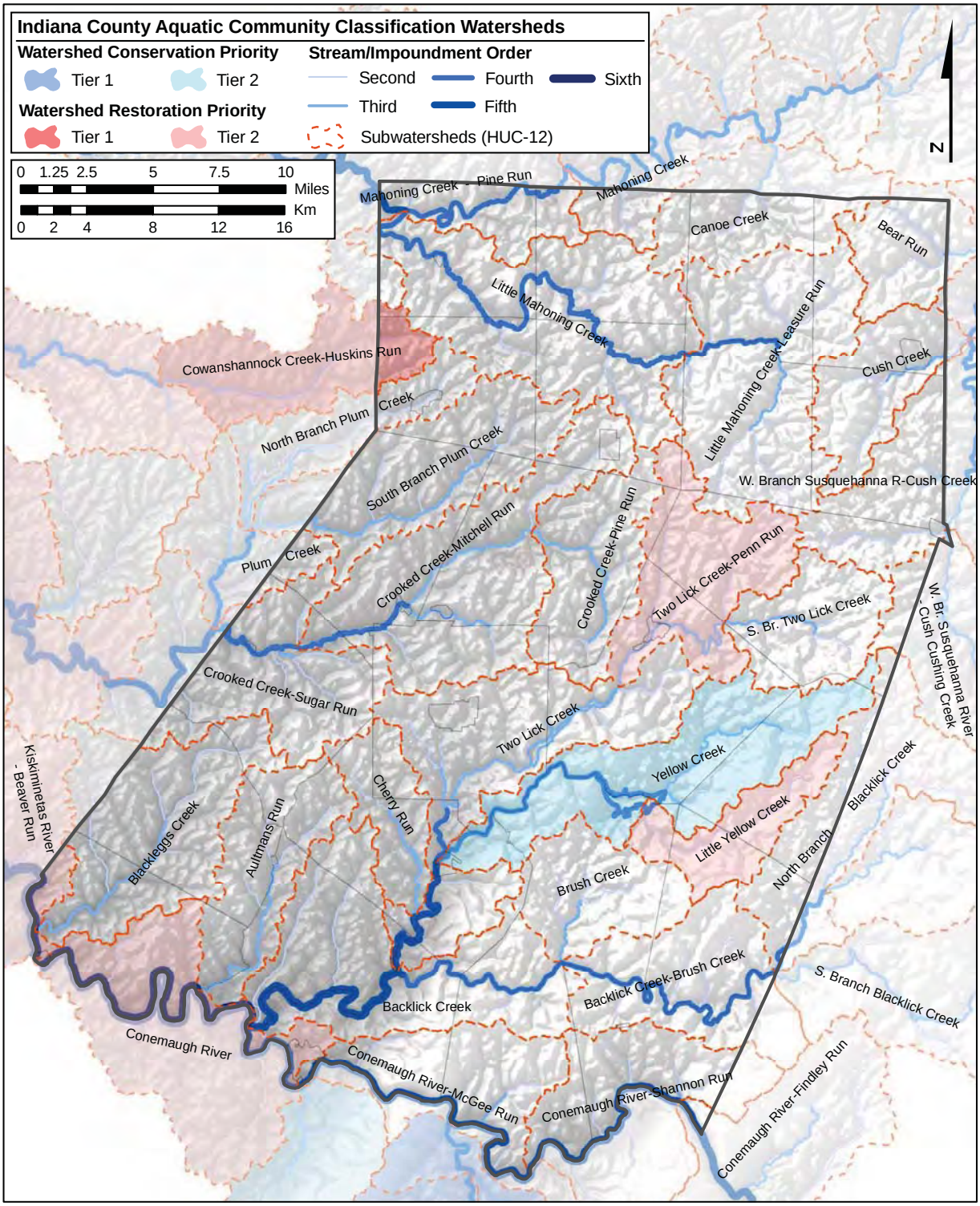

Figure 13: Conservation and Restoration Priority Watersheds of Indiana County from the ACC report. HUC 12 watersheds of Indiana County are shown, with the name of each watershed, the major streams, and conservation status.

References

- Walsh, M., J. Deeds, and B. Nightingale. 2007a. Classifying lotic systems for conservation: project methods and results of the Pennsylvania Aquatic Community Classification Project. Pennsylvania Natural Heritage Program.
- Walsh, M. C., J. Deeds, and B. Nightingale. 2007b. User's manual and data guide to the Pennsylvania Aquatic Community Classification. Pennsylvania Natural Heritage Program, Western Pennsylvania Conservancy.

Coldwater Fish Community

Typified by: brook trout (*Salvelinus fontinalis*) mottled sculpin (*Cottus bairdii*), brown trout (*Salmo trutta*), rainbow trout (*Oncorhynchus mykiss*)

Species of concern: none

Community Description and Habitat: This headwater stream community occurs in small swift headwater streams. Water temperatures are the coldest among the fish communities. The Coldwater Community represents small, swift streams with brook trout and slightly larger streams with both brook trout and brown trout or with brown trout only. The Coldwater Community occurs in Farnsworth Branch, Tionesta Creek, Arnot Run, Upper Sheriff Run, Dunham Road, Perry Magee Run, tributaries to the West Branch of Caldwell Creek, and Ott Run. Most streams are designated as Coldwater Fisheries by PA DEP in Warren County. While DEP-classified Coldwater Fisheries may support trout, in many cases the streams also have cool and warm water fish communities.

Brook Trout
photo source: http://www.cnr.vt.edu/efish

A natural landscape often surrounds the streams where the Coldwater Community is found and supports the stream habitat. Forested riparian buffers and watersheds preserve the cold and well-oxygenated waters and maintain high quality stream habitats and water quality. Natural cover, like logs and woody debris from the forest, and loose gravels required for spawning habitat should be abundant to support the fish community. Forage fish and invertebrates serve as a food supply for the brook and brown trout.

Stream quality rating: High

Threats and Disturbances: Small, swift streams characterized by the Coldwater Fish Community typically have few disturbances. However, some streams in Warren County, such as the West Branch of Caldwell Creek and its tributaries, have fish consumption advisories because of mercury contamination (DEP 2006).

Conservation Recommendations: Protecting headwater streams with natural landcover should be a priority for Warren County. Preventing pollution and habitat disturbance in high quality, small streams will protect the Coldwater Community. However, fixing ongoing watershed problems at the headwaters is beneficial for downstream waters.

Mercury contamination is a challenging problem to watershed managers. Because mercury in polluted air travels long distances from industrial sources, mercury deposition must be addressed through state and federal regulation of air pollution.

Small, cold fast flowing streams are the typical habitat of the Coldwater Fish Community.
photo source: PNHP

Streams in these watersheds may have wild-reproducing populations of brook and brown trout and may be a recreational fishery resource. Trout streams in Pennsylvania are highly valued by fisherman, but have been greatly altered by the transplantation of European brown trout and rainbow trout from western North America. Habitats for native brook trout have been restricted by competition with other trout species

References

- PA Department of Environmental Protection. 2006. Pennsylvania Integrated Water Quality Monitoring and Assessment Report.
- Walsh, M., J. Deeds, and B. Nightingale. 2007a. Classifying lotic systems for conservation: project methods and results of the Pennsylvania Aquatic Community Classification Project. Pennsylvania Natural Heritage Program.
- Walsh, M. C., J. Deeds, and B. Nightingale. 2007b. User's manual and data guide to the Pennsylvania Aquatic Community Classification. Pennsylvania Natural Heritage Program, Western Pennsylvania Conservancy,

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Coolwater Community

Typified by: Blacknose dace *(Rhinichthys atratulus*), creek chub (*Semotilus atromaculatus*), stocked brown trout (*Salmo trutta*), white sucker (*Catostomus commersoni*), redside dace (*Clinostomus elongatus*), longnose dace (*Rhinichthys cataractae*), fathead minnow (*Pimephales promelas*), pearl dace (*Margariscus margarita*), and slimy sculpin (*Cottus cognatus*)

Fathead Minnow
Photo source:
http://www.cnr.vt.edu/efish

Species of concern: none

Community Description and Habitat:
In Warren County, many streams were classified as the Coolwater Community. For instance, the Coolwater Community was found in Stony Creek, Jackson Run, Storehouse Run, Reynolds Run, parts of Little Brokenstraw Creek, Blue Eye Run, East Branch Spring Creek, West Branch Caldwell Creek, Caldwell Creek, Tidoute Creek, East Hickory Creek, Elkhorn Run, parts of Farnsworth Branch, Stillwater Creek, Dutchman Run, and Bush Creek.

This community type has varied habitat characterized by generalist fish species, and, therefore, can occur in a variety of stream conditions. The community can best be described by small to medium size streams that are faster than other valley streams and have temperatures intermediate between warm and cold streams. These streams may be called "Cold Water Fishery" by PA DEP, typically meaning that they support brown trout. 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 examples of the highest quality Coolwater Community habitats.

Fast-flowing cobble valley streams are habitat for the Coolwater Fish Community
Photo source: PNHP

Stream quality rating: Low-medium

Threats and Disturbances: This community occurs downstream of headwaters is subjected to the pollution common to valley streams. Agriculture, wastewater from industry and mercury contamination influence water quality where the Coolwater Community resides. Siltation from crop-related agriculture degrades the habitat in Stillwater Creek; it is classified as impaired by PA DEP (2006). Wastewater inputs in Dutchman Run contribute to low dissolved oxygen and organic enrichment (PA DEP 2006). There is fish consumption advisory in West Branch Caldwell Creek because of mercury contamination (DEP 2006).

Conservation Recommendations:
Restoration of stream temperature, habitat, and water quality to natural conditions is recommended. Management of agriculture adjacent to streams through riparian vegetation buffers, soil conservation, and other runoff reduction techniques will ameliorate water quality impairments. Addressing point source pollution from industrial sources is also recommended. Reduction of excess nutrients will improve water quality for the impaired stream and waters downstream. The mercury pollution in Warren County has been carried long distances by air currents from industrial sources. Improved federal regulation of air pollution would reduce the amount of mercury that drifts to Warren County from industrial sources and is deposited in waterways.

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 a natural ecological transition between cold, headwater streams and warm, larger streams. The habitat is distinct among other habitat types and should be protected and restored.

References

- PA Department of Environmental Protection. 2006. Pennsylvania Integrated Water Quality Monitoring and Assessment Report.
- Walsh, M., J. Deeds, and B. Nightingale. 2007a. Classifying lotic systems for conservation: project methods and results of the Pennsylvania Aquatic Community Classification Project. Pennsylvania Natural Heritage Program.
- Walsh, M. C., J. Deeds, and B. Nightingale. 2007b. User's manual and data guide to the Pennsylvania Aquatic Community Classification. Pennsylvania Natural Heritage Program, Western Pennsylvania Conservancy,

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Warmwater Community

Typified by: Greenside darter (*Etheostoma blennioides*), northern hogsucker (*Hypentelium nigricans*), central stoneroller (*Campostoma 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*), t onguetied minnow (*Exoglossum laurae*), Ohio lamprey (*Icthyomyzon bdellium*)

Northern Hogsucker
Photo Source: http://www.ohiodnr.com/dnap

Species of concern: none

Community Description and Habitat: The Warmwater Community usually occurs in medium to large valley streams or rivers, like Conewango Creek, Allegheny River, Brokenstraw Creek, Tionesta Creek, and F our Mile Run. 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. The habitat of community fish is a range of conditions. The best examples of this stream community occurs high quality valley streams with little silt and turbidity. In impaired waterways, p oorer water q uality conditions and increased turbidity and low dissolved oxygen occur.

Medium-sized streams without many groundwater inputs are typical of Warmwater Community streams.

Photo source: PNHP

Stream quality rating: Medium

Threats and Disturbances: Water quality and habitat may be influenced by non-point source pollution. The Allegheny River and Conewango Creek have fish consumption advisories because of mercury contamination (PA DEP 2006). Additionally impervious surfaces (such as roads and parking lots) or poorly managed agriculture in the Warmwater Community watersheds may contribute to poor water quality or degraded habitats.

Conservation Recommendations: This community is a h igh conservation priority. Warm water stream s in good condition are no t common. The fish a ssociates of th is community type are not rare individually, however, the community group occupies habitats in need of protection in Pennsylvania.

Addressing mercury pollution within Warren County is ch allenging because of air pollution carry mercury may travel a long distance before its de position in t he county. Acc umulation of mercury in fish and waterways should be addressed through federal and regional controls of air pollution. Since warm water streams mainly occur in valleys downstream of human influences, they are often subject to pollution from non-point sources, such as a griculture and urban runoff. Storm water management, restoration of riparian buffer zones, erosion control, and exclusion of livestock from streams are some mitigation techniques for non-point source pollution. Managing storm water is especially important for valley streams.

References

- PA Department of Environmental Protection. 2006. Pennsylvania Integrated Water Quality Monitoring and Assessment Report.
- Walsh, M., J. Deeds, and B. Nightingale. 2007a. Classifying lotic systems for conservation: project methods and results of the Pennsylvania Aquatic Community Classification Project. Pennsylvania Natural Heritage Program.
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Large River Community

Typified by: Channel catfish (*Ictalurus punctatus*), sauger (*Sander canadensis*), freshwater drum (*Aplodinotus grunniens*), walleye (*Stizostedion vitreus),* quillback carpsucker (*Carpiodes cyprinus*), smallmouth buffalo (*Ictiobus bubalus*), river redhorse (*Moxostoma carinatum*), mooneye (*Hiodon tergisus*), white crappie (*Pomoxis annularis*), longnose gar (*Lepisosteus osseus*), brook silverside (*Labisthesthes 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 Large River Community occurs most commonly in large streams and rivers in Warren County. The community is typical of rivers like the Allegheny River and wide streams like the Conewango Creek.

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.

Rivers, like the Allegheny River, are common habitats of this community type.
Photo source: PNHP

Stream quality rating: Medium

Threats and Disturbances: In typical large streams and rivers, the cumulative degradation from a number of upstream watershed sources contributes to the challenging nature of managing this community's habitat.

Agricultural non-point source pollution and habitat degradation occurs in some watersheds in Warren County . Air pollution also contributes to degraded water quality and bioaccumulation of contaminants in fish. It is the likely source of mercury causing the fish consumption restrictions for Allegheny River and Conewango Creek (PA DEP 2006).

Although dredging is uncommon in Warren County, river dredging in the Allegheny and Ohio River watersheds for gravel and sand mining is also a threat to this community type in other locations. Removing cover and bottom substrate, and altering natural river contours is very detrimental to the habitat of Large River Community fish.

Conservation recommendations: Addressing flow and water quality issues resulting in stream impairment and fish consumption should be a priority for Warren County. Reducing excessive sediment and nutrient loading from agricultural sources through best management practices is recommended to benefit the community. Restoration of habitat and water quality to natural conditions is recommended. Management of agriculture adjacent to streams through riparian vegetation buffers, soil conservation, runoff reduction techniques will ameliorate water quality impairments. The mercury pollution in Warren County has been carried long distances by air currents from industrial sources. Improved federal regulation of air pollution would reduce the amount of mercury that drifts to Warren County from industrial sources and is deposited in waterways.

References

- PA Department of Environmental Protection. 2006. Pennsylvania Integrated Water Quality Monitoring and Assessment Report.
- Walsh, M., J. Deeds, and B. Nightingale. 2007a. Classifying lotic systems for conservation: project methods and results of the Pennsylvania Aquatic Community Classification Project. Pennsylvania Natural Heritage Program.
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High Quality Small Stream Community

Typified by: Brushlegged mayfly (Isonychiidae), fingernet caddisfly (Philopotamidae), dobsonfly (Corydalidae), saddlecase maker (Glossosomatidae), watersnipe fly (Athericidae), common burrower (Ephemeridae), snail-case maker caddisfly (Helicopsychidae)

Brushlegged Mayfly
Photo source: www.dec.state.ny.us

Community Description and Habitat: This community is found in small size streams that are high gradient and fast flowing. Blue Eye Run, Prosser Creek, parts of Spring Creek and its tributaries, Hosmer Run and its tributaries, and Fairbank Run are some examples of the community habitat.

The High Quality Small Stream Community is typically found in streams with sandy substrate mixed with larger cobble and boulders. This community type is indicative of high quality streams. The organisms associated with t his 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 Jefferson County, this community mainly occurs in watersheds with that are primarily forested, however, in some locations influences from watershed agriculture alters the community from its natural state. In particular, the Prosser Creek watershed is dominated by agriculture. Where the agriculture is low-intensity or streams are protected by riparian buffers (or other mitigation measures), the community persist. However, poorly managed agriculture will degrade the community and organisms will shift to more pollution tolerant varieties.

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 are less common here than in other stream types. Protecting high quality small streams should be a priority for watershed managers. Measures should include pollution and habitat degradation prevention.

If agricultural influences are impairing stream water quality or habitat, practices that reduce soil erosion and nutrient runoff are recommended. Riparian buffers should be installed and maintained to capture silt and excess nutrients. Buffer vegetation that shade streams and stabilize water temperatures is encouraged. Eliminating livestock from streams stabilizing eroding stream banks will improve in-stream habitats for macroinvertebrate communities.

References

- Walsh, M., J. Deeds, and B. Nightingale. 2007a. Classifying lotic systems for conservation: project methods and results of the Pennsylvania Aquatic Community Classification Project. Pennsylvania Natural Heritage Program.
- Walsh, M. C., J. Deeds, and B. Nightingale. 2007b. User's manual and data guide to the Pennsylvania Aquatic Community Classification. Pennsylvania Natural Heritage Program, Western Pennsylvania Conservancy, Middletown, PA, and Pittsburgh, PA.

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High Quality Mid-Sized Stream Community

Typified by: Green stonefly (Chloroperlidae), giant black stonefly (Pteronarcyidae), spiny crawler (Ephemerellidae), flat-headed mayfly (Heptageniidae), free-living caddisfly (Rhyacophilidae), light brown stonefly (Perlodidae), prong gill mayfly (Leptophlebiidae), common stoneflies (Perlidae), crane fly (Tipulidae), roachlike stoneflies (Peltoperlidae), clubtail dragonfly (Gomphidae), northern case maker (Limnephilidae), Uenoid caddisfly (Uenoidae), Odonocerid caddisflies (Odontoceridae)

Giant black stonefly (Pteronarcyidae)
Photo source: www.dec.state.ny.us

Community Description and Habitat: The High Quality Mid-Sized Stream Community in most locations is found in small to medium-sized streams, like Reynolds Run, Prosser Creek, tributaries to Little Brokenstraw Creek, Damon Run,. Perry Magee Run, parts of the Allegheny River, Tidioute Creek, and Martin Run. Streams are generally high gradient systems with good habitat quality. The community watersheds typically are undisturbed by humans and are often in mainly forested basins. Community taxa are a combination of stoneflies, mayflies, caddisflies, and other organisms that are pollution sensitive.

Stream quality rating: High

Threats and Disturbances: Streams with the High Quality Stonefly Community generally have few threats, compared to other communities. Relatively natural watershed landcover in Tidioute Creek and Perry Magee Run watersheds help protect the water quality and stream habitat. Other watersheds, like Prosser Creek, and Damon Run may be disturbed by agricultural influences. Preventing detrimental disturbances from farming practices, roads and other impervious surfaces will maintain a relatively high quality stream community in mid-sized streams. Parts of the Allegheny River have a fish consumption advisory because of mercury contamination (PA DEP 2006). Many levels of the flowing water ecosystem, including macroinvertebrate communities, are impacted by the contamination.

Mid-sized, high gradient streams with high quality habitats and water quality are the typical habitat of this community.
Photo source: PNHP

Conservation Recommendations: Watershed managers should work to conserve high quality small to medium size streams in good condition. Managing agricultural practices that contribute sediment, nutrients, and runoff is one method to maintain relatively high quality streams in rural watersheds. Encouraging stream bank fencing and riparian buffers, and crop and soil erosion best management practices are some examples of agricultural management. The mercury pollution in Warren County has been carried long distances by air currents from industrial sources. Improved federal regulation of air pollution would reduce the amount of mercury that drifts to Warren County from industrial sources and is deposited in waterways.

References

- PA Department of Environmental Protection. 2006. Pennsylvania Integrated Water Quality Monitoring and Assessment Report.
- Walsh, M., J. Deeds, and B. Nightingale. 2007a. Classifying lotic systems for conservation: project methods and results of the Pennsylvania Aquatic Community Classification Project. Pennsylvania Natural Heritage Program.
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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. Typical community habitats are medium to large streams in good condition; however, the community can also be found in small tributaries to larger streams, as is the case in Warren County. Sandstone streams that are fast flowing are the habitats for this community. In Warren County, the streams may be influenced by watershed agriculture. Pine Creek, tributaries to Brokenstraw Creek, tributaries to Little Brokenstraw Creek, Telick Run, Winton Run, Birch Springs Run, Wade Run, and parts of the Allegheny River are examples of this community habitat.

Nemourid broadback stonefly
Photo source: www.dec.state.ny.us

Stream quality rating: Medium

Threats and Disturbances: Because of the rural nature of Warren County, agricultural sources may contribute excess siltation and nutrients. County streams, such as tributaries to Brokenstraw Creek, Pine Creek, and Winton Run are influenced by agriculture in the watershed. Poorly managed runoff, soil erosion, and livestock access to streams may degrade water quality and habitats. In some locations, runoff from roads, parking lots, and other impervious surfaces contributes to poor stream quality. The occurrence of unnatural stream flows resulting from storm water can lead to eroding streambanks and loss of stream habitat.

Conservation Recommendations: While non-point source pollution problems occur in watersheds with the Common Large Stream Community, pollution is less severe than in other valley streams. In areas where non-point source agricultural pollution occurs, runoff and stream bank erosion can be controlled by installing vegetative buffers of an adequate width along streams in pastures and crop fields. Where livestock have access to streams, fencing the streams to exclude them and to add riparian buffers to pastures will also help improve stream habitats.

In areas of development, the establishment or maintenance of vegetative riparian buffers and storm water detention will help to mitigate the effects of increased levels of stormwater. Efforts to create water recharge into the watershed (where impervious surfaces are creating runoff) should be considered.

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

References

- Walsh, M., J. Deeds, and B. Nightingale. 2007a. Classifying lotic systems for conservation: project methods and results of the Pennsylvania Aquatic Community Classification Project. Pennsylvania Natural Heritage Program.
- Walsh, M. C., J. Deeds, and B. Nightingale. 2007b. User's manual and data guide to the Pennsylvania Aquatic Community Classification. Pennsylvania Natural Heritage Program, Western Pennsylvania Conservancy, Middletown, PA, and Pittsburgh, PA.

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Fatmucket Mussel Community

Typified by: Fatmucket *(Lampsilis siliquoidea),* giant floater *(Pyganodon grandis),* three-ridge *(Amblema plicata),* wabash pigtoe *(Fusconaia flava*)

Fatmucket
Photo source: PNHP

Species of concern: Wabash pigtoe (S2 G5), three-ridge (S2S3 G5)

Habitat: Preferring quiet, muddy waters, the Fatmucket Community inhabits various large streams and rivers ranging from moderate to slow-flowing habitats. In Warren County, the community occurs in the Allegheny River.

The community occurs in rivers with sand and gravel substrate, but reaches greatest abundance in standing water, in clay, silt, or mud substrate. However, this species is ecologically widespread, occurs in a variety of habitats. A moderate number of rare and intolerant taxa are associated with this community. The Fatmucket Community is common in many parts of the Ohio River Basin.

Stream quality rating: Undetermined

Community rarity: No

Threats: Similar to other mussel communities in the county, the Fatmucket Community is threatened by pollution from agricultural sources and impervious surfaces, like roads and parking lots. Mercury pollution causes a fish consumption advisory in parts of the Allegheny River (PA DEP 2006).

Conservation recommendations: Conserving naturally low-gradient streams and the backwaters of rivers is a priority for the Fatmucket Community. Managing non-point sources in watersheds with potential runoff from agriculture and impervious sources will maintain conditions for the Fatmucket Community to thrive.

Slow-flowing backwaters of rivers are the primary habitat for the Fatmucket community.
Photo source: PNHP

Other agricultural best management practices, such as utilizing grassed waterways, no-till, and fencing cattle from streams will further protect these communities. Strategies for retention of stormwater and encouraging groundwater recharge could be applied where impervious surfaces create runoff. Proactive approaches to reducing sediment and nutrient loading from agriculture, including management of livestock, crops, and soils to minimize stream degradation, are also suggested. The mercury pollution in Warren County has been carried long distances by air currents from industrial sources. Improved federal regulation of air pollution would reduce the amount of mercury that drifts to Warren County from industrial sources and is deposited in waterways.

References

- PA Department of Environmental Protection. 2006. Pennsylvania Integrated Water Quality Monitoring and Assessment Report.
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Flutedshell Mussel Community

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*)

Fluted Shell
Photo source: PNHP

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 small-medium sized rivers. In Warren County, it occurs in the Allegheny River. Community habitats have sand and gravel beds, and are relatively slow flowing. 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 watersheds associated with this community contain much agriculture and may be challenged by poor water quality and habitat degradation. Runoff from impervious surfaces, such as roads and parking lots, may contribute non-point source pollution. In Allegheny River and its tributaries, livestock grazing and other types of agriculture degrade the stream by contributing silt and nutrients. Organic enrichment creates low dissolved oxygen conditions. Sections of the Allegheny River have a fish consumption advisory because of mercury contamination (DEP 2006).

Conservation Recommendations: This community is characterized by high mussel diversity, many rare species, and very few species that can tolerate pollution, and is a high conservation priority. The upper Allegheny River watersheds have special conservation value because of its diverse mussels. Protection of this current high quality mussel habitat is important for the long-term viability of the spike mussel community in the large river systems.

This community type is common in low gradient habitats with sand and gravel substrates.
Photo source: PNHP

Managing agricultural and road runoff is a priority for the Flutedshell Mussel Community watersheds. Strategies for retention of stormwater and encouraging recharge could be applied where impervious surfaces create runoff. Proactive approaches to reducing sediment and nutrient loading from agriculture, including management of livestock, crops, and soils to minimize stream degradation, are also suggested. The mercury pollution in Warren County has been carried long distances by air currents from industrial sources. Improved federal regulation of air pollution would reduce the amount of mercury that drifts to Warren County from industrial sources and is deposited in waterways.

References

- PA Department of Environmental Protection. 2006. Pennsylvania Integrated Water Quality Monitoring and Assessment Report.
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Spike Mussel Community

Typified by: Spike mussel (*Elliptio dilatata*), and black sandshell (*Ligumia recta*)

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.

Spike mussel
Photo source: PNHP

Species of concern: black sandshell (S3S4 G5), mucket (S4 G5), fatmucket (S4 G5), fluted-shell (S4 G5)

Stream quality rating: High

Habitat: The habitat for the Spike Community includes streams and rivers. Waters may ranges from moderate currents to slow –flowing habitats. The community species are often associated with riffles. The spike mussel exists in a wide range of habitats, of varied size and depth. It is one of the most abundant mussels in the Allegheny basin. A number of rare and intolerant taxa are often associated with this community. Thus, this community is found in ecosystems that are still able to support species that cannot survive in other areas, and is a high protection priority. In Warren County, the community was found in the Allegheny River.

Threats:
The community habitats in the Allegheny River in Warren County are a refuge from severe habitat degradation that is occurring in other parts of the river. Dredging of the river bottom in the navigational pool system for sand and gravel resources is rapidly destroying habitat in the river. In Warren County, other sources of habitat and water quality degradation are from road runoff and from poorly managed agriculture. There is fish consumption advisory in the Allegheny River because of mercury contamination (PA DEP 2006). Mussel populations and communities may also be negatively influenced by mercury pollution.

Conservation Recommendations: This community is characterized by high mussel diversity, many rare species, and few species that can tolerate pollution, and is a high conservation priority. This community occurs in sections of the watershed that are currently well protected, and less affected by the threats noted above than communities that occur further downstream or in highly disturbed areas. Protection of current high quality mussel habitat is important for the long-term viability of the Spike Mussel Community in large river systems.

Managing agricultural and road runoff is a priority for the Spike Community watersheds. Strategies for retention of stormwater and encouraging groundwater recharge could be applied where impervious surfaces create runoff. Proactive approaches to reducing sediment and nutrient loading from agriculture, including management of livestock, crops, and soils to minimize stream degradation, are suggested. The mercury pollution in Warren County has been carried long distances by air currents from industrial sources. Improved federal regulation of air pollution would reduce the amount of mercury that drifts to Warren County from industrial sources and is deposited in waterways.

The spike community is found in low gradient areas of the Allegheny River and some of its tributaries, as well as some stream reaches in the Beaver River basin.
Photo source: PNHP

References

- PA Department of Environmental Protection. 2006. Pennsylvania Integrated Water Quality Monitoring and Assessment Report.
- Walsh, M., J. Deeds, and B. Nightingale. 2007a. Classifying lotic systems for conservation: project methods and results of the Pennsylvania Aquatic Community Classification Project. Pennsylvania Natural Heritage Program.
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