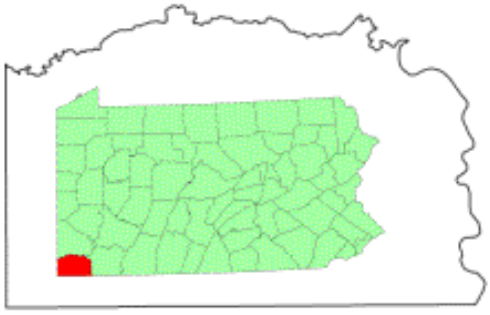
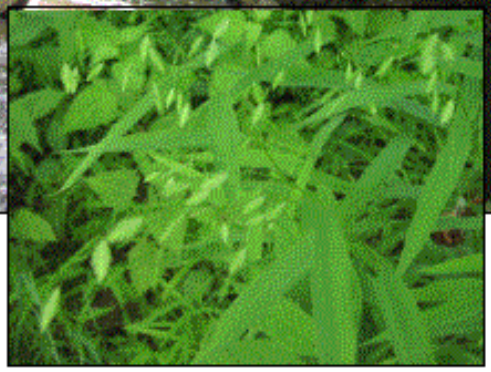


Greene County

Natural Heritage Inventory



Clockwise from above: River Oats, Tributary to Whiteley Creek, Pocketbook Mussel, Pink Lady's Slipper, Typical woodland in Greene County, Dunkard Creek at Brave, Pa

GREENE COUNTY
NATURAL HERITAGE INVENTORY

Prepared for:

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27 June 2005

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Copies of this report are available in electronic format through Western Pennsylvania Conservancy's web site – www.paconserve.org – and through the Greene County Planning Commission.

PREFACE

The Western Pennsylvania Conservancy (WPC) served as the principal investigator and prepared the report and maps for this study. Established in 1932, Western Pennsylvania Conservancy 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 its goals, WPC initiates conservation projects independently and establishes partnerships with agencies and organizations having similar interests.

Along with The Nature Conservancy (TNC) and The Department of Conservation and Natural Resources (DCNR), WPC is a partner in the Pennsylvania Natural Heritage Program (PNHP) that is responsible for collecting, tracking and interpreting information regarding the Commonwealth's biological diversity. County inventory projects are an important part of the work of PNHP. Additionally, PNHP is a member of NatureServe, the organization that coordinates Natural Heritage efforts throughout an international network of member programs (known as natural heritage programs or conservation data center), operating in all 50 U.S. states, Canada, Latin America and the Caribbean.

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 inventory projects 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. This Natural Heritage Inventory focuses on the best examples of living ecological resources in Greene County. Historic, cultural, educational, water supply, agricultural and scenic resources are among the many that the county must address through other projects and programs.

Although the 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 Greene County's natural heritage. Further investigations could, and likely will, uncover previously unidentified areas of significance. Likewise, in-depth investigations of sites listed in this report could reveal features of further or greater significance than have been documented. We encourage additional inventory work across the county to further the efforts begun with this study.

Consider the inventory as an invitation for the people of Greene County to explore and discuss their natural heritage and to learn about and participate in the conservation of the living resources of the county. Ultimately, it will be up to the landowners and residents of Greene County to determine how to use this information. Some considerations of the application of this information for a number of groups follow:

Planners and Government Staff. Typically, the planning office in a county administers county inventory projects. Often, the inventories are used in conjunction with other resource information (agricultural areas, slope and soil overlays, floodplain maps, etc.) in review for various projects and in comprehensive planning. Natural Heritage Areas may be included under various categories of zoning, such as conservation or forest zones, within parks and greenways, and even within 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 Corp of Engineers can use the inventory to understand the extent of the resource.

Agencies can also learn the requirements of the individual plant, animal, or community elements, and the general approach that protection could assume. County Conservation Districts may use the inventories to focus attention on resources (e.g. high diversity streams or wetlands) and as reference in encouraging good management practices.

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

Environmental consultants are increasing called upon to produce resource plans (e.g. Rivers Conservation Plans) that must integrate a variety of biological, physical and social information. County Natural Heritage Inventories can help to define watershed-level resources and priorities for conservation.

Developers. Working with environmental consultants, developers can consider options for development that add value and protect key resources. Incorporating greenspaces, 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 opportunities where development and conservation can complement one another.

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

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

ACKNOWLEDGEMENTS

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

We especially thank:

Dr. Carol Loeffler, pilot for the aerial reconnaissance of the county
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The members of the Botanical Society of Western Pennsylvania

We would also like to thank the Department of Conservation and Natural Resources – Office of Wild Resources Conservation, the Department of Community and Economic Development and the Hopwood Charitable Trust for providing the funding to make this report possible, and we owe a very special thank-you to the people of Greene County for their interest and hospitality.

We want to recognize the Pennsylvania Natural Heritage Program and NatureServe for providing the foundation for the work that we perform for these studies. 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, and we gratefully acknowledge the vision of these projects as 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.

Robert Coxe
Ecologist
Western Pennsylvania Conservancy

EXECUTIVE SUMMARY

Introduction

Our natural environment is key to human health and sustenance. A healthy environment provides clean air and water; supports fish, game and agriculture; and furnishes renewable sources of materials for countless aspects of our livelihoods and economy. The first steps in ensuring protection of our natural environment are to recognize environmentally sensitive or ecologically important areas and determine their importance. A County Natural Heritage Inventory is designed to identify and map important biotic (living) and ecological resources. This information helps county, state, and municipal government; the public, and business and industry plan development with the preservation of these environmentally important sites in mind. Biotic/ecological resources inherited by the citizens of this region include:

- Lands that support important components of Pennsylvania's native species biodiversity
- Populations of species that are facing imperilment at a state and/or global level, and their habitats
- Natural communities (assemblages of plants and animals) that are regionally important to biodiversity because they are exceptionally undisturbed and/or unique within the state
- Areas important for wildlife habitat, open space, education, scientific study, and recreation
- Areas that have been left relatively undisturbed by human activity
- Potential habitats for species of special concern

The identification and delineation of Natural Heritage Areas are based on the ecological values present. Important selection criteria include the existence of habitat for plants and animals of special concern, the existence of ecologically significant natural communities, and the size and landscape context of a site. Large, relatively undisturbed areas provide the backbone that links habitats and provide corridors for plants and animals. Although agricultural lands and open space may be included as part of inventory areas, the focus rests on areas that are the best examples of biotic/ecological resources in Greene County.

Natural Heritage Inventory Classification

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

Natural Heritage Areas

Biological Diversity Area (BDA):

An area 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 surrounding lands important in the support of these special elements.

Conservation Planning Application: BDAs are mapped according to their sensitivity to human activities. "Core" areas delineate essential habitat that cannot absorb significant levels of activity without substantial impact to the elements of concern. "Supporting Natural Landscape" include areas that maintain vital ecological processes or secondary habitat that may be able to accommodate some types of low-impact activities.

Landscape Conservation Area (LCA):

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.

Important Bird Areas (IBA):

The Pennsylvania Audubon Society administers the Pennsylvania 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." An IBA can be large or small, public or private and must meet one of several criteria (http://pa.audubon.org/Ibamain.htm).

Conservation Planning Application: 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; thus, the recommendations for LCA stewardship to minimize fragmentation are applicable. Natural communities that have a particular habitat value for birds (e.g., wetland) are typically the basis for smaller-scale IBAs; therefore, a high degree of protection should be given to these sites. Conservation plans are in the process of being completed for all IBAs in the state.

Important Mammal Areas (IMA):

The Important Mammal Areas Project (IMAP) is being carried out by a broad based 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).

Conservation Planning Application: Planning for these areas should consider how best to maintain their value as mammal habitat. The value of these sites may be associated with high mammalian diversity, high-density populations, occurrence of species of special concern, or educational potential. Stewardship plans are in the process of being completed for all IMAs in the state.

Methods

Forty county inventories have been completed in Pennsylvania to date. The Greene County Natural Heritage Inventory followed the same methodologies as previous inventories, which proceeded in the following stages:

- site selection
- ground survey
- data analysis

Site Selection

A review of the Pennsylvania Natural Diversity Inventory (PNDI) database (see Appendix II) determined where sites for special concern species and important natural communities were known to exist in Greene County. Knowledgeable individuals were consulted concerning the occurrence of rare plants and unique natural communities in the county. Geological maps, USGS topographical maps, National Wetlands Inventory maps, USDA soil surveys, recent aerial photos, and published materials were also used to identify areas of potential ecological significance (Reschke 1990). Once preliminary site selection was completed, reconnaissance flights over chosen areas of the county were conducted. Wetlands were of primary interest during fly-overs in Greene County.

Ground Survey

Areas identified as potential sites were scheduled for ground surveys. 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 (Appendix III, pg. 133) were completed for each site. The flora, fauna, level of disturbance, approximate age of community and local threats were among the most important data recorded for each site. In cases where permission to visit a site was not granted, when enough information was available from other sources, or when time did not permit, sites were not ground surveyed.

Data Analysis

Data obtained during the 2003 and 2004 field seasons was combined with prior existing data and summarized. All sites with species or communities of statewide concern, as well as exceptional examples of more common natural communities, were selected as Biological Diversity Areas (BDAs). Spatial data on the elements of concern were then compiled in a geographic information system (GIS) format using ESRI ArcView 3.2a software.

The boundaries defining each BDA were based on physical and ecological factors, and specifications for species protection provided by jurisdictional government agencies. The BDAs were then assigned a significance rank based on size, condition, rarity of the unique feature, and the quality of the surrounding landscape (see Appendix I, pg. 129 for further description of ranks). Landscape Conservation Areas were designated around landscape features that provide a uniting element within a collection of BDAs, or large blocks of contiguous forest identified using GIS-based spatial analysis. County municipalities served as the organizing unit for the data.

Results

Sixty-nine areas of ecological significance are recognized in the Greene County Natural Heritage Inventory (Table 1). This includes 56 Biological Diversity Areas and 13 Landscape Conservation Areas that are categorized according to their significance to the protection of the biological diversity and ecological integrity of the region (table 1, pg. xi). Significance ranks are Exceptional, High, Notable, and County (for a full explanation of these ranks, see Appendix I, pg. 129). These areas are shown in Figure 1, pg. ix.

PNHP and agency biologists can provide more detailed information with regard to the location of natural resources of concern in a project area, the needs of the particular resources in question, and the potential impacts of the project to those resources.

If a ground survey is necessary to determine whether significant natural resources are present in the area of the project, PNHP or an agency biologist will recommend a survey be conducted. PNHP, through Western Pennsylvania Conservancy, or other knowledgeable contractors can be retained for this purpose. Early consideration of natural resource impacts is recommended to allow sufficient time for thorough evaluation. Given that some species are only observable or identifiable during certain phases of their life cycle (i.e., the flowering season of a plant or the flight period of a butterfly), a survey may need to be scheduled for a particular time of year.

If the decision is made to move forward with a project in a sensitive area, WPC can work with municipal officials and project personnel during the design process to develop strategies for minimizing the project's ecological impact while meeting the project's objectives. The resource agencies in the state may do likewise.

Note that projects involving numerous activities that will require state permits will require a PNDI review. Consultation with WPC or another agency does not take the place of the PNDI review. However, early consultation and planning as detailed above can provide for a more efficient and better integrated permit review, and a better understanding among the parties involved as to the scope of any needed project modifications.

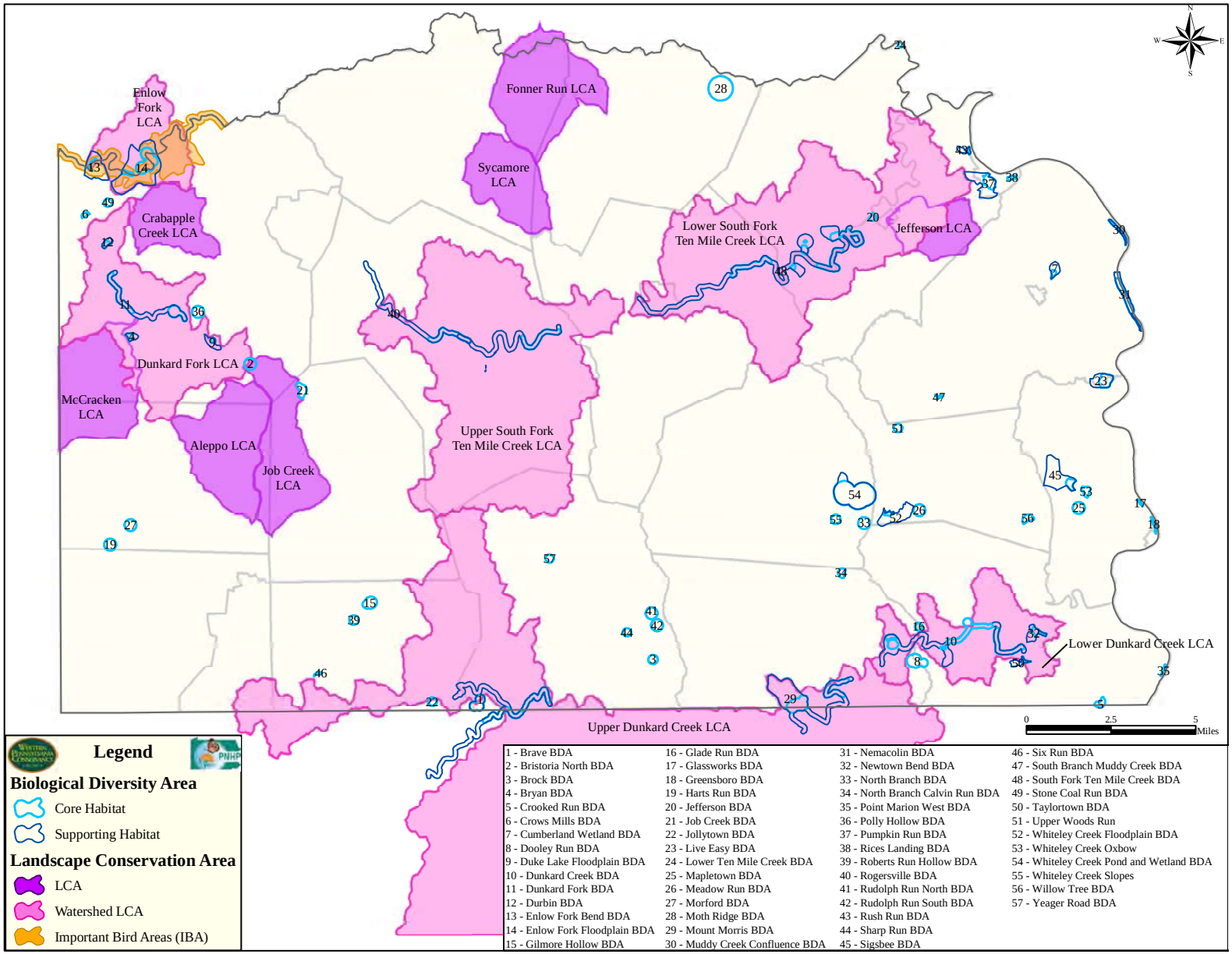


Figure 1. Natural Heritage Areas and Important Bird Areas in Greene County

Table 1. Natural Heritage Areas categorized by significance

Site	Municipality	Description	Page
Exceptional Significance			
Brave BDA	Gilmore Twp. Wayne Twp.	Aquatic habitat in the headwaters of Dunkard Creek that is the location for an animal and plant species of special concern.	109
Dunkard Creek BDA	Dunkard Twp. Perry Twp.	Aquatic habitat, rich slopes and roadsides that are habitat for four animals and five plant species of special concern.	41
Enlow Fork LCA	Richhill Twp.	Watershed of Enlow Fork that is the location of several rare plant species and has potential for a contiguous forested area.	16
Lower Dunkard Creek LCA	Dunkard Twp. Perry Twp.	Watershed just upstream of the Dunkard Creek confluence to the Monongahela River that is critical to the water quality in an aquatic habitat.	19
Lower South Fork Ten Mile Creek LCA	Franklin Twp. Jefferson Twp. Morgan Twp.	Watershed on South Fork Ten Mile Creek that is critical to the water quality of an aquatic habitat.	18
Mount Morris BDA	Perry Twp.	Aquatic habitat of Dunkard Creek, floodplain and rich slopes that home to a plant species, natural community and three animal species of special concern.	90
Pumpkin Run BDA	Rices Landing Borough	Valley of Pumpkin Run with circumneutral slopes and floodplain that is the location of a yellow oak-redbud woodland and four plant species of special concern.	71
Sigsbee BDA	Monongahela Twp.	Calcareous slope and wooded ravine of a tributary to Whiteley Creek that is the location of three plant species of special concern.	77
South Fork Ten Mile Creek BDA	Frankin Twp Jefferson Twp. Morgan Twp. Waynesburg Borough	Aquatic habitat and wooded slopes of tributaries that are the location of three animals and four plants of special concern.	67
Upper Dunkard Creek LCA	Freeport Twp. Gilmore Twp. Jackson Twp. Wayne Twp.	Watershed on Dunkard Creek that is critical to the water quality of an aquatic habitat.	21
High Significance			
Dunkard Fork BDA	Richhill Twp.	Aquatic habitat in South Fork of Dunkard Fork that is the location for two animals and two plant species of special concern.	96
Enlow Fork Floodplain BDA	Richhill Twp	Floodplain on Enlow Fork that provides a habitat for a plant species of special concern.	99
Job Creek BDA	Jackson Twp	Rich roadside that is home to a plant species of special concern.	63
Mapletown BDA	Monongahela Twp	Slope and floodplain above Whiteley Creek that is home to three plant species of special concern.	77

Table 1. Natural Heritage Areas categorized by significance

Site	Municipality	Description	Page
Rogersville BDA	Center Twp	Aquatic habitat on South Fork Ten Mile Creek that supports an animal species of special concern.	29
Rush Run BDA	Jefferson Twp.	Circumneutral slope above Rush Run that supports two plant species and a yellow oak-redbud woodland.	65
Upper South Fork Ten Mile Creek LCA	Center Twp. Franklin Twp. Jackson Twp. Wayne Twp.	Watershed on South Fork Ten Mile Creek that is critical to the water quality of an aquatic habitat.	21
Notable Significance			
Bristoria North BDA	Richhill Twp	Rich roadside that is home to a plant species of special concern.	94
Brock BDA	Wayne Twp.	Open area that is the location of a plant species of special concern.	110
Bryan BDA	Richhill Twp.	Rich roadside that is the location of a plant species of special concern.	94
Crooked Run BDA	Dunkard Twp	Seepage slope on Crooked Run that is the location of a plant species of special concern.	41
Crows Mills BDA	Richhill Twp	South-facing slope north of Dunkard Fork that is the location of two plant species of special concern.	95
Dooley Run BDA	Dunkard Twp Perry Twp	Open and wooded area that is the location of a plant species of special concern.	89
Duke Lake Floodplain BDA	Richhill Twp	Floodplain at the upper end of Duke Lake that is the location of a plant species of special concern.	95
Dunkard Fork LCA	Richhill Twp.	Watershed that is critical for aquatic habitats in Dunkard Fork of Wheeling Creek.	16
Durbin BDA	Richhill Twp.	Circumneutral slope above Dunkard Fork that is the location of a plant species of special concern.	98
Enlow Fork Bend BDA	Richhill Twp	Floodplain on Enlow Fork of Wheeling Creek that is the location for a plant species of special concern.	99
Gilmore Hollow BDA	Gilmore Twp.	Powerline and gas rights-of-way that are the location of a plant species of special concern.	51
Glade Run BDA	Dunkard Twp. Perry Twp.	Roadside rock outcrop that provides habitat for a plant species of special concern.	89
Glassworks BDA	Monongahela Twp.	River shore of the Monongahela River that is the of a plant species of special concern.	75
Greensboro BDA	Monongahela Twp.	River levee of the Monongahela River that is the location of a plant species of special concern.	75
Harts Run BDA	Aleppo Twp.	Roadside location of a plant species of special concern.	25

Table 1. Natural Heritage Areas categorized by significance

Site	Municipality	Description	Page
Jefferson BDA	Jefferson Twp.	Rock outcrop above South Fork Ten Mile Creek that provides unique habitat for a plant species of special concern.	65
Jollytown BDA	Gilmore Twp.	Woodland opening that is the location of a plant species of special concern.	51
Live Easy BDA	Cumberland Twp. Monongahela Twp.	Floodplain and south-facing slope on Little Whiteley Creek that is the location of a plant species of special concern.	76
Lower Ten Mile Creek BDA	Morgan Twp.	Floodplain of Ten Mile Creek that is the location of a plant species of special concern.	83
Meadow Run BDA	Greene Twp.	Roadside that is habitat for a plant species of special concern.	57
Morford BDA	Aleppo Twp.	Open roadside habitat that is home to a plant species of special concern.	25
Moth Ridge BDA	Washington Twp.	Open field that is the location of an animal species of special concern.	107
Muddy Creek Confluence BDA	Cumberland Twp.	Rivershore of the Monongahela River that is the location of two plant species of special concern.	35
Nemacolin BDA	Cumberland Twp.	Rivershore of the Monongahela River that is the location of a plant species of special concern.	35
Newtown Bend BDA	Dunkard Twp.	Floodplain and mesic slopes along a bend in Dunkard Creek that are home to two plant species of special concern.	44
North Branch BDA	Whiteley Twp.	Open roadside that is home to a plant species of special concern.	115
North Branch Calvin Run BDA	Perry Twp.	Regenerating clearcut and thickets that are the location of a plant species of special concern.	91
Point Marion West BDA	Dunkard Twp.	River shore of the Monongahela River that is the location of a plant species of special concern.	45
Polly Hollow BDA	Richhill Twp.	Shaded slope of Polly Hollow that is the location of a plant species of special concern.	101
Rices Landing BDA	Rices Landing Borough	Mesic slopes above the Monongahela River that are the location of a plant species of special concern.	72
Roberts Run Hollow BDA	Gilmore Twp.	Young wooded area on a tributary to Roberts Run that is the location of a plant species of special concern.	52
Rudolph Run North BDA	Wayne Twp.	Open area that provides habitat for a plant species of special concern.	110

Table 1. Natural Heritage Areas categorized by significance

Site	Municipality	Description	Page
Rudolph Run South BDA	Wayne Twp.	Powerline right-of-way that is the location of a plant species of special concern.	111
Sharp Run BDA	Wayne Twp.	Roadside that is the location of a plant species of special concern.	111
Six Run BDA	Gilmore Twp.	Roadside slope in the valley of Six Run that is the location of a plant species of special concern.	53
South Branch Muddy Creek BDA	Cumberland Twp.	Roadside fencerow in a pasture that is the location of a plant species of special concern.	38
Taylortown BDA	Dunkard Twp.	Mesic woods that are the location of a plant species of special concern.	45
Upper Woods Run BDA	Greene Twp.	Woodland area in the headwaters of Woods Run that is the location of a plant species of special concern.	57
Whiteley Creek Floodplain BDA	Greene Twp.	Wooded rich floodplain that is the location of a plant species of special concern.	58
Whiteley Creek Oxbow BDA	Monongahela Twp.	Disturbed area along an old oxbow of Whiteley Creek that is the location of a plant species of special concern.	79
Whiteley Creek Pond and Wetland BDA	Greene Twp. Whiteley Twp.	Pond and constructed wetland in the floodplain of Whiteley Creek that is the location of an animal species of special concern.	115
Whiteley Creek Slopes BDA	Whiteley Twp.	Young wooded area in State Game Lands that are the location of a plant species of special concern.	116
Willow Tree BDA	Greene Twp.	Roadside and slope thicket that is the location of a plant species of special concern.	59
Yeager Road BDA	Wayne Twp.	Roadside that is the location of a plant species of special concern.	111
County Significance			
Aleppo LCA	Aleppo Twp. Richhill Twp.	Area on South Fork of Dunkard Fork of Wheeling Creek that has high potential for restoration to a contiguous forested area.	15
Crabapple LCA	Richhill Twp.	Area on Crabapple Creek that has high potential for restoration to a contiguous forested area.	15
Cumberland Wetland BDA	Cumberland Twp.	One of the few large, natural wetlands in Greene County located on a tributary to Muddy Creek.	33
Fonner Run LCA	Morris Twp. Washington Twp.	Area in the Fonner Run watershed that has high potential for restoration to a contiguous forested area.	17
Jefferson LCA	Cumberland Twp. Jefferson Twp.	Area that straddles the divide between South Fork Ten Mile Creek and Pumpkin Run that has high potential for restoration to a contiguous forested area.	17

Table 1. Natural Heritage Areas categorized by significance

Site	Municipality	Description	Page
Job Creek LCA	Aleppo Twp. Jackson Twp. Richhill Twp.	Area in rural Greene County in the watershed of Job Creek that has high restoration potential to a contiguous forested area.	18
McCracken LCA	Aleppo Twp. Richhill Twp.	Area centered on Barney's Run and Hewitt Run in northwestern Greene County that has high potential to be restored to a contiguous forested area.	19
Sycamore LCA	Morris Twp. Washington Twp.	Area centered on the divide between tributaries to Bates Creek and Browns Creek that has high potential to be restored to a contiguous forested area.	20

Discussion and Recommendations

Status of natural features today

The landscape and waterways of Greene County have undergone considerable change over the course of human settlement, most notably from timber extraction, mining, and agriculture. During the timber boom in the early twentieth century, almost the entire landscape of the county underwent general clear-cutting, and subsequent widespread fires. Mining began with deep mine excavation, and transitioned to mostly strip-mining operations as mining technology developed. Now the remaining coal is being extracted using long-wall mining techniques, but the effects of this activity on the landscape have not yet been determined. Another legacy of mining is widespread water pollution that seriously impairs aquatic ecosystems in many of the county's waterways. Throughout the county, the condition of ecological resources today closely reflects the history of human land use.

Although mining and timber extraction remain prevalent in the county, natural communities have redeveloped across large swaths of the landscape previously used for timber extraction, coal mining, and clay mining. Especially in the northern part of the county, there are large areas of contiguous forest that provide reasonable habitat for forest dwelling species. Greene County spans two major regional topographic transitions—most of the county is covered by the Waynesburg Hills, with small sections of Pittsburgh Plateau along the Monongahela River in the eastern part of the county. The forest ecosystems present are reflective of the southern position of the county with patches of mixed mesophytic forest typical of more southern regions scattered throughout the county.

Today the condition of forest communities varies across the county. While many areas have re-grown, and developed a broad ecological spectrum of natural forest communities, many areas are fragmented by roads, surface mined areas, artificial clearings, old industrial facilities or utility rights-of-way. The character and quality of forested areas also reflects variable timber management practices, with some areas less sustainably managed than others. Over-browsing by deer poses a threat to biological diversity and forest regeneration in many regions of the county. The more isolated parts of the county generally show the best examples of the original forest. Most of the areas adjacent to the Monongahela River show the scars of the regions industrial past.

However, despite the variable condition of the forests, they are a great asset to the county's ecological integrity and are regionally important in sustaining mid-Atlantic populations for many animal species. Those areas of large, contiguous blocks of forest are particularly important. Contiguous forested areas offer enhanced habitat value over fragmented forested areas. While a number of generalist species can succeed and reproduce in small patches of forest, many species can only utilize large, unbroken tracts of forest. Most of the forest patches in Greene County are small with the largest being about 300-400 acres. Even so, the forests of Greene County support a variety of birds including worm-eating warbler and scarlet tanager. If these small blocks of forest are joined through restoration efforts and strong forest management efforts to become larger tracts, Greene County has the potential to achieve even greater significance in supporting biodiversity in the future.

Planning for biodiversity and ecological health tomorrow

Provision for the future health of ecological resources in Greene County will require a combination of efforts to steward specific sites that host unique species and communities, broader-scale planning to maintain the unique contiguity of its forested regions, and restoration efforts to alleviate water pollution and restore ecological function to damaged landscapes and waterways.

Forests—contiguity and connectivity

In the forested landscapes, objectives for large-scale planning should include maintaining and increasing contiguity and connectivity of natural land. Municipal and regional land use plans can support maintenance of forest contiguity by encouraging residential or commercial projects to re-develop in existing town centers or re-use previously altered landscapes, and by orienting new infrastructure along existing corridors rather than through unfragmented natural landscapes. Another planning consideration is the maintenance of natural landscape corridors that span between forest patches and connect forests, wetlands, and waterways. Many species—examples include many birds, amphibians, and insects— use an aquatic or wetland habitat in one phase of their life, then migrate to an upland, forested habitat for their adult life. Neither habitat can be utilized alone, so corridors connecting the two types are vital.

Aquatic Ecosystems—treasures and challenges

Greene County's waterways, divided between streams draining to the Monongahela River and those draining to the Ohio River, include some of the county's most scenic features and some of its greatest ecological challenges. Due to the circumneutral geology of the county most of the streams in Greene County are rich in life but are being negatively impacted by abandoned mine drainage and long wall mining. Remediation of mine drainage pollution is the greatest challenge to restoration of water quality and living aquatic ecosystems in many of the county's waterways. In some areas reduction in the release of other pollutants into runoff, including sediments, nutrients, and chemical contaminants, will also be necessary to improve water quality. Stewardship and restoration of native forest communities in riparian buffers along waterways will greatly improve water quality and enhance the habitat value for various aquatic and semi-aquatic species. Attending to the basic ecological functions of streams and wetlands will pay dividends by ensuring the continued availability of clean water for human communities, enabling the restoration of healthy fisheries, and enhancing the quality of life for which the region is known.

Evaluating proposed activity within Natural Heritage Areas

A very important part of encouraging conservation of the Natural Heritage Areas identified within the Greene County Natural Heritage Inventory is the careful review of proposed land use changes or development activities that overlap with Natural Heritage Areas. The following overview should provide guidance in the review of these projects or activities.

Always contact the Greene County Planning Commission. The County Planning Commission should be aware of all activities that may occur within Natural Heritage Areas in the county, so that they may interface with the County Conservation District and other necessary organizations or agencies to better understand the implications of proposed activities. They also can supply guidance to the landowners, developers, or project managers as to possible conflicts and courses of action.

Once informed of the proposed activity, the County Planning Commission should then contact Western Pennsylvania Conservancy (WPC) for direction in arranging further review of the activity. Depending upon the resources contained within the Natural Heritage Area, the agencies/entities responsible for the resource will then be contacted. The points of contact and arrangements for that contact can be determined on a case-by-case basis by the County and WPC. In general, the responsibility for reviewing natural resources is partitioned among agencies in the following manner:

- *U.S. Fish and Wildlife Service* for all federally listed plants or animals.
- *Pennsylvania Game Commission* for all state and federally listed terrestrial vertebrate animals.

- *Pennsylvania Fish and Boat Commission* for all state and federally listed aquatic vertebrate and invertebrate animals as well as all state and federally listed reptiles and amphibians.
- *Pennsylvania Bureau of Forestry* for all state and federally listed plants.
- *Western Pennsylvania Conservancy* for all natural communities, terrestrial invertebrates and non-listed species.

WPC and agency biologists can provide more detailed information with regard to the location of the natural resources of concern in a project area, the needs of the particular resources in question, and about potential impacts of the project to those resources.

If a ground survey is necessary to determine whether significant natural resources are present in the area of the project, WPC or an agency biologist will recommend a survey be conducted. WPC or other knowledgeable contractors can be retained for this purpose. Early consideration of natural resource impacts is recommended to allow sufficient time for thorough evaluation. Given that some species are only observable or identifiable during certain phases of their life cycle (i.e., the flowering season of a plant or the flight period of a butterfly), a survey may need to be scheduled for a particular time of year.

If the decision is made to move forward with a project in a sensitive area, WPC can continue to work with municipal officials and project personnel during the design process to develop strategies for minimizing the project's ecological impact while meeting the project's objectives. The resource agencies in the state may do likewise.

Note that projects involving numerous activities that will require state permits will require a PNDI review. Consultation with WPC or another agency does not take the place of the PNDI review. However, early consultation and planning as detailed above can provide for a more efficient and better integrated permit review, and a better understanding among the parties involved as to the scope of any needed project modifications

TABLE OF CONTENTS

PREFACE i
ACKNOWLEDGEMENTS iii
EXECUTIVE SUMMARY v
INTRODUCTION 1
OVERVIEW OF GREENE COUNTY NATURAL FEATURES
Environmental History of Greene County 3
Physiography and Geology 3
Soils 4
Vegetation 7
METHODS 11
Site Selection 11
Ground Surveys 11
Data Analysis and Mapping 12
RESULTS .....
Landscape Conservation Areas 13
Conservation at the Landscape Scale 13
Greene County LCAs 15
Biological Diversity Areas (by municipality) 23
Aleppo Township 25
Center Township 28
Cumberland Township and Carmichaels Borough 32
Dunkard Township 40
Franklin Township and Waynesburg Borough 48
Gilmore Township 50
Jackson Township 62
Jefferson Township, Jefferson Borough, and Rice's Landing Borough 64
Monongahela Township and Greensboro Borough 74
Morgan Township and Clarksville Borough 82
Morris Township 86
Perry Township 88
Richhill Township and Gray Township 92
Springhill Township and Freeport Township 104
Washington Township 106
Wayne Township 108
Whiteley Township 114
GENERAL RECOMMENDATIONS 119
GLOSSARY 123
LITERATURE CITED 125
APPENDICES 129
APPENDIX I: Significance Ranks 129
APPENDIX II: Pennsylvania Natural Heritage Program 131
APPENDIX III: Site Survey Forms 133
APPENDIX IV: Natural Community Classification 135
APPENDIX V: Status of Species 141
APPENDIX VI: Plants and Animals of Special Concern in Greene County 149
APPENDIX VII: Sustainable Forestry Information Sources 151
APPENDIX VIII: GIS Data Sources 155
APPENDIX IX: Plant and Animal Fact Sheets 155

LIST OF TABLES

Table 1. Natural Heritage Areas categorized by significance xi
Table 2. Soil associations of Greene County 6
Table 3. Forest Block LCAs in Greene County 14
Table 4. Watershed LCAs in Greene County 14

LIST OF FIGURES

Figure 1. Natural Heritage Areas and Important Bird Areas of Greene County ix
Figure 2. Physiographic provinces of Greene County 5
Figure 3. Cumberland Wetland 34
Figure 4. Shore of the Monongahela River 37
Figure 5. Dunkard Creek upstream of Taylortown 43
Figure 6. Small Woodland Sunflower (*Helianthus micrcephalus*) 54
Figure 7. Limestone ridge and yellow oak-redbud woodland at Rush Run 66
Figure 8. Mouth of Ruff Creek at South Fork Ten Mile Creek 68
Figure 9. Aquatic habitat at South Fork Ten Mile Creek 69
Figure 10. Tributary to Whiteley Creek 78
Figure 11. Ten Mile Creek Floodplain, where Harbinger-of-Spring (*Erigenia bulbosa*) is located 84
Figure 12. Dunkard Fork near confluence with Crabapple Run 98
Figure 13. Enlow Fork 100
Figure 14. Whiteley Pond in State Game Lands #223 116

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—all of which have the potential for long-term sustainability. Fully functional ecosystems are the key indicators of a healthy environment and working to maintain ecosystems is essential to the long-term sustainability of our economies.

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

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

A natural community is "an interactive assemblage of plant and animal species that share a common environment and occur together repeatedly on the landscape" (Massachusetts Biomap 2000). Natural communities are usually defined by their dominant plant species or the geological features on which they depend; examples include red maple swamp, hemlock forest, and serpentine grassland. Each type of natural community represents habitat for a different assemblage of species, hence identification and stewardship of the full range of native community types is needed to meet the challenge of conserving habitat for all species.

From an ecological perspective, a landscape is "a large area of land that includes a mosaic of natural community types and a variety of habitats for many species." (Massachusetts Biomap 2000). At this scale, it is important to consider whether communities and habitats are isolated or connected by corridors of natural landscape traversable by wildlife, and whether the size of a natural landscape is sufficient to support viable populations and ecosystems. Because all the living and non-living elements of an ecosystem are interconnected and interdependent, it is essential to conserve native biodiversity at all these scales (genes, species, natural communities, and landscapes) if ecosystems are to continue functioning.

Pennsylvania's natural heritage is rich in biodiversity and the state includes many examples of high quality natural communities and large expanses of natural landscapes. Over 20,000 species are known to occur in the state, and the extensive tracts of forest in the northern and central parts of the state represent a large fraction of the remaining areas of suitable habitat in the mid-Atlantic region for many forest-

dependent species of birds and mammals. Unfortunately, biodiversity and ecosystem health are seriously threatened in many parts of the state by pollution and habitat loss. Of the 3500 species of animals and vascular plants that have been documented in the state, more than one in ten are imperiled, 156 have been lost since European settlement, and 351 are threatened or endangered (21st Century Environment Commission 1998). Many of these species are imperiled because available habitat in the state has been reduced and/or degraded.

Fifty-six percent of Pennsylvania's wetlands have been lost or substantially degraded by filling, draining, or conversion to ponds (T.E. 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 83,000 miles of stream in Pennsylvania, almost 70,000 miles have been assessed for water quality and nearly 11,000 miles have been designated as impaired due to abandoned mine discharges (AMD), acid precipitation, and agricultural and urban runoff (PA 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, while an additional 23% are imperiled; and among freshwater mussels— one of the most globally imperiled groups of organisms— 18 of Pennsylvania's 67 native species are extinct and another 22 are imperiled (Goodrich et al. 2003).

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% is interior forest habitat, and some of the species that depend upon interior forest habitat are in decline (Goodrich et al. 2003). In addition to habitat fragmentation, forest pests, acid precipitation (which causes nutrient leaching and stunted growth), overbrowsing by deer, and invasive species also threaten forest ecosystem health.

The Pennsylvania Natural Heritage Program (PNHP) assesses the conservation needs of animal and vascular plant species native to Pennsylvania. While Pennsylvania also hosts a diversity of other life forms such as mosses, fungi, bacteria, and protists, too little is known of these species to assess their conservation status. The goal of this report is to identify areas important in sustaining biodiversity at the species, natural community, and landscape levels and provide that information to more fully inform land use decisions. Using information from PNHP, 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 in the state or exceptional examples of the more common community types. The areas that support these features are identified as Biological Diversity Areas (BDAs). At a broader scale, CNHIs recognize landscape-level features termed Landscape Conservation Areas (LCAs). LCAs identify areas of relatively intact natural landscape such as large areas of forest unbroken by roads or other fragmenting features; areas which function as a corridor connecting patches of natural landscape; and regions in which a high number of other biodiversity features are concentrated.

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

Natural History Overview of Greene County

The natural landscape is best described as an ecosystem, a term that describes a group of interacting living organisms and the physical environment they inhabit. These landscapes are an expression of many factors coming together and interacting. These include physical factors such as climate (photoperiod, maximum and minimum temperatures and exposure), geological (soil, minerals and topography), chemical (fire and deposition), biotic factors (living things and their interactions) and physical features (streams, rivers, mountains). These combined factors provide the framework for locating and identifying exemplary natural communities and species of special concern in the county. The following sections provide a brief overview of the physiology, soils, surface water, and vegetation of Greene County.

Environmental History of Greene County

Natural disturbances such as tornados, blow-downs, ice storms, and fires have historically played a large role in the formation of ecosystems. Human-induced disturbances have also influenced the character of ecosystems throughout history. Before European settlement, Native Americans cleared land for agriculture and settlement, and may also have set fires. Since European settlement, human activities have been even more dramatically influential in forming and altering the character of Greene County's ecosystems, causing extinction of some species and the introduction of others.

Before the arrival of Europeans, Greene County may have been a mosaic of forest and savanna. The forests were probably much as we see them today with mixed species of oak (*Quercus* spp.) and maple (*Acer* spp.) dominating, although the American chestnut (*Castanea dentata*) is now gone as a major component of eastern forests and of Greene County forests in particular, and the conifer component (*Pinus* and *Tsuga* spp.) may have been higher, reflecting their relict status from the last ice age. Many animals not now present in Greene County roamed over the land, including woodland buffalo, elk, and eastern cougars. Bird species like the Carolina parakeet and passenger pigeon flew over the land in flocks so large that they darkened the sky. What effect these species had on the landscape and the many embedded habitats of the county is hard to determine.

When the Europeans arrived in the New World, they found a partly forested landscape with openings or prairie-like areas created perhaps created by buffalo grazing and intentional fires set by Native Americans. As European settlement grew, more land was converted to agriculture using slash and burn methods to clear expanses of forest. At about the turn of the 20th Century, the number of farms began to wane as more people worked in factories in the cities and fewer relied on agriculture. One of the industrial bases of Greene County, the Monongahela River was, like the rest of Greene County, once lined by large swaths of forests; but starting in the late 1800s industrial activity in the river valley started to increase in concert with the growth of the steel industry in Pittsburgh and other steel-producing towns in the valley. By the 1980s these factories and mills closed, leaving a landscape of disused strip-mines and industrial brownfields. In other parts of the county, old farms grew back into forest and the result is the Greene County that we see today; a patchwork of young and older forest, reverting pasture and post-industrial land.

Physiography 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. Physiography relates in part to a region's topography and climate. These two factors, along with bedrock type, significantly increase soil development, hydrology, and land use patterns of an area. Additionally, both physiography and geology are important to the patterns of plant community distribution, which in turn influences animal

distribution. Because of the differences in climate, soils, and moisture regimes, certain plant communities are expected to occur within some provinces and not others.

Greene County covers 371,000 acres and lies primarily in the Waynesburg Hills Section with small sections of the Pittsburgh Low Plateau of the Appalachian Plateau Physiographic Province (Figure 2, pg. 5). The Appalachian Plateau province is underlain by layers of rock, predominantly sandstones and shales, that originated from sediment deposition and compression. These layers were uplifted 500-400 million years ago when two island chains collided with the eastern edge of North America (the Taconic and Acadian orogenies, or mountain-building events) to form a plateau elevated above the surrounding regions. Unlike the Allegheny Mountain Province to the east, the rock layers in the plateau region did not fold extensively to form mountain ridges; topographic relief at the surface in this area is mostly defined by stream valleys eroded and downcut over geologic time.

The highest elevations in the county are located on the divide between the Ohio River and the Monongahela River, which is just west of a north-south line drawn through the middle of the county. Two watersheds, Fish Creek and Wheeling Creek, drain to the Ohio River while several drain to the Monongahela River, including South Fork Ten Mile Creek, Muddy Creek, Whiteley Creek and Dunkard Creek.

The rock layers that reach the surface in Greene County are classified according to their age of origin into seven formation types: Casselman, Pittsburgh, Uniontown, Waynesburg, Washington, Greene and Carmichaels formations. Sandstone is the predominant rock type in most of the county, with shale, limestone, conglomerate, siltstone, and coal layers also interspersed.

Soils

Soil character exerts a strong influence on vegetation, as all plant species have individual requirements for nutrient availability, moisture levels, and pH level. A soil association is a natural grouping of soils based on similarities in climatic or physiographic factors and soil parent materials. It may include a number of soil types provided they are all present in significant proportions (Canadian Soil Information System, 2003). The soils of Greene County are made up of three main series: Dormont-Culleoka association, Dormont-Culleoka-Newark association and Glenford-Dormont-Library association. The soils of Greene County have been described in Soil Survey of Greene and Washington Counties, Pennsylvania (Siebert, et al., 1983). Table 2 (pg. 6) summarizes information from the Soil Survey about soil associations found in Greene County.

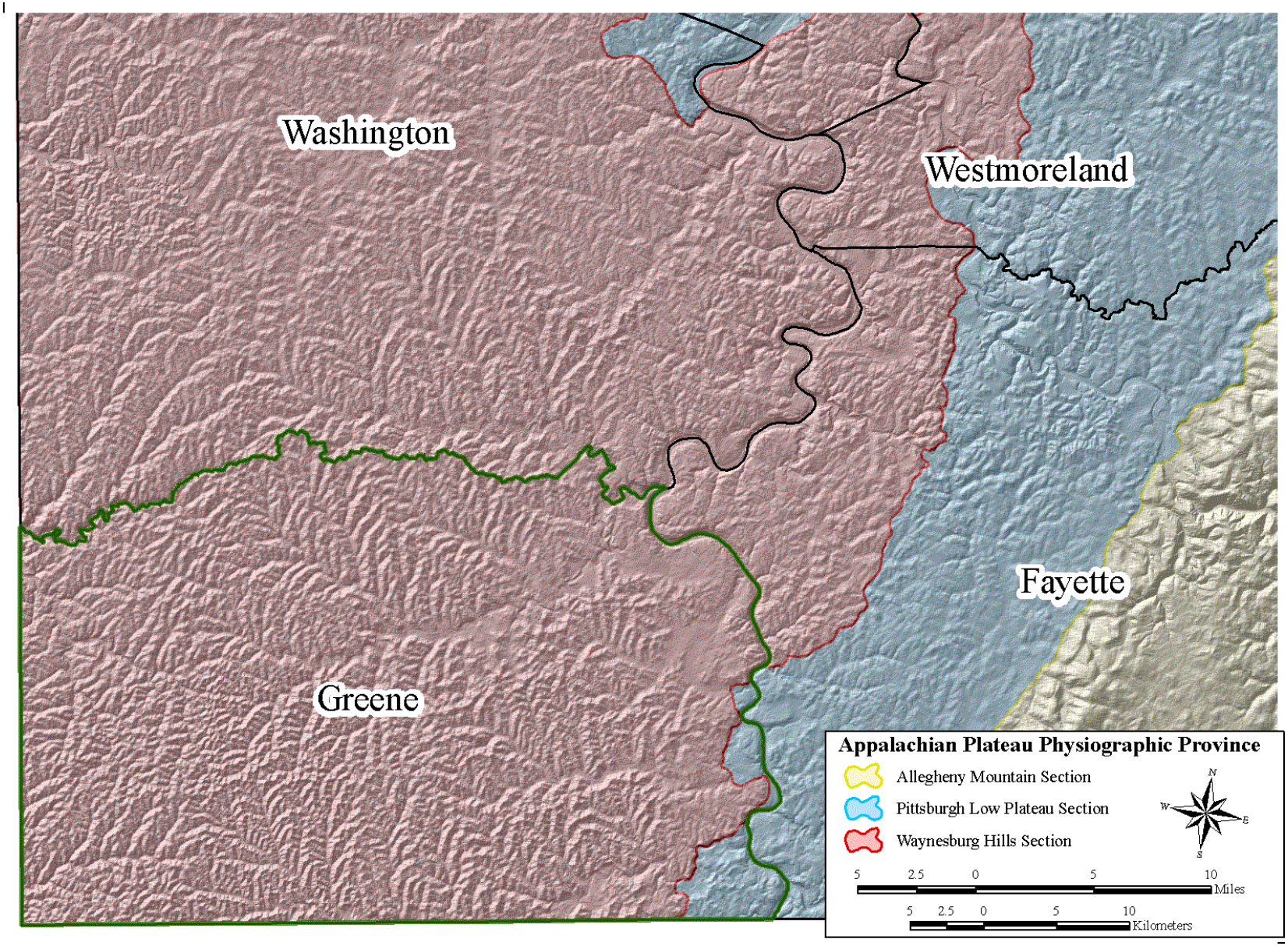


Figure 2. Physiographic provinces of Greene County

Table 2. Soil associations of Greene County

Soil Association	Parent Materials	Description	Land Use
Dormont-Culleoka	Residuum of weathered shale, siltstone, limestone and colluviuum.	Moderately well drained and well drained, deep and moderately deep, gently sloping to very steep soils; on hilltops, ridges, benches, and hillsides	Less sloping areas can be used for farming and most areas are suitable for trees. Slope, erosion and a seasonal high water table are the main limitations for use.
Guernsey-Dormont-Culleoka	Residuum of weathered clay shale, siltstone, sandstone, limestone and colluviuum.	Moderately well drained and well drained, deep and moderately deep, gently sloping to moderately steep soils; on hilltops, ridges, benches, and hillsides	Use is best suited to trees. Slopes, erosion and seasonally high water tables are the main limitations.
Dormont-Culleoka-Newark	Residuum and alluvium from shale, siltstone, sandstone and limestone	Well drained to somewhat poorly drained, deep and moderately deep, nearly level to very steep soils; on hilltops, ridges, benches, hillsides, and floodplains.	Less sloping soils are suited to farming. Slope, erosion, a seasonally high water table and occasional flooding are the main limitations.
Udorthents-Culleoka-Dormont	Most of the soil is from strip mines	Well drained to somewhat poorly drained, very shallow to deep, gently sloping to very steep soils; on hilltops, ridges, benches, and hillsides.	Less sloping areas are suited to farming if properly reclaimed. Most of the area is suited to trees. Slope, erosion and seasonally high water table are the main limitations.
Glenford-Dormont-Library	Slackwater alluvium derived from from calcareous shale and sandstone.	Moderately well drained and somewhat poorly drained, deep, nearly level to sloping soils; on terraces and surrounding uplands	Most areas are cultivated or used for hay and to a lesser extent community development. Less sloping soils are suited to farming and most acreage is suited to trees.

Vegetation

Forest Communities

Greene County is a patchwork landscape of field and forest. As is true of most forests in Pennsylvania, the forests of Greene County are almost all second- or third- growth stands and there are no known areas of old growth in the county. Greene County is located primarily in the Waynesburg Hills section of the Pittsburgh low plateau region in Pennsylvania with this region supporting a number of forest community types. However, the current composition of the forests has been influenced not only by the range of variation in natural characteristics such as soil, geology, and climate, but also by the relatively extreme conditions experienced during recent history, including clearcutting for sheep farming near the turn of the last century, decades of severe deer overbrowsing, and the accumulation of acid precipitation in soils over several decades.

Roadside Communities

Roadsides, utility rights-of-way, and other maintained early successional habitats contain several plant species of special concern in Greene County requiring high degree of disturbance to maintain open conditions. Yellow leafcup (*Polymnia uvedalia*), passionflower (*Passiflora lutea*),Nuttall's hedge nettle (*Stachys nuttallii*), and many other adventitious species are found in these early successional, disturbed habitats. Because of the unique climatic, physiographic, and geologic factors in the Waynesburg Hills physiographic province, the floral composition of roadsides and rights-of-way in Greene and southern Washington Counties are markedly different than those of other counties.

While the distribution of these species prior to European settlement of Greene County is not known, the natural patchwork of openings resulting from storms and blowdowns allowed successional, high light requiring species to exist free of shade tolerant later successional species. Birds and mammal species, frequenting these early successional or edge-type habitats, traditionally provided the necessary means of dispersal from one patch to another. Widespread logging and clearing of the forests for pastureland in the early part of the 20th century probably created additional early successional habitat. Since then, natural forest regeneration, suppression of fires, and agricultural abandonment and subsequent succession to shrublands have limited the available habitat and these plants are now restricted to sites where road maintenance, plowing, mowing, and herbicide treatments provide necessary disturbances.

While these areas do provide habitat for a unique set of special concern species, we do not recognize these populations and communities as "natural" although roadsides and utility rights-of-way maintained as perpetually early successional habitats may approximate natural habitat for species requiring a high degree of constant disturbance. These are populations of adventitious plant species are able to thrive in human-impacted environments, but such impacts fragment natural communities that may harbor remaining populations of species requiring large tracts of interior forest – a precious commodity in Greene County and much of Southwestern Pennsylvania. While certain management practices should be encouraged to maintain populations of these rare but adventitious species (i.e. mowing after flowering and fruiting, limiting use of certain herbicides, etc.) in areas where they already exist, creation of new maintained areas to support these species should not be encouraged.

Wetland Communities

Wetlands provide essential habitat for many plant and animal species, as well as valuable ecosystem services such as water filtration and flood control. The ecological character of a wetland is influenced by local soil type, disturbance history, bedrock composition, and hydrological regime. Types of wetlands range from forested seeps where groundwater saturates the surface only when heavy precipitation raises the water table, to open marshes that are continuously flooded, to low areas along streambanks that are flooded during high water events, to beaver meadows where the water level fluctuates over relatively long periods of time. Some types of wetland, such as those that are created by beaver dams, develop very quickly, and major changes can be observed in their character over mere decades. However, other types of wetland, such as sphagnum bogs, form extremely slowly, their present-day condition resulting from slow ecological processes operating over many thousands of years.

The landscape of Greene County is not very favorable to the formation of extensive wetlands, and most wetlands in the county occur either along streams in affiliation with floodplain features (back-channels, stream braiding, etc.) or as seepages on hillsides and at the bases of slopes. Wetlands resulting from excavations and impoundments are also present in the county; although they may provide habitat for typical wetland species, they were not the focus, with several exceptions, of surveys in the county given that artificially created wetlands typically do not host as rich or distinctive an assembly of native species as do natural wetlands.

Floodplain and Riparian wetlands

Floodplain wetland communities occur along rivers and streams in low-lying areas. These locations are periodically inundated by the floodwaters of spring rains and snow melt or seasonal intense storm events, but may be dry down for parts of the year, some are near to the water table and remain moist throughout the year. Floodplains in the county are predominantly forested, but also may have more open portions dominated by shrubs or herbs, especially where flood activity is most frequent and intense.

Floodplain wetlands in Greene County include both major floodplains of creeks like Dunkard Fork of Wheeling Creek and South Fork Ten Mile Creek as well as small seepage and springs associated with the headwaters of numerous drainages in the county. Floodplain forests in Greene County typically have canopies of sycamore (*Platanus occidentalis*), boxelder (*Acer negundo*), tuliptree (*Liriodendron tulipifera*), black maple (*Acer nigrum*) and red maple (*Acer rubrum*). Common understory trees include spicebush (*Lindera benzoin*), witch-hazel (*Hamamelis virginiana*) and snowberry (*Symphoricarpos orbiculatus*). Common herbs are spring beauty (*Claytonia virginica*), trout-lily (*Erythronium americanum*), wing stem (*Verbesina alternifolia*) and white thoroughwort (*Ageratina altissima*).

Seepage wetlands

A second major category of wetlands found in the county are seepage wetlands. Where groundwater intersects at the surface, a broad area of saturated soil called a “seep” will form, if the volume is low, or a concentrated stream of water (a spring) will be formed if the volume is higher and the outlet more constricted. Underground aquifers are charged by precipitation draining through soil to accumulate in and flow through bedrock layers, following fissures and areas of low-density rock. The parts of the landscape that accumulate and eventually percolate water into the ground are recharge zones. In many places, these zones are given special designation and protection to ensure groundwater quality and quantity. Seepage wetlands form at the foot of slopes; precipitation received by the upland areas

sinks down through loose, permeable layers of sandstone bedrock, is re-directed laterally upon encountering a more dense layer of rock, and eventually emerges at the surface. Groundwater dissolves minerals from the bedrock layers through which it flows, and thus may substantially influence the chemical environment of a seepage wetland. Seeps in Greene County are expected to be slightly acidic to circumneutral given that the bedrock has a high amount of limestone.

Seepage areas are typically shaded by forest canopy, and thus provide consistently cool and wet habitat conditions, which certain plant and animal species thrive upon. Many species of salamanders use seeps for habitat, and typical plant species are jewelweed (*Impatiens* spp.), bee balm (*Monarda* spp.), slender manna-grass (*Glyceria melicaria*), golden ragwort (*Senecio aureus*), cinnamon fern (*Osmunda cinnamomea*) and glade fern (*Deparia acrostichoides*).

Wetlands and Mining

Where mining has occurred in the upland areas above any wetland that receives groundwater input, drainage through the disrupted bedrock layers will typically contaminate these groundwater flows with dissolved metals (mainly iron, aluminum, and manganese) and acids. Upon reaching the surface and encountering oxygen in the air, some of the metal compounds convert to solid form, thus accumulating in seepage areas as the orange (iron), bluish-white (aluminum), or black (manganese)-colored sediment characteristically associated with mine drainage. Aluminum, manganese, and high acidity are all toxic to aquatic life; iron is less toxic. However, the accumulation of sediments of any of the metals degrades aquatic habitats by blocking light needed by aquatic plants and microorganisms, and clogging the tissues of aquatic animals. The impacts of abandoned mine discharges (AMD) on a particular wetland will depend on the concentration of the contaminants in the discharge and the volume of the discharge, relative to the overall volume of the wetland.

Long-wall mining is widespread in Greene County and the effects of subsidence and direct disruption of surface is hard to quantify. Change in the topography and hydrology of streams has been noted with subsequent alteration in aquatic habitat. Decrease or full disruption of springs, wells and other groundwater sources have also been noted. Studies are ongoing to determine some of the implications of this type of mining on streams and wetlands. For a list of references and studies, see Literature Cited (pg. 125).

METHODS

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

Site Selection

Inventory site selection is guided by information from a variety of sources. A review of the Pennsylvania Natural Heritage Program database (see Appendix II) determined what locations were previously known for species of special concern and important natural communities in Greene County. Local citizens knowledgeable about the flora and fauna of Greene County were contacted for site suggestions. Individuals from academic institutions and state and federal agencies that steward natural resources (e.g., Pennsylvania Game Commission, Pennsylvania Bureau of Forestry, Carnegie Museum of Natural History Powdermill Nature Preserve) were also contacted to obtain information about lands or resources they manage. National Wetland Inventory maps, compiled by the US 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, geology 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 (e.g., contiguous forest, wetlands), disturbances (e.g., utility line rights-of-way, strip mines, timbered areas) and a variety of easily interpretable features. 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. Wetlands and contiguous blocks of forest were of primary interest during fly-overs in Greene County. Based on aerial photo interpretation and aerial surveys, some sites were eliminated from consideration if they proved to be highly disturbed, fragmented, lacked the targeted natural feature, or were purely attributable to human-made features (e.g., impoundments, clearings, farm fields).

Ground Surveys

Areas identified as inventory sites were scheduled for ground surveys. Biologists conducted field surveys throughout Greene County during 2002 and 2003. 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 (see Appendix III) were completed for each site. Boundaries for each site were drawn on USGS 1:24,000 topographic maps. If a species of special concern was recorded and the population was of sufficient size and vigor, a voucher specimen was collected and archived in the herbarium of the Carnegie Museum of Natural History. The flora, fauna, level of disturbance, approximate age and condition 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 enough information was available from other sources, sites were not ground surveyed.

Data Analysis and Mapping

Data on species of special concern and natural communities obtained during the 2002 and 2003 field seasons were combined with existing data and summarized. Plant and animal species nomenclature follows that adopted by the Pennsylvania Biological Survey. Community descriptions primarily follow Fike (1999); for systems not addressed in Fike (i.e. subterranean and non-vegetated habitats), Smith (1991) was followed. All sites with rare species and/or natural communities, as well as exceptional examples of more common natural communities were selected for inclusion in Biological Diversity Areas (BDAs). Spatial data on the elements of concern were then compiled in a Geographic Information System (GIS) format using ESRI ArcView 3.2a software. Boundaries defining core habitat and supporting natural landscape for each BDA were derived from the occupied habitat data based upon Pennsylvania Natural Heritage Program conservation planning specifications for the elements of concern within the BDA. Specifications outline protocols for identifying lands important in the support of elements of concern and are based on scientific literature and professional judgment for individual species or taxonomic groups of species. They may incorporate physical factors (e.g., slope, aspect, hydrology), ecological factors (e.g., species composition, disturbance regime), and specifications provided by jurisdictional government agencies. Boundaries tend to vary in size and extent depending on the physical characteristics of a given site and the ecological requirements of its unique natural elements. For instance, two wetlands of exactly the same size occurring in the same region may require areas of very different size and extent for support if one receives mostly ground water and the other mostly surface water, or if one supports migratory waterfowl and the other does not. BDAs were assigned a significance rank to help prioritize future conservation efforts. This ranking is based on the extent, condition, and rarity of the unique feature, as well as the quality of the surrounding landscape (see Appendix I for further description of ranks).

Landscape Conservation Areas (LCAs) are typically delineated to represent ecologically important natural landscapes that encompass large areas and offer valuable ecosystem services. They may be large blocks of contiguous forest, extensive wetland complexes (in glaciated regions), areas linking ecologically significant features such as those recognized for BDAs, or areas which are particularly undisturbed and ecologically intact within the county. Within Greene County, there are no large blocks of contiguous natural landscape remaining, and no topographic features such as ridgelines which strongly define the landscape. Landscape Conservation Areas were selected to identify: 1) areas which have the best potential for restoration into large, contiguous blocks of forest, and 2) watersheds which support portions of waterways hosting species of special concern.

To identify potential forest blocks, landcover was intersected with state roads and rights-of-way 20 m and greater to divide the county into smaller blocks of landscape. The blocks were evaluated (using ArcView 3.2 spatial analyst) to determine the area of the block, the percentage forest cover, percentage agricultural cover, percentage other land use, percentage core forest and number of miles of roads within the block. Blocks at least 600 acres in size with high percentage forest cover, high percentage core forest and a low number of road miles were selected as potential forest blocks. Core forest was defined as forest at least 100 m distant from any non-forest land cover (all cover types except deciduous forest, mixed forest, evergreen forest, forested wetlands and non-forested wetlands were classified as “non-forest”) and any road or right-of-way. Six hundred acres was chosen as target size because research suggests that forested areas must contain 600-1,000 acres of core forest in order to sustain populations of forest-interior birds that breed successfully enough to maintain or increase in number (Robbins, et al 1989)

Watersheds were selected as LCAs when the waterway hosted at least one species of special concern in Pennsylvania: in ranking the significance of these LCAs, higher values were given to watersheds that host rarer species (considering state and global rarity) and have a higher percentage forest cover.

LANDSCAPE CONSERVATION AREAS

Conservation at the Landscape Scale

The Landscape Conservation Areas identified in Greene County are large areas with ownership typically divided among many entities, individuals, corporations, and public agencies. These areas include the most feasible places for the development of large, contiguous forest ecosystems and watersheds that support important aquatic resources. In both cases, the areas require substantial efforts to improve the ecological health of the landscape and increase natural cover in order to realize their full potential as unique habitat that provides valuable ecosystem services to human communities. These efforts will require coordinated efforts by the many landowners involved.

Potential Forest Block LCAs

Features that fragment habitat for different species range from dirt trails to roads, gas wells, cleared areas, and land conversion for residential, urban, or industrial use. Species have different thresholds for what degree of disturbance will be a barrier to movement or make adjacent forest habitat unusable to them. However, as the collection of fragmenting features of all types grows, the amount of area influenced by edge effects grows and the ability of the ecosystem to support its most sensitive species declines.

Within the LCAs identified as "potential forest blocks," forest cover is currently somewhat fragmented by non-forest land cover and by small roads or trails. These features reduce the ability of the forest to support many species that require interior conditions. However, the areas do not contain large fragmenting features such as state roads, large powerline right-of-ways, or urban land use. Because of the ecological importance of interior forest habitat and the current lack of any substantial areas of interior forest in Greene County, it is recommended that plans be developed to restore large areas of contiguous forest within those "potential forest block" LCAs that are most suitable for this use, factoring in the current land uses and the needs of local communities. Large forested areas can be developed by planning to allow non-forest areas surrounding existing forest lands to revert to forest, and removing/minimizing fragmenting features. Combining rights-of-way and road corridors into a single corridor can minimize fragmentation. From both an ecological and a practical viewpoint, large roads are ideal locations for utility right-of-ways, because the corridors already exist, the need for multiple fragmenting corridors in the landscape is eliminated, and easy access for maintenance is ensured.

The impact of individual features such as wells, roads, right-of-ways, or other clearings can also be minimized by the use of ecologically informed best management practices in construction and maintenance. (See Arkansas Forestry Commission pg. 117 for road management, Appendix VII on pg. 151 for further information sources.)

In addition to forest contiguity, it is also important to steward forest ecosystem health by managing for native diversity in plant, animal, and natural communities, and conserving ecologically important aspects of the physical landscape such as soil structure, naturally decomposing dead wood, and structural diversity in forest composition. In Greene County, a large concern is management of invasive plant species, which have established robust populations in many forested areas, reducing the forests' value to native species. Timber harvesting can be compatible with the ecological viability of the region if it is pursued according to a plan designed for the long-term sustainability of both the timber resource and the forest ecosystem, with the use of ecologically informed best management practices. Surface mining in previously unmined areas is not compatible with the ecological assets of the area. Mined areas create a permanent loss of habitat, as it is extremely difficult if not impossible to restore a forest ecosystem with

healthy function and biodiversity to a disused surface mine. Mining also causes water quality degradation that is difficult to remediate. A number of resources, listed in Appendix VII (pg 151), are available to private landowners interested in sustainably managing their forestlands for biodiversity conservation, forest health, and forest products including timber, mushrooms, and high-value medicinal herbs. A good place to start is the PA Bureau of Forestry's Forest Stewardship Program, which assists landowners in developing a forest management plan based on their envisioned goals for their land.

Table 3. Forest Block LCAs in Greene County

LCA	Size (Acres)	% Agriculture	% Forest	% in Tier 3 Core Forest	% in Tier 2 Core Forest	Coniferous Forest (acres)
Aleppo LCA	4516	21	79	30	35	4
Crabapple Creek LCA	2488	25	75	31	33	3
Fonner Run LCA	5060	27	73	28	35	14
Jefferson LCA	2239	26	73	31	35	3
Job Creek LCA	4138	11	89	49	56	32
McCracken LCA	4496	25	75	30	34	1
Sycamore LCA	2987	26	74	26	32	23

Watershed LCAs

In these LCAs, conservation efforts should focus on improving water quality. One aspect of water quality improvement is reduction and elimination of point source pollution from mining discharges, industrial facilities, sewage treatment, or other sources. Another aspect of water quality improvement is reduction of non-point source pollution, including soil erosion and nutrient runoff from agricultural areas and silt runoff from dirt roads. Water quality is also integrally related to land cover; forest cover retains soil, filters runoff and precipitation, and maintains a natural cycle of nutrient uptake and release. Increasing the proportion of forest within a watershed correlates with increasing water quality. Therefore, the same recommendations that are given above for the "potential forest block" LCAs are also appropriate guides for efforts to increase forest cover in these watersheds. The riparian area directly adjacent to the waterway is especially important; increased forest cover in this area will realize strong benefits in water quality improvement, and also improve the ecological value of the stream. Streams with naturally forested riparian areas at least several hundred meters wide can serve as important corridors for wildlife to move across the landscape. Creation of a contiguous forested riparian buffer along streams serves many ecological functions, and can also be a valuable scenic and recreational asset.

Table 4. Watershed LCAs in Greene County

LCA	Size (Acres)	Evergreen Forest (Acres)	Forested Wetland (Acres)	% Tier 3 Core Forest	% Tier 2 Core Forest	% Forest	% Agriculture	% other use (quarry, residential, commericial)
Dunkard Fork LCA	9,503	95.1	0.0	34	38	78	21	1
Enlow Fork LCA	3,945	0.66	0.0	35.9	49.2	86.5	13.5	0.1
Lower Dunkard Creek LCA	6, 164	23.5	5.8	27	32	73	21	6
Upper Dunkard Creek LCA	14,564	55.1	0.1	9	10	77	22	1
Lower South Fork Ten Mile Creek LCA	20, 895	64.8	0.0	16	20	58	33	9

Greene County LCAs

Aleppo LCA

Aleppo LCA spans more than 4,500 acres and is located in the drainage of South Fork of Dunkard Fork of Wheeling Creek with about 75% covering the South Fork and 25% covering the North Fork. This area has high forest cover and low road density. With a relatively small number of fragmenting features and a high proportion of non-forested area in agriculture, the potential for restoring forest cover and maintaining a low degree of fragmentation is high.

Most of the tributaries and the forks have little or no wooded riparian buffers. The herbaceous layer in many of these areas is suffering from incursions of garlic mustard (*Alliaria petiolata*), an exotic species. Oil and gas wells further fragment the LCA on its eastern end.

Threats and Stresses

Fragmenting features in the Aleppo LCA include roads, pastures, and oil and gas wells. Fragmentation increases the area negatively impacted by edge effects, reduces the habitat available for interior specialists, and increases the area of habitat vulnerable to the establishment of exotic invasive plants. The hydrology and structure of the substrate is likely being impacted to some degree by long-wall mining, the total effects of which are currently unknown.

Streams throughout this LCA are more susceptible to agricultural and residential runoff pollution because they lack adequate vegetation buffers. Many pastures in the area also lack fencing to prevent cattle from crossing into streams, where they increase erosion, siltation, and nutrient loading.

Recommendations

The municipalities in this watershed can work to provide more adequate riparian buffer along the streams in this LCA to help in reducing erosion and siltation, and to reduce the impact of non-point source pollution from agricultural and residential applications of fertilizer and pesticide.

Further fragmentation should be avoided and a more contiguous pattern of forest should be pursued through targeted restoration efforts. Research needs to be done on the impacts of long-wall mining, the total effects of which are currently unknown.

Crabapple Creek LCA

Crabapple Creek LCA includes 2,488 acres centered on the middle of Crabapple Creek, which drains the valley between North Fork of Dunkard Fork and Enlow Fork. Most of the forests here are low quality with thick understory layers from historic forestry practices. Most of the tributaries in this LCA have adequate forested riparian buffers, but the main floodplains of Crabapple Creek suffer from a lack of wooded buffers. Currently some long-wall mining is occurring in the watershed. In spite of the above, with proper management this area could potentially become one of the larger contiguous forested areas in Greene County.

Threats and Stresses

Though most tributaries to Crabapple Creek have adequate riparian vegetation buffers, the main branch of the creek lacks buffers for much of its length, which may compromise the benefit of buffers farther upstream and leave the stream vulnerable to non-point source pollution. Some of the larger patches of forests are suffering from a lack of structure in the understory, with deer overbrowsing a likely cause. Long-wall mining could eventually negatively impact the ecosystems here, especially the hydrology, although the true effects are currently unknown.

Recommendations

Further fragmentation should be avoided and a more contiguous pattern of forest pursued through targeted restoration efforts. The forests currently here should be allowed to mature in order the achieve healthy structure in the understory. Reduction of deer browsing pressure may be key to achieving this goal. Research needs to be done on the effects of long-wall mining on the forest ecosystem in general.

Dunkard Fork Watershed LCA

Dunkard Fork LCA encompasses 9,503 acres of the Dunkard Fork watershed, which supports several aquatic animals of special concern. Like most of the larger streams in Greene County, Dunkard Fork lacks an adequately wooded riparian buffer. Most of the floodplains along this stream are open and used for agriculture as either fields or pasture. A large part of this LCA is part of Ryerson Station State Park and the LCA contains many BDAs including Durbin BDA, Dodds Ridge BDA, Duke Lake Floodplain BDA, Bristoria South BDA, Dunkard Fork BDA and Bryan BDA.

Threats and Stresses

The lack of riparian buffers on Dunkard Fork leaves the stream vulnerable to siltation and non-point source pollution from the broader watershed. Duke Lake in Ryerson Station State Park is gradually filling in with sediment because of erosion upstream. Long-wall mining may be impacting the watersheds with this LCA by decreasing groundwater input and changing the physical structure of the streams.

Recommendations

Efforts should be made to increase the amount and width of the wooded buffers along all of the tributaries of Dunkard Fork, which will help to reduce erosion and siltation and protect the stream from non-point source pollution. More research needs to be done as to the impacts of long-wall mining on aquatic habitats, including those within this watershed. Development of new fragmenting features such as roads and utility right-of-ways should be avoided or minimized.

Enlow Fork LCA

Enlow Fork LCA includes 3,945 acres in the centered on Enlow Fork in the northwest corner of Greene County. Four plant species of special concern are found within this LCA and it has the potential to become one of the larger contiguous forested areas in Greene County. Most of the non-forested land uses are in agriculture, opening the possibilities of reforestation in strategic areas of the watershed and LCA.

Threats and Stresses

Long wall mining is ongoing in this watershed and forest practices are not uniformly sustainable. Large open fields that intersect corridors such as the main valley of Enlow Fork, introduce general habitat diversity but do not add to the contiguity and interior conditions of existing forests, the rarest of habitats in the county.

Recommendations

Efforts to increase the amount and width of the wooded buffers along all streams, will help to reduce erosion and siltation and protect the stream from non-point source pollution. Joining as many forested areas as possible under uniform sustainable management and considering possibilities for combining blocks through reforestation efforts would be of great value to this landscape. More research needs to be done as to the impacts of long-wall mining on aquatic habitats. Development of new fragmenting features such as roads and utility rights-of-way should be avoided or minimized.

Fonner Run LCA

Fonner Run LCA is located in the north-central part of Greene County and spotlights an area that has high potential for being restored to a contiguous forest block. This LCA covers 5,060 acres of forest and farmland, with relatively few fragmenting features such as roads or power line right-of-ways. A combination of preserving existing forested areas and allowing targeted fields to revert to mature forest could turn Fonner Run LCA into a large block of ecologically significant contiguous forest, providing habitat for a wide variety of interior specialist species.

Threats and Stresses

The primary threat to Fonner Run LCA is the expansion of agricultural and residential areas. Additional clearing of existing forest will reduce and isolate the forest blocks within the LCA, making them less ecologically valuable by reducing the proportion of interior habitat and increasing the proportion of edge-type habitat. Even with no expansion of cleared areas, however, the areas of edge habitat present within this LCA offer edge adapted species and exotics extensive entry points into the forests.

Recommendations

Conservation efforts in Fonner Run LCA should be directed towards increasing the total area of contiguous forest and both monitoring for and containing exotic species colonization. Working with landowners in the LCA to make them aware of available conservation incentive programs (see the Recommendations section, pg 119) and the impact of exotic plants would be a logical starting point.

Jefferson LCA

Jefferson LCA encompasses 2,290 acres in the eastern part of Greene County. It is recognized as a possible restoration area, with potential to develop a large contiguous forest block in Greene County in a place where there are few large forest areas in the county. Most of the LCA is located on the watershed divide between Pumpkin Run on the south and east and a tributary to South Fork Ten Mile Creek on the north. Currently very few roads or other fragmenting features cut through the LCA. If allowed to regenerate to mature forest, this area may be able to support viable populations of nesting songbirds.

Threats and Stresses

Conversion of forest land to other uses, such as agriculture, residential development, or mining, is the primary threat in this LCA. Fragmenting features such as roads and utility rights-of-way could serve to isolate populations of birds and other animals and negatively impact the quality of remaining habitat.

Recommendations

Further fragmentation and land use conversion from forest should be avoided. Programs and approaches to aid in the conversion of areas that are not currently in forest back to natural forest conditions would help connect existing habitat fragments and create larger areas of contiguous forest.

Job Creek LCA

Most of the 4,138 acres in Job Creek LCA are owned by the Pennsylvania Game Commission as part of State Game Lands #179. The LCA covers the headwaters of Job Creek, which flows into North Fork of Dunkard Fork. Some areas of the southern part of the block are covered by plantations of Norway spruce (*Picea abies*) and large infestations of the invasive exotic plant multiflora rose (*Rosa multiflora*). Most of the area drains into Job Creek.

Threats and Stresses

Plantations of non-native Norway spruce and large infestations of multiflora rose reduce the ecological value of some areas of this LCA for native plants and animals. Although the State Game Lands are largely without traditional fragmenting features such as roads and power line rights-of-way, significant areas of cleared land and oil drilling activity probably compromise the existing forest. Large areas of edge-type habitat will make existing forest more vulnerable to the establishment of exotic invasive plants, particularly the expansion of the multiflora rose infestations.

Recommendations

Cleared areas within this LCA should be allowed to revert to mature forest to create larger areas of contiguous forest and, correspondingly, more interior forest habitat. Efforts should be made to reduce or control the multiflora rose infestation, and areas free from this invasive plant should be monitored to ensure that it does not expand its range within the LCA.

Lower South Fork Ten Mile Creek LCA

This LCA is delineates the more than 22,000 acres of immediate watershed around an occurrence of a special animal that is located in South Fork Ten Mile Creek. Unlike the other LCAs, which focus on the development of contiguous forest, this one spotlights those areas that could have an impact on the species of special concern. Activities in this LCA need to consider their effects on the water quality in the watershed.

Threats and Stresses

The Lower South Fork Tenmile Creek LCA encompasses significant areas of development, including the town of Waynesburg. The species of focus for this LCA is particularly sensitive to water pollution and

sedimentation. Much of Lower South Fork Tenmile Creek is without forested buffers, and the particular stretch of the stream in which species of special concern are found is paralleled by a major road. These factors conspire to leave the stream vulnerable to non-point source runoff pollution from agricultural fields, residential lawns and gardens, and urban paved surfaces.

Recommendations

Residents and farmers within this LCA should be made aware of the ecological and economic benefits of best management practices (BMPs) designed to reduce the amount of fertilizer, herbicide, and pesticide runoff to streams. Efforts should also be made to establish more substantial buffer zones along Lower South Fork Tenmile Creek, especially near the stretch occupied by the species of concern.

Lower Dunkard Creek LCA

The Lower Dunkard Creek LCA consists of 6,164 acres surrounding the Dunkard Creek BDA, which contains occurrences of four animal species of concern and two plant species of concern, **yellow leafcup (*Polymnia uvedalia*)** and **dwarf crested iris (*Iris cristata*)**. The LCA is a patchwork of forest fragments, agricultural fields, residential development, and strip-mined areas transected by several state roads and power line rights-of-way.

Threats and Stresses

Because of their sensitivity to changes in water quality, the animal species of concern within this LCA are most threatened by non-point source pollution, including fertilizer and pesticide runoff from agricultural and residential areas and abandoned mine drainage (AMD) related to the old strip mines located throughout the LCA. Much of the length of Dunkard Creek within the LCA, especially within the supporting landscape for the BDA, has at least some forested riparian buffers but these buffers are very narrow in places, and elsewhere nonexistent. Also, the widespread fragmentation of the forested areas within the broader LCA reduces their ecological value and their contribution to the health of the watershed, and makes the area vulnerable to the establishment of exotic species.

Recommendations

Improved riparian buffering along Dunkard Creek and reduced fragmentation of the forested areas throughout Lower Dunkard Creek LCA are the two most important steps toward conserving the species of concern found in this area. Future development of the area should be planned to minimize additional fragmentation (for instance, by using existing rights-of-way rather than creating new ones), and cleared areas should be allowed to revert to forest wherever possible in order to create larger areas of contiguous forest. Containment of existing exotic species infestations and monitoring for new ones will also be important. Residents of the area should also be made aware of measures they can take to improve the ecological health of this LCA; see the Recommendations section (pg.119) for specific programs and resources to assist with this goal.

McCracken LCA

McCracken LCA is a 4,496-acre area of forest and farmland on the western boundary of Greene County. Three-quarters of this LCA is forested, and it contains relatively few fragmenting features, giving it good potential for restoration to a significant area of contiguous forest. Achieving this goal will require both

the preservation and management of existing forest and the restoration of targeted cleared areas to mature forest.

Threats and stresses

A primary concern for this LCA will be discouraging and controlling the establishment of exotic plant species. Invasive exotics like multiflora rose (*Rosa multiflora*) and bush honeysuckles (*Lonicera* spp.) are generally slow to establish under a full forest canopies, however, large amounts of edge with significant populations of exotics provide the source for dispersal of seeds into blocks of forest. Additionally, openings in the forest can likewise lead to infestations of numerous invasive exotic species.

Recommendations

Conservation efforts within this LCA should be directed toward increasing and preserving the total area of contiguous forest. New development efforts in the area should be planned to minimize the creation of new fragmenting features, and, working with landowners, existing cleared areas should be evaluated to identify which could be most beneficial if allowed to revert to forest. Monitoring for the establishment of invasive species and containment of existing occurrences will also be important.

Sycamore LCA

Sycamore LCA is a high restoration potential area located between Bates Run and Browns Run. This LCA is notable among the rest for the low density of fragmenting features within its 2,987 acres of forest and farmland.

Threats and Stresses

Existing fragmentation of the forest within this LCA, though not as severe as other parts of the county, creates significant areas of edge habitat and points of entry for exotic species. Further fragmentation created by development or expansion of existing agricultural fields within the LCA will only exacerbate this situation and reduce the ecological value of the Sycamore LCA forest.

Recommendations

Allowing targeted cleared areas to revert to mature forest can reduce the amount of edge-type habitat and increase the area and contiguity of forest within Sycamore LCA, creating valuable interior habitat and reducing the area's vulnerability to the establishment of exotic species. Working with landowners within the LCA to increase forested acreage and to monitor for and control exotics will greatly benefit the area's natural systems.

Upper Dunkard Creek Watershed LCA

Upper Dunkard Creek LCA encompasses 14,564 acres at the headwaters of Dunkard Creek in the south-central and southwestern part of Greene County. This LCA is delineated to support important aquatic habitats and the sections of the watershed strongly associated with those habitats. Within this LCA Dunkard Creek splits into two large forks, the Pennsylvania Fork and the West Virginia Fork, each which receive several large tributaries. The West Virginia Fork of Dunkard Creek is subject to large areas of surface mining, and the Pennsylvania Fork features a road within the riparian zone in its lower stretches. All drainages suffer from a lack of riparian vegetation buffers.

Threats and Stresses

The surface mining in West Virginia could cause increased sedimentation into Dunkard Creek and negatively impact the aquatic organisms living here. Where roads parallel the streams in this watershed, sedimentation from road maintenance, road salt and herbicides sprayed along the rights-of-way are also a concern. The lack of wooded riparian buffers exacerbates the above problems by allowing sediment and runoff pollution direct access to the streams.

Recommendations

Mining activities in this watershed should take steps to minimize the amount of sediment washing into the Dunkard Creek system. Road maintenance oriented to control the amount of runoff from activities such as grading and herbicide application near the stream would be helpful. Maintaining significant riparian buffers, preferably in forested condition, would provide more overall protection to aquatic habitats.

Upper South Fork Ten Mile Creek LCA

Upper South Fork Ten Mile Creek LCA is a 22,379-acre area of the South Fork Ten Mile Creek watershed encompassing the core and supporting habitat for Rogersville BDA, which supports two populations of an animal species of concern. Although this LCA contains the towns of East View and Rogersville and some developed areas along State Roads 18 and 21, it is mostly a mosaic of farmland and forest.

Threats and Stresses

A primary danger to the species of concern in the Rogersville BDA, which is particularly sensitive to changes in water quality, is non-point source pollution such as fertilizer, pesticide, or herbicide runoff from farms and residential lawns, petroleum product runoff from roads and parking lots, or sediment from open banks associated with cattle and equipment crossings of the creek. Much of the stretch of South Fork Ten Mile Creek within the LCA lacks forested riparian buffers, reducing the amount of filtration possible before runoff water reaches the stream. Fragmentation of the forested areas throughout the watershed is also a concern, as it leaves the LCA vulnerable to the establishment of exotic species and reduces the overall ecological value of the existing forest.

Recommendations

Development of healthy buffer vegetation along the South Fork Ten Mile Creek is a top priority to protect the species of concern living there, and an important first step will be working with landowners along the

stream to make them aware of watershed-based programs that provide incentives to develop buffer zones, build fences to keep cattle out of the creek, and implement other best management practices (BMPs). Another component of any conservation strategy for this LCA should be public education about healthy watershed practices, such as reduced use of fertilizer and pesticide in residential gardens. Finally, allowing targeted cleared areas to regenerate to mature forest will improve the contiguity of existing forest blocks and improve the overall ecological condition of the watershed. Resources and strategies for accomplishing these goals are discussed in the Recommendations section (pg.119).

BIOLOGICAL DIVERSITY AREAS (Listed by Municipality)

Detailed maps and descriptions of Greene County's Natural Heritage Areas follow, organized by township. For each township a map, a summary table, and full report are provided. Townships are arranged alphabetically within each region. Boroughs are treated together with an adjacent township due to their small size.

Biological Diversity Areas, Landscape Conservation Areas, Managed Lands, and Important Bird Areas are indicated on the municipality maps and are labeled in bold.

Summary Table Conventions

A summary table of sites precedes each map and lists identified Biological Diversity Areas, Landscape Conservation Areas, and Managed Lands.

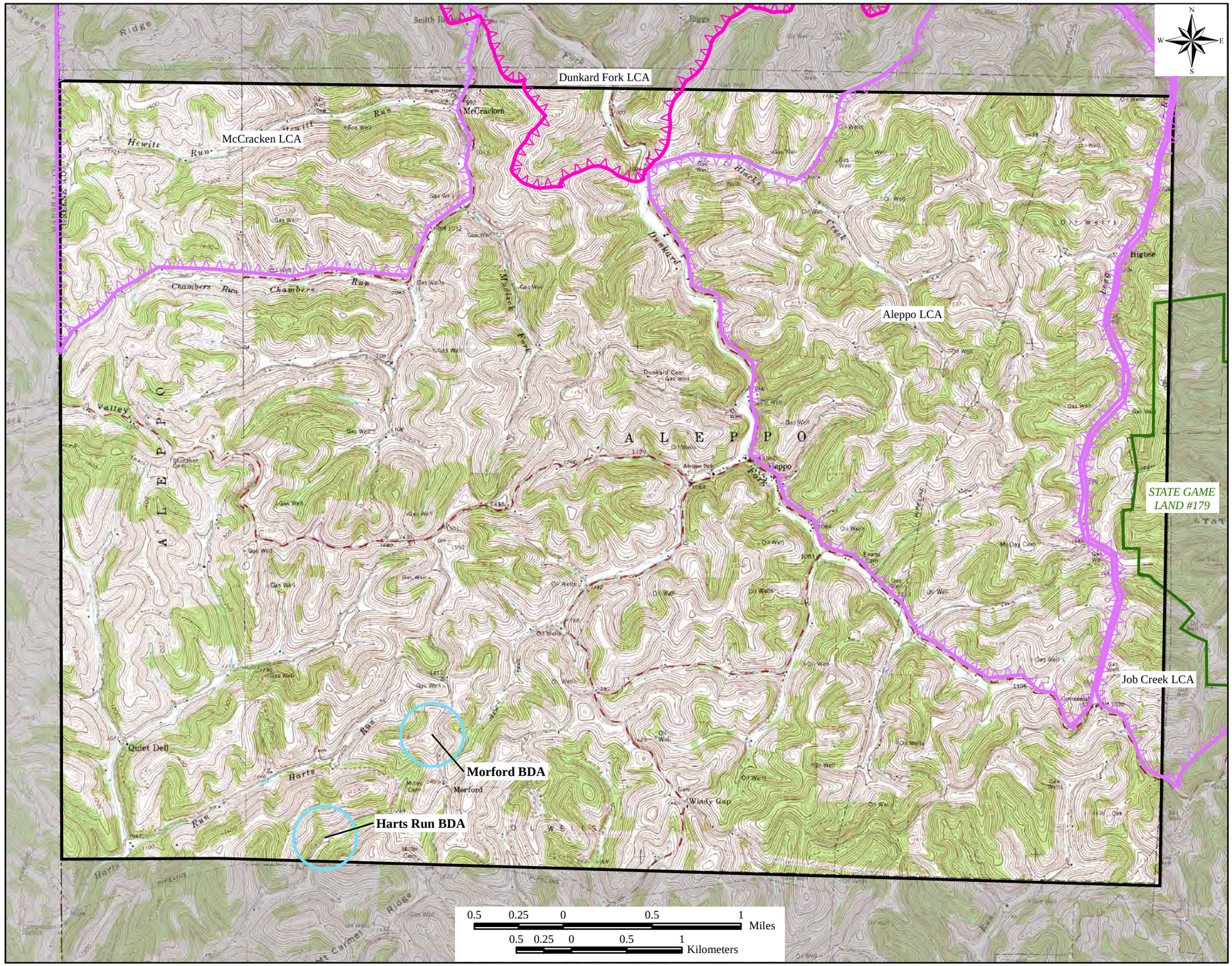
- Managed lands are listed after the Natural Heritage Areas
- A categorical designation of a site's relative significance is listed after the site name. Table 1 (pg. xi) summarizes sites by significance category. Definitions of the significance categories are outlined in Appendix I (pg. 129).
- Listed under each site name are any state-significant natural communities and species of special concern that have been documented within the area.
    - see Appendix IV (pg. 135) for a list of Natural Communities recognized in Pennsylvania.
    - Some species perceived to be highly vulnerable to intentional disturbance are referred to as "special animals" or "special plants" rather than by their species name. Within each site these species are numbered.
    - The PNDI (Pennsylvania Natural Diversity Inventory) rarity ranks, and current legal status (detailed in Appendix V, pg. 141) are listed for each community and species.
- The text that follows each table discusses the natural qualities of the site and includes descriptions, potential threats, and recommendations for protection.

This report does not intend to encourage visitation of private lands without explicit permission of the landowner. Also, the report does not contain all the detailed information required to manage the species of special concern. If more information is needed, ecological professionals at the Western Pennsylvania Conservancy or at the state natural resource agencies should be contacted. Hopefully, this report will encourage communication between ecological professionals—at the Conservancy and within state natural resource agencies—and municipalities, organizations, and individuals.

Aleppo Township

		PNDI Rank		Legal Status			
		Global	State	Federal	State	Last Seen	Quality
NATURAL HERITAGE AREAS:							
Aleppo LCA	*County Significance*						
Dunkard Fork LCA	*High Significance*						
Harts Run BDA	*Notable Significance*						
Yellow Leafcup (*Polymnia uvedalia*)		G5	SR		PT	2003	E
Job Creek LCA	*County Significance*						
McCracken LCA	*County Significance*						
Morford BDA	*Notable Significance*						
Passionflower (*Passiflora lutea*)		G5	S1		PE	2003	E
Yellow Leaf-cup (*Polymnia uvedalia*)		G5	SR		PT	2003	E
OTHER CONSERVATION AREAS:	*none identified*						
GEOLOGIC FEATURES:	*none identified*						

Aleppo Township



Greene County
Natural Heritage Inventory
Aleppo Township

Biological Diversity Areas:

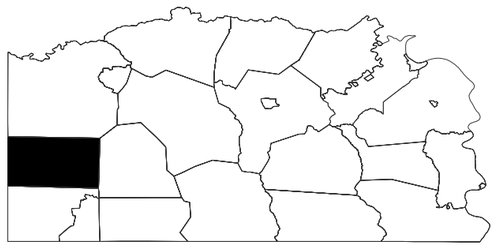
- Harts Run
- Morford

Landscape Conservation Areas:

- Aleppo
- Dunkard Fork
- Job Creek
- McCracken

Managed Lands:

- State Game Land #179



Legend

- Important Bird Areas (IBA)
- Managed Lands

Landscape Conservation Area (LCA)

- LCA
- Watershed LCA

Biological Diversity Area (BDA)

- Core Habitat
- Supporting Habitat

ALEPPO TOWNSHIP

Aleppo Township is located in west central Greene County. The township, like most of Greene County, is rural, with 76% of the land forested and the remainder in pastureland. The village of Aleppo is the center of population in the township. There are six Natural Heritage Areas located in Aleppo Township: Aleppo LCA (pg. 15), Dunkard Fork LCA (pg. 16), Harts Run BDA, Job Creek LCA (pg. 18), McCracken LCA (pg. 19), Morford BDA (pg. 25).

Harts Run BDA

Harts Run flows through a valley in which Morford Road descends from Morford. Descending through the valley, the road cuts many times into the slopes producing a roadside habitat favorable for a Pennsylvania plant species of special concern; **yellow leaf-cup (*Polymnia uvedalia*)**. This species is often found on riverbanks, ravines, and thickets where conditions are more open and soil exposed. In this case, the road right-of-way is meeting some of its habitat requirements.

Threats and Stresses

Roadside spraying of herbicides and mowing at the wrong times present the greatest threats to this population. Other maintenance activities such as re-grading may cause the roadbank to slide and negatively impact the population. Logging of the adjacent uplands could cause erosion of the roadbank and negatively impact the plants.

Recommendations

Protection of this site will involve the landowner, Aleppo Township and the Pennsylvania Department of Transportation. Educating all parties involved about the presence and requirements of the plants growing here would be a good first step in protection. Working with the township to provide guidance for the timing of road maintenance would further enhance the survival and may even make the habitat more viable for the plants.

Morford BDA

Morford BDA involves an area along Miller Road and is the location for two plant species of special concern; **passionflower (*Passiflora lutea*)** and **yellow leafcup (*Polymnia uvedalia*)**. This BDA is located just below a ridge-top on the divide between Dunkard Fork and Harts Run, which eventually flows into the Pennsylvania Fork of Fish Creek. Both of these plants are often found in thickets, waste places and other open places where there is a high amount of light.

Threats and Stresses

Roadside spraying of herbicides presents the most direct possible threat to the species located here. Other maintenance activities that directly disturb the roadside bank or logging on the uplands nearby may negatively impact the plant populations. Being on a roadside, invasive species could perhaps compromise the site in the future.

Recommendations

Protection of this site will involve the landowner, Aleppo Township and the Pennsylvania Department of Transportation. Educating all parties about the presence of and requirements of the species would be a good first step. Road maintenance activities should be scheduled with the plants in mind. Roadside mowing should be done in the spring and not done in the summer and fall to allow the plants to flower and fruit. Herbicide use is not advised for this site. Invasive species encroachments should be minimized where possible.

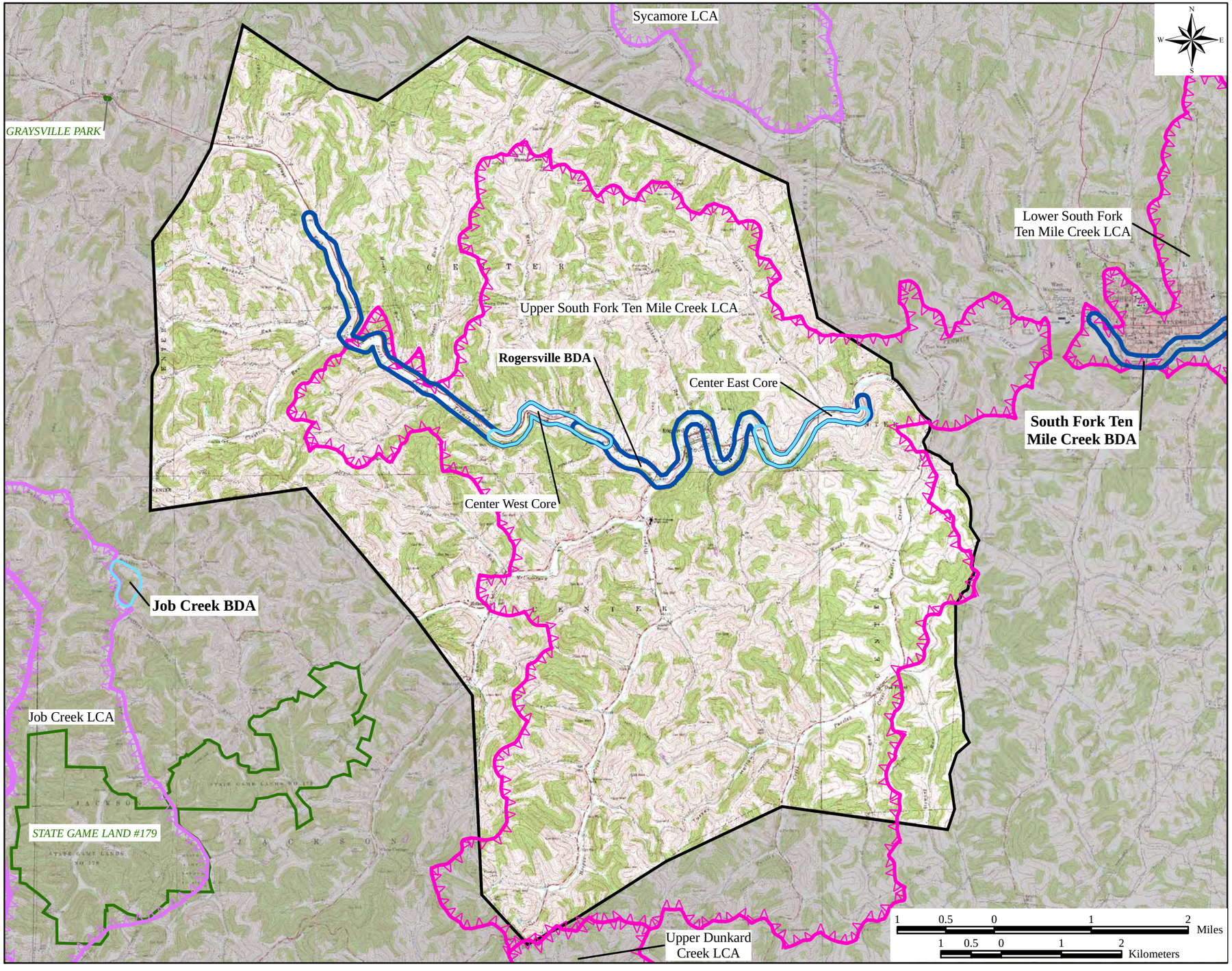
Center Township

	PNDI Rank		Legal Status			
	Global	State	Federal	State	Last Seen	Quality
NATURAL HERITAGE AREAS:						
Rogersville BDA	*Notable Significance*					
Special Animal 1	G5	S2			1993	E
Upper Dunkard Creek LCA	*Exceptional Significance*					
Upper South Fork Ten Mile Creek LCA	*High Significance*					

OTHER CONSERVATION AREAS: *none identified*

GEOLOGIC FEATURES: *none identified*

Center Township

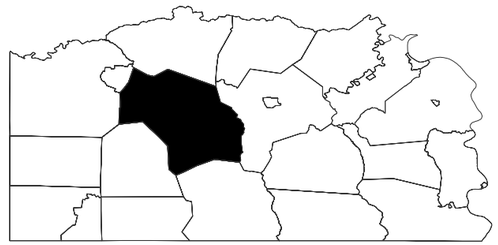


Greene County
Natural Heritage Inventory
Center Township

Biological Diversity Areas:
Rogersville

Landscape Conservation Areas:
Upper Dunkard Creek
Upper South Fork Ten Mile Creek

Managed Lands:
None



Legend

- Important Bird Areas (IBA)
- Managed Lands

Landscape Conservation Area (LCA)
- LCA
- Watershed LCA

Biological Diversity Area (BDA)
- Core Habitat
- Supporting Habitat

CENTER TOWNSHIP

Center Township, as the name implies, is located at the geographic center of Greene County. This township is located at the headwaters of South Fork Ten Mile Creek, which drains the whole of this township. Land use is roughly divided with 62% of the township in forest and 37% in agriculture. The village of Rogersville is the center of population. There are three Natural Heritage Areas located in Center Township: Rogersville BDA, Upper Dunkard Creek LCA (pg. 21), and Upper South Fork Ten Mile Creek LCA (pg. 21).

Rogersville BDA

South Fork Ten Mile Creek in the vicinity of Rogersville is the focus of this BDA. The BDA is divided into two core areas, Center West and Center East. Both the Center West and Center East Cores are the location of an animal species of special concern; **Special Animal 1**.

Center East and West Cores

Both of these core areas spotlight aquatic habitats on South Fork Ten Mile Creek that are the location of an animal species of special concern; Special Animal 1. The silver shiner and creek chub are strongly tied to the life cycle of this animal of concern (Watters and O'Dee, 1997) and the health of those fish populations are critical for special animal 1. The special concern animal lives within specific habitats within the creek and are therefore sensitive to direct impacts to its habitat, local water quality and sedimentation.

Threats and Stresses

Core Habitat Area: The special animal living in this BDA is sensitive to changes in water chemistry, sedimentation and increased nutrients. Agricultural practices and road maintenance that promote increased soil loss and nutrient inputs could negatively impact the population found here. Direct impacts such as the crossing of streams by roads can disturb riffle features that are important for freshwater invertebrates. Agricultural nutrients such as fertilizers and pesticides can be toxic to these organisms and can contribute to algae blooms which lower the amount of dissolved oxygen in the water. Impacts from long-wall mining, such as settling, may prove detrimental to these organisms.

Supporting Landscape: Supporting landscape for the Rogersville BDA includes the stretch of South Fork Tenmile Creek that flows through the town of Rogersville, a segment of the stream that will be particularly vulnerable to runoff from the town's paved areas, including automotive products and de-icing salt. Again, water chemistry changes due to such non-point source pollution pose a significant threat to the species of concern found here, particularly as the land around Rogersville becomes more developed.

Recommendations

Core Habitat Area: Efforts should be made to avoid the creation of new disruptions to this BDA, such as new road bridges or mining operations. Riparian buffer zones should be preserved and, where absent, allowed to revert to natural vegetation in order to reduce the impact of non-point source pollution. Construction projects along state road 21, which runs through much of the BDA, should follow careful management practices to limit introduction of new sedimentation or runoff pollution into the stream.

Supporting Landscape: Working with the municipalities, the Pennsylvania Department of Transportation, and farmers to establish adequate wooded buffers and using best management practices (BMPs) would go a long way in protecting the water quality of the streams. Specific BMPs and other landscape-level conservation measures are discussed in the Recommendations section (pg. 119). Any longwall mining activities under South Fork Ten Mile Creek should be carefully evaluated as to the effect on the animals living here and the preservation of their habitat. Post-mining monitoring of the habitat would be useful in evaluating habitat changes over time.

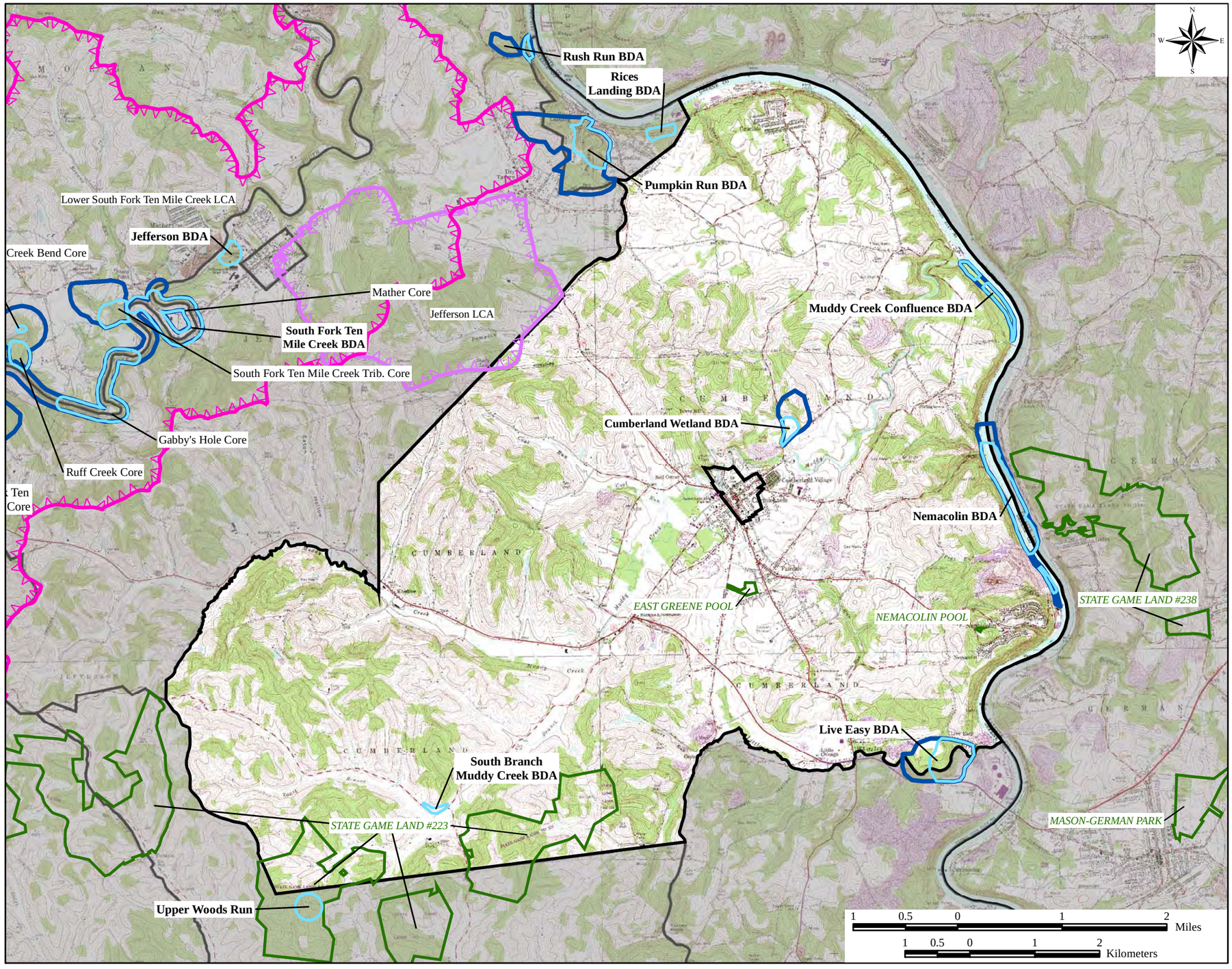
Cumberland Township and Carmichaels Borough

	PNDI Rank		Legal Status		
	Global	State	Federal	State	Last Seen	Quality
NATURAL HERITAGE AREAS:						
Cumberland Wetland BDA	*County Significance*				
Jefferson LCA	*County Significance*				
Live Easy BDA	*Notable Significance*				
Harbinger-of-Spring (*Erigenia bulbosa*)	G5	S2	PT	2003	E
Muddy Creek Confluence BDA	*Notable Significance*				
River Oats (*Chasmanthium latifolium*)	G5	S1	PE	2003	E
Blue Mistflower (*Eupatorium coelestinum*)	G5	S3	TU	2003	E
Nemacolin BDA	*Notable Significance*				
River Oats (*Chasmanthium latifolium*)	G5	S1	PE	2003	E
Blue Mistflower (*Eupatorium coelestinum*)	G5	S3	TU	2003	E
South Branch Muddy Creek BDA	*Notable Significance*				
Passionflower (*Passiflora lutea*)	G5	S1	PE	2003	E

OTHER CONSERVATION AREAS: *none identified*

GEOLOGIC FEATURES: *none identified*

Cumberland Township & Carmichaels Borough

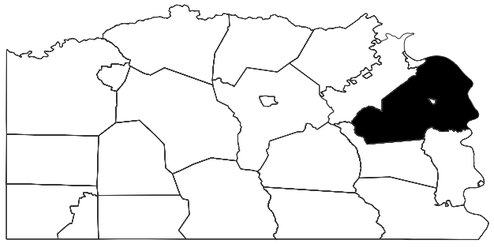


Greene County
Natural Heritage Inventory
Cumberland Township & Carmichaels Borough

Biological Diversity Areas:
- Cumberland Wetland
- Live Easy
- Muddy Creek Confluence
- Nemacolin
- South Branch Muddy Creek

Landscape Conservation Areas:
- Jefferson

Managed Lands:
- State Game Land #223



Legend

- Important Bird Areas (IBA)
- Managed Lands

Landscape Conservation Area (LCA)
- LCA
- Watershed LCA

Biological Diversity Area (BDA)
- Core Habitat
- Supporting Habitat

CARMICHAELS BOROUGH

Carmichaels Borough is located in the eastern part of Greene County in the watershed of Muddy Creek. Most of the Borough is urbanized with about a third being in forest or pasture. There are no Natural Heritage Areas located in Carmichaels Borough.

CUMBERLAND TOWNSHIP

Cumberland Township is located in eastern Greene County and surrounds the Carmichaels Borough. Muddy Creek is the main drainage in the area, and most of the township is characterized by a low topography that is unusual in Greene County. At one time in geologic history, this area was covered by Lake Monongahela, which laid down sandy deposits to create the unique topography. Cumberland Township is about 55% forested and most of the rest, 41%, is in agriculture. There are six Natural Heritage Areas in Cumberland Township: Cumberland Wetland BDA, Jefferson LCA (pg. 17), Live Easy BDA, Muddy Creek Confluence BDA, Nemacolin BDA, and South Branch Muddy Creek BDA.

Cumberland Wetland BDA

Presently bounded by two roads, Cumberland Wetland is located in a sharp bend of a tributary to Muddy Creek. The wetland can essentially be divided into two sections marking two different land uses. The east side of the wetland is roughly in its natural state with woody vegetation and a cattail marsh; the west side, on the other hand, is an active, though wet, pasture.

Common woody species on the east side include black willow (*Salix nigra*), green ash (*Fraxinus pennsylvanica*), red maple (*Acer rubrum*), and box elder (*Acer negundo*). The understory is mostly of shrubs and contains silky dogwood (*Cornus amomum*), Morrow's honeysuckle (*Lonicera morrowii*), mountain holly (*Nemopanthus mucronatus*), and multiflora rose (*Rosa multiflora*). Herbs present are typical for most wetlands in the area with spike rush (*Juncus effusus*), fowl manna grass (*Glyceria striata*), sallow sedge (*Carex lurida*), horsetail (*Equisetum arvense*) and swamp milkweed (*Asclepias incarnata*). About half of the east side is covered by wide-leafed cattail (*Typha latifolia*).

The west side does not have a woody canopy, only some scattered individual black locust (*Robinia pseudoacacia*) trees, which presumably cattle find unpalatable. Given the open conditions, the west side has more of a diversity of sedges than that found on the east side. Common sedges include sallow sedge (*Carex lurida*), nodding sedge (*C. gynandra*) and fox sedge (*C. annectens*). Other herbs on this side are ironweed (*Vernonia novaboracensis*), reed canary grass (*Phalaris arundinacea*), timothy (*Phleum pratense*), little red-top (*Agrostis alba*), and orange-spotted jewelweed (*Impatiens capensis*).

Figure 3. Cumberland Wetland

Threats and Stresses

One of the roads bordering the wetland is the location of a trash dump with most of the trash accumulating at the bottom of the slope next to the wetland. Flowing through a pasture with no fencing to exclude cattle, the stream and the wetland may be receiving higher levels of nutrients and sediment at crossing points. Overall this wetland is small, making it vulnerable to continued invasion of exotic invasive species such as multiflora rose, which is already established here.

Recommendations

Cleanup of the roadside dump area should be considered, and further dumping discouraged. Activities affecting the hydrology of the wetland stand to negatively impact the wetland. Roadside maintenance needs to keep nutrient inputs such as road salt and soil to a minimum. Fencing of the stream to restrict cattle would help to reduce sedimentation and nutrient inputs into the stream.

Live Easy BDA

Live Easy BDA is discussed in Monongahela Township.

Muddy Creek Confluence BDA

Upstream of the confluence of Muddy Creek and the Monongahela River are the sandy shores and levees and floodplain of the Monongahela River. A **sycamore (river birch) box elder floodplain forest** and two Pennsylvania plant species of special concern; **river oats (*Chasmanthium latifolium*)** and **blue mistflower (*Eupatorium coelestinum*)** are found on the levees and shore of the Monongahela River. The adjacent floodplain is a historic location of **passionflower (*Passiflora lutea*)**, another plant species of special concern, which was not found during the survey. Canopy species on the shore and floodplain include sycamore (*Platanus occidentalis*), box elder (*Acer negundo*), silver maple (*Acer saccharinum*) and sugar maple (*Acer saccharum*). The thicker understory is made up of spicebush (*Lindera benzoin*), flowering dogwood (*Cornus florida*), basswood (*Tilia americana*) and bitternut hickory (*Carya cordiformis*).

Threats and Stresses

Core Habitat Area: Due to the openness and natural disturbance regime present on the Monongahela River shore, this area is highly susceptible to invasive species such as Japanese stiltgrass (*Microstegium vimineum*) and Japanese knotweed (*Polygonum cuspidatum*). Changes in the normal pool level in the lock and dam system may eliminate the habitat either through flooding or undermining of the levee and floodplain benches on which these species grow.

Supporting Landscape: Interference with the river's normal flooding regime can potentially have adverse consequences for the special plant species found at this site, and the populations may also be impacted by disturbance of the surrounding forest and runoff from developed lands upslope of the site.

Recommendations

Core Habitat Area: Informing and involving both the Monongahela Riverkeeper, the US Army Corps of Engineers, and other interested groups in monitoring invasive species would help in preventing their spread. Any adjustments to the normal pool level should consider the impact on the plant populations.

Supporting Landscape: New development of the land uphill of the site should take into consideration the presence of these plant populations. Fragmentation of the forest can increase its vulnerability to invasive species, so efforts should be made to avoid creating new fragmenting features such as roads or power line rights-of-way. More detailed recommendations are found above in the Recommendations section (pg. 119).

Nemacolin BDA

Nemacolin BDA covers the floodplain of the Monongahela River downstream of the village of Nemacolin and across the river from the village of Gates. The southern part of the BDA shows the effects of the region's past and is covered by numerous mine spoils and industrial complexes.

Most of the floodplain except for that in the southern part of the BDA is covered in a mature forest that is considered a floodplain forest (sycamore-river birch floodplain forest/silver maple forest). While the canopy is full and maturing, the understory is not well-structured and shows little stratification. The herbaceous layer has a depressed diversity and both the understory and herbaceous layer are heavily populated with exotic invasive species. Dominant canopy species include sycamore (*Platanus occidentalis*), silver maple (*Acer saccharinum*), boxelder (*Acer negundo*), and black willow (*Salix nigra*). Understory species include spicebush (*Lindera benzoin*), green ash (*Fraxinus pennsylvanica*), and black cherry (*Prunus serotina*). On the riverbank, alder (*Alnus serrulata*) can be found. The herbaceous composition is dependent on location in the floodplain. Typically growing on these levees are plants like wingstem (*Verbesina alternifolia*), reed grass (*Phalaris arundinacea*), sunflower (*Helianthus strumosus*), beggar's ticks (*Bidens frondosa*), and jumpseed (Polygonum virginianum). Two Pennsylvania plant species of special concern; **river oats (*Chasmanthium latifolium*)** and **blue mistflower (*Eupatorium coelestinum*)** are part of the herbaceous layer within this site. These plants as well as many of the other species associated with the floodplain levees, require a regular flood regime and increased light conditions. A sandy shoal on the Greene County side of the river is home to another plant species of special concern; **broad-leafed water milfoil (*Myriophyllum heterophyllum*)**.

Threats and Stresses

Core Habitat Area: Exotic invasive species, fragmentation, and altered flood regimes represent the primary threats to the integrity of the habitats along the Monongahela River. In particular, one population of river oats is on a riverbank directly downhill from an abandoned strip mine and rail line, an area especially vulnerable to invasion by exotic plants.

Supporting Landscape: Due to the county's topography and use of the river as a transportation corridor, the floodplains have been used and transformed through the years. Those points most accessible to the river are often loading points for barges and processing facilities, many of which are derelict brownfields. Habitat left between these disturbed areas, in which this BDA is located, suffered the effects of being reduced to small woodlots, logging, and higher levels of the river created by the lock and dam system. The abundance of disturbance has proved to be fertile ground for invasive species. So far, in Greene County, most of the Monongahela River floodplain has been spared the worst affects of exotic species invasions. One species, Japanese knotweed (*Polygonum cuspidatum*) is present in high density in the Point Marion area and stands to seriously impact the diversity present in these floodplains, though little was found during surveys of the Greene County side of the Monongahela River. The Fayette County Natural Inventory revealed the infestations of this species already occurring on the Youghiogheny River and the Washington County Natural Heritage Inventory found the species along the Monongahela River. This section of River is a prime candidate for knotweed establishment.

Figure 4. Shore of the Monongahela River

Recommendations

Core Habitat Area: Monitoring of these special plant species as well as the habitats that they are a part of would be a good step in the conservation of this area. Also, river hydrology is important to maintaining these areas and consideration of the effect of alteration of river processes through dams and locks and dredging should be considered as part of the larger river management picture.

Supporting Landscape: Allowing the floodplains and river shore to revert to a more natural condition, restoring a larger riparian buffer and remediation of brownfields may allow some protection to the natural communities from invasive species and other direct disturbances. Monitoring for and early response to the establishment of invasive species like Japanese knotweed will be key to preserving this area of habitat. The General Recommendations section (pg. 119) discusses management practices in greater detail.

South Branch Muddy Creek BDA

South Branch Muddy Creek Road parallels the course of the creek of the same name and runs through many large pastures, hayfields and small woodlots. A fencerow at the intersection of this road and Carmichaels Road is the location for a plant species of special concern; **passionflower (*Passiflora lutea*)**. This area consists of a shrub-covered fencerow and pasture.

Threats and Stresses

Road maintenance activities such as mowing and herbicides stand to be the greatest threat to the survival of this plant population. Direct impacts such as cutting or thinning of the narrow, wooded fencerow may eliminate the population altogether. Invasive species while not currently a problem may become a problem in the future. Especially worrisome are species such as multiflora rose (*Rosa multiflora*) and bush honeysuckle (*Lonicera* spp.) which are abundant locally.

Recommendations

Protection of this plant population will ultimately involve the landowner and the township officials. Eventually maintenance of the fencerow will involve these plants. Making both of these parties aware of the plants and their requirements would represent a good first step towards the protection of this site. Monitoring of the plants of special concern and control of exotic invasive species present at the site would be good goals for more concentrated management efforts.

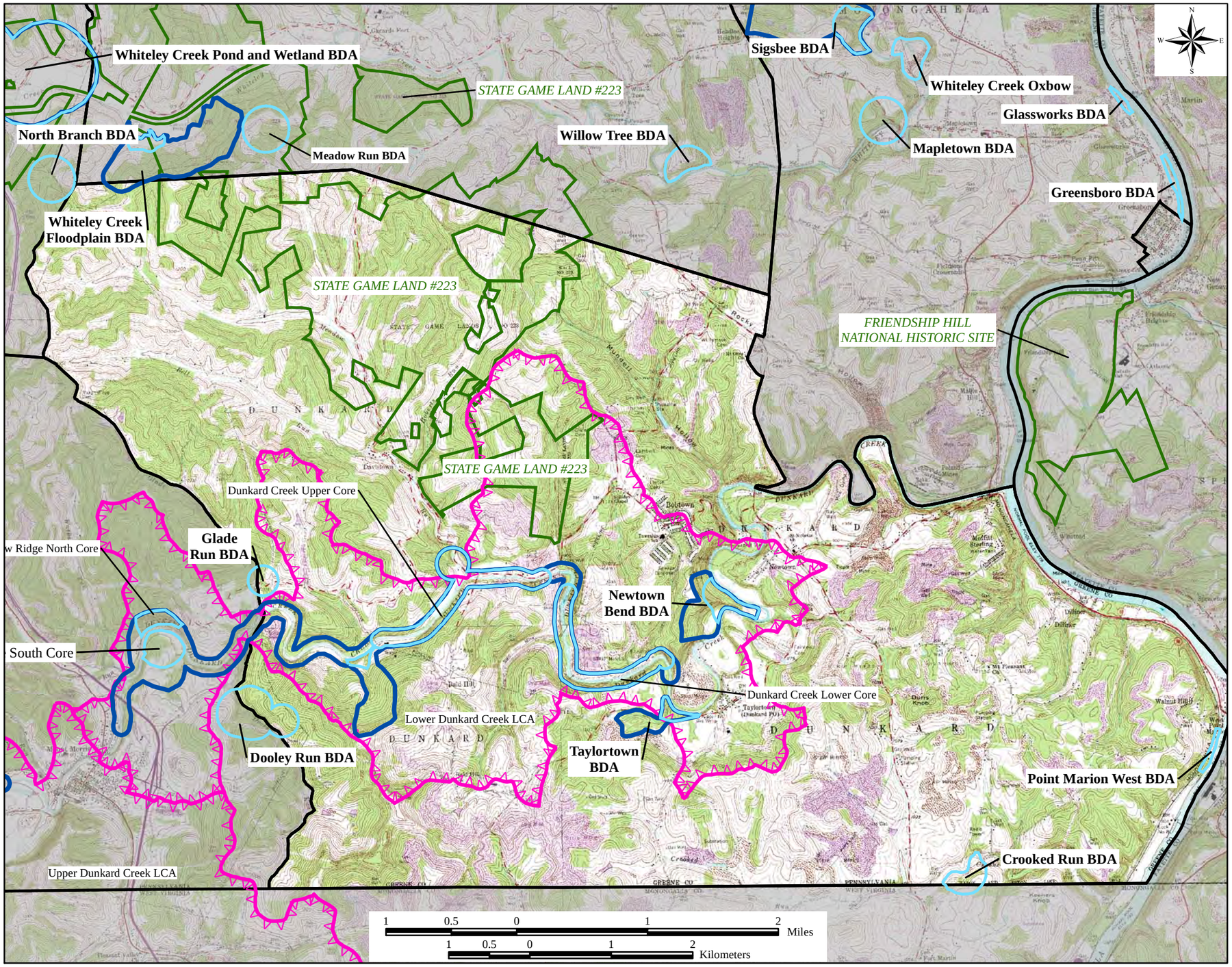
Dunkard Township

	PNDI Rank		Legal Status		
	Global	State	Federal	State	Last Seen	Quality
NATURAL HERITAGE AREAS:						
Crooked Run BDA	*Notable Significance*				
Blue Monkshood (*Aconitum uncinatum*)	G4	S2		PT	1988	BC
Dooley Run BDA	*Notable Significance*				
Sourwood (*Oxydendrum arboreum*)	G5	S3S4		PT	2004	E
Dunkard Creek BDA	*Exceptional Significance*				
Solitary Pussytoes (*Antennaria solitaria*)	G5	S1		PE	2004	E
Dwarf Crested Iris (*Iris cristata*)	G5	S1		PE	2004	E
Sourwood (*Oxydendrum arboreum*)	G5	S1		PE	1997	E
Yellow Leafcup (*Polymnia uvedalia*)	G4G5	SR		PT	2004	E
Special Animal 1	G5	S2S3		PT	1993	E
Special Animal 2	G3	S1		PE	1993	E
Special Animal 3	G5	S2		PE	1993	E
Special Animal 4	G4	S1		PE	1993	E
Glade Run BDA						
Broad leaved Spleenwort (*Asplenium pinnatifidum*)	G4	S3		PR	1996	E
Newtown Bend BDA	*Notable Significance*				
Crested Dwarf Iris (*Iris cristata*)	G5	S1		PE	1997	D
Harbinger-of-Spring (*Erigenia bulbosa*)	G5	S2		PT	2004	E
Point Marion West BDA	*Notable Significance*				
Blue Mistflower (*Eupatorium coelestinum*)	G5	SR		N	2000	E
Taylortown BDA	*Notable Significance*				
Puttyroot Orchid (*Aplectrum hyemale*)	G5	S3		PR	1997	E
Whiteley Creek Floodplain BDA	*Notable Significance*				
Harbinger-of-Spring (*Erigenia bulbosa*)	G5	S2		PT	2004	E

OTHER CONSERVATION AREAS: *none identified*

GEOLOGIC FEATURES: *none identified*

Dunkard Township

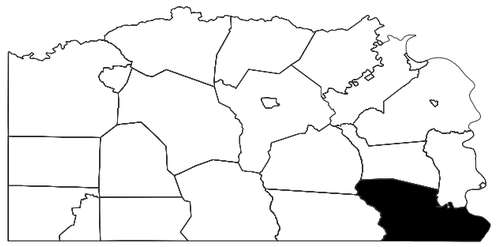


Greene County
Natural Heritage Inventory
Dunkard Township

Biological Diversity Areas:
- Crooked Run
- Dooley Run
- Dunkard Creek
- Glade Run
- Newtown Bend
- Point Marion West
- Taylortown
- Whiteley Creek Floodplain

Landscape Conservation Areas:
- Lower Dunkard Creek

Managed Lands:
- State Game Land #223



Legend

- Important Bird Areas (IBA)
- Managed Lands

Landscape Conservation Area (LCA)
- LCA
- Watershed LCA

Biological Diversity Area (BDA)
- Core Habitat
- Supporting Habitat

DUNKARD TOWNSHIP

Dunkard Township lies at the southeastern corner of Greene County, bordered on the east by the Monongahela River. State Game Lands #223, one the largest areas of public land in Greene County, covers a large portion of this township. Most of the township is forested (78%) with agriculture coming in at a distant second (17%). About 2.5% of the township has been surfaced mined. Dunkard Creek, a tributary to the Monongahela River flows west to east through the township. Dunkard Township contains eight Natural Heritage Areas: Crooked Run BDA, Dooley Run BDA, Dunkard Creek BDA, Glade Run BDA, Newtown Bend BDA, Point Marion West BDA, Taylortown BDA, and Whiteley Creek Floodplain BDA.

Crooked Run BDA

Crooked Run flows along the stateline of Pennsylvania and West Virginia in the very southeastern-most corner of Greene County. The moist banks of the run is the location of a Pennsylvania plant species of special concern; **blue monkshood (*Aconitum uncinatum*)**.

Threat and Stresses

Most of the area surrounding this population has been strip-mined and many invasive species are abundant enough to threaten the special plant population. At the current time it is unknown how the mining has affected the hydrology at the site, but if there is contaminated water, increased water or decrease in seepage water then the site may become unfavorable to the plants.

Recommendations

This site has not been surveyed for 18 years and the current condition of the site is not known. Resurvey and continued monitoring of this plant population would be an important step in the conservation strategy for these plants. General changes in the habitat, invasive species and changes in the hydrology are all characteristics to note.

Dooley Run BDA

Dooley Run BDA is discussed under Perry Township (pg. 89).

Dunkard Creek BDA

Dunkard Creek BDA is located downstream of the village of Mount Morris and is similar to South Fork Ten Mile Creek BDA in having numerous species and core habitats as the focus of the area. The Dunkard Creek Upper and Lower core habitat areas are oriented around aquatic habitats while the Dunkard Creek Upper and Meadow Ridge core areas feature terrestrial habitats.

Dunkard Creek Lower Core

This core is the location of two animal species of special concern; **Special Animals 1 and 2**, which depend upon good water quality and the riffle habitats of Dunkard Creek as it descends to the

Monongahela River. These animals are also strongly affiliated with certain fish species and the core area delineated here reflects the extent of the stream habitat that these animals may use in their life cycles.

Dunkard Creek Upper Core

This core is the location of four animal species of special concern; **Special Animals 1 through 4** and two plant species, **yellow leafcup (*Polymnia uvedalia*)** and **dwarf crested iris (*Iris cristata*)**. The animals depend on the riffles which have developed at the confluence of Roberts Run, a tributary to Dunkard Creek. The plants are present within an open roadside within the floodplain of Roberts Run.

Meadow Ridge North Core

This core is the location of a circumneutral south-facing slope on which a plant species of special concern, **solitary pussytoes (*Antennaria solitaria*)**, is living. Solitary pussytoes relies on dry outcrops, which are plentiful here.

Meadow Ridge South Core

This core is located in the Greene County Industrial park, which has open habitat that is favorable to a plant species of special concern; **sourwood (*Oxydendrum arboreum*)**. Though it is an understory species in the South, in Pennsylvania this species is often found in places where it can obtain more light and a warmer microclimate, which apparently allows it to live farther north than it otherwise would.

Figure 5. Dunkard Creek upstream of Taylortown

Threats and Stresses

Core Habitat Area: All of the aquatic habitats at this site are being impacted by abandoned mine drainage (AMD). The Dunkard Creek Upper Core was noted during surveys to be near an aluminum discharge from a tributary into Roberts Run, which then flows into Dunkard Creek. Aluminum in high concentrations is toxic to the animal species of concern found in this area. De-icing salt runoff from a road bridge that crosses just above the special animal occurrence may also impact the population.

Supporting Landscape: The accumulated impacts of AMD and agricultural runoff from higher in the upper reaches of the watershed create very stressful conditions for the animals living here. Fertilizer runoff from agricultural fields can create algae blooms and anoxic conditions, and the species of concern present at this site can be sensitive to water chemistry changes created by mine runoff. A key factor in reducing the effects of such non-point source pollution is the size and health of buffer zones of natural vegetation along streams; clearing of buffer zone vegetation can exacerbate these effects.

Recommendations

Core Habitat Area: Remediation of the AMD discharges in the lower part of the valley is paramount to the protection of the animals living here. The aluminum discharge is of particular concern and in need of greatest attention.

Supporting Landscape: Landowners in upstream areas should be encouraged to use best management practices (BMPs) to reduce erosion and runoff. Municipalities can work to encourage landowners to establish and maintain sufficient riparian buffers on streams in order to reduce sedimentation and nutrient inputs into the stream. Management practices are discussed in greater detail in the Recommendations section (pg. 119).

Newtown Bend BDA

Newtown Bend is a prominent bend in Dunkard Creek and is the location of two Pennsylvania plant species of special concern; **crested dwarf iris (*Iris cristata*)** and **harbinger-of-spring (*Erigenia bulbosa*)**. The forest communities within this BDA are disturbed and contain the remnants of past land uses, including coke ovens and staging areas for mine entrances. The crested dwarf iris is growing in a narrow strip of shore on the creek while the harbinger-of-spring is found on the moist, forested slopes above.

The floodplain along the bend includes a sycamore (river birch) boxelder floodplain forest dominated by sycamore (*Platanus occidentalis*), silver maple (*Acer saccharinum*), boxelder (*Acer negundo*) and tuliptree (*Liriodendron tulipifera*) and a pasture. The forest includes a thick understory made up of spicebush (*Lindera benzoin*), bladdernut (*Staphylea trifoliata*) and eastern hop-hornbeam (*Ostrya virginiana*).

The slopes that support harbinger-of-spring are forested with a young to mature red oak-mixed hardwood forest of red oak (*Quercus rubra*), sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), red maple (*Acer rubrum*) and shagbark hickory (*Carya ovata*). Understory associates include spicebush (*Lindera benzoin*), sassafras (*Sassafras albidum*) and yellow oak (*Quercus muehlenbergii*).

Threats and Stresses

Core Habitat Area: Most of the forest here is thick and in some places regenerating. There are few immediate threats to the sites and no development pressure was noted. Canopy removal could impact the harbinger-of-spring on the slopes by altering the hydrology and microclimate. As with most sites in Greene County, exotic invasive species represent the greatest threat to this site. Activities that result in the removal of the overstory or impact the forest communities could exacerbate the effects of these species.

Supporting Landscape: The forested landscape supporting this BDA is probably most vulnerable to development pressure from Bobtown, which is just north of the site. Creation of new fragmenting features can reduce the ecological value of the forest block, endangering the species of concern supported at this site.

Recommendations

Core Habitat Area: Most of the area in this BDA has already experienced a great amount of human disturbance. Natural communities present need to be allowed to mature and regain their natural character and conditions. Invasive species, especially in areas with high levels of disturbance such as this site, are an issue and monitoring of the species of concern and of invasive plant populations are both important to the long-term viability of the plant species existing here.

Supporting Landscape: Further timber management and activities associated with the site should take place with the requirements of the plants in mind, and future development projects should be planned to minimize the creation of new fragmenting features, which can reduce the support provided to the BDA by this forest block.

Point Marion West BDA

Point Marion West BDA is near and similar to the Point Marion Riverside BDA that was delineated in the Fayette County Natural Heritage Inventory in 2000. Like the east side of the river in Fayette County, the Greene County side is characterized by a sandy bank on which **blue mistflower (*Eupatorium coelestinum*)**, a Pennsylvania plant species of special concern, grows. Associated plant species on the bank include silver maple (*Acer saccharinum*), basswood (*Tilia americana*), spike rush (*Juncus effusus*), false nettle (*Boehmeria cylindrica*), twisted sedge (*Carex torta*) and nodding sedge (*Carex gynandra*).

Threats and Stresses

Threats to the shore of the river include dredging, raising the normal pool level and invasion of aggressive exotic plants such as purple loosestrife (*Lythrum salicaria*), multiflora rose (*Rosa multiflora*) and Japanese knotweed (*Polygonum cuspidatum*). Both Japanese knotweed and multiflora rose populations are near to this site. Direct disturbance of the plants or habitat from placement of dredging spoils, equipment, or boat launches could be detrimental.

Recommendations

Monitoring and control of invasive plant species would help assure that good examples of riverine habitat remain available for the native flora and fauna. Activities associated with the shoreline and floodplain of the river should also take into consideration this habitat and population of special concern species.

Taylortown BDA

The twisting course of Dunkard Creek involves numerous sections of well-developed floodplain and Taylortown BDA feature one of these floodplains. It is the location of **puttyroot orchid (*Aplectrum hyemale*)**. The life cycle of orchids involves producing a great number of seeds. The seeds produced are the smallest of any flowering plant – as small as one-hundredth of an inch – and lack endosperm, the food-storing tissue typically found in seeds (Constanz 1994). In place of the endosperm the seeds depend on mycorrhizal fungi for at least part of their nourishment after germination (Henry et al. 1975).

Therefore, the reproduction of orchids is dependent on a number of factors that may or may not be present at a given site, and the overall reproductive success is low. Also, orchids do not always flower or produce aboveground vegetation each year, making survey for these plants challenging.

Threats and Stresses

Puttyroot orchid is particularly sensitive to forest disturbance due in part to its dependence upon mycorrhizal fungi. Changes in microclimate, hydrology and soil characteristics can impact both the plants and their fungal associate. Loss of canopy would cause an increase in the light and could lead to

higher temperatures, lower moisture levels and decreased leaf litter deposition; conditions likely not favorable for puttyroot orchid.

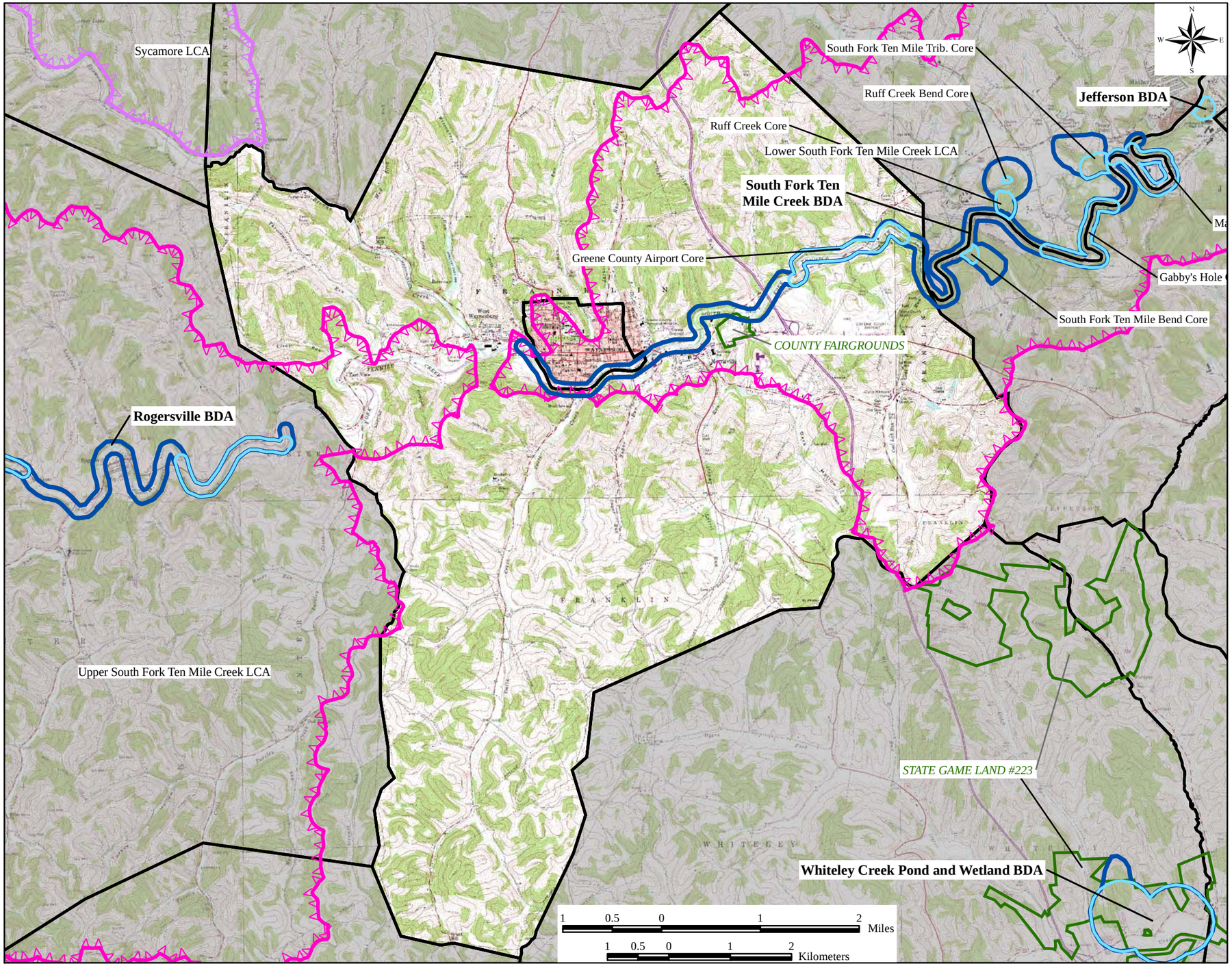
Recommendations

Informing the landowner of the presence and needs of the plants is crucial for protection. Planning before any proposed timber harvest or other activities could consider ways to avoid the plants and consider the microclimate within the BDA. Earth-moving activities that impact the plants or the fungi should be kept away from the plant population. This plant population and habitat would benefit from regular monitoring.

Franklin Township and Waynesburg Borough

	PNDI Rank		Legal Status		
	Global	State	Federal	State	Last Seen	Quality
NATURAL HERITAGE AREAS:						
Lower South Fork Ten Mile Creek LCA	*Exceptional Significance*					
South Fork Ten Mile Creek BDA	*Exceptional Significance*					
Pinnate-lobed Spleenwort (*Asplenium pinnatifidum*)	G4	S3	PR		
Harbinger-of-Spring (*Erigenia bulbosa*)	G5	S2	PT	2004	E
White Trout Lily (*Erythronium albidum*)	G5	S3	TU	2003	E
Rock Skullcap (*Scutellaria saxatilis*)	G3	S1	PE	2003	E
Crane Fly Orchid (*Tipularia discolor*)	G4G5	S3	PR	2002	D
Special Animal 1	G5	S2	PE	1993	E
Special Animal 2	G5	S2S3	PT	1993	E
Heron Rookery					
Upper South Fork Ten Mile Creek LCA	*Notable Significance*					
OTHER CONSERVATION AREAS:	*none identified*					
GEOLOGIC FEATURES:	*none identified*					

Franklin Township & Waynesburg Borough

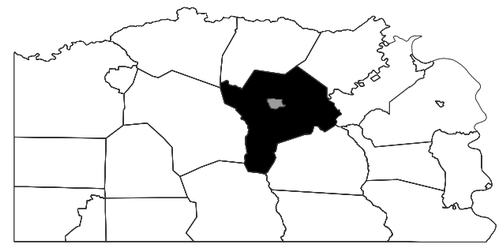


Greene County
Natural Heritage Inventory
Franklin Township
& Waynesburg Borough

Biological Diversity Areas:
South Fork Ten Mile Creek

Landscape Conservation Areas:
Lower South Fork Ten Mile Creek
Upper South Fork Ten Mile Creek

Managed Lands:
Greene County Fairgrounds



Legend

Important Bird Areas (IBA)
Managed Lands

Landscape Conservation Area (LCA)
LCA
Watershed LCA

Biological Diversity Area (BDA)
Core Habitat
Supporting Habitat

FRANKLIN TOWNSHIP

Franklin Township sits in the east central part of Greene County and surrounds the Borough of Waynesburg. South Fork Ten Mile Creek drains the northern parts of the township while tributaries to Whiteley Creek drain a small part of the southern section of the township. The township is about half forested (63%) with the remaining cover classified as agricultural (30%) and urban (6%). The percentage of urban cover is likely to increase with increasing development pressure from the Borough of Waynesburg. Franklin Township contains one Natural Heritage area, South Fork Ten Mile Creek BDA.

South Fork Ten Mile Creek BDA

South Fork Ten Mile Creek BDA is discussed under Jefferson Township (pg. 67).

WAYNESBURG BOROUGH

Waynesburg Borough is located in the center of Franklin Township. Waynesburg is drained by South Fork Ten Mile Creek. The Borough of Waynesburg is about 70% developed. There are two Natural Heritage Areas located in Waynesburg Borough, South Fork Ten Mile Creek BDA, and Upper South Fork Ten Mile Creek LCA (pg. 21).

South Fork Ten Mile Creek BDA

South Fork Ten Mile Creek BDA is discussed under Jefferson Township (pg. 67).

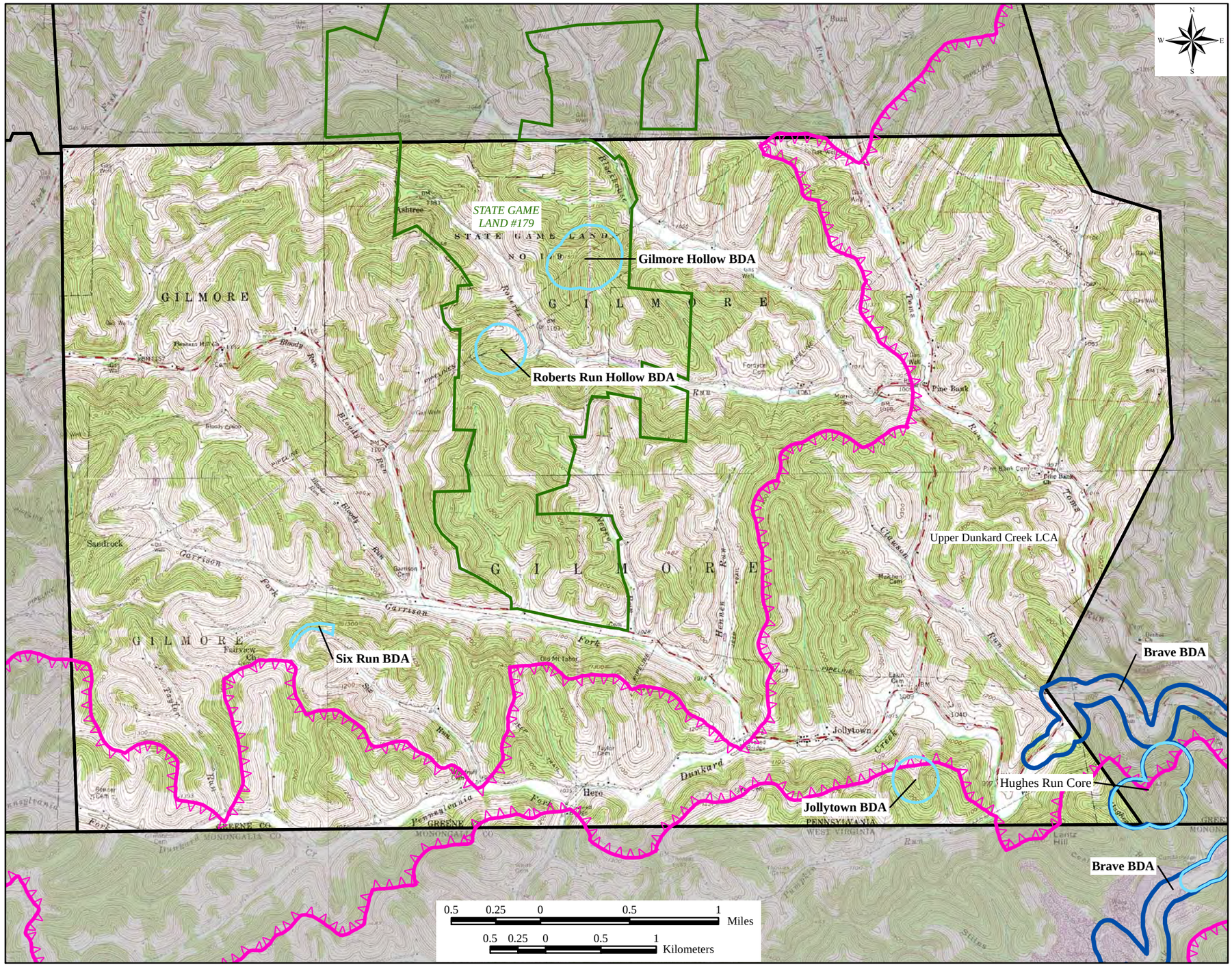
Gilmore Township

	PNDI Rank		Legal Status		
	Global	State	Federal	State	Last Seen	Quality
NATURAL HERITAGE AREAS:						
Brave BDA	*Exceptional Significance*				
Blue Mistflower (*Eupatorium coelestinum*)	G5	S3		TU	2004	E
Yellow Leafcup (*Polymnia uvedalia*)	G4G5	SR		PT	2004	E
Special Animal 1	G5	S2S3		PT	1993	E
Special Animal 2	G3	S1		PE	1993	E
Special Animal 3	G3	S1?		CU	1993	E
Upper Dunkard Creek LCA	*Exceptional Significance*				
Gilmore Hollow BDA	*Notable Significance*				
Yellow leaf-cup (*Polymnia uvedalia*)	G4G5	SR		PT	2004	E
Jollytown BDA	*Notable Significance*				
Yellow leaf-cup (*Polymnia uvedalia*)	G4G5	SR		PT	2004	E
Roberts Run Hollow BDA	*Notable Significance*				
Yellow leaf-cup (*Polymnia uvedalia*)	G4G5	SR		PT	2003	E
Six Run BDA	*Notable Significance*				
Small Woodland Sunflower (*Helianthus microcephalus*)	G5	S3		TU	2003	E

OTHER CONSERVATION AREAS: *none identified*

GEOLOGIC FEATURES: *none identified*

Gilmore Township



Greene County
Natural Heritage Inventory
Gilmore Township

Biological Diversity Areas:

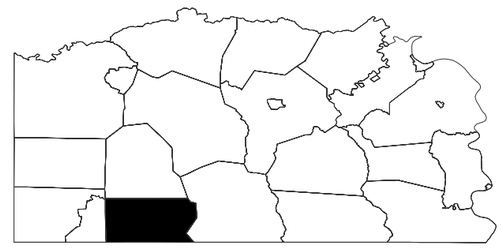
Brave
Gilmore Hollow
Jollytown
Roberts Run Hollow
Six Run

Landscape Conservation Areas:

Upper Dunkard Creek

Managed Lands:

State Game Land #179



Legend

Important Bird Areas (IBA)
Managed Lands

Landscape Conservation Area (LCA)

LCA
Watershed LCA

Biological Diversity Area (BDA)

Core Habitat
Supporting Habitat

GILMORE TOWNSHIP

Gilmore Township is located in south-central Greene County. The divide between Dunkard Creek, which flows to the Monongahela River and Fish Creek, which flows to the Ohio River, runs north to south through the western end of this township. Most of the township is wooded (79%) with the remainder in agriculture (20%). There are six Natural Heritage Areas located in Gilmore Township: Brave BDA, Upper Dunkard Creek LCA (pg. 21), Gilmore Hollow BDA, Jollytown BDA, Roberts Run Hollow BDA, and Six Run BDA.

Brave BDA

Brave BDA is discussed under Wayne Township (pg. 109).

Gilmore Township Hollow BDA

Several utility rights-of-way run through the hollow of small tributary to Roberts Run. Affiliated with the openings created by these rights-of-way is a Pennsylvania plant species of special concern; **yellow leafcup (*Polymnia uvedalia*)**. This species is often found on riverbanks, ravines and thickets where conditions are more open and soil exposed. In this case, the utility corridors are meeting some of its habitat requirements.

Threats and Stresses

Both of these habitats are artificially maintained and require the use of mechanical clearing and herbicides to keep them open. Although beneficial as methods to maintain open habitat, they can also negatively impact the plants if timed incorrectly and if applied directly to the plants.

Recommendations

Maintenance and protection of the plants here will require an awareness of the plants by both the Pennsylvania Game Commission and the utilities or contractors working on clearing the rights-of-ways. Although less than natural habitats, these open areas are important to this particular plant population and there may be opportunities to maintain this BDA as a location for this species. By considering the timing of mowing and cutting, the plants can be allowed to mature and go to seed; a positive for continued reproduction. Utility companies and maintenance contractors could consider cutting or discrete application of herbicide as an alternative to broad herbicide application within the core area where these plants are found.

Jollytown BDA

Jollytown BDA is located within a red oak-mixed hardwood forest on a ridge separating two small tributaries to Dunkard Creek. A gap in the canopy provides habitat for **yellow leafcup (*Polymnia uvedalia*)** by allowing increased light levels of light to penetrate to the ground layer vegetation. Other associated species include snowberry (*Symphoricarpos orbiculatus*), pagoda plant (*Blephilia hirsuta*) and multiflora rose (*Rosa multiflora*), an invasive exotic species.

The surrounding forest is a mature red oak-mixed hardwood forest dominated by white oak (*Quercus alba*) and red oak (*Quercus rubra*) with associates of tuliptree (*Liriodendron tulipifera*) and white ash (*Fraxinus americana*). Understory associates include spicebush (*Lindera benzoin*), yellow buckeye (*Aesculus flava*), eastern hop-hornbeam (*Ostrya virginiana*) and American hornbeam (*Carpinus caroliniana*).

Threats and Stresses

Yellow leafcup depends on natural openings, which in forested areas occur progressively as trees die or are blown down. Seeding and establishment of new populations may be the key to allowing these early successional plants to survive over time. If allowed to thrive and reproduce during the tenure of this gap in the forest, these plants may successfully seed to other open areas. However, multiflora rose is already present in this gap and may out-compete the population sooner than reestablishment of the forest canopy might.

Recommendations

Controlling the multiflora rose at this site would be a good first step in helping this population to survive at this location. Closure of the canopy is a natural process that may lead to the ultimate loss of this population, but unless the species across its range requires management, further management may not be warranted.

Roberts Run Hollow BDA

Roberts Run BDA features a small valley with a regenerating forest of saplings with sparsely scattered overstory trees. Species composing the overstory include red oak (*Quercus rubra*), American beech (*Fagus grandifolia*), black walnut (*Juglans nigra*), sugar maple (*Acer saccharum*) and tuliptree (*Liriodendron tulipifera*). The thick understory is made up of the canopy members plus American hop-hornbeam (*Carpinus caroliniana*), sassafras (*Sassafras albidum*), flowering dogwood (Cornus florida) and spicebush (*Lindera benzoin*). Common herbs include mayapple (*Podophyllum peltatum*), wing-stem (*Verbesina alternifolia*), black cohosh (*Cimicifuga racemosa*) and American grooveburr (*Agrimonia gryposepala*). The high light levels make this habitat favorable for a plant species of special concern; **yellow leafcup (*Polymnia uvedalia*)**. This species is often found on riverbanks, ravines, and thickets where conditions are more open and soil exposed.

Threats and Stresses

The whole valley of this tributary to Roberts Run has been cut at some point on the point in the recent past and is now regenerating. As for many of the sites for yellow leafcup in Greene County, the habitat for this plant was created or supplemented by human disturbance. In this instance with uniform regeneration, light levels will likely fall quickly and lead to the slow decline of this plant population. Additionally, multiflora rose (Rosa multiflora) is present and reproducing. As with other sites, it may lead to a premature shading of the yellow leafcup populations.

Recommendations

The recommendations here are the same as those in Jollytown BDA. Closure of the canopy at this site may have a much shorter timeline due to the amount of regeneration occurring.

Six Run BDA

Six Run BDA features roadside location of small woodland **sunflower (*Helianthus microcephalus*)**, a Pennsylvania plant species of special concern. This plant is often associated with dry, upland woods and rocky banks. Roadside occurrences are common and the circumneutral and high roadbanks of State Road 3008 is an acceptable habitat for this species.

Threats and Stresses

Maintenance of the road including mowing and spraying of herbicides are the most direct threats to this plant population. Excavation of the underlying substrate could cause the collapse of the roadbank resulting in the elimination of the habitat. Invasive species are always a problem on roadsides, and multiflora rose (*Rosa multiflora*) is certainly abundant in this area. Although an artificially created and maintained habitat, it is worth noting that this is an uncommon plant whose natural upland habitats have dwindled with conversion to other land uses. Protecting, to the extent possible, locations like this help to maintain the distribution and possibly genetics of the species.

Recommendations

The landowner, Gilmore Township, and the Pennsylvania Department of Transportation all have a stake in the survival of this population. Education about the presence of this element and work to establish management approaches to this area that could include mowing only in the spring and early fall would help with the protection of this plant population.

Figure 6. Small Woodland Sunflower (*Helianthus microcephalus*)

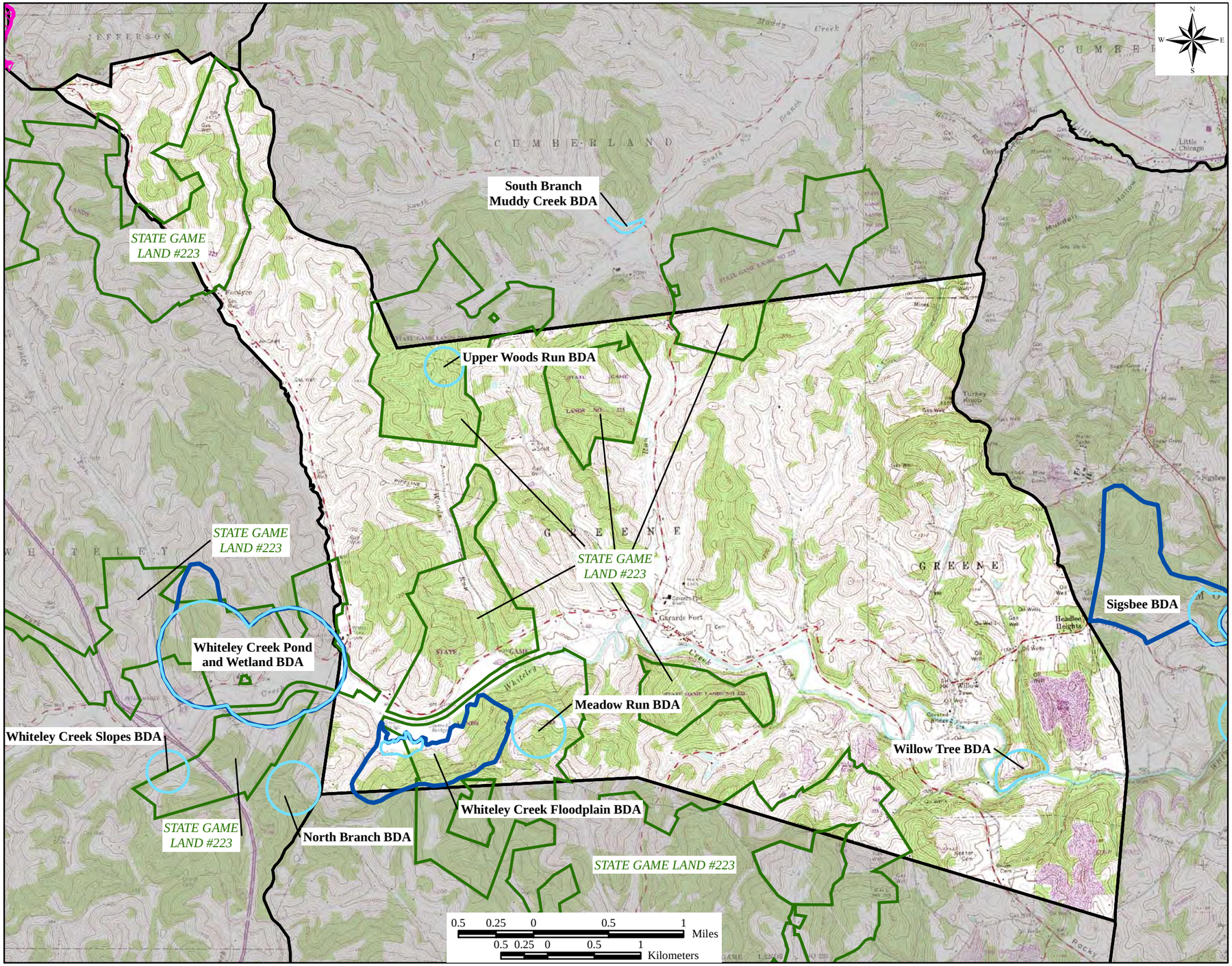
Greene Township

	PNDI Rank		Legal Status			
	Global	State	Federal	State	Last Seen	Quality
NATURAL HERITAGE AREAS:						
Meadow Run BDA		*Notable Significance*				
Small Woodland Sunflower (*Helianthus microcephalus*)	G5	S3		TU	2003	E
Upper Woods Run BDA		*Notable Significance*				
Passionflower (*Passiflora lutea*)	G5	S1		PE	2003	E
Whiteley Creek Floodplain BDA		*Notable Significance*				
Harbinger-of-spring (*Erigenia bulbosa*)	G5	S2		PT	2004	E
Whiteley Creek Pond and Wetland BDA		*Notable Significance*				
Special Animal 1	G5	S2S3			2003	E
Willow Tree BDA		*High Significance*				
Passionflower (*Passiflora lutea*)	G5	S1		PE	2003	E
Yellow leaf-cup (*Polymnia uvedalia*)	G4G5	SR		PT	2003	E

OTHER CONSERVATION AREAS: *none identified*

GEOLOGIC FEATURES: *none identified*

Greene Township



Greene County
Natural Heritage Inventory
Greene Township

Biological Diversity Areas:

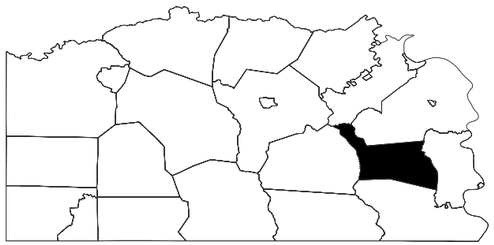
Meadow Run
Upper Woods Run
Whiteley Creek Floodplain
Whiteley Creek Pond and Wetland
Willow Tree

Landscape Conservation Areas:

None

Managed Lands:

State Game Land #223



Legend

Important Bird Areas (IBA)
Managed Lands

Landscape Conservation Area (LCA)

LCA
Watershed LCA

Biological Diversity Area (BDA)

Core Habitat
Supporting Habitat

GREENE TOWNSHIP

Greene Township is located in the eastern part of Greene County in the watershed of Whiteley Creek. The village of Garards Fort is the center of population in a township that is roughly 60% wooded and about 30% in agriculture. Parts of the township are covered by State Game Lands #223. There are five Natural Heritage Areas in Greene Township: Meadow Run BDA, Upper Woods Run BDA, Whiteley Creek Floodplain BDA, Whiteley Creek Pond and Wetland BDA, and Willow Tree BDA.

Meadow Run BDA

Meadow Run BDA includes a circumneutral, wooded, south-facing slope on which a Pennsylvania plant species of special concern; **small woodland sunflower (*Helianthus microcephalus*)**, is growing. This species is often found on riverbanks, ravines and thickets where conditions are more open and soil exposed. The more open situation in the woodland provides the necessary light levels needed by this species.

Threats and Stresses

This population of plants has few immediate threats. Upslope activities, removal of timber and exotic species are always issues when considering the set of species that, in Greene County, are keyed in on relatively open, wooded slopes.

Recommendations

Making the landowner aware of the presence of this plant species as well as follow-up monitoring of this population are the most useful and immediate recommendations for ensuring some degree of protection for this plant species.

Upper Woods Run BDA

Upper Woods Run BDA is the location of a Pennsylvania plant species of special concern; **passionflower (*Passiflora lutea*)**. The plants are growing in a disturbed red oak-mixed hardwood forest within State Game Lands #223 in the headwaters of Woods Run. This plant species is often associated with riverbanks and thickets in Pennsylvania; places where light levels are relatively high and competition from other plants is low. The more open conditions of the site provide reasonable habitat for this plant species. Canopy species in this middle aged to mature red oak-mixed hardwood forest include red oak (*Quercus rubra*), white oak (*Quercus alba*), red maple (*Acer rubrum*), American beech (*Fagus grandifolia*) and tuliptree (*Liriodendron tulipifera*). Understory associates are spicebush (*Lindera benzoin*), white ash (*Fraxinus americana*), flowering dogwood (*Cornus florida*) and redbud (*Cercis canadensis*). Common herbs include Christmas fern (*Polystichum acrostichoides*), naked tick-trefoil (*Desmodium nudiflorum*), garlic mustard (*Alliaria petiolata*) and jumpseed (*Polygonum virginianum*).

Threats and Stresses

A large infestation of multiflora rose (*Rosa multiflora*) exists near the plants of special concern and given the disturbed nature of the woods and the amount undergrowth in the forest this species may be out-competed, especially by multiflora rose. Given the small size of the population here and the deteriorating conditions, it is doubtful that this site will be viable for a long period of time.

Recommendations

Any management that can be accomplished within this BDA that would reduce the amount of multiflora rose and extend longevity of the more open conditions of this area would be useful. Although increasing shade from the overstory may lead to the decline of this species, timbering and other activities should carefully consider the implications to this population of concern.

Whiteley Creek Floodplain BDA

Whiteley Creek, unlike most streams in Greene County, has some fairly large and wide floodplains. Some of the largest are in Greene Township before the creek descends rapidly to join the Monongahela River. One section of floodplains within this reach of the creek provides habitat for a Pennsylvania plant species of special concern; **harbinger-of-spring (*Erigenia bulbosa*)**. This plant species typically grows on floodplain terraces and moist slopes, often in mature and undisturbed forested situations. In this BDA, a **sycamore (river birch) boxelder floodplain forest** dominated by sycamore (*Platanus occidentalis*), black cherry (*Prunus serotina*), red maple (*Acer rubrum*), sugar maple (*Acer saccharum*) and boxelder (*Acer negundo*) covers most of this floodplain. Canopy species plus yellow buckeye (*Aesculus flava*) make up the understory. Common herbs include Christmas fern (*Polystichum acrostichoides*), intermediate log fern (*Dryopteris intermedia*), common blue violet (*Viola sororia*) and wing stem (*Verbesina alternifolia*).

Threats and Stresses

Core Habitat Area: Maintaining intact forested conditions is important for the long-term viability of this species. Changes in microhabitat or hydrology could have negative impacts on this plant population. Also, invasive species could pose a threat. Large areas of multiflora rose (*Rosa multiflora*) are present in this floodplain and could cover the rest of the floodplain if their progress is not stopped. These aggressive invaders could outcompete the native species for light and nutrients, particularly native understory species like harbinger-of-spring.

Supporting Landscape: Alteration of Whiteley Creek's natural flooding regime may potentially impact the native plants found here and increase the area's vulnerability to invasion by exotic species. Likewise, logging or development activity in the mature forest surrounding this BDA may disrupt the support it provides to the core habitat area.

Recommendations

Core Habitat Area: Maintaining intact forest conditions and limited direct disturbances within the BDA would be important for successfully protecting this plant population. Invasive species need to be aggressively managed at this site in order to ensure the long-term viability of this population.

Supporting Landscape: New development in the land surrounding the core habitat area should minimize the creation of new fragmenting features and avoid altering the structure of the forested area supporting this BDA. Detailed recommendations for landscape-level management can be found in the Recommendations section (pg. 119).

Whiteley Pond and Wetland BDA

On a wide floodplain of Whiteley Creek is a created wetland that provides habitat for an animal species of special concern; **Special Animal 1**. This species depends on permanent water bodies in its larval stage and specific wetland habitat types during its adult stage. Nearby to the wetland lies a pond and associated headwater wetland. Both of these areas are within State Game Lands #223. The larger created wetland is dominated by wide-leaved cattail (*Typha latifolia*).

Threats and Stresses

Core Habitat Area: Although associated with an artificial wetland and body of water, the presence of this species may indicate that natural stream habitats in the vicinity are being utilized. Water quality and foraging habitat are therefore likely good. This animal travels up to 500 meters from appropriate habitat to forage and defend territory. A road between the wetland and the pond could be a hazard to the animals when crossing. Although I-79 is nearby, it is beyond the 500-meter area.

Supporting Landscape: Activities that alter the hydrology or add sediment to the pond or wetland, including maintenance or expansion, could be if issue to the quality of this BDA. Alteration of the landscape that drains into this pond and wetland can also potentially impact this species of concern.

Recommendations

Core Habitat Area: Informing municipal officials, the Pennsylvania Department of Transportation and the Game Commission would be a good first step in the protection of this site. Activities that directly impact, alter hydrology or add sediment could impact the water quality and therefore the species' habitat.

Supporting Landscape: Management of the landscape surrounding this wetland should aim to minimize disturbance and preserve the water quality of the BDA. Preservation of the forest blocks uphill from the site will likely benefit the wetland and the species of concern that lives there. Specific recommendations can be found in the Recommendations section (pg. 119).

Willow Tree BDA

Willow Tree BDA features a roadside and moist slope on which two plant species of special concern are found. **Yellow Leaf-cup (*Polymnia uvedalia*)** is growing at the bottom of a small drainage and **passionflower (*Passiflora lutea*)** grows further up the slope. The slope is covered by a thin, regenerating yellow oak-redbud woodland with black maple (*Acer nigrum*) and yellow oak (*Quercus muehlenbergii*) in the canopy. Hackberry (*Celtis occidentalis*) and redbud (*Cercis canadensis*) are present as understory trees. Common herbs include hairy pagoda plant (*Blephilia hirsuta*), ground ivy (*Glechoma hederacea*), white snakeroot (*Ageratina altissima*) and spring beauty (*Claytonia virginica*).

Threats and Stresses

Roadside maintenance if done at the wrong time or could eliminate the plants growing here. Exotic invasive species, especially multiflora rose (*Rosa multiflora*) and garlic mustard (*Alliaria petiolata*) and ground ivy (*Glechoma hederacea*) are an important threat to this site. These aggressive invaders could eventually outcompete the native species for nutrients and light. Due to the steepness of the slope, disturbances above the BDA could result in increased siltation and runoff which could negatively impact the plant population.

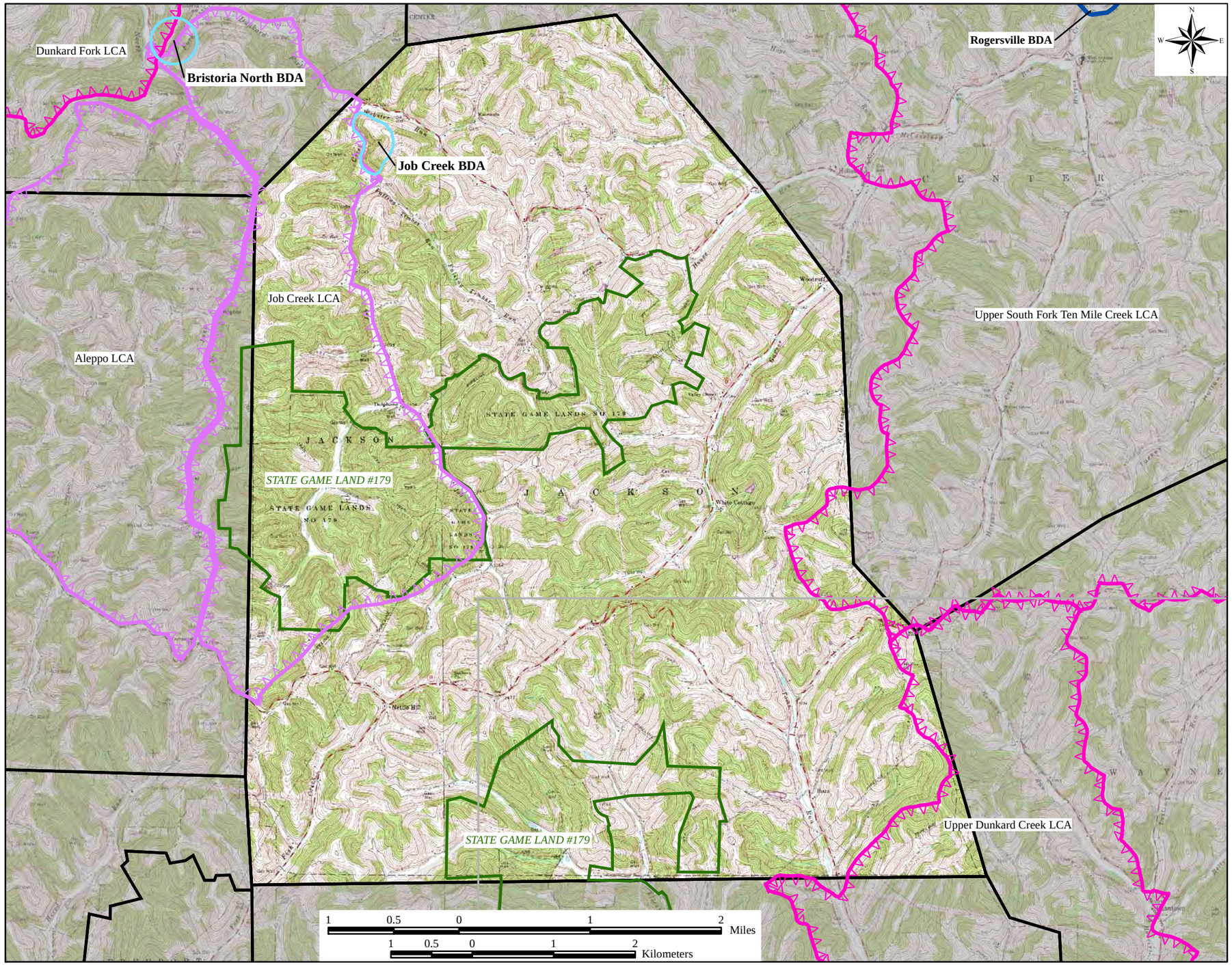
Recommendations

Municipal crews and the Pennsylvania Department of Transportation can be made aware of the location of the species of special concern. Roadside maintenance activities should take place in the spring and fall to allow the plants to flower and fruit. This site needs to be monitored for invasive species and any infestations controlled. Activities that cause increased siltation or runoff are not recommended here.

Jackson Township

	PNDI Rank		Legal Status			
	Global	State	Federal	State	Last Seen	Quality
NATURAL HERITAGE AREAS:						
Job Creek BDA	*Notable Significance*					
Nuttall's Hedge Nettle (*Stachys nuttallii*)	G5?	S1		PE	2003	E
Job Creek LCA	*County Significance*					
Upper Dunkard Creek LCA	*Exceptional Significance*					
Upper South Fork Ten Mile Creek LCA	*High Significance*					
OTHER CONSERVATION AREAS:	*none identified*					
GEOLOGIC FEATURES:	*none identified*					

Jackson Township

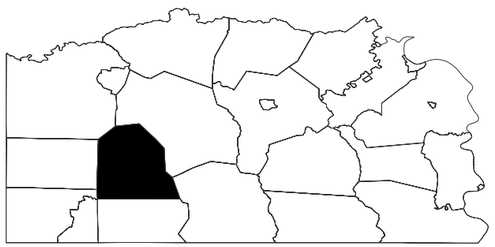


Greene County
Natural Heritage Inventory
Jackson Township

Biological Diversity Areas:
Job Creek

Landscape Conservation Areas:
Job Creek
Upper Dunkard Creek
Upper South Fork Ten Mile Creek

Managed Lands:
State Game Land #179



Legend

Important Bird Areas (IBA)
Managed Lands

Landscape Conservation Area (LCA)
LCA
Watershed LCA

Biological Diversity Area (BDA)
Core Habitat
Supporting Habitat

JACKSON TOWNSHIP

Jackson Township occupies the west central Greene County. South Fork Ten Mile Creek originates here and State Game Lands #179 are located in the center of the township. About 81% of the township is forested and the rest (19%) is pastureland. There are four Natural Heritage Areas in Jackson Township: Job Creek BDA, Job Creek LCA (pg. 18), Upper Dunkard Creek LCA (pg. 21), Upper South Fork Ten Mile Creek LCA (pg. 21).

Job Creek BDA

Job Creek BDA centers on a roadside occurrence of **Nuttall's hedge nettle (*Stachys nuttallii*)** between Webster Run and Falling Timber Run on Job Creek. This site can best be described as a rich roadside habitat having a high diversity of plant species with a partial canopy. The canopy includes sugar maple (*Acer saccharum*), boxelder (*Acer negundo*), American beech (*Fagus grandifolia*) and white oak (*Quercus alba*). Understory species include witch-hazel (*Hamamelis virginiana*), basswood (*Tilia americana*), flowering dogwood (*Cornus florida*) and Eastern hop-hornbeam (*Ostrya virginiana*). Common herbs include orange-spotted jewelweed (*Impatiens capensis*), Canadian clearweed (*Pilea pumila*), mullein (*Verbascum thapsus*), garlic mustard (*Alliaria petiolata*) and white wood aster (*Eurybia divaricata*). Nuttall's hedge nettle is a member of the mint family that grows in a variety of habitats including wooded slopes and openings. The conditions here at the roadside edge offer high light levels as well as mesic habitat.

Threats and Stresses

Given that the population exists within the right-of-way of a road, herbicide spraying, mowing and road maintenance pose the greatest threats to the Nuttall's hedge nettle.

Recommendations

Informing municipal crews in Jackson Township of the presence of this rare plant species would be an important step in providing some protection to this plant population. Direct application of herbicide could lead to permanent loss or severe impacts to this population and should be avoided with the BDA and mowing favored as an alternative. Mowing should ideally be timed to occur after the plants have flowered and the seeds have matured and dispersed, in order to ensure a viable seed bank for maintenance or expansion of the population.

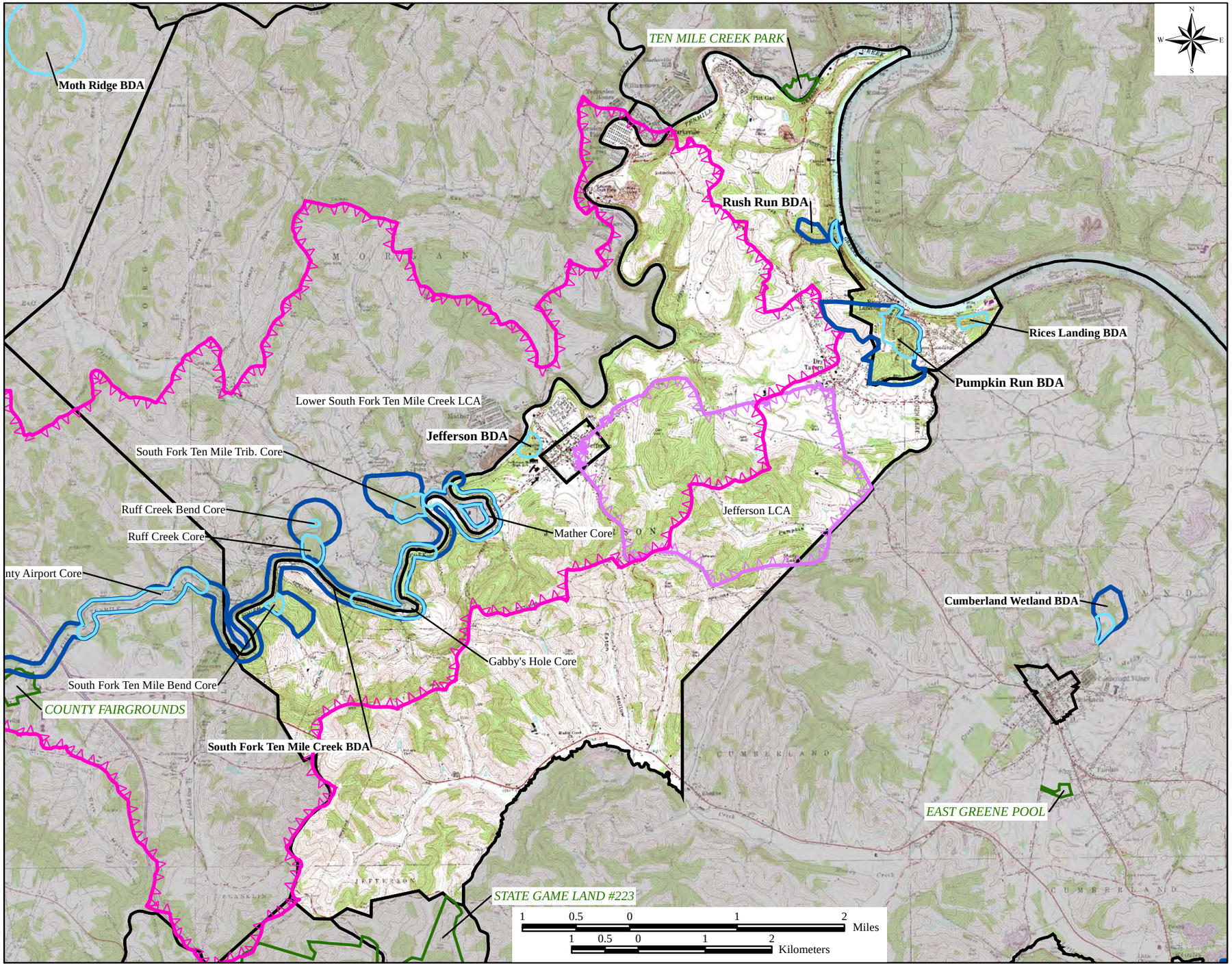
Jefferson Township, Jefferson Borough, and Rices Landing Borough

	PNDI Rank		Legal Status		
	Global	State	Federal	State	Last Seen	Quality
NATURAL HERITAGE AREAS:						
Jefferson BDA	*Notable Significance*				
Broad Leaved Spleenwort (*Asplenium pinnatifidum*)	G4	S3		PR	?	?
Jefferson LCA	*County Significance*				
Lower South Fork Ten Mile Creek LCA	*Exceptional Significance*				
Pumpkin Run BDA	*Exceptional Significance*				
Harbinger-of-spring (*Erigenia bulbosa*)	G5	S2		PT	2004	E
Small woodland sunflower (*Helianthus microcephalus*)	G5	S3		TU	2004	E
Passionflower (*Passiflora lutea*)	G5	S1		PE	2003	E
Yellow oak-redbud woodland	G?	S2			2005	E
Rices Landing BDA	*Notable Significance*				
Harbinger-of-Spring (*Erigenia bulbosa*)	G5	S2		PT	2004	E
Rush Run BDA	*High Significance*				
Small Woodland Sunflower (*Helianthus microcephalus*)	G5	S3		TU	2004	E
Snow Trillium (*Trillium nivale*)	G4	S3		PR	2004	E
Yellow Oak-Redbud Woodland	G?	S2			2004	E
South Fork Ten Mile Creek BDA	*Exceptional Significance*				
Broad Leaved Spleenwort (*Asplenium pinnatifidum*)	G4	S3		PR	1996	E
Harbinger-of-Spring (*Erigenia bulbosa*)	G5	S2		PT	2004	E
White Trout Lily (*Erythronium albidum*)	G5	S3		TU	2003	E
Rock Skullcap (*Scutellaria saxatilis*)	G3	S1		PE	2003	E
Crane Fly Orchid (*Tipularia discolor*)	G4G5	S3		PR	2001	E
Special Animal 1	G5	S2		PE	1993	E
Special Animal 2	G5	S2S3		PT	1993	E
Heron Rookery						

OTHER CONSERVATION AREAS: *none identified*

GEOLOGIC FEATURES: *none identified*

Jefferson Township, Jefferson Borough, & Rices Landing Borough



Greene County
Natural Heritage Inventory
Jefferson Township, Jefferson Borough, & Rices Landing Borough

Biological Diversity Areas:

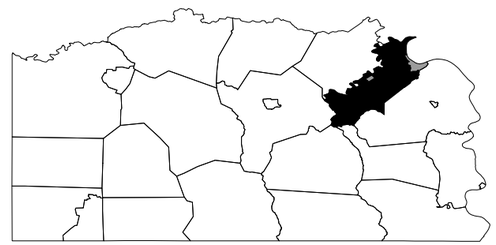
- Jefferson
- Pumpkin Run
- Rices Landing
- Rush Run
- South Fork Ten Mile Creek

Landscape Conservation Areas:

- Jefferson
- Lower South Fork Ten Mile Creek

Managed Lands:

None



Legend

- Important Bird Areas (IBA)
- Managed Lands

Landscape Conservation Area (LCA)

- LCA
- Watershed LCA

Biological Diversity Area (BDA)

- Core Habitat
- Supporting Habitat

BOROUGH OF JEFFERSON

The Borough of Jefferson sits on a hill just south of South Fork of Ten Mile Creek in the northeastern part of Greene County and is surrounded by Jefferson Township. While the Borough is mostly developed, it is still forested in sections. There is one Natural Heritage Area located in Jefferson Borough, Jefferson LCA (pg. 17).

JEFFERSON TOWNSHIP

Jefferson Township is located in the northeastern part of Greene County. It is bordered on the north by South Fork of Ten Mile Creek and to the south by Muddy Creek. About 60% of Jefferson Township is forested and 35% is in agriculture. There are seven Natural Heritage Areas located in Jefferson Township: Jefferson BDA, Jefferson LCA (pg. 17), Lower South Fork Ten Mile Creek LCA (pg. 18), Pumpkin Run BDA, Rices Landing BDA, Rush Run BDA, and South Fork Ten Mile Creek BDA.

Jefferson BDA

Jefferson BDA is located to the north of the Borough of Jefferson and is the location of several sandstone outcrops within the South Fork of Ten Mile Creek Valley. The crevices within these outcrops collect soil and moisture and can provide substrate for plants to establish. A plant species of special concern; **broad-leaved spleenwort (*Asplenium pinnatifidum*)** grows on these outcrops. This plant is typically found growing in these shaded, rocky habitats using the rocks themselves for substrate.

Threats and Stresses

The biggest threat to this occurrence is direct disturbance to the outcrops and loss of habitat. Increased light levels caused by loss of the canopy could lead changes in microclimate and negatively impact this plant population.

Recommendations

Maintaining shaded, forested conditions and minimizing activities directly associated with the rock outcrops within the core area would be a management strategy that should allow these plants to exist and reproduce into the future.

Rush Run BDA

Rush Run BDA focuses on the small valley of Rush Run, a direct tributary to the Monongahela River. This forested valley features shaded slopes with circumneutral soil and a limestone ridge that includes Benwood Limestone strata in its geological profile. The high amount of limestone makes this place favorable for a natural community, **yellow oak-redbud woodland** and provides habitat for two plant species of special concern**; snow trillium (*Trillium nivale*)** and **small woodland sunflower (*Helianthus microcephalus*)**. All of these plants are keyed into the higher pH soil produced by the limestone. Typical canopy associates here include yellow oak (*Quercus muehlenbergii*), white oak (*Quercus alba*), red oak (*Quercus rubra*), black locust (*Robinia pseudoacacia*) and black cherry (*Prunus serotina*). The understory is very similar to that in the Upper Rush Run Core.

Figure 7. Limestone ridge and yellow oak-redbud woodland at Rush Run

Threats and Stresses

Core Habitat Area: The steepness of the site makes it unfavorable for many activities, particularly development. Some invasive species such garlic mustard (*Alliaria petiolata*) and multiflora rose (*Rosa multiflora*) may colonize in time but they are not currently nearby. Given the steepness of the site and the proximity to the Greene River Trail, excessive visitation may harm the plants and cause additional erosion of the habitat.

Supporting Landscape: Disturbance of the land uphill from these limestone ridge areas and fragmentation of the forest which surrounds this BDA are probably the most significant threats to the species found here. For instance, spills related to automotive accidents on the road that runs above Rush Run (as of motor oil, gasoline, or even chemicals being transported by truck) may flow into the stream and impact the floodplain landscape connected to the BDA.

Recommendations

Core Habitat Area: The rare plants growing here need to be monitored with consideration given to invasive species. These slopes would furnish an excellent opportunity to provide interpretive signage

about the natural features of the valley for the Greene River Trail users. Care in placement and information provided would need to be exercised to avoid encouraging visitation to the steep slopes.

Supporting Landscape: Management of the landscape surrounding this BDA should avoid further fragmentation of the forest and monitor for the establishment of invasive exotic plants. Specific concerns and recommendations are discussed in the Recommendations section (pg. 119).

South Fork Ten Mile Creek BDA

South Fork Ten Mile Creek BDA is centered on a stretch of South Fork Ten Mile Creek, which supports a number of rare plant and animal species. This BDA also contains a variety of habitats, including riffle and run communities, shaded rich slopes, and sycamore-dominated floodplain forests. There are seven core areas in the BDA: Gabby's Hole, Greene County Airport, Mather, Ruff Creek, Ruff Creek Bend, South Fork Ten Mile Creek Bend, and South Fork Ten Mile Creek Tributary. The cores areas are described below.

Gabby's Hole Core

Gabbys Hole is the local name for a popular swimming hole on South Fork Ten Mile Creek and a tributary forms a gravel bar in the creek near the "hole". The slopes upstream on the tributary are the location of a Pennsylvania plant species of special concern; **rock skullcap (*Scutellaria saxatilis*)**. This species is considered to be globally as well as state rare and is one of the rarer plants currently known to be in the county. Ideal habitat for this species is a shaded forest community with rich soils. The plants here are growing in an area that was timbered some years ago and is regenerating with sugar maple (*Acer saccharum*), boxelder (*Acer negundo*), white pine (*Pinus strobus*), and black cherry (*Prunus serotina*) in the canopy and spicebush (*Lindera benzoin*), pawpaw (*Asimina triloba*), and witch-hazel (*Hamamelis virginiana*) in the understory.

Greene County Airport Core

South Fork Ten Mile Creek flows to the north of the Greene County Airport and is the subject of this core area. The rich floodplain of the creek provides habitat for a plant species of special concern; **Crane Fly Orchid (*Tipularia discolor*)**. The riffles of the stream are the location of an animal species of special concern; **Special Animal 1**. Crane-fly orchid requires rich shaded floodplain forests and the animal requires good water quality and specific in-stream habitat.

Mather Core

Upstream of Mather, a number of sand and gravel bars sit within South Fork Ten Mile Creek. Riffles and runs within these sections of stream supply the habitat for two animal species of special concern; **Special Animal 1** and **Special Animal 2**, both of which require clean water streams.

Ruff Creek Core

Ruff Creek is a large tributary to South Fork Ten Mile Creek and drains the north-central part of Greene County. Ruff Creek runs through the center of this BDA and a significant swath of forested floodplain. This floodplain supplies habitat for a special concern plant species; **harbinger-of-spring (*Erigenia bulbosa*)**. Harbinger-of-spring typically grows on floodplain terraces and moist slopes, often in mature and undisturbed forested situations.

Several natural communities are present in this area. A **sycamore (river birch) boxelder floodplain forest** composed predominately of sycamore (*Platanus occidentalis*), boxelder (*Acer negundo*), and black maple (*Acer nigrum*); and an understory of spicebush (*Lindera benzoin*) and witch-hazel (*Hamamelis virginiana*) covers the floodplain.

Upstream of the confluence of Ruff Creek and South Fork Ten Mile Creek, Ruff Creek makes another large bend forming a higher, drier peninsula than the one described above. A red oak-mixed hardwood forest covers this peninsula and is dominated by red oak (*Quercus rubra*), American beech (*Fagus grandifolia*), white oak (*Quercus alba*), tuliptree (*Liriodendron tulipifera*), and hemlock (*Tsuga canadensis*). Witch-hazel (*Hamamelis virginiana*), flowering dogwood (*Cornus florida*) and pawpaw (*Asimina triloba*) dominate the understory.

Downstream of this bend, Ruff Creek exposes strata of limestone and limy shale. On the soils that have formed under the influence of these strata, a mixture of sugar maple-basswood and red oak-mixed hardwood forest grows. Canopy species include sugar maple (*Acer saccharum*), red oak (*Quercus rubra*), slippery elm (*Ulmus rubra*), and white ash (*Fraxinus americana*). The understory is more expressive of the higher pH soils with associates of red bud (*Cercis canadensis*), bladdernut (*Staphylea trifoliata*) and yellow oak (*Quercus muehlenbergii*).

Figure 8. Mouth of Ruff Creek at South Fork Ten Mile Creek

Ruff Creek Bend Core

Upstream of the confluence of South Fork Ten Mile Creek and Ruff Creek, Ruff Creek makes a sharp bend to the south and then to the west. The floodplain forest found in Ruff Creek Bend core supplies habitat for **great blue heron (*Ardea herodias*)**, an animal species of special concern. Large sycamores within this forest are key in providing nesting habitat and the location is pivotal for the minimal disturbance needed by this species.

South Fork Ten Mile Creek Bend Core

In this core area, a stretch of South Fork Ten Mile Creek features a shallow area of rocky bottom and riffles which support an animal species of special concern; **Special Animal 1**. Water willow (*Justicia americana*) grows in the rocky substrate. This animal requires the fast flowing rocky areas with clean water in order to survive.

Figure 9. Aquatic habitat at South Fork Ten Mile Creek

South Fork Ten Mile Creek Tributary Core

This core focuses on the floodplain of a small tributary to South Fork Ten Mile Creek. The rich, humic soils and mature red oak-mixed hardwood forest provides habitat for a plant species of special concern; **white trout lily (*Erythronium americanum*)**. Canopy dominants here include red maple (*Acer rubrum*), red oak (*Quercus rubra*), white oak (*Quercus alba*) and sugar maple (*Acer saccharum*). Eastern hop-hornbeam (*Ostrya virginiana*) and spicebush (*Lindera benzoin*) make up the understory. Common herbs and associates of the species of special concern include Pennsylvania violet (*Viola pennsylvanica*), wild ginger (*Asarum canadense*), blue phlox (*Phlox divaricata*), Christmas fern (*Polystichum acrostichoides*) and Virginia bluebells (*Mertensia virginica*).

Threats and Stresses

Core Habitat Area: All of the plant species living in this BDA are sensitive to increased light that would result from loss of the canopy. Direct disturbances such as earth-moving would likely eliminate the populations. Invasive species such as multiflora rose (*Rosa multiflora*), garlic mustard (*Alliaria petiolata*) threaten all of the plants, and fig buttercup (*Ranunculus ficaria*) poses a threat to the early-blooming plants such as harbinger-of-spring because it competes for space at the same time of the year.

The relatively quiet and isolated area where the animal species of concern breed has remained unchanged for sometime, allowing this population to remain viable. However, these animals are sensitive to disturbance, including casual visitation, which occurs within a few hundred meters from their locations. Any activities that occur frequently or continuously within the core stand to impact the animals. Removal of trees, living or dead, could remove valuable habitat essential to these animals.

Supporting Landscape: All of the special animals living in the South Fork Ten Mile Creek Bend and Mather Cores require shallow areas with appropriate substrate and high quality water in which to live. Input of nutrients from agricultural runoff, sewage treatment plants, and urban runoff pose a negative threat to the animals living here. A large portion of the stream frontage in this BDA is lined by dirt roads, which may contribute sediments and chemicals such as herbicides, petrochemical products like tar and asphalt, and salt in the winter. Sedimentation can be one of the biggest concerns for these animals.

Recommendations

Core Habitat Area: For the plant species in the BDA, activities that result in increased light levels are not recommended for any of the core areas in the BDA. Controlling invasive species in the core areas and more broadly throughout the BDA can help the viability of the natural communities and the special concern species that exist here.

Given the presence of the animal species of special concern within this BDA, current levels of activity and disturbance are likely compatible with their needs. Assuring that landowners within the corridor are aware of the natural history and needs of the animals would confer added protection.

Supporting Landscape: Working with landowners to establish sufficient riparian zones around farms and buffer zones along roads would help limit the impact of sediment to the creek and its tributaries. Landowners should be encouraged to use best management practices (BMPs) and increase riparian buffers to help lower the impacts of storm events washing large amounts of nutrients into the stream. Stream bank fencing should be used to actively discourage cattle from crossing the streams. Management recommendations are discussed in greater detail in the Recommendations section (pg. 119).

RICE'S LANDING BOROUGH

The Borough of Rice's Landing is located in the eastern part of the county on the Monongahela River and includes the lower watershed of Pumpkin Run. Pumpkin Run, a prominent tributary to the Monongahela River in Rice Landing Borough is the location of park in the borough and a BDA. There are two Natural Heritage Areas located in Rice's Landing Borough.

Pumpkin Run BDA

Pumpkin Run cuts a deep valley on its way to the river. The lower part of the run is the location of a borough park which represents a large section of the BDA. Within the park are three Pennsylvania plant species of special concern and one natural community; **passionflower (*Passiflora lutea*)**, small **woodland sunflower (*Helianthus microcephalus*)**, **harbinger-of-spring (*Erigenia bulbosa*)** and a **yellow oak-redbud woodland**. This area along with South Fork Ten Mile Creek BDA contains the greatest known number of rare species and unique habitats in Greene County. The limestone strata that underlie this area help to create the mineral-rich soil conditions that promote the formation of interesting natural communities, often with unique and rare species as associates. Three distinct natural communities are located here; a red oak-mixed hardwood forest, a sycamore (river birch) box elder floodplain forest and a yellow oak-redbud woodland.

The red oak-mixed hardwood forest covers the east facing slopes in the lower sections of the run and most of the upper sections of the valley. Canopy dominants in this forest include red oak (*Quercus rubra*), black cherry (*Prunus serotina*), shagbark hickory (*Carya ovata*), eastern hemlock (*Tsuga canadensis*) and black maple (*Acer nigrum*). Understory associates include spicebush (*Lindera benzoin*), shingle oak (*Quercus imbricaria*) and white ash (*Fraxinus americana*). Common herbs include wing stem (*Verbesina alternifolia*), deer tongue grass (*Dichanthelium clandestinum*), Christmas fern (*Polystichum acrostichoides*), nut sedge (*Cyperus strigosus*) and white snakeroot (*Eupatorium rugosum*).

The sycamore (river birch) boxelder floodplain forest is primarily located in the upper riparian sections of the run. Dominant species in this forest are black maple (*Acer nigrum*), shagbark hickory (*Carya ovata*), sycamore (*Platanus occidentalis*) and box elder (*Acer negundo*). Understory species are a combination of those present in all of the communities along the run plus black walnut (*Juglans nigra*), American hornbeam (*Carpinus caroliniana*) and slippery elm (*Ulmus rubra*). A diversity of herbaceous species cover the forest floor and include green-head coneflower (*Rudbeckia laciniata*), blue cohosh (*Caulophyllum thalictrioides*), plantain leaf sedge (*Carex plantaginea*), wood nettle (*Laportea canadensis*), hispid greenbrier (*Smilax hispida*) and intermediate log fern (*Dryopteris intermedia*).

The yellow oak-redbud woodland sections are fairly open and dry, occupying primarily the west facing slopes in the lower sections of the run. Three of the plant species of special concern; passionflower, small woodland sunflower and American gromwell are supported by this community. Canopy dominants include yellow oak (*Quercus muehlenbergii*), white oak (*Quercus alba*) and red oak (*Quercus rubra*). The understory is thick and populated by shrubs such as pawpaw (*Asimina triloba*), redbud (*Cercis canadensis*), bladdernut (*Staphylea trifoliata*) and others. Herbs in this community include American gromwell (*Lithospermum latifolium*), passionflower (*Passiflora lutea*) and small woodland sunflower (*Helianthus microcephalus*), as well as green violet (*Hybanthus concolor*), wild coffee (*Triosteum aurianticum*), round-leaf groundsel (*Senecio obovatus*), whorled rosinweed (*Silphium trifoliatum*) and brown wide-lip orchid (*Liparis lilifolia*).

Threats and Stresses

Core Habitat Area: Most of the Pumpkin Run area is managed by Rice's Landing Borough as a park – the management of the land includes mowing and general lawn care. Some of the special concern species are located within the mowing zone, but mowing at the right times may actually help these species. However, if mowing occurs at the wrong time, i.e. during flowering or fruiting, it may negatively impact the species living here. Sediments washing down from activities above could impact the plants growing on the slopes. Invasive species could negatively impact the viability of the natural community and shade out and out-compete the plant species.

Supporting Landscape: As development from nearby Dry Tavern and Rice's Landing approach the edges of the forested areas supporting this BDA, fragmentation becomes a larger issue. Fertilizer and pesticide runoff from residential lawns and exotic species introduced from domestic landscaping are also potential threats to the species found here.

Recommendations

Core Habitat Area: Informing the park maintenance personnel of Rice's Landing Borough of the presence of the species here would be a good first step in the protection of these species and viability of the natural community. Working with the borough on mowing schedules may help the viability of the plant populations and increase their presence. Invasive species need to be monitored and any infestations need to be controlled.

Supporting Landscape: Community education about the impacts of over-fertilizing, pesticides, and the availability of native species for landscaping applications has potential to greatly benefit this BDA and the landscape surrounding it. Management recommendations are discussed in detail above, in the Recommendations section (pg. 119).

Rice's Landing BDA

This BDA is located on the bench of a slope overlooking the Monongahela River in the Borough of Rice's Landing. Rice's Landing Road runs just below the bench. Most of the forest areas fronting the Monongahela River have been disturbed by the high amount of industrial activity in the valley. This site is no different and many invasive species and grapevines (*Vitis* spp.) are present. In spite of the disturbance this site still has rich mesic soil and supports a plant species of special concern; **harbinger-of-spring (*Erigenia bulbosa*)**. Harbinger of spring is often found on rich floodplains and moist woods.

Threats and Stresses

This plant population is threatened in particular, by competition from invasive or, in this case, aggressive native grape species. Multiflora rose (*Rosa multiflora*) and grape (*Vitis* spp.) are already pervasive at the site. Road maintenance such as widening or grading may negatively impact the plants if the roadbank is destabilized.

Recommendations

Informing and educating the maintenance workers from the Borough of Rice's Landing and the landowner about the plants would help in the conservation and protection of the plants. Any invasive species directly impacting the plants should be removed and preferably invasive species should be

controlled within the entire core area. Road maintenance sensitive to the location of the plants and their requirements would benefit the populations of the special concern species growing here.

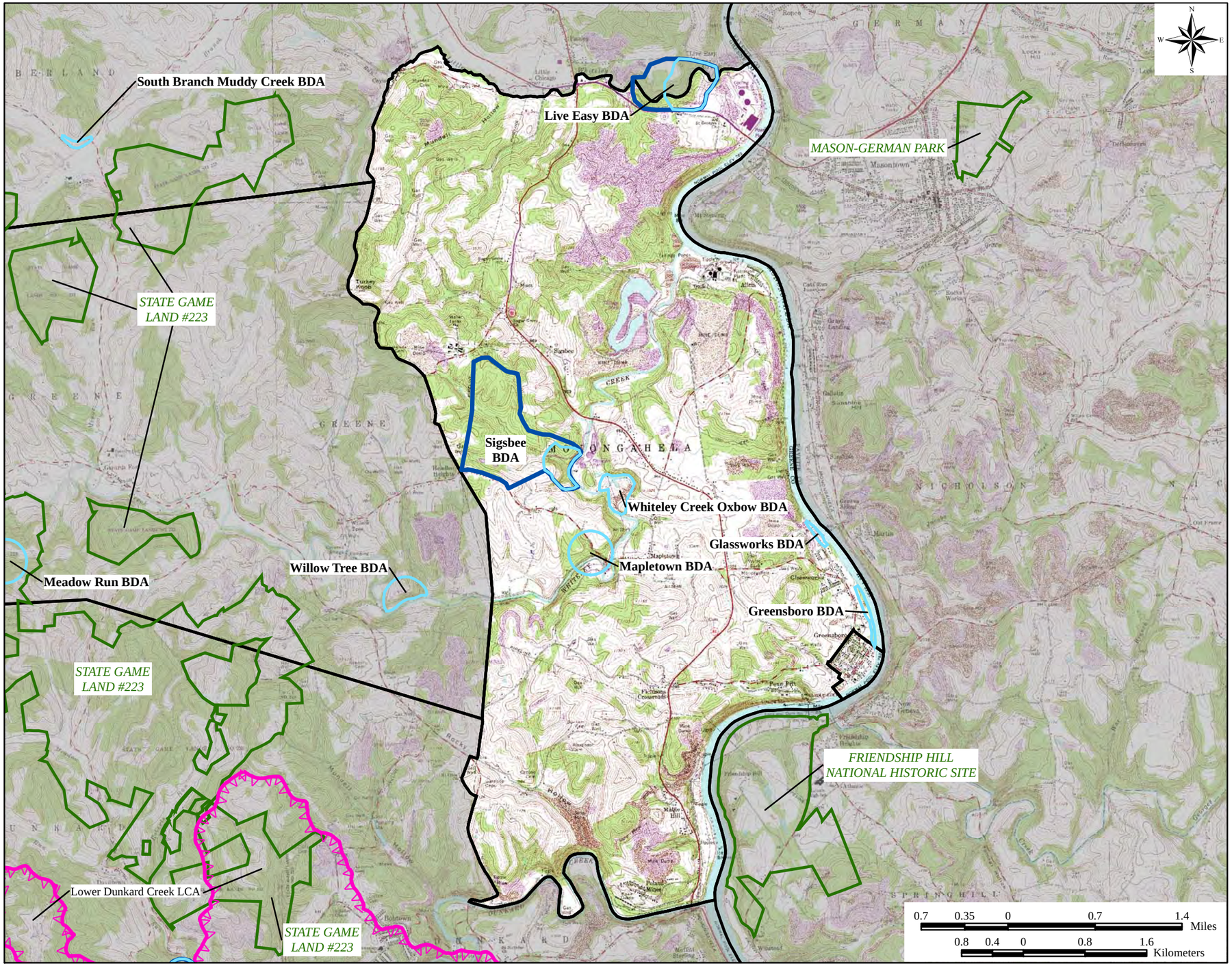
Monongahela Township and Greensboro Borough

	PNDI Rank		Legal Status		
	Global	State	Federal	State	Last Seen	Quality
NATURAL HERITAGE AREAS:						
Glassworks BDA	*Notable Significance*				
Blue Mistflower (*Eupatorium coelestinum*)	G5	S3		TU	2003	E
Greensboro BDA	*Notable Significance*				
River oats (*Chasmanthium latifolium*)	G5	S1		PE	2003	E
Live Easy BDA	*Notable Significance*				
Harbinger-of-Spring (*Erigenia bulbosa*)	G5	S2		PT	2003	E
Mapletown BDA	*High Significance*				
Passionflower (*Passiflora lutea*)	G5	S1		PE	2003	E
Crane Fly Orchid (*Tipularia discolor*)	G4G5	S3		PR	2004	E
Harbinger-of-Spring (*Erigenia bulbosa*)	G5	S2		PT	2003	E
Sigsbee BDA	*High Significance*				
Small Woodland Sunflower (*Helianthus microcephalus*)	G5	S3		TU	2003	E
October Ladies Tresses (*Spiranthes ovalis*)	G5	S1		PE	2003	E
Nuttall's Hedge Nettle (*Stachys nuttallii*)	G5?	S1		PE	2003	E
Yellow Oak-redbud woodland	G?	S2			2004	E
Whiteley Creek Oxbow BDA	*Notable Significance*				
Blue Mistflower (*Eupatorium coelestinum*)	G5	S3		PR	2003	E

OTHER CONSERVATION AREAS: *none identified*

GEOLOGIC FEATURES: *none identified*

Monongahela Township & Greensboro Borough



Greene County
Natural Heritage Inventory
Monongahela Township & Greensboro Borough

Biological Diversity Areas:

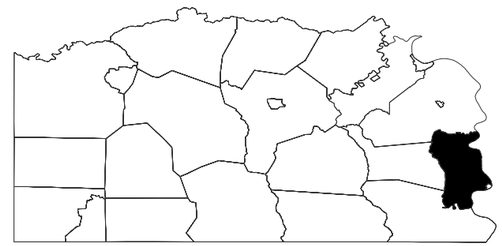
Glassworks
Greensboro
Live Easy
Mapletown
Sigsbee
Whiteley Creek Oxbow

Landscape Conservation Areas:

None

Managed Lands:

None



Legend

Important Bird Areas (IBA)
Managed Lands

Landscape Conservation Area (LCA)

LCA
Watershed LCA

Biological Diversity Area (BDA)

Core Habitat
Supporting Habitat

MONONGAHELA TOWNSHIP

Monongahela Township is located in the east central part of Greene County and is bordered on the east side by the Monongahela River. Most of the township, about 60%, is forested, and 30% is agricultural. Six percent of the township has been strip-mined and numerous old industrial complexes are located along the river. There are six Natural Heritage Areas within Monongahela Township: Glassworks BDA, Greensboro BDA, Live Easy BDA, Mapletown BDA, Sigsbee BDA, and Whiteley Creek Oxbow BDA.

Glassworks BDA

This site is located on a site that once hosted a coal processing plant and most of the floodplain has been heavily disturbed. In spite of the disturbance, one species of special concern; **blue mistflower (*Eupatorium coelestinum*)**, grows on the sandy bank of the river near some old coal tipples. The associated species on the river shore include pale woodland sunflower (*Helianthus strumosus*), white snakeroot (*Ageratina altissima*), beggar's tick (*Bidens frondosa*) and wing stem (*Verbesina alternifolia*). This species is often found on river and streambanks and roadsides in Pennsylvania.

Threats and Stresses

The greatest threat to this site is the potential colonization of invasive exotic species. Japanese knotweed (*Polygonum cuspidatum*) is a particular threat in the floodplains of the Monongahela River. This species is present upstream at the confluence of the Monongahela and Cheat Rivers at Point Marion, but has not yet reached a critical mass on the Greene County side of the river. This species is especially a threat because of the disturbance present along the river. In the coming years this species may become more and more a threat as it moves downstream. Erosion or changes to the structure of the riverbank could also impact the blue mistflower population.

Recommendations

The owner of the property needs to be informed of the presence and be on the watch for Japanese knotweed in the area. Any infestations need to be dealt with quickly in order to preserve the habitat for the species of special concern but also of the remaining floodplain habitat. If at all possible, the floodplains should be allowed to revert back to their original condition. Any activities that directly disturb the riverbank need to consider the impact to this species.

Greensboro Floodplain BDA

Greensboro Floodplain BDA is on the shore of the Monongahela River and includes Greensboro borough park. A Pennsylvania plant species of concern; **river oats (*Chasmanthium latifolium*)** grows on a narrow levee along this section of the river. River oats are commonly found in open places where there is occasional flooding and scouring, often on sandy substrate. In this section is a silver maple forest dominated by box elder (*Acer negundo*), silver maple (*Acer saccharinum*) and black locust (*Robinia pseudoacacia*). The understory is thick with spicebush (*Lindera benzoin*), witch-hazel (*Hamamelis virginiana*), and pawpaw (*Asimina triloba*). Common herbaceous species are rice-cut grass (*Leersia virginica*), wing stem (*Verbesina alternifolia*), white thoroughwort (*Eupatorium rugosum*), greenbrier (*Smilax rotundifolia*) and deer tongue grass (*Dichanthelium clandestinum*).

Threats and Stresses

The small size and large edge of the floodplain forest and associated habitat poses an issue to the viability of the natural community. Invasive species, most particularly Japanese knotweed (*Polygonum cuspidatum*) are an ever present problem for these small, relatively intact floodplains. Because the Monongahela River is part of the lock-and-dam system, the natural flooding regime is altered and seasonal flooding is less predictable or regular.

Recommendations

Increasing the width of the wooded sections between the town park and the river would help establish shaded, canopy conditions that are less appropriate for Japanese knotweed and other invasives. Avoiding this section of the river shore with any activities that would directly impact the natural community existing here would benefit the effort to control invasives as well as maintain an example of this community type in this part of the river.

Live Easy BDA

Little Whiteley Creek is the focus of Live Easy BDA and creates habitat for a plant species of special concern; **Harbinger-of-spring (*Erigenia bulbosa*)**. The slopes of the valley are covered by red maple (*Acer rubrum*), white oak (*Quercus alba*), American beech (*Fagus grandifolia*), tulip tree (*Liriodendron tulipifera*) and black oak (*Quercus velutina*). The floodplain has similar composition with the addition of sycamore (*Platanus occidentalis*). The understory is dominated by yellow buckeye (*Aesculus flava*) and spicebush (*Lindera benzoin*). The herbaceous layer is composed of spring beauty (*Claytonia virginica*), Christmas fern (*Polystichum acrostichoides*), intermediate log fern (*Dryopteris intermedia*), wild ginger (*Asarum canadense*) and garlic mustard (*Alliaria petiolata*). Of particular note here is the presence of fig buttercup (*Ranunculus ficaria*), an aggressive, exotic plant that can form dense cover, especially in the early spring when, harbinger-of-spring is up and flowering.

Threats and Stresses

Core Habitat Area: This site lies within a very disturbed context. The forested areas are small and fragmented. Invasive species and further disturbance are continuing issues on the site.

Supporting Landscape: The land surrounding this BDA includes significant areas of strip mining and, downhill from the BDA, a major power plant. Strip mining will have dramatically damaged the ecological value of this landscape, isolating the Live Easy BDA and reducing its ecological stability. Heavily disturbed areas like strip mines may also provide habitat for source populations of invasive plants.

Recommendations

Core Habitat Area: Although fragmentation of this BDA is not likely to decrease, it may be possible to protect current habitat and expand forested areas to the extent possible. Control of fig buttercup is probably the most critical short-term need. As for many of these wooded, rich slopes where limestone associated species grow, maintaining the integrity of the slope and the structure of the forest may be the best management to steer toward. Making the landowner aware of the plants of concern and habitat types will be important in tracking and protecting these species.

Supporting Landscape: Remediation and restoration of the strip-mined areas surrounding this BDA could greatly help to improve its long-term prospects. Specific management recommendations are discussed above in the Recommendations section (pg. 119).

Mapletown BDA

Mapletown BDA includes a slope and floodplain fronting Whiteley Creek just west of the village of Mapletown. Within the BDA, Whiteley Creek cuts a steep, south-facing slope. This young forested slope is the location of a species of special concern; **passionflower (*Passiflora lutea*)**. The floodplain adjacent to the slope is the location of two rare plant species, **crane fly orchid (*Tipularia discolor*)** and **harbinger-of-spring (*Erigenia bulbosa*)**. Two roads cut parallel across the slope and broadly define the extent of the forest community.

This young forest could best be described as a sugar maple-basswood forest with black maple (*Acer nigrum*) dominating instead of sugar maple (*Acer saccharum*). This forest also has some elements of a mixed mesophytic forest, including the presence of yellow buckeye (*Aesculus flava*). Other canopy species include black cherry (*Prunus serotina*), shagbark hickory (*Carya ovata*), tuliptree (*Liriodendron tulipifera*) and yellow oak (*Quercus muehlenbergii*). Common understory species include spicebush (*Lindera benzoin*), flowering dogwood (*Cornus florida*) and bitternut hickory (*Carya cordiformis*). Common herbs include smooth rockcress (*Arabis laevigata*), yellow jewelweed (*Impatiens pallida*), beggar's tick (*Bidens frondosa*), moonseed (*Menispermum canadense*) and white wood aster (*Eurybia divaricata*).

This floodplain forest is typical of those along Whiteley Creek and is best classified as a **sycamore (river birch) boxelder floodplain forest**. Canopy species include sycamore (*Platanus occidentalis*), red maple (*Acer rubrum*), white ash (*Fraxinus americana*) and yellow buckeye (*Aesculus flava*). Spicebush (*Lindera benzoin*) is the predominant shrub in the floodplain. Herbs include garlic mustard (*Alliaria petiolata*), waterleaf (*Hydrophyllum* spp.), golden ragwort (*Senecio aureus*) and ground ivy (*Glechoma hederacea*).

Threats and Stresses

Invasive species are definitely an important factor at this site with garlic mustard (*Alliaria petiolata*), ground ivy and multiflora rose (*Rosa multiflora*) already established. A trash dump at the top of the slope is sending debris down the slope and the dumping itself and future clean up could potentially affect the plants growing here.

Recommendations

Invasive species need to be controlled at this site and the woods need to be allowed to mature with a larger canopy. Remedying the trash problem and exercising care in the clean up will be of benefit to the site and hopefully to the plants of concern.

Sigsbee BDA

This BDA features a dry limestone slope and a wooded ravine that provide habitat for three plant species of special concern; **small woodland sunflower (*Helianthus microcephalus*)**, **October ladies tresses (*Spiranthes ovalis*)** and **Nuttall's hedge nettle (*Stachys nuttallii*)**. Both the sunflower and the ladies

tresses are growing in a **yellow oak-redbud woodland** composed of yellow oak (*Quercus muehlenbergii*) in the canopy and an understory of eastern hop-hornbeam (*Ostrya virginiana*), redbud (*Cercis canadensis*), buckeye (*Aesculus flava*) and bladdernut (*Staphylea trifoliata*).

The Nuttall's hedge nettle is growing in the wooded ravine with a canopy of sycamore (*Platanus occidentalis*), red maple (*Acer rubrum*) and American beech (*Fagus grandifolia*). Understory associates include sugar maple (*Acer saccharum*), eastern hop-hornbeam (*Ostrya virginiana*), bladdernut (*Staphylea trifoliata*) and black cherry (*Prunus serotina*).

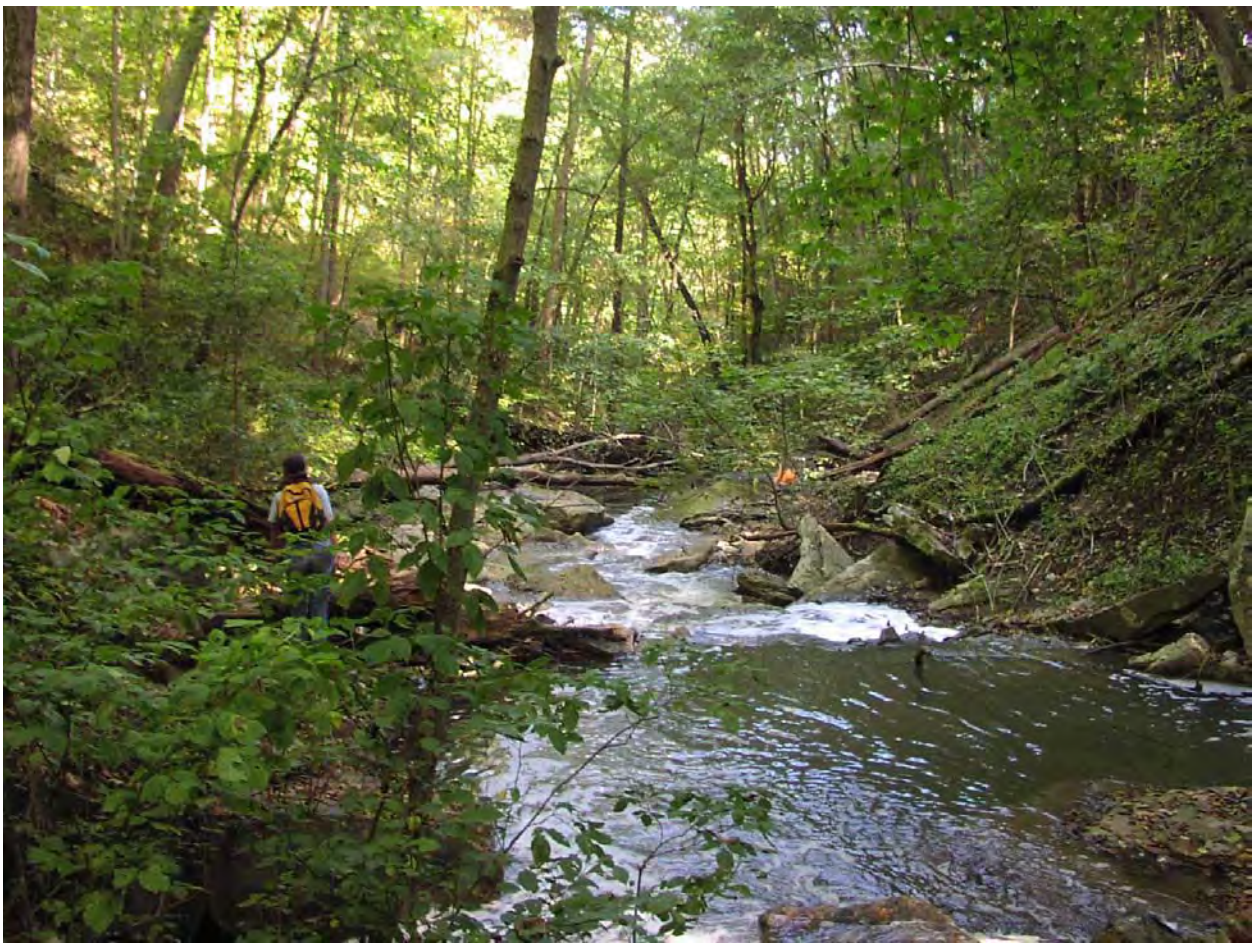


Figure 10. Tributary to Whiteley Creek

Threats and Stresses

Core Habitat Area: The core habitat of this BDA is small and bisected by a road. It may also be impacted by discharges from the filtration plant located across Whiteley Creek. Its small size and proximity to cleared areas makes it vulnerable to the establishment of exotic plant species.

Supporting Landscape: The habitat of interest within this BDA is relatively small and confined by a number of intensive land uses including a filtration plant and some strip mines. The area of limestone

influence is also small and the adjacent disturbance makes this area vulnerable to invasion by exotic invasive species.

Recommendations

Core Habitat Area: Working with the landowner to monitor the plants of special concern would be a good step in their protection. Activities that would directly disturb the area within the BDA or significantly change the microhabitat, hydrology or light levels should consider the needs of the plant species of concern.

Supporting Landscape: Expanding the area currently in forest and restoring sections of the surrounding landscape that are no longer in active use would help to limit encroachment of invasive species and maintain the quality of the existing habitat. Specific recommendations are discussed in detail below, in the Recommendations section (pg. 119).

Whiteley Creek Oxbow BDA

In wetland areas created by depressions in strip mine spoils around an old oxbow of Whiteley Creek grows a plant species of special concern; **blue mistflower (*Eupatorium coelestinum*)**. This plant is often found in open areas such as riverbanks, roadsides and disturbed places. The population here is fairly small with about dozen plants. The area is now open woodland with a canopy of boxelder (*Acer negundo*) and sycamore (*Platanus occidentalis*). Multiflora rose (*Rosa multiflora*) dominates the shrub layer and horsetail (*Equisetum arvense*), white snakeroot (*Ageratina altissima*) and colt's foot (*Tussilago farfara*) are found in the herb layer.

Threats and Stresses

Given the amount of disturbance at this site and the affinity of the plants to this site, it is hard to identify definitive stresses. Loss of open, wet habitat due to changes in the stream, establishment of a full overstory or rampant growth of invasive species like multiflora rose (*Rosa multiflora*) stands to be the greatest immediate threat to this plant population. As in many places in Greene County, well-established populations of multiflora rose nearby could expand into the open, wet habitat, especially during drier periods.

Recommendations

This area is an example of one of many highly altered areas that furnish habitat for a rare (in Pennsylvania) plant species. The longevity of the plant population of concern or the habitat in general is unknown. Though species is considered globally secure, it is ranked vulnerable in the state, so the population is worth some attention. The mistflower population would ideally be monitored and habitat changes noted. Making the landowner aware of the plants would be a good first step in providing some protection to this small population.

BOROUGH OF GREENSBORO

The Borough of Greensboro lies on the Monongahela River and was once a thriving port and glass-making center. There is one Natural Heritage Area located in the Borough of Greensboro.

Greensboro Floodplain BDA

Greensboro Floodplain BDA is discussed under Monongahela Township (pg. 75).

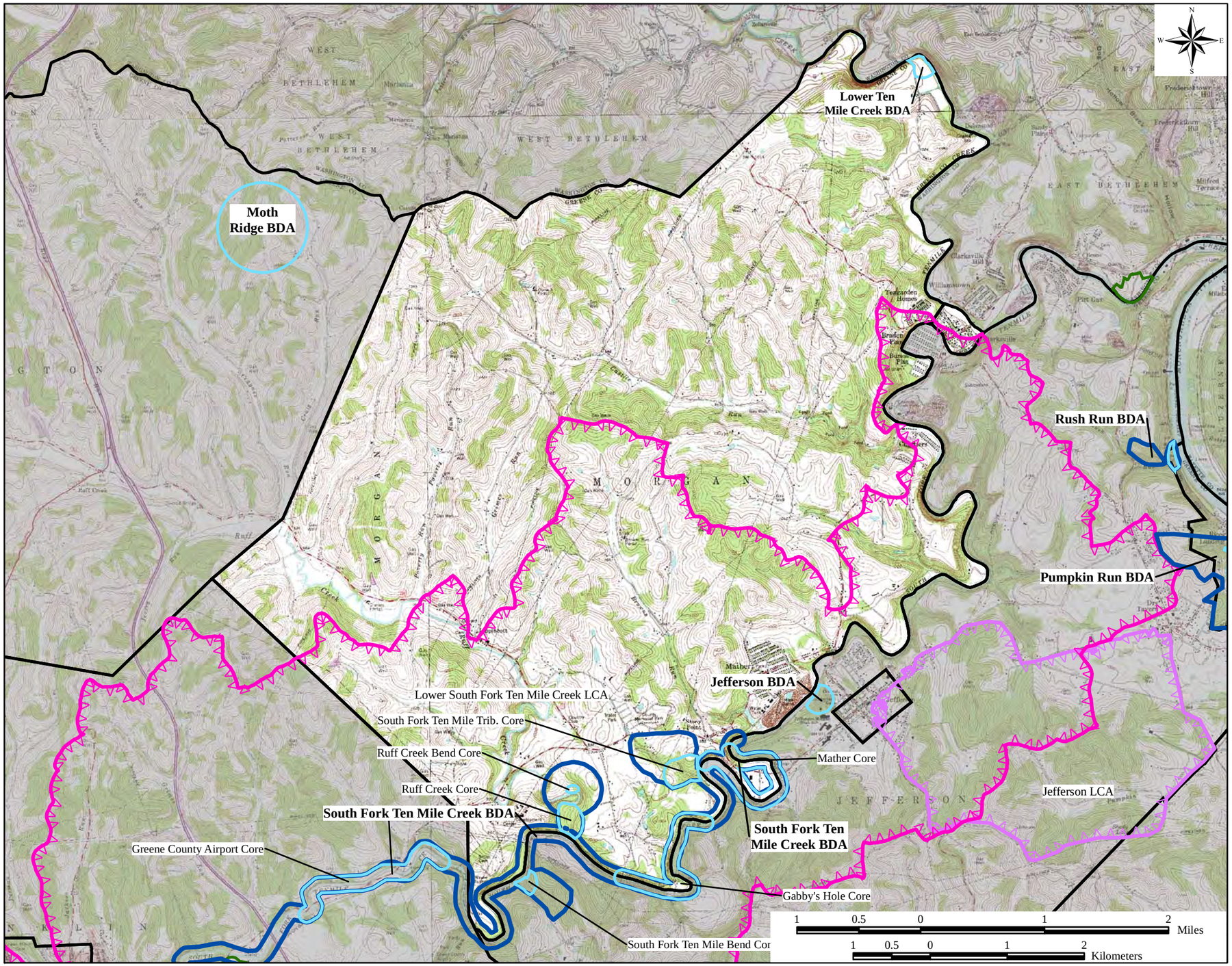
Morgan Township and Clarksville Borough

	PNDI Rank		Legal Status			
	Global	State	Federal	State	Last Seen	Quality
NATURAL HERITAGE AREAS:						
Lower South Fork Ten Mile Creek LCA		*Exceptional Significance*				
Lower Ten Mile Creek BDA		*High Significance*				
Harbinger-of-Spring (*Erigenia bulbosa*)	G5	S2		PT	2004	E
South Fork Ten Mile Creek BDA		*Exceptional Significance*				
Pinnate-lobed Spleenwort (*Asplenium pinnatifidum*)	G4	S3		PR	1996	E
Harbinger-of-Spring (*Erigenia bulbosa*)	G5	S2		PT	2004	E
White Trout Lily (*Erythronium albidum*)	G5	S3		TU	2003	E
Rock Skullcap (*Scutellaria saxatilis*)	G3	S1		PE	2003	E
Crane Fly Orchid (*Tipularia discolor*)	G4G5	S3		PR	2001	E
Special Animal 1	G5	S2		PE	1993	E
Special Animal 2	G5	S2S3		PT	1993	E
Heron Rookery						

OTHER CONSERVATION AREAS: *none identified*

GEOLOGIC FEATURES: *none identified*

Morgan Township & Clarksville Borough

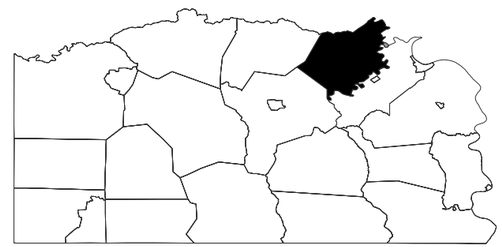


Greene County
Natural Heritage Inventory
Morgan Township
& Clarksville Borough

Biological Diversity Areas:
Lower Ten Mile Creek
South Fork Ten Mile Creek

Landscape Conservation Areas:
Lower South Fork Ten Mile Creek

Managed Lands:
None



Legend

- Important Bird Areas (IBA)
- Managed Lands

Landscape Conservation Area (LCA)
- LCA
- Watershed LCA

Biological Diversity Area (BDA)
- Core Habitat
- Supporting Habitat

BOROUGH OF CLARKSVILLE

The Borough of Clarksville is located at the confluence of Ten Mile and South Fork Ten Mile Creeks in northeastern Greene County. About half of the borough is developed and the rest is either forest or open land. There are no Natural Heritage Areas located in the Borough of Clarksville.

MORGAN TOWNSHIP

Morgan Township lies on the northeastern corner of Greene County. South Fork Ten Mile Creek receives a large tributary, Ruff Creek, in this township. The township is roughly half forestland (56%) and half pastureland (42%). There are three Natural Heritage Areas located in Morgan Township: Lower South Fork Ten Mile Creek LCA (pg. 18), Lower Ten Mile Creek BDA, and South Fork Ten Mile Creek BDA.

Lower Ten Mile Creek Valley BDA

Lower Ten Mile Creek BDA lies on a floodplain of Ten Mile Creek, where a plant species of special concern, **harbinger-of-spring (*Erigenia bulbosa*),** is found. This BDA is located just upstream of the confluence of Ten Mile Creek with its southern fork and shortly after its confluence with the Monongahela River. This BDA composed of north facing slopes with some wide floodplains. The slopes are the location of a tulip tree-beech-maple forest with tendencies towards a red oak-mixed hardwood forest. Dominant species in the canopy include American beech (*Fagus grandifolia*), chestnut oak (*Quercus prinus*), black cherry (*Prunus serotina*), shagbark hickory (*Carya ovata*), sugar maple (*Acer saccharum*), and sycamore (*Platanus occidentalis*). The understory has spicebush (*Lindera benzoin*) and American yew (*Taxus canadensis*). This was one of the few places in Greene County where yew was seen. Herbs include trout lily (*Erythronium americanum*), waterleaf (*Hydrophyllum virginianum*), smooth rock cress (*Arabis laevigata*), wing stem (*Verbesina alternifolia*) and round-leaf groundsel (*Packera obovata*).

Figure 11. Ten Mile Creek Floodplain, where Harbinger-of-Spring (*Erigenia bulbosa*) is located

Threats and Stresses

Most of the floodplains on the Greene County side have narrow, wooded buffer strips or none at all as at this site. The lack of buffers makes this area vulnerable to aggressive exotic species such as Japanese knotweed (*Polygonum cuspidatum*) and multiflora rose (*Rosa multiflora*). Pesticide use on the right-of-way present at the west end of the BDA could harm the natural communities here.

Recommendations

Wooded buffers of the stream and the tops of the slopes should be enhanced. Infestations of invasive species should be removed when noticed to protect the integrity of the natural community occurring on the slope.

South Fork Ten Mile Creek BDA

South Fork Ten Mile Creek BDA is discussed in Jefferson Township.

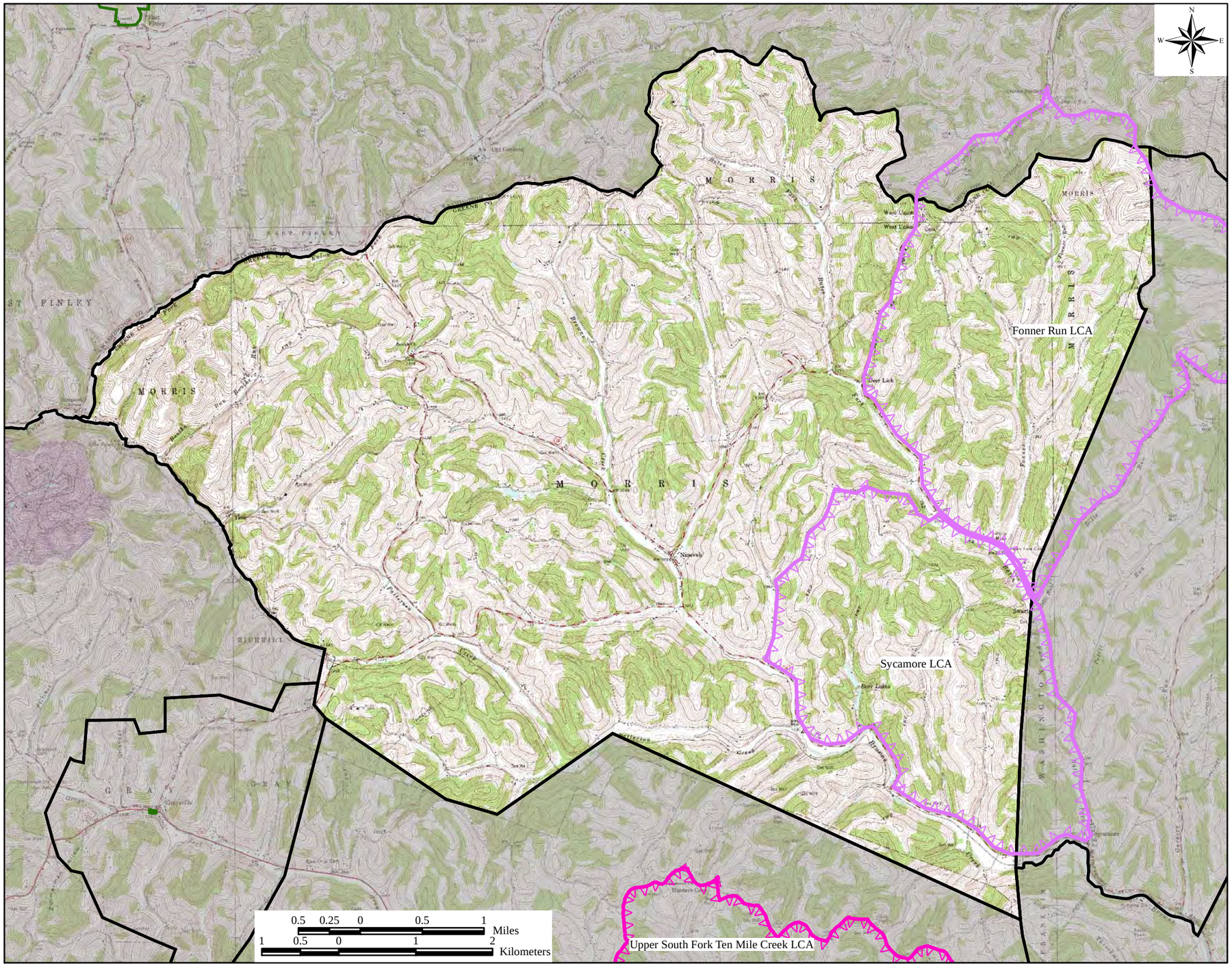
Morris Township

	PNDI Rank		Legal Status			
	Global	State	Federal	State	Last Seen	Quality
NATURAL HERITAGE AREAS:						
Fonner Run LCA			*County Significance*			
Sycamore LCA			*County Significance*			

OTHER CONSERVATION AREAS: *none identified*

GEOLOGIC FEATURES: *none identified*

Morris Township

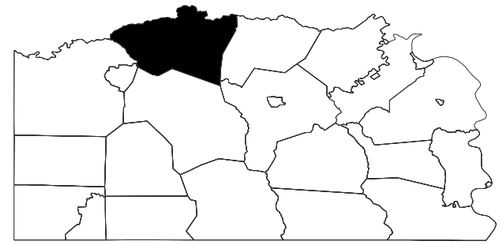


Greene County
Natural Heritage Inventory
Morris Township

Biological Diversity Areas:
None

Landscape Conservation Areas:
Fonner Run
Sycamore

Managed Lands:
None



Legend

Important Bird Areas (IBA)
Managed Lands

Landscape Conservation Area (LCA)
LCA
Watershed LCA

Biological Diversity Area (BDA)
Core Habitat
Supporting Habitat

MORRIS TOWNSHIP

Morris Township is located in the northern part of Greene County. It is located at the divide between those streams that drain towards Wheeling Creek, Enlow Fork, and those that drain to the Monongahela River. Morris Township is 64% forested and 35% agriculture. There are two Natural Heritage Areas located in Morris Township, both LCAs: Fonner Run LCA (pg. 17) and Sycamore LCA (pg. 20).

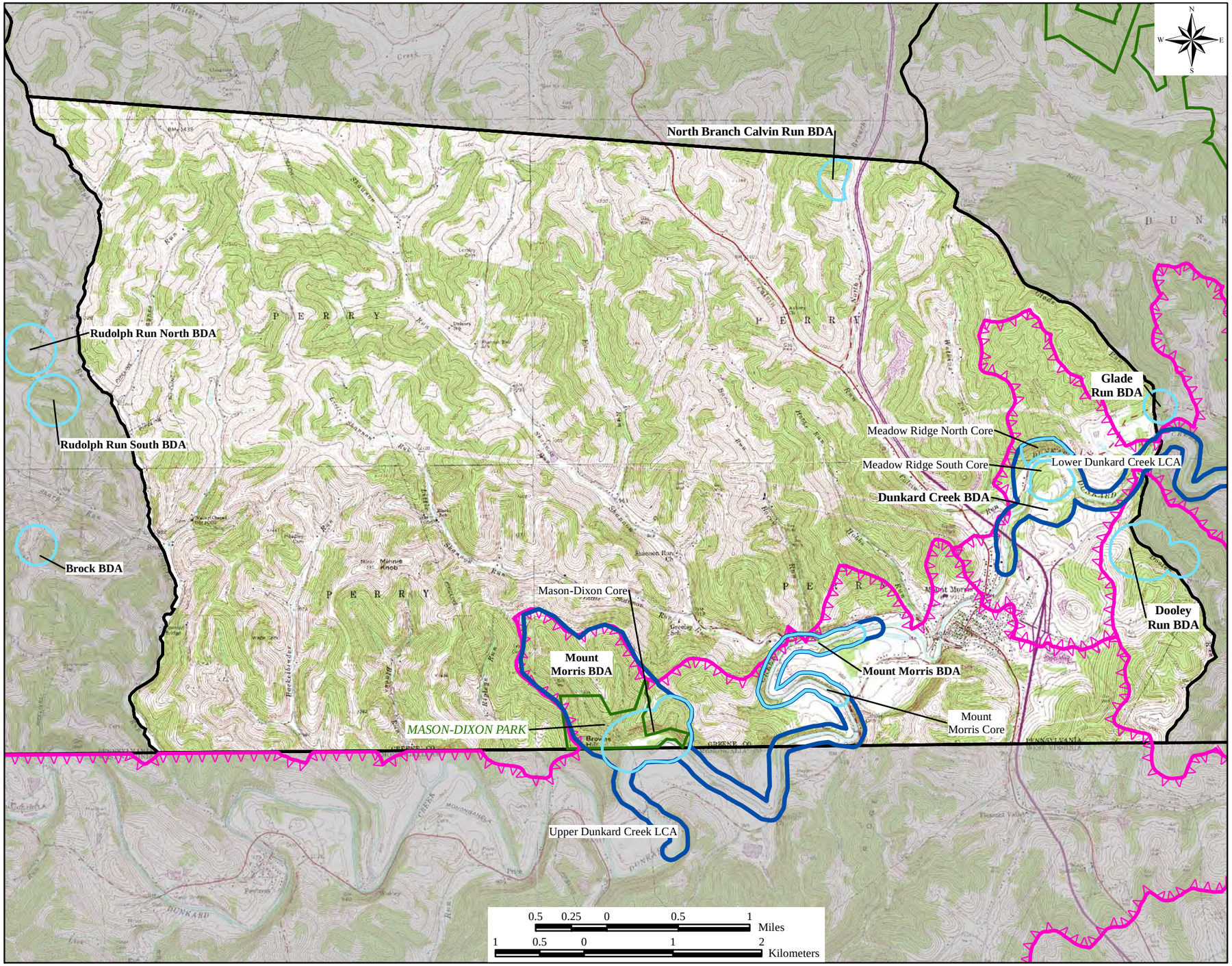
Perry Township

	PNDI Rank		Legal Status		
	Global	State	Federal	State	Last Seen	Quality
NATURAL HERITAGE AREAS:						
Dooley Run BDA	*Notable Significance*					
Sourwood (*Oxydendrum arboreum*)	G5	S1		PT	2004	E
Dunkard Creek BDA	*Exceptional Significance*					
Solitary Pussytoes (*Antennaria solitaria*)	G5	S1		PE	2004	E
Crested Dwarf Iris (*Iris cristata*)	G5	S1		PE	2004	E
Sourwood (*Oxydendrum arboreum*)	G5	S3S4		PR	2004	E
Yellow Leafcup (*Polymnia uvedalia*)	G4G5	SR		PT	2004	E
Special Animal 1	G5	S2S3		PT	1993	E
Special Animal 2	G3	S1		PE	1993	E
Special Animal 3	G5	S2		PE	1993	E
Special Animal 4	G4	S1		PE	1993	E
Glade Run BDA	*Notable Significance*					
Broad Leaved Spleenwort (*Asplenium pinnatifidum*)	G4	S3		PR	1996	C
Lower Dunkard Creek LCA	*Exceptional Significance*					
Mount Morris BDA	*High Significance*					
Mixed Mesophytic Forest	G?	S1S2		E	2003	E
Special Animal 1	G5	S2S3		PT	1993	E
Special Animal 2	G3	S1		PE	1993	E
Special Animal 3	G5	S2		PE	1993	E
North Branch Calvin Run BDA	*Notable Significance*					
Sourwood (*Oxydendrum arboreum*)	G5	S3S4		PT	2004	E
Upper Dunkard Creek LCA	*Exceptional Significance*					

OTHER CONSERVATION AREAS: *none identified*

GEOLOGIC FEATURES: *none identified*

Perry Township

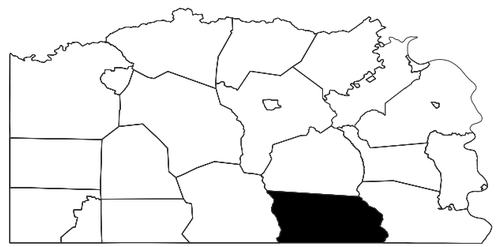


Greene County Natural Heritage Inventory
Perry Township

Biological Diversity Areas:
- Dooley Run
- Dunkard Creek
- Glade Run
- Mount Morris
- North Branch Calvin Run

Landscape Conservation Areas:
- Lower Dunkard Creek
- Upper Dunkard Creek

Managed Lands:
- Mason-Dixon Park



Legend

- Important Bird Areas (IBA)
- Managed Lands

Landscape Conservation Area (LCA)
- LCA
- Watershed LCA

Biological Diversity Area (BDA)
- Core Habitat
- Supporting Habitat

PERRY TOWNSHIP

Perry Township is located in the south central part of Greene County. Mount Morris, the center of population, is located on Dunkard Creek, which is the major drainage within the township. Perry Township is 78% forested and 20% agriculture. There are seven Natural Heritage Areas located in Perry Township: Dooley Run BDA, Dunkard Creek BDA, Glade Run BDA, Lower Dunkard Creek LCA (pg. 19), Mount Morris BDA, North Branch Calvin Run BDA, and Upper Dunkard Creek LCA (pg. 21).

Dooley Run BDA

Dooley Run is a small tributary to Dunkard Creek in south central Greene County downstream of the village of Mount Morris. The watershed supports a variety of land uses including pasture and forestry. In a timbered area within the Dooley Run Valley is a population of a plant species of special concern, **sourwood (*Oxydendrum arboreum*)**. This particular location is a historically known place for this species and some of the trees noted in the 1950s appear to still persist at the site. Sourwood is a species of southern distribution that reaches the northern limit of its range in the southwestern part of Pennsylvania. Sourwood, while being an understory species in the South, appears to be able to thrive only in the warmer microclimates found in the southwestern part of the state and then only where light levels are high (e.g. edge habitats). Those older trees at this site were noted to be in declining health. However, nearby open areas contained many thriving saplings.

Threats and Stresses

Sourwood seems to favor open places and often finds favorable habitat in disturbed areas like pastures and timbered stands of forest. Some of this particular population is growing within a full canopy section of forest and may be in decline. Competition from other vegetation, both native and non-native alike may be the biggest issue for the health of this and all sourwood populations in Pennsylvania.

Recommendations

Maintaining some edge habitat through timber management and management of agricultural fields and other land uses would be important and other land uses would be important in maintaining the viability of this population. Making land owners aware of the species and encouraging the accommodation of its habitat needs in timber management plans for the area would be a good step toward conservation of this unique species.

Dunkard Creek BDA

Dunkard Creek BDA is discussed in Dunkard Township (pg. 41).

Glade Run BDA

Glade Run BDA is centered on a sandstone rock outcrop with crevices that provide habitat for a plant species of special concern; **broad-leaved spleenwort (*Asplenium pinnatifidum*)**. This species often grows on dry sandstone outcrops in filtered light situations. This area sits in a patch of forest just above Glade Run Road and the partially shaded habitat appears to be suitable for this species.

Threats and Stresses

The primary threat here is maintenance of the road adjacent to the rock outcrop. Road salt spray and herbicide use could negatively impact the plants growing in the rocks. Changes in the microclimate associated with rock outcrops and crevices could adversely affect the plants living here.

Recommendations

Informing the municipal officials of the presence and requirements of the plants would be a good first step in their protection. Cautious use of road salt and herbicides could limit exposure to the outcrops and plants. Limiting removal of timber around the outcrops and other direct alterations in the immediate vicinity would likewise better assure the long-term survival of these plants.

Mount Morris BDA

Mount Morris BDA is composed of two main core areas. The Mount Morris Core is located just upstream of the village of Mount Morris and is an aquatic habitat within Dunkard Creek. The Mason-Dixon Core is located in the upper section of the BDA along a tributary to Dunkard Creek and is part of a county park.

Mount Morris Core

This core is the location of three animal species of special concern; **Special Animals 1-3**. The aquatic habitat provides the riffles and clean water needed for the animals living here.

Mason-Dixon Core

This core is the location of a rare plant species and an exceptional natural community. These large forest areas provide habitat for birds and other animals to live and breed. The floodplain upstream and below is the location for a **mixed mesophytic forest**. Good examples of this forest type, which reaches the northern limit in southwestern Pennsylvania, occur in Greene and Fayette Counties.

The canopy of the mixed mesophytic forest is dominated by yellow buckeye (*Aesculus flava*), boxelder (*Acer negundo*) and sycamore (*Platanus occidentalis*). The sparse understory is largely composed of blackhaw viburnum (*Viburnum prunifolium*). Herbaceous species include twinleaf (*Jeffersonia diphylla*), jack-in-the-pulpit (*Arisaema triphyllum*), marginal shield fern (*Dryopteris marginalis*) and common blue violet (*Viola sororia*).

Threats and Stresses

Core Habitat Area: Input of nutrients from agricultural runoff, sewage treatment plants and urban runoff pose a negative threat to the animals living here. A large portion of the stream frontage in this BDA is lined by roads, which may contribute sediments and chemicals such as herbicides, petrochemical products (like tar and asphalt) and salt in the winter.

There are no immediate threats to the natural community in the Mason-Dixon Core. The forest area is fairly large and well buffered.

Supporting Landscape: The Mount Morris Core is bordered on one side by cleared, more-developed land from which the river likely receives non-point source pollution as discussed above.

The landscape uphill of the Mason-Dixon Core is a larger area of mostly contiguous forest, which contains two small streams – but across Dunkard Creek it is cleared and more developed.

Recommendations

Core Habitat Area: Establishing adequate riparian buffers within the core landscape areas is an important aspect of long-term maintenance of water quality. Broad-based education and on-the-ground programs directed toward landowners, whether public or private, to assist with the management of riparian areas will be essential. Input of nutrients and sediment within the core area is particular concern and those areas should be of priority for any programs undertaken in the watershed. Municipalities throughout the Dunkard Creek can likewise utilize BMPs and establish careful road maintenance procedures and establish adequate riparian zones and buffers adjacent to roads.

Management of the Mason-Dixon Park should continue, as it has in order to ensure the health of the natural community here. Invasive species need to be monitored at the site and any infestations need to be eradicated.

Supporting Landscape: As above, establishment of adequate buffers along the supporting habitat upstream of the Mount Morris Core will be critical to protecting the species of concern found there. Management strategies are discussed in detail above, in the Recommendations section (pg. 119).

North Branch Calvin Run BDA

Much of the landscape in Greene County is being actively utilized for forestry including parts of the Calvin Run watershed. Some of the areas that are regenerating provide habitat for **sourwood (*Oxydendrum arboreum*)**, a species of southern distribution and a species of special concern in Pennsylvania. Like most of the other areas where sourwood occurs there is a high density of saplings and a very few larger individuals. Sourwood, while being a an understory species in the South, appears to be able to thrive only in the warmer microclimates found in the southwestern part of the state and then only where light levels are high (e.g. edge habitats).

Threats and Stresses

Sourwood seems to favor open places and often finds favorable habitat in disturbed places like pastures and timbered stands of forest. Competition from other vegetation, both native and non-native alike may be the biggest issue for the health of this and all other sourwood populations on Pennsylvania.

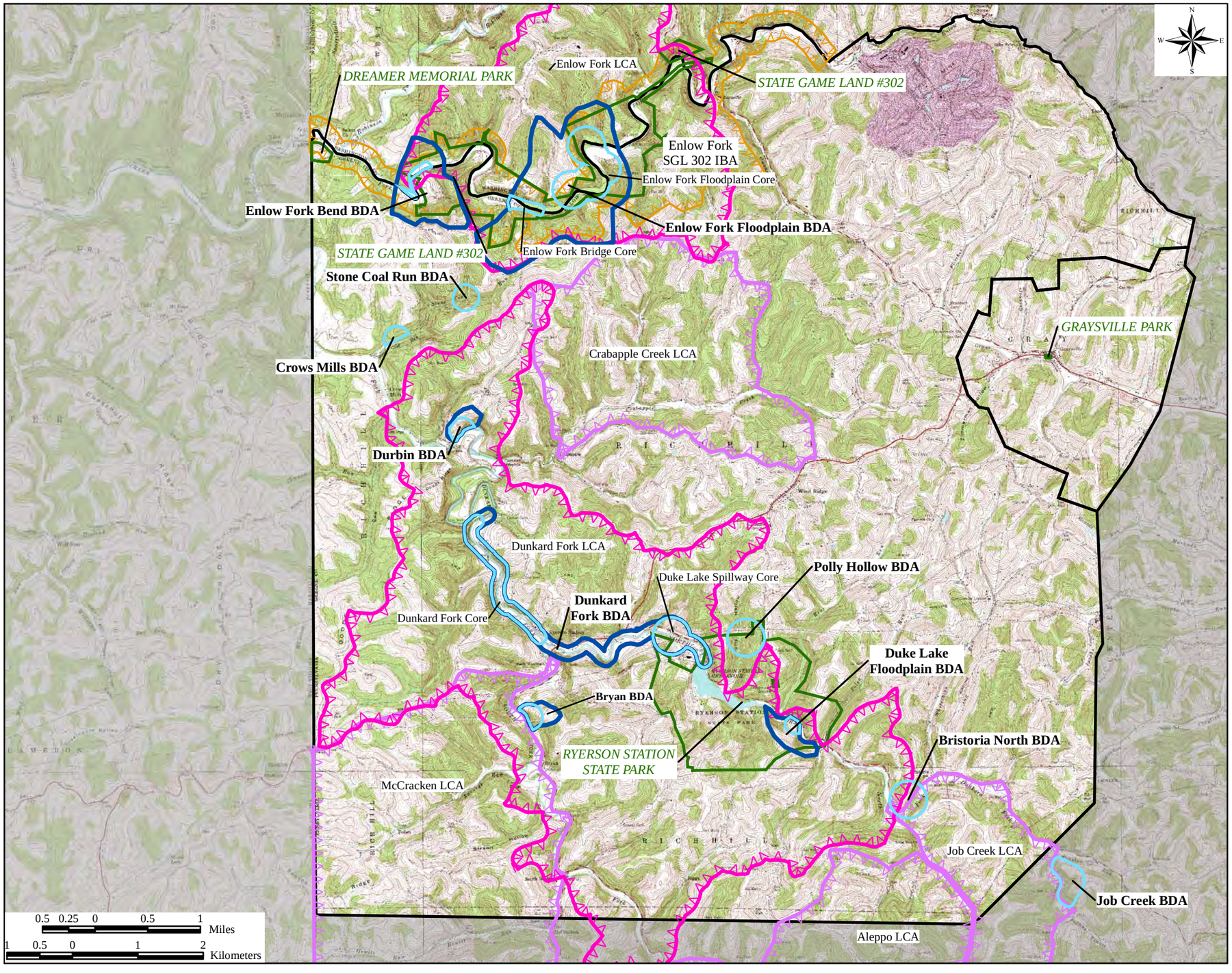
Recommendations

Maintaining some edge habitat through timber management and management of agricultural fields and other land uses would be important in maintaining the viability of this population. Making landowners aware of the species and encouraging the accommodation of its habitat needs in timber management plans for the area would be a good step toward conservation of this unique species.

Richhill Township and Gray Township

	PNDI Rank		Legal Status			
	Global	State	Federal	State	Last Seen	Quality
NATURAL HERITAGE AREAS:						
Aleppo LCA	*County Significance*					
Bristoria North BDA	*Notable Significance*					
Yellow Leaf-cup (*Polymnia uvedalia*)	G4G5	SR		PT	2003	E
Bryan BDA	*Notable Significance*					
Nuttall's Hedge Nettle (*Stachys nuttallii*)	G5?	S1		PE	2004	E
Crabapple Creek LCA	*County Significance*					
Crows Mills BDA	*Notable Significance*					
Yellow Leafcup (*Polymnia uvedalia*)	G4G5	SR		PT	2004	E
Duke Lake Floodplain BDA	*Notable Significance*					
Harbinger-of-Spring (*Erigenia bulbosa*)	G5	S2		PT	2004	E
Dunkard Fork BDA	*High Significance*					
Yellow Leafcup (*Polymnia uvedalia*)	G4G5	SR		PT	2004	E
Special Animal 1	G5	S2		PE	1993	E
Special Animal 2	G5	S2		PT	2001	E
Durbin BDA	*Notable Significance*					
American Beakgrain (*Diarrhena americana*)	G4	S1		PE	2003	E
Enlow Fork Bend BDA	*Notable Significance*					
Curtis' Goldenrod (*Solidago curtisii*)	G4G5	S1		PE	1984	E
Enlow Fork Floodplain BDA	*High Significance*					
White-Trout Lily (*Erythronium albidum*)	G5	S3		TU	2001	E
Great Indian Plantain (*Cacalia muehlenbergii*)	G4	S1		PE	2001	E
Curtis' Goldenrod (*Solidago curtisii*)	G4G5	S1		PE	?	?
Nuttall's Hedge Nettle (*Stachys nuttallii*)	G5?	S1		PE	?	?
Enlow Fork LCA	*Exceptional Significance*					
Job Creek LCA	*County Significance*					
McCracken LCA	*County Significance*					

Richhill Township & Gray Township



Greene County
Natural Heritage Inventory
Richhill & Gray Township

Biological Diversity Areas:

- Bristoria North
- Bryan BDA
- Crows Mills
- Duke Lake Floodplain
- Dunkard Fork
- Durbin
- Enlow Fork Bend
- Enlow Fork Floodplain
- Polly Hollow
- Stone Coal Run

Landscape Conservation Areas:

- Aleppo
- Crabapple Creek
- Dunkard Fork
- Enlow Fork
- Job Creek
- McCracken

Managed Lands:

- Dreamer Memorial Park
- Graysville Park
- Ryerson Station State Park
- State Game Land #302

Legend

- Important Bird Areas (IBA)
- Managed Lands

Landscape Conservation Area (LCA)

- LCA
- Watershed LCA

Biological Diversity Area (BDA)

- Core Habitat
- Supporting Habitat

Polly Hollow BDA			*Notable Significance*			
Solitary Pussytoes (*Antennaria solitaria*)		G5	S1	PE	2004	E
Stone Coal Run BDA			*Notable Significance*			
American Beakgrain (*Diarrhena americana*)		G4?	S1	PE	2003	E

OTHER CONSERVATION AREAS: *none identified*

GEOLOGIC FEATURES: *none identified*

GRAY TOWNSHIP

Gray Township is located in western Greene County and is the smallest township in the county. The village of Graysville is the center of population. Grays Fork, a headwater tributary to South Fork of Ten Mile Creek, drains the township. Gray Township is roughly divided between forest (58%) and agriculture (41%). There are no Natural Heritage Areas located in Gray Township.

RICHHILL TOWNSHIP

Richhill Township makes up the northwestern part of Greene County and drained by two major tributaries to Wheeling Creek, Enlow Fork and Dunkard Fork. Most of the township is in pasture (26%) or wooded (72%) and the village of Wind Ridge is the center of population. With fifteen, Richhill has the most natural heritage areas of any township in Greene County: Aleppo LCA (pg. 15), Bristoria North BDA, Bryan BDA, Crabapple Creek LCA (pg. 15), Crows Mills BDA, Duke Lake Floodplain BDA, Dunkard Fork BDA, Durbin BDA, Enlow Fork Bend BDA, Enlow Fork Floodplain BDA, Enlow Fork LCA, Job Creek LCA, McCracken LCA, Polly Hollow BDA, and Stone Coal Run BDA.

Bristoria North BDA

A roadside occurrence of **yellow leafcup (*Polymnia uvedalia*)**, a Pennsylvania threatened plant species, is the focus of this BDA. This plant is typically found in open disturbed areas throughout Greene County. This species grows in places of high light such as pastures, utility right-of-ways and thickets.

Threats and Stresses

Roadside maintenance may impact this plant population either directly or indirectly through interference with plant reproduction. Exotic invasive species, especially multiflora rose (*Rosa multiflora*) and garlic mustard (*Alliaria petiolata*), are an important threat at this site. Due to the steepness of the slope, disturbances above the BDA could result in increased runoff, which could negatively impact the plant population.

Recommendations

Municipal crews and the Pennsylvania Department of Transportation need to be made aware of the location of the species of special concern. Roadside maintenance activities should take place in the spring and fall to allow the plants to flower and fruit. This site needs to be monitored for invasive species and any infestations need to be controlled. Activities that cause increased siltation or runoff are not recommended here.

Bryan BDA

Bryan BDA is the location of a rich roadside bank on which a population of **Nuttall's hedge nettle (*Stachys nuttallii*)** is growing. Exposures of limestone sediments along road cuts can provide unique environmental conditions that encourage a diversity of species keyed into such conditions. This roadside is also a location for large-leaf waterleaf (*Hydrophyllum macrophyllum*), a formerly state-listed plant found throughout the watershed.

Threats and Stresses

Core Habitat Area: Herbicide spraying, mowing, winter salt application and direct disturbances are all threats in a roadside habitat. Competition by exotic invasive plants is also a consideration at this site.

Supporting Landscape: Uphill from this BDA, the land is open with residential development, a potential source of fertilizer and pesticide runoff.

Recommendations

Core Habitat Area: Appraising municipal crews involved in roadside maintenance and the landowner as to the presence and requirements of these species would be an important step in the conservation of this population. If possible, mowing can be substituted for the application of herbicides within the BDA and mowing timed to avoid the mid and late season growth, flowering and fruiting of these plants. Exotic invasive species such as multiflora rose (Rosa multiflora) and garlic mustard (Alliaria petiolata), once familiar to the maintenance personnel involved, could be controlled with spot application of herbicide.

Supporting Landscape: Education about the consequences of herbicide and fertilizer over-application could help to bring nearby homeowners onboard to protect this BDA. Management strategies are discussed the General Recommendations section (pg. 119).

Crows Mills BDA

This site is located on a south-facing slope above Dunkard Fork of Wheeling Creek. The open woods provide habitat for a Pennsylvania rare plant species; **Yellow Leafcup (*Polymnia uvedalia*)**. This species is often found on riverbanks, ravines and thickets where conditions are more open and soil exposed. In this case the open woods are providing suitable habitat.

Threats and Stresses

The major threats to the population of yellow leafcup are direct disturbance of the slope and competition from invasive exotic species. Multiflora rose (*Rosa multiflora*) and garlic mustard (*Alliaria petiolata*) are quite prolific in the area and constitute the majority of the invasive species threats.

Recommendations

Controlling the multiflora rose at this site would be a good first step in helping this population to survive at this location. Closure of the canopy is a natural process, which may lead to the ultimate loss of this population, but unless the species as a whole requires management, further management may not be warranted.

Duke Lake Floodplain BDA

Duke Lake BDA is centered on the floodplain within the upper headwaters of Duke Lake in Ryerson Station State Park. On the floodplain and adjacent lower slopes grows a Pennsylvania threatened plant species; **harbinger-of-spring (*Erigenia bulbosa*)**.

Threats and Stresses

Core Habitat Area: The level of protection and security of this site is high given that it is under the protection of Ryerson Station State Park. Species such as multiflora rose (*Rosa multiflora*) and Japanese knotweed (*Polygonum cuspidatum*) pose perhaps the biggest threat to these plants. These invasive species compete with the native species for space, light and available nutrients. Multiflora rose is well established in the nearby area. Although unlikely, increased flooding or significant change in lake level or extent could affect sections of the stream valley that are part of this site.

Supporting Landscape: Uphill of this BDA is a mix of open and forested areas; nearby open space may make this site vulnerable to invasion by exotic species, but (as discussed above), the supporting landscape's location within a state park makes management of this risk significantly easier.

Recommendations

Core Habitat Area: Monitoring of this plant population and the associated habitat would be a good step in the long-term management of this plant species. Encroachment by invasives, especially herbaceous plants like garlic mustard and ground ivy, may be detrimental to the viability of the harbinger-of-spring population. Any activities taking place in the core, including trail building and timber removal and maintenance need to consider the potential impact on the plants.

Supporting Landscape: Monitoring for exotic competitors in the areas uphill of this BDA and the broader park is the best option to prevent their establishment and protect the species of concern. Management strategies are discussed in detail above, in the Recommendations section (pg. 119).

Dunkard Fork BDA

Dunkard Fork is a major tributary to Wheeling Creek that drains most of the western end of Greene County. Downstream of Ryerson Station State Park, the fork is the location of two plants and two animal species of special concern. The BDA is divided into four separate core areas, Duke Lake Spillway, Dunkard Fork, Dunkard Fork Tributary and Ryerson Station Slope.

Duke Lake Spillway Core

Below the dam of Duke Lake is a section of stream and valley, which provides habitat for an animal and a plant species of special concern; **Special Animal 1** and **yellow leafcup (*Polymnia uvedalia*)**. The in-stream habitat which consists of riffle and runs is important to the animals of concern, furnishing the substrate on which they anchor, feed and reproduce. The floodplain section of the valley supports a population of yellow leafcup. This plant is often found in places of increased light such as pastures, roadsides, utility right-of-ways and thickets.

Dunkard Fork Core

This core features the many sandy pools located along this stretch of Dunkard Fork that provide habitat from an animal species of special concern; **Special Animal 2**.

Threats and Stresses

Core Habitat Area: The special animal living in Dunkard Fork requires shallow areas with appropriate substrate and high quality water in which to live. Input of nutrients from agricultural runoff poses a negative threat to the animals living here. A large portion of the stream frontage in this BDA is lined by roads, which may contribute sediments through maintenance and chemicals through the application of herbicides, petrochemical products like tar and asphalt and salt in the winter. Sedimentation can be one of the biggest concerns for these animals.

The major threats to the population of yellow leafcup are direct disturbance to the floodplain and competition from invasive exotic species. Multiflora rose (*Rosa multiflora*) and garlic mustard (*Alliaria petiolata*) are quite prolific in the area and constitute the majority of the invasive species threats.

Supporting Landscape: Lack of complete vegetative buffers along Dunkard Fork make the habitat upstream and downstream of the core BDAs vulnerable to non-point source pollution from roads and nearby residential development, to which the animal species of concern is especially sensitive.

Recommendations

Core Habitat Area: Working with landowners to establish sufficient riparian zones around farms and with municipal crews for buffer zones around roads would help limit the impact of sediment to the creek and its tributaries. Landowners should be encouraged to use best management practices (BMPs) and increase riparian buffers to help lower the impacts of storm events washing large amounts of nutrients into the stream. Streambank fencing should be used to restrict cattle from crossing undesignated points on the streams.

Activities upslope of the special animal populations that result in more sediment or runoff are not advised. Removal of the canopy on this sensitive site should be avoided if possible in order to preserve the integrity of the slope.

In all places, exotic invasive species need to be monitored and removed when they threaten the rare plant species.

Supporting Landscape: As above, riparian buffers should be extended along Dunkard Fork to reduce the impact of road, agricultural, and residential runoff sources. Management strategies are discussed in detail above, in the Recommendations section (pg. 119).

Figure 12. Dunkard Fork near confluence with Crabapple Run

Durbin BDA

In the area of Durbin, Dunkard Fork makes several sharp bends and forms an oxbow. One of these bends cuts into a south-facing slope on which a rare plant species; **American beakgrain (*Diarrhena americana*)** lives. This species is associated with moist, open woods.

Threats and Stresses

Core Habitat Area: Removal of the forest canopy and earth-moving activities may directly impact the plant population growing on this steep slope. Any activity, which might reduce the slope's stability or increase sediment or nutrient runoff from the area upslope of the American beakgrain population may endanger the plants.

Supporting Landscape: Many activities would face severe limitation within the slope portion of this BDA due to the steepness of the slope. Activities taking place above the slope that would result in materials or sediment introduction downslope may unfavorably impact the habitat and plants of concern here. Direct disturbance within the BDA would likely impact all or part of the population of plants growing on the slope.

Recommendations

Core Habitat Area: Limiting activities within the BDA and maintaining the current habitat conditions would be the best immediate strategy for maintaining the plant population of concern on these slopes. Monitoring of the population as well as noting of invasive species would assist with development of future management recommendations.

Supporting Landscape: Minimizing human impacts upslope from the BDA will be critical to protecting the population of this plant species of concern. Additional forest fragmentation should be avoided, and regeneration permitted wherever possible. Monitoring for invasive species is a good first step to preventing their establishment. Management strategies are discussed in detail above, in the Recommendations section (pg. 119).

Enlow Fork Bend BDA

Enlow Fork Bend BDA is the location of a Pennsylvania special concern plant species; **Curtis's goldenrod (*Solidago curtisii*)**. This species is often found on shaded floodplains with rich, mesic soils.

Threats and Stresses

Core Habitat Area: Gross changes in habitat such as loss of the canopy within the core could negatively impact the species of special concern found here. Sediment, fertilizer, and herbicide runoff from agricultural land uses within the core habitat area may also harm the population. Because of the significant open space within the core habitat area, invasive species could also pose a problem.

Supporting Landscape: Loss of forested landscape around the core area is an important general concern to this BDA. Alterations to the local flooding regime, which could dramatically change the floodplain habitat, may also endanger the plant population.

Recommendations

Core Habitat Area: A full forest canopy should be maintained in the core area to maintain conditions appropriate to the plant population of concern found here. Direct disturbances to the forest floor are best avoided, and measures should be taken to reduce agricultural impacts to the population (see General Recommendations, page 119). Any invasive species found in the core should be removed, if possible.

Supporting Landscape: Forest canopy removal and earth-disturbing activities should not be conducted on the slopes above the floodplain of the creek. Flow-altering activities (e.g. dam construction) upstream of the plant population should avoid alteration of the natural flooding regime. Timbering, if conducted, should be done with appropriate erosion control precautions. Invasive species should be monitored and controlled within the supporting landscape to prevent incursions into the core area.

Enlow Fork Floodplain BDA

Enlow Fork Floodplain BDA contains two core areas; Enlow Fork Bridge and Enlow Fork Floodplain. Part of this BDA was recognized during the Washington County Natural Heritage Inventory and named the Enlow Fork Valley BDA. The work in Greene County expanded and better defined parts of this BDA.

Enlow Fork Bridge Core

A wooded floodplain on Enlow Fork that is the focus of this core area and the location of a rare plant species known as **Curtis' goldenrod (*Solidago curtisii*)**. A **sycamore (river birch) box elder floodplain forest** dominated by sycamore (*Platanus occidentalis*), black maple (*Acer nigrum*) and box elder (*Acer negundo*) covers the floodplain. Understory associates include spicebush (*Lindera benzoin*), green ash (*Fraxinus pennsylvanica*), black locust (*Robinia pseudoacacia*) and bitternut hickory (*Carya cordiformis*). Common herbs include green-head coneflower (*Rudbeckia laciniata*), Canadian clearweed (*Pilea pumila*), wing stem (*Verbesina alternifolia*), orange-spotted jewelweed (*Impatiens capensis*) and Christmas fern (*Polystichum acrostichoides*).

Enlow Fork Floodplain Core

The Enlow Fork Floodplain core involves part of the floodplain and adjacent slopes along this section of the creek. The forested area is narrow and bordered by a field. The forested slopes and floodplain provide habitat for three plant species of special concern; **white trout-lily (*Erythronium albidum*), great Indian plantain (*Cacalia muehlenbergii*)** and **Curtis' goldenrod (*Solidago curtisii*).** All of these plants require the moist to mesic rich soils found in floodplains.

Figure 13. Enlow Fork

Threats and Stresses

Core Habitat Areas: Loss of the forest canopy within the core areas could negatively impact the species of special concern found here. Invasive species such as multiflora rose (*Rosa multiflora*), which are common in the area, pose an issue to the habitat cores. Alteration of the local flood regime could significantly impact these floodplain habitats, potentially endangering the plant species of concern found here.

Supporting Landscape: Earth-disturbing activities or canopy removal on the slopes above the floodplain could wash sediment unto the plants and negatively impact them. Agricultural runoff from the surrounding uplands is likely impacting plant populations in the floodplain, and significant cleared spaces throughout the supporting landscape will serve as entry points for the establishment of invasive plants in the core habitat areas.

Recommendations

Core Habitat Areas: Making the Pennsylvania Game Commission aware of the presence and requirements of the species living here will be an important step in ensuring sensitive management of this area. Further surveying and monitoring of the species of special concern as well as of infestations of exotic invasive species would assist in making future management decisions for this site. More research and evaluation of the affects of long-wall mining on the natural communities and habitats in Greene County and the rest of southwestern Pennsylvania will be essential for the management of these biological resources.

Supporting Landscape: Forest canopy removal and earth-disturbing activities should not be conducted on the slopes above the floodplain of the creek. Forest canopy removal, if conducted, should be done with appropriate erosion control precautions. Invasive species should be monitored and controlled within the supporting landscape to prevent incursions into the core area. Successional lands should be allowed to mature and agriculture should be confined to those areas currently in use. Any residential development planned for the area should be encouraged in clusters and around existing villages. Industrial development should also be confined to existing sites. Additional utility lines should make use of existing rights-of-way and road construction limited to improvement or expansion of existing roads.

Polly Hollow BDA

Polly Hollow is a small tributary to North Fork of Dunkard Fork of Wheeling Creek and is located in Ryerson Station State Park. Most of the valley is covered by a mature red oak – mixed hardwood forest and sugar maple – basswood forests. A gas pipeline right-of-way cuts across the valley and slopes. The Polly Hollow Trail runs through the valley. A Pennsylvania plant species of special concern; **solitary pussytoes (*Antennaria solitaria*)** grows near the trail in this section of the park and is the focus of this BDA. This plant is often found in places where there is compaction or disturbance of the soil.

The surrounding forest is dominated by white oak (*Quercus alba*), red oak (*Quercus rubra*), American beech (*Fagus grandifolia*), red maple (*Acer rubrum*) and black cherry (*Prunus serotina*). Understory species include black gum (*Nyssa sylvatica*), cucumber tree (*Magnolia acuminata*), spicebush (*Lindera benzoin*) and slippery elm (*Ulmus rubra*). Common herbs include spring beauty (*Claytonia virginica*), white wood aster (*Eurybia divaricata*), round-leaf groundsel (*Senecio obovatus*), ditch stonecrop (*Sedum ternatum*) and white bittercress (*Cardamine bulbosa*).

Threats and Stresses

Maintaining the habitat for this plant may involve maintaining the Polly Hollow Trail in this location. The biggest threat at this location may be trampling by trail users and direct disturbance from trail maintenance. Overall management of the park and utility rights-of-way may also affect the habitat within this BDA.

Recommendations

Ensuring that maintenance crews, volunteers and the public are aware of the importance of this area would be a good first step in the long term viability of this plant population. Signage and possibly strategic fencing would help direct people around the critical section of the BDA.

Stone Coal Run BDA

Stone Coal Run BDA involves the wooded valley of Stone Coal Run and is the location of **American beakgrain (*Diarrhena americana*)**; a plant species of special concern. This plant prefers the moist soil found in floodplains and slopes.

Threats and Stresses

No imminent threats are noted for this population. This area is being subjected to long-wall mining, but the impacts of this activity on the terrestrial flora are still unknown. More research and evaluation of the affects of long-wall mining on the natural communities is essential to determine the impact of this practice.

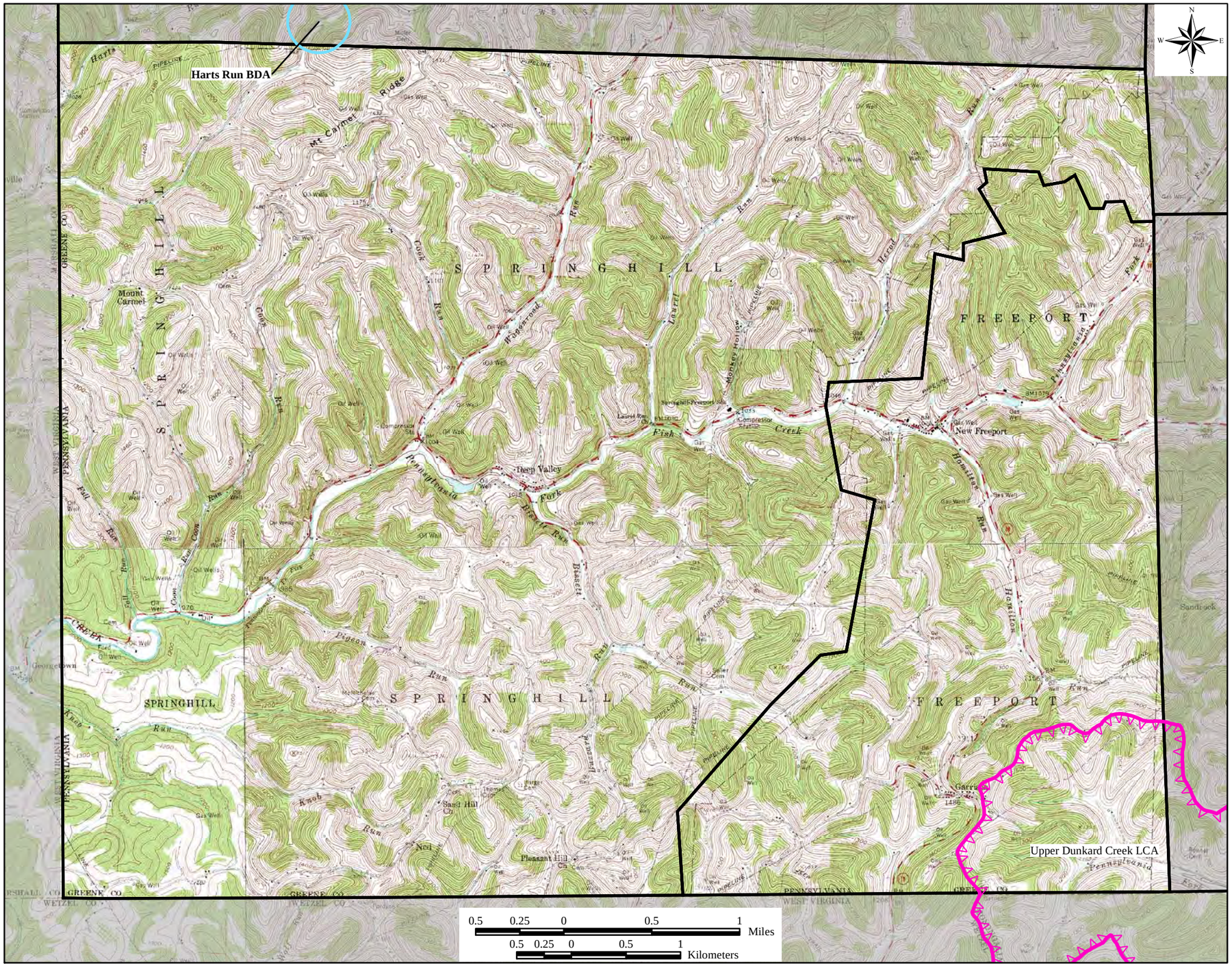
Recommendations

More research and evaluation of the affects of long-wall mining on the natural communities and habitats in Greene County and the rest of southwestern Pennsylvania will be essential for the management of these biological resources.

Springhill Township and Freeport Township

	PNDI Rank		Legal Status			
	Global	State	Federal	State	Last Seen	Quality
NATURAL HERITAGE AREAS:						
Harts Run BDA	*Notable Significance*					
Yellow Leaf-cup (*Polymnia uvedalia*)	G4G5	SR		PT	2003	E
Upper Dunkard Creek LCA	*Exceptional Significance*					
OTHER CONSERVATION AREAS:	*none identified*					
GEOLOGIC FEATURES:	*none identified*					

Springhill Township & Freeport Township

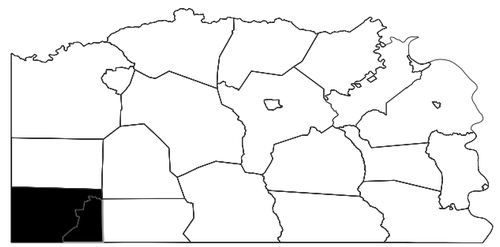


Greene County
Natural Heritage Inventory
Springhill Township
& Freeport Township

Biological Diversity Areas:
Harts Run

Landscape Conservation Areas:
Upper Dunkard Creek

Managed Lands:
None



Legend

- Important Bird Areas (IBA)
- Managed Lands

Landscape Conservation Area (LCA)

- LCA
- Watershed LCA

Biological Diversity Area (BDA)

- Core Habitat
- Supporting Habitat

FREEPORT TOWNSHIP

Freeport Township is located in the southwestern part of Greene County east of Springhill Township. It encompasses most of the headwaters of Pennsylvania Fork of Fish Creek. Land uses in the township are mostly woodland (81%) and pasture (18%). There is one Natural Heritage Area located in Freeport Township, Upper Dunkard Creek LCA (pg. 21).

SPRINGHILL TOWNSHIP

Springhill Township makes up the southwest corner of Greene County and Pennsylvania. Pennsylvania Fork of Fish Creek drains most of the township. Forest comprises most of the township at 85% with the rest being agriculture. There is one Natural Heritage Area located in Springhill Township, Harts Run BDA.

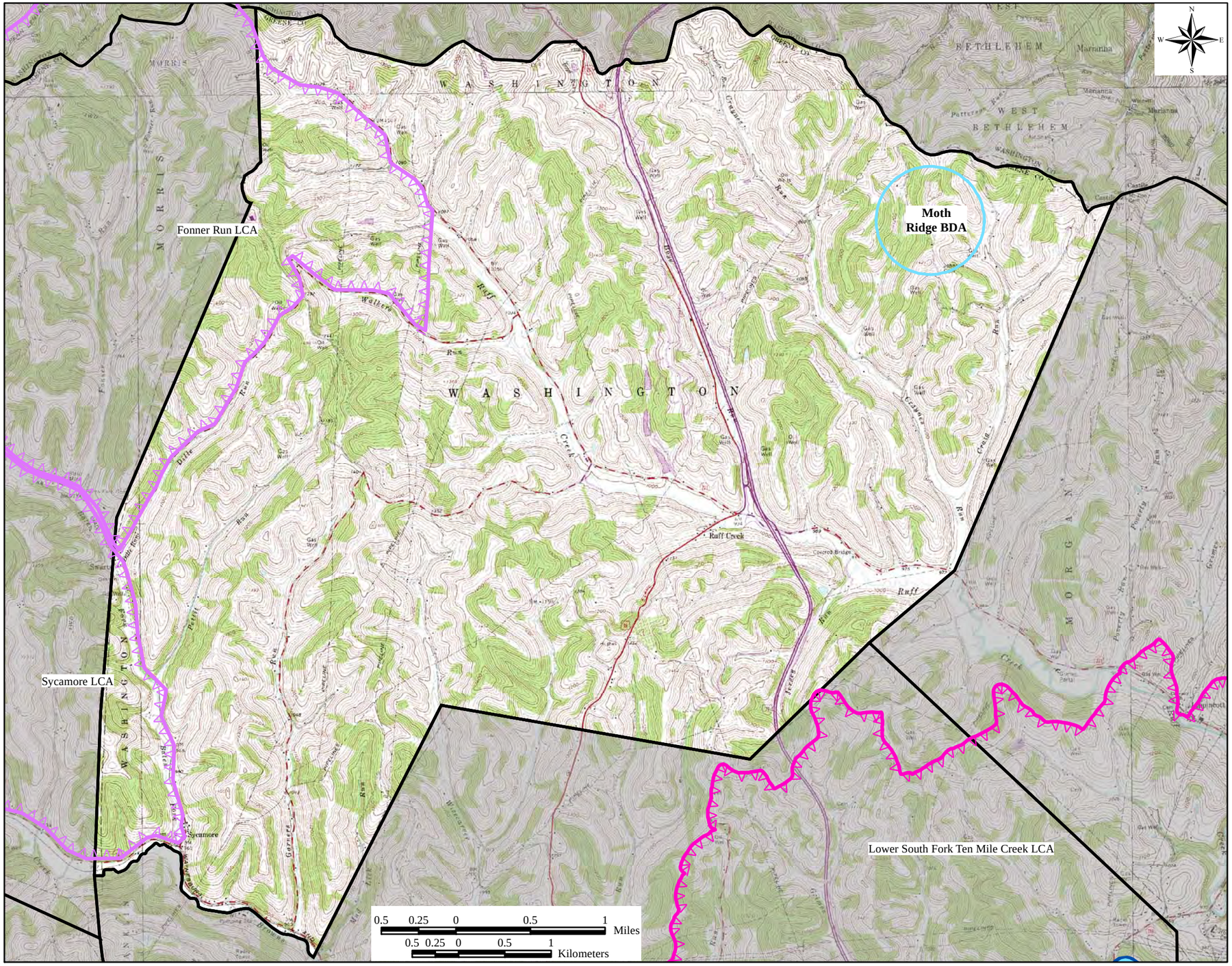
Harts Run BDA

Harts Run BDA is discussed under Aleppo Township (pg. 25).

Washington Township

		PNDI Rank		Legal Status		
		Global	State	Federal	State	Last Seen	Quality
NATURAL HERITAGE AREAS:							
Fonner Run LCA		*County Significance*					
Lower South Fork Ten Mile Creek LCA		*Exceptional Significance*					
Moth Ridge BDA		*Notable Significance*					
Regal Moth (*Citheronia regalis*)		G5	SU			1994	E
Sycamore LCA		*County Significance*					
OTHER CONSERVATION AREAS:	*none identified*						
GEOLOGIC FEATURES:	*none identified*						

Washington Township



Greene County
Natural Heritage Inventory
Washington Township

Biological Diversity Areas:

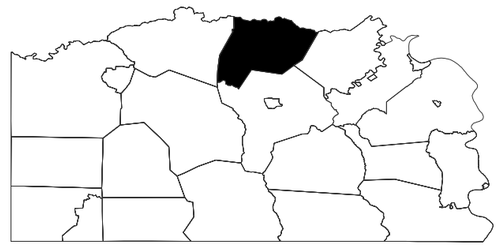
Moth Ridge

Landscape Conservation Areas:

Fonner Run
Lower South Fork Ten Mile Creek
Sycamore

Managed Lands:

None



Legend

Important Bird Areas (IBA)
Managed Lands

Landscape Conservation Area (LCA)

LCA
Watershed LCA

Biological Diversity Area (BDA)

Core Habitat
Supporting Habitat

WASHINGTON TOWNSHIP

Washington Township is located in the north central part of Greene County in the headwaters of Ruff Creek and tributaries to South Fork Ten Mile Creek. Land use is roughly split between forest (63%) and agriculture (38%). There are four Natural Heritage Areas in Washington Township: Moth Ridge BDA, Fonner Run LCA (pg. 17), Lower South Fork Ten Mile Creek LCA (pg. 18), and Sycamore LCA (pg. 20).

Moth Ridge BDA

Moth Ridge BDA is an open area that provides habitat for an animal species of special concern; **Regal Moth (*Citheronia regalis*)**. The mature forest contains black walnut (*Juglans nigra*) and shagbark hickory (*Carya ovata*); tree species on which the species feeds. The caterpillars, which are the largest in North America, feed on leaves.

Threats and Stresses

The landowner is well aware of the requirements of this species and is interested in its protection. Management of the forests within the BDA will be particularly critical to the continued maintenance of the population of this moth of special concern.

Recommendations

Future surveys and monitoring of the population of the moth and its habitat would assist in better estimating populations as well as in the management of forest and associated habitats. A continued high level of concern from the landowner and maintenance of mature forest are desirable for the conservation of this species.

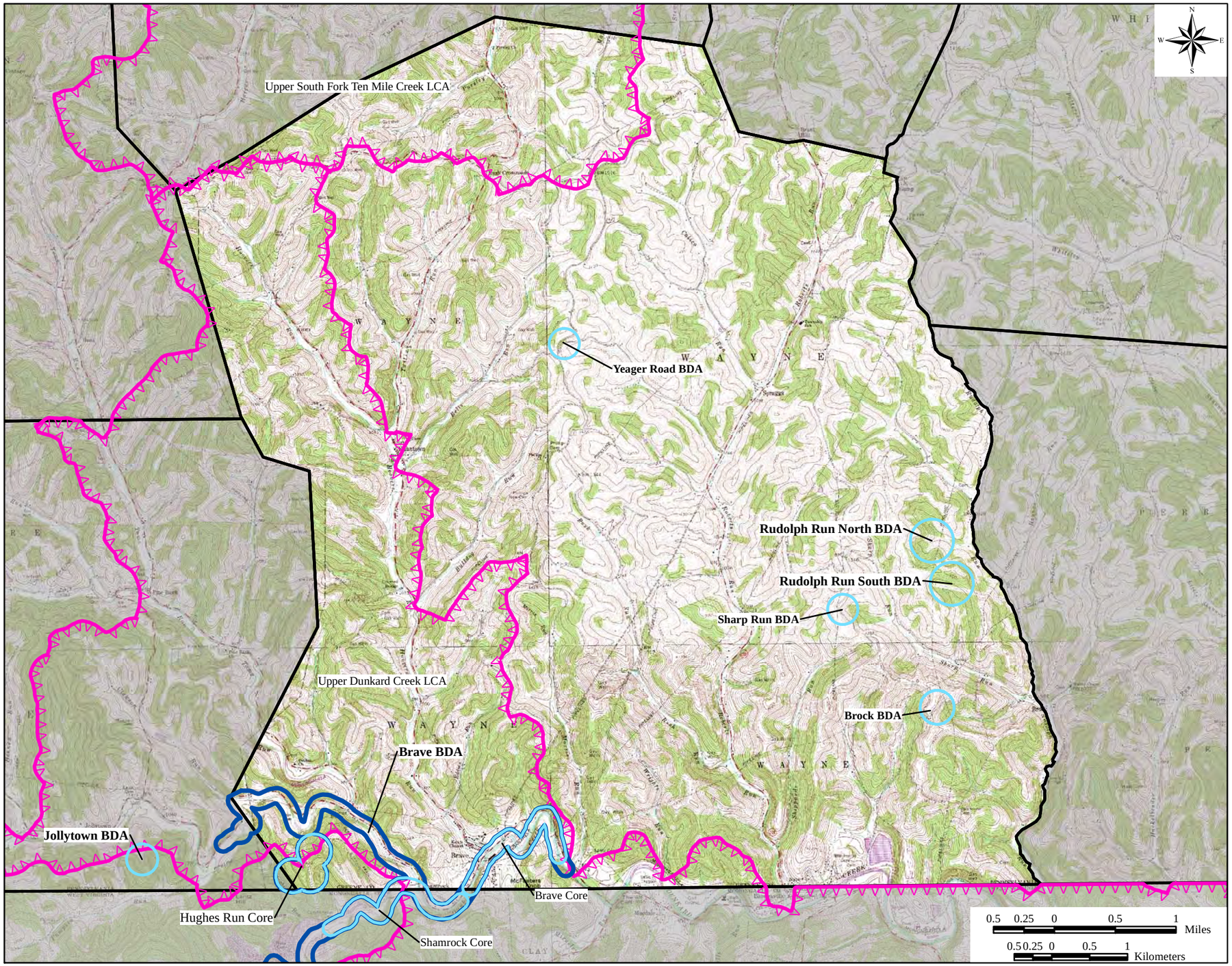
Wayne Township

	PNDI Rank		Legal Status		
	Global	State	Federal	State	Last Seen	Quality
NATURAL HERITAGE AREAS:						
Brave BDA	*Exceptional Significance*					
Blue Mistflower (*Eupatorium coelestinum*)	G5	S3		TU	2004	E
Yellow Leafcup (*Polymnia uvedalia*)	G4G5	SR		PT	2004	E
Special Animal 1	G5	S2S3		PE	1993	E
Special Animal 2	G3	S1		PE	1993	E
Special Animal 3	G3	S1?		CU	1993	E
Brock BDA	*Notable Significance*					
Yellow Leafcup (*Polymnia uvedalia*)	G4G5	SR		PT	2004	E
Rudolph Run North BDA	*Notable Significance*					
Sourwood (*Oxydendrum arboreum*)	G5	S3S4		PT	2004	E
Rudolph Run South BDA	*Notable Significance*					
Small Woodland Sunflower (*Helianthus microcephalus*)	G5	S3		TU	2004	E
Sharp Run BDA	*Notable Significance*					
Yellow Leafcup (*Polymnia uvedalia*)	G4G5	SR		PT	2004	E
Upper Dunkard Creek LCA	*Exceptional Significance*					
Upper South Fork Ten Mile Creek LCA	*High Significance*					
Yeager Road BDA	*Notable Significance*					
Yellow Leafcup (*Polymnia uvedalia*)	G4G5	SR		PT	2004	E

OTHER CONSERVATION AREAS: *none identified*

GEOLOGIC FEATURES: *none identified*

Wayne Township



Greene County
Natural Heritage Inventory
Wayne Township

Biological Diversity Areas:

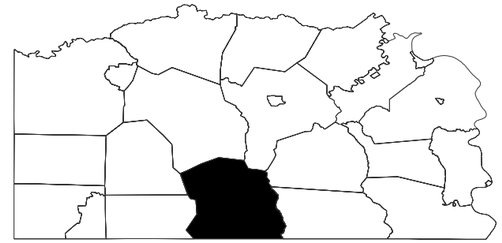
- Brave
- Brock
- Rudolph Run North
- Rudolph Run South
- Sharp Run
- Yeager Road

Landscape Conservation Areas:

- Upper Dunkard Creek
- Upper South Fork Ten Mile Creek

Managed Lands:

- None



Legend

- Important Bird Areas (IBA)
- Managed Lands

Landscape Conservation Area (LCA)

- LCA
- Watershed LCA

Biological Diversity Area (BDA)

- Core Habitat
- Supporting Habitat

WAYNE TOWNSHIP

Wayne Township is located in the south central part of Greene County and is approximately evenly divided in land use between forest and pasture. Dunkard Creek flows through the southern end of the county and drains the township. There are eight Natural Heritage Areas located in Wayne Township: Brave BDA, Brock BDA, Rudolph Run North BDA, Rudolph Run South BDA, Sharp Run BDA, Upper Dunkard Creek LCA (pg. 21), Upper South Fork Ten Mile Creek LCA (pg. 21), and Yeager Road BDA.

Brave BDA

Brave BDA is an aquatic habitat in the upper reaches of Dunkard Creek that provides habitat for three animal species of special concern; **Special Animals 1-3** and two plant species, **yellow leafcup (*Polymnia uvedalia*)** and **blue mistflower** (***Eupatorium coelestinum*)**. These animals require clean water and a stony substrate found in riffles for habitat. Dunkard Creek in the Brave area is a mixture of forest, pastureland and strip mines. The BDA is divided into three core areas, Brave, Hughes Run and Shamrock.

Brave Core

This core is an aquatic habitat in Dunkard Creek that is home to two animal species of special concern; **Special Animals 1-2**. The animals here rely on the clean water and riffle habitats.

Hughes Run Core

This core is the location of the two plant species of special concern, which are growing along an old road, a regenerating forest, and a power line right-of-way.

Shamrock Core

This core is the location of a special concern animal species, **Special Animal 1** at the confluence of Dunkard Creek and West Virginia Fork of Dunkard Creek.

Threats and Stresses

Core Habitat Area: Lack of complete riparian vegetative buffers makes these BDAs vulnerable to non-point source runoff from nearby developed areas, including the town of Brave. Some areas within the core habitat have also been strip mined, greatly reducing their ecological value. Direct disturbance and incursions by invasive species are the major threats to the plant species growing in this core.

Supporting Landscape: The aquatic habitats here are located just downstream of an active strip-mining operation on West Virginia Fork of Dunkard Creek. Excessive sedimentation could result if runoff is not controlled at the mine. Nutrients and agricultural runoff could threaten the water quality. Riparian vegetation should be increased in order to provide buffers for runoff.

Recommendations

Core Habitat Area: More riparian buffering is needed to protect these two stretches of Dunkard Fork, and restoration of strip-mined areas will help to improve water quality.

Supporting Landscape: Landowners in the watershed should be encouraged to adopt best management practices (BMPs) in order to reduce runoff. Municipal officials should work to maintain adequate riparian buffers to trap runoff that occurs. Mine officials should try to control sediment that may wash into the stream. Municipal crews involved in roadside maintenance should not apply herbicides in the vicinity of the plants. Management strategies are discussed in detail above, in the Recommendations section (pg. 119).

Brock BDA

Yellow leafcup (*Polymnia uvedalia*), a plant species of special concern, is the subject of Brock BDA. The plants are growing on both sides of a roadside above and below the road. Associates of the plants include wrinkle-leaf goldenrod (*Solidago rugosa*), summer grape (*Vitis aestivalis*), motherwort (*Leonurus cardiaca*), moonseed (*Menispermum canadense*) and yellow sweet clover (*Melilotus officinalis*).

Threats and Stresses

Roadside spraying of herbicides and mowing at the wrong times present the greatest threats to this population. Other maintenance activities such as re-grading may cause the roadbank to slide and negatively impact the population. Logging of the adjacent uplands could cause erosion of the roadbank and negatively impact the plants.

Recommendations

Protection of this site will involve the landowner, Wayne Township and the Pennsylvania Department of Transportation. Educating all parties involved about the presence and requirements of the plants growing here would be a good first step in protection. Working with the township to provide guidance for the timing of road maintenance would further enhance the survival and may even make the habitat more viable for the plants.

Rudolph Run North BDA

Rudolph Run North is the location of a tree species of special concern; **sourwood (*Oxydendrum arboreum*)**. While being an understory species in the South, in Pennsylvania this species is often found in places where it can obtain more light and a warmer microclimate. Apparently the warmer microclimate allows this species to live farther north than it otherwise would.

Threats and Stresses

Sourwood seems to favor open places and often finds favorable habitat in disturbed areas like pastures and timbered stands of forest. Competition from other vegetation, both native and non-native alike may be the biggest issue for the health of this and all sourwood populations in Pennsylvania.

Recommendations

Maintaining some edge habitat through timber management and management of agricultural fields and other land uses would be important in maintaining the viability of this population. Making land owners aware of the species and encouraging the accommodation of its habitat needs in timber management plans

for the area would be a good first step toward conservation of these unique species. Direct impacts to the plants growing in this BDA should be avoided.

Rudolph Run South BDA

Rudolph Run South BDA is the location of **small woodland sunflower (*Helianthus microcephalus*)**. This species is often found in places that are open and provide increased light and with circumneutral soils.

Threats and Stresses

This population of plants has few immediate threats. Upslope activities, removal of timber and exotic species are always issues when considering the set of species that, in Greene County, are keyed in on relatively open, wooded slopes.

Recommendations

Making the landowner aware of the presence of this plant species as well as follow-up monitoring of this population are the most useful and immediate recommendations for ensuring some degree of protection for this plant species.

Sharp Run BDA

Sharp Run BDA is located on a small tributary to Sharp Run and is the location of **yellow leafcup (*Polymnia uvedalia*)**. This species grows in places where it can get high amounts of light such as pastures, roadsides and thickets.

Threats and Stresses

This species may depend on natural openings, which in forested areas, occur progressively as trees die or are blown down. Seeding and establishment of new populations may be the key to allowing these early successional plants to survive over time. If allowed to thrive and reproduce during the tenure of this gap in the forest, these plants may successfully seed to other areas. Multiflora rose (*Rosa multiflora*) is already present in this gap and may serve to out-compete the population sooner than reestablishment of the forest canopy might.

Recommendations

Closure of the canopy is a natural process that may lead to the ultimate loss of this population, but unless the species as a whole requires protection, further management may not be warranted.

Yeager Road BDA

Yeager Road BDA is a roadside occurrence of **yellow leafcup (*Polymnia uvedalia*)**. This plant favors those places where it can get a high amount of light such as pastures, roadsides and thickets.

Threats and Stresses

Roadside spraying of herbicides presents the most direct possible threat to the species located here. Other maintenance activities that directly disturb the roadside bank or logging on the uplands nearby may negatively impact the plant populations. Being on a roadside, invasive species could perhaps compromise the site in the future.

Recommendations

Protection of this site will involve the landowner, Wayne Township, and the Pennsylvania Department of Transportation. Educating all parties about the presence of the species and its requirements would be a good first step. Road maintenance activities should be scheduled with the plants in mind. Invasive species encroachments should be monitored and controlled where possible.

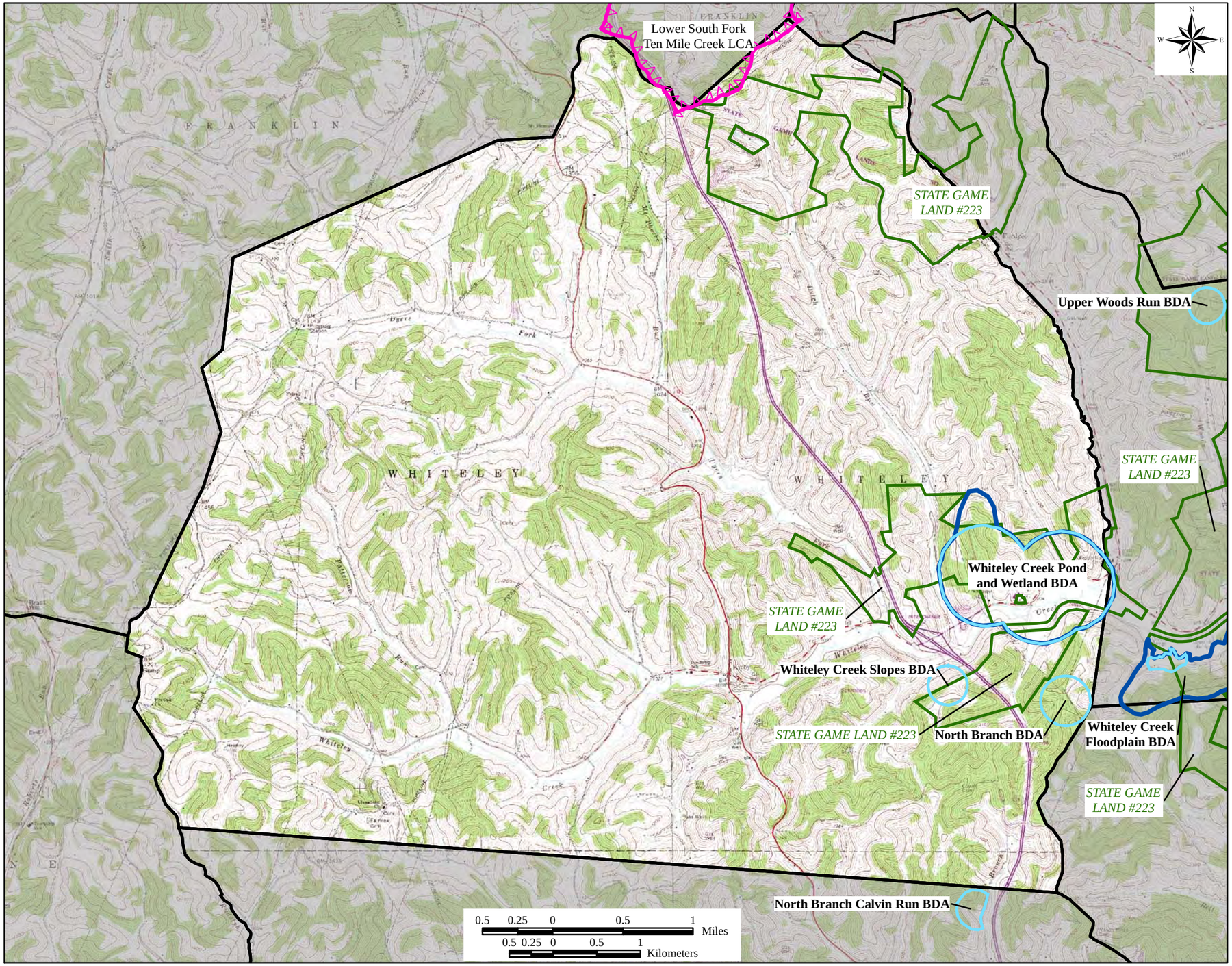
Whiteley Township

	PNDI Rank		Legal Status			
	Global	State	Federal	State	Last Seen	Quality
NATURAL HERITAGE AREAS:						
North Branch BDA		*Notable Significance*				
Passionflower (*Passiflora lutea*)	G5	S1		PE	2003	E
Whiteley Pond and Wetland BDA		*Notable Significance*				
Special Animal 1	G5	S2S3			2004	E
Whiteley Creek Slopes BDA		*Notable Significance*				
Yellow Leaf-cup (*Polymnia uvedalia*)	G4G5	SR		PT	2004	E

OTHER CONSERVATION AREAS: *none identified*

GEOLOGIC FEATURES: *none identified*

Whiteley Township



Greene County
Natural Heritage Inventory
Whiteley Township

Biological Diversity Areas:

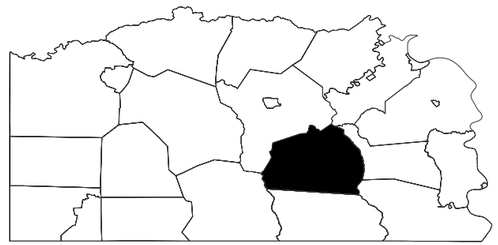
North Branch
Whiteley Creek Pond and Wetland
Whiteley Creek Slopes

Landscape Conservation Areas:

Lower South Fork Ten Mile Creek

Managed Lands:

State Game Land #223



Legend

Important Bird Areas (IBA)
Managed Lands

Landscape Conservation Area (LCA)

LCA
Watershed LCA

Biological Diversity Area (BDA)

Core Habitat
Supporting Habitat

WHITELEY TOWNSHIP

Whiteley Township is located in the central part of Greene County and is centered on Whiteley Creek. Most of the township is either forested (64%) or is in pasture (34%). The village of Kirby is the center of population in the township. There are three Natural Heritage Areas in Whiteley Township: North Branch BDA, Whiteley Pond and Wetland BDA, and Whiteley Creek Slopes BDA.

North Branch BDA

A roadside population of **passionflower (*Passiflora lutea*)** is the focus of North Branch BDA. This species is generally found in open or semi-open areas with high light levels and limited competition from other (overstory) plants. In Greene County, the many edges and roadsides can provide habitat for this species.

Threats and Stresses

Roadside maintenance activities such as mowing at the wrong times stands to be the greatest threat to the survival of this plant population. Invasive species while not currently a problem may become a problem in the future. Especially concerning are species such as multiflora rose (*Rosa multiflora*) and bush honeysuckle (*Lonicera* spp.) which are abundant locally.

Recommendations

Municipal crews and the Pennsylvania Department of Transportation should be made aware of the presence and requirements of the plants living here. Mowing should only be done in the spring and not in the summer or fall when the plants are flowering and fruiting. Herbicides should not be used in the vicinity of the plants. Winter road salt application should be minimized near the plants if it is safe to do so. Monitoring of the plants of special concern and control of exotic invasive species present at the site would be good goals for more concentrated management efforts.

Whiteley Creek Pond and Wetland BDA

Just east of I-79 in State Game Lands #179 is a pond on a tributary to and a mitigation wetland next to Whiteley Creek. These aquatic habitats provide habitat for an animal species of special concern; **Special Animal 1**.

Figure 14. Whiteley Pond in State Game Lands #223

Threats and Stresses

This special animal patrols and forages for food up to 500 meters from the wetland or pond that is the central part of its home territory. Activities such as logging or earth moving that change the habitat or foraging area of the animals could negatively impact their population.

Recommendations

Informing the Game Commission of the presence of the animals would help in the protection of the animals located here. Any of the above activities should consider their impact on the animals living here.

Whiteley Creek Slopes BDA

West of I-79, a small section of State Game Lands #179 is cut off from the main part of the game lands by the highway. Most of the woods here are medium aged with some interspersed thickets. The thickets provide the open light habitat needed by a plant species of special concern; **yellow leafcup (*Polymnia uvedalia*)**.

Threats and Stresses

Perhaps the greatest threat to this plant population is multiflora rose (*Rosa multiflora*). The habitat occupied by this plant population is a young regenerating forest.

Recommendations

Informing the Game Commission of the presence of the species would be a good first step in the protection of this species. Invasive species definitely need to be monitored at this site.

GENERAL RECOMMENDATIONS

The following are general recommendations for protection of natural heritage areas (NHAs) within a county. Approaches to protecting a NHA are wide-ranging and factors such as land ownership, time constraints, and tools/resources available should be considered when prioritizing protection of these sites. Prioritization works best when incorporated into a long-term, large-scale plan, however, opportunities may arise that do not conform to a plan and the decision on how to manage or protect a natural heritage area may be made on a site-by-site basis. Keep in mind that personnel in our program or staff from state natural resource agencies are available to discuss more specific options as needed.

1. **Consider conservation initiatives for NHAs on private land.**
   Conservation easements protect land while leaving it in private ownership. An easement is a legal agreement between a landowner and a conservation or government agency that permanently limits a property's use in order to protect its conservation values. It can be tailored to the needs of both landowner and conservation organization and will not be extinguished with new ownership. Tax incentives may apply to conservation easements donated for conservation purposes.

   Lease and management agreements also allow the landowner to retain ownership and temporarily ensure protection of land. There are no tax incentives for these conservation methods. A lease to a land trust or government agency can protect land temporarily and ensure that its conservation values will be maintained. This can be a first step to help a landowner decide if they want to pursue more permanent protection methods. Management agreements require landowner and land trust to work together to develop a plan for managing resources such as plant or animal habitat, protection of a watershed, forest or agricultural land with land trust offering technical expertise.

   Land acquisition by a conservation organization can be at fair market value or as a bargain sale in which a sale is negotiated for a purchase price below fair market value with tax benefits that reduce or eliminate the disparity. Pinpoint areas that may be excellent locations for new county or township parks. Sites that can serve more than one purpose such as wildlife habitat, flood and sediment control, water supply, recreation, and environmental education would be particularly ideal. Private lands adjacent to public lands should be examined for acquisition when a NHA is present on either property and there is a need 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.

   Local zoning ordinances are one of the best-known regulatory tools available to municipalities. Examples of zoning ordinances a municipality can adopt include: overlay districts where the boundary is tied to a specific resource or interest such as riverfront protection and floodplains, and zoning to protect stream corridors and other drainage areas using buffer zones.

2. **Prepare management plans that address species of special concern and natural communities.**
   Many of the already-protected NHAs are in need of additional management recommendations to ensure the continued existence of the associated natural elements. Incorporate site-specific recommendations into existing management plans or prepare new plans. Recommendations may include: removal of exotic plant species; leaving the area alone to mature and recover from previous disturbance; creating natural areas within existing parks; limiting land-use practices such as mineral extraction, residential or industrial development, and agriculture; and implementing sustainable forestry practices. For example, some species simply require continued availability of a natural community while others may need specific management practices such as canopy thinning, mowing, or burning to maintain their habitat requirements.

   Existing parks and conservation lands provide important habitat for plants and animals at both the county level and on a regional scale. For example, these lands may serve as nesting or wintering areas for birds or as stopover areas during migration. Management plans for these areas should emphasize a reduction in activities that fragment habitat. Adjoining landowners should be educated about the importance of their land as it relates to habitat value, especially for species of special 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; especially those that protect biodiversity, supply drinking water, and are attractive recreational resources. Many rare species, unique natural communities or locally significant habitats occur in wetlands and water bodies and are directly dependent on natural hydrological patterns and water quality for their continued existence. Ecosystem processes also provide clean water supplies for human communities and do so at significant cost savings in comparison to water treatment facilities. Hence, protection of high quality watersheds is the only way to ensure the viability of natural habitats and water quality. Scrutinize development proposals for their impact on entire watersheds, not just the immediate project area. Cooperative efforts in land use planning among municipal, county, state, and federal agencies, developers, and residents can lessen the impact of development on watersheds.

4. **Provide for buffers around NHAs.**
   Development plans should provide for natural buffers between disturbances and NHAs. Disturbances may include construction of new roads and utility corridors, non-sustainable timber harvesting, and disruption of large pieces of land. County and township officials can encourage landowners to maintain vegetated buffer zones within riparian zones. Vegetated buffers (preferably of PA-native plant species) help reduce erosion and sedimentation and shade/cool the water. This benefits aquatic animal life, provides habitat for other wildlife species, and creates a diversity of habitats along the creek or stream. Staff at the Pennsylvania Natural Heritage Program (PNHP) or natural resources agencies can provide further guidance regarding buffer considerations appropriate for various kinds of natural resources within NHAs, e.g., barren community, wetland, water body, or forest.

   Watersheds or subwatersheds where natural communities and species of special concern occur (outlined on the Township maps in this report) should be viewed as areas of sensitivity, although all portions of the watershed may not be zones of potential impact. As an example, conserving natural areas around municipal water supply watersheds provides an additional protective buffer

around the water supply, habitat for wildlife, and may also provide low-impact recreation opportunities.

5. **Reduce fragmentation of surrounding landscape.**
Encourage development in sites that have already seen past disturbances. Care should be taken to ensure that protected natural areas do not become "islands" surrounded by development. In these situations, the site is effectively isolated and its value for wildlife is reduced. Careful planning can maintain natural environments and plants and animals associated with them. A balance between growth and the conservation of natural and scenic resources can be achieved by guiding development away from the most environmentally sensitive areas.

The reclamation of previously disturbed areas, or brownfields development, for commercial and industrial projects presents one way to encourage economic growth while allowing ecologically sensitive areas to remain undisturbed. Cluster development can be used to allow the same amount of development on much less land and leave much of the remaining land intact for wildlife and native plants. By compressing development into already disturbed areas with existing infrastructure (villages, roads, existing ROW's), large pieces of the landscape can be maintained intact. If possible, networks or corridors of woodlands or greenspace should be preserved linking sensitive natural areas to each other.

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, and 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 disrupting the integrity of the ecosystems they occupy. Management for invasives depends upon the extent of establishment of the species. Small infestations may be easily controlled or eliminated but more well established populations might present difficult management challenges. Below is a list 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; facilitating information development and exchange; and coordinating on-the-ground removal and training. A membership brochure is available as a pdf file at http://www.ma-eppc.org.

- Several excellent web sites exist to provide information about invasive exotic species. The following sources provide individual species profiles for the most troublesome invaders, with information such as the species' country of origin, ecological impact, geographic distribution, as well as an evaluation of possible control techniques.
    - The Nature Conservancy's "Weeds on the Web" at http://tncweeds.ucdavis.edu/

- The Virginia Natural Heritage Program's invasive plant page at http://www.dcr.state.va.us/dnh/invinfo.htm
- The Missouri Department of Conservation's Missouri Vegetation Management Manual at http://www.conservation.state.mo.us/nathis/exotic/vegman/
- U.S. Department of the Interior, National Park Service invasive species monitoring resources at: http://science.nature.nps.gov/im/monitor/invasives.htm (under construction).

- The following site is a national invasive species information clearinghouse listing numerous other resources on a variety of related topics: http://www.invasivespecies.gov/

GLOSSARY

Alluvium: detrital deposits made by streams on riverbeds, flood plains, and alluvial fans; Especially a deposit of silt or silty clay laid down during time of flood.

Ambystomid: a small to moderate-sized terrestrial or semi aquatic New World salamander. Ambystomid salamanders possess lungs, as compared to plethodontid salamanders, which do not.

Anthropogenic: human caused.

Bedrock: the solid rock that underlies loose material, such as soil, sand, clay, or gravel.

Biocide: a natural or synthetic substance toxic to living organisms. Some ecologists advocate the use of this term instead of 'pesticides', since most pesticides are also toxic to species other than the target pest species. Indirectly, pesticides may also affect non-target organisms detrimentally in many other ways (e.g. by loss of food species or loss of shelter) so that the effects of pesticides may also be felt throughout a whole ecosystem. The term 'biocide' indicates this property more clearly than 'pesticide'.

Biological Diversity Area (BDA): An area containing and important in the support of plants or animals of special concern at state or federal levels, exemplary natural communities, or exceptional native diversity.

Bituminous coal: coal that contains more than 14% volatile matter. It is dark brown to black and burns with a smoky flame. Bituminous coal is the most abundant type of coal.

Bog: a low-nutrient, highly acidic wetland where sphagnum peat accumulates to the point where plant roots have minimal contact with either surface water or groundwater.

Calcareous: containing calcium carbonate. When the term is used to describe a type of rock, it implies that as much as 50% of the rock is calcium carbonate. Limestone is the most important and widely distributed of the carbonate rocks.

Calciphilic: thriving in environments rich in calcium salts.

Colluvium: weathered rock debris that has moved down a hill slope chiefly by gravity; includes talus and cliff debris.

Ecology: the study of relations between organisms and their natural environment, living and nonliving.

Ecosystem: The biotic (living) community and its abiotic (nonliving) environment functioning as a system.

Endemic: a species or other taxonomic group that is restricted to a particular geographic region, owing to such factors as isolation or response to soil or climatic conditions.

Eutrophication: the process of nutrient enrichment (usually by nitrates and phosphates) in aquatic ecosystems, such that the productivity of the system ceases to be limited by the availability of nutrients. It occurs naturally over geologic time, but may be accelerated by human activities (e.g., sewage disposal or agricultural run-off).

Food-web: a conceptual diagram that represents the feeding relationships of organisms within an ecosystem. It consists of a series of interconnecting food-chains, and shows the transfer of energy from primary producers (green plants) through a series of organisms that eat and are eaten. Only some of the many possible relationships can be shown in such a diagram and it is usual to include only one or two carnivores at the highest trophic levels.

Geomorphic: pertaining to the form of the earth or of its surface features.

Instar: an insect larva that is between one molt (ecdysis) of its exoskeleton and another, or between the final ecdysis and its emergence in the adult form. Instars are numbered and there are usually several during larval development.

Landscape Conservation Area (LCA): A large contiguous area; important because of its size, contiguous forest, open space, habitats, and/or inclusion of one or more Biological Diversity Areas, and although including a variety of land uses, has not been heavily disturbed and thus retains much of its natural character.

Mast: a fruit, especially of beech, but also of oak, elm, and other forest trees.

Mesic: refers to an environment that is neither extremely wet (hydric) nor extremely dry (xeric).

Mineral soil: a soil composed predominantly of, and having its properties determined predominantly by, mineral matter. Usually contains < 20 percent organic matter, but may contain an organic surface layer up to 30 centimeters thick.

Mycorrhiza: a close physical association between a fungus and the roots of a plant, from which both fungus and plant appear to benefit; a mycorrhizal root takes up nutrients more efficiently than does an uninfected root. A very wide range of plants can form mycorrhizae of one form or another, and some plants appear incapable of normal development in the absence of their mycorrhizal fungi.

Old-field ecosystem: develops on abandoned farmland as the land gradually reverts to forest.

Physiographic Province: A region of which all parts are similar in geologic structure and Climate and which has consequently had a unified geomorphic history; a region whose relief features and landforms differ significantly from that of adjacent regions.

Riparian: pertaining to or situated on the bank of a body of water, especially of a river.

Toe slope: The lowest part of a slope or cliff; the downslope end of an alluvial fan.

Trophic level: A step in the transfer of energy within a food-web. There may be several trophic levels within a system, for example: producers (autotrophs), primary consumers (herbivores), and secondary consumers (carnivores); further carnivores may form fourth and fifth levels.

Vernal: occurring in the spring.

Xeric: a dry, as opposed to a wet (hydric) or intermediate (mesic) environment.

Xerophyte: a plant that can grow in very dry conditions and is able to withstand periods of drought.

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APPENDIX I: SIGNIFICANCE RANKS

The Natural Heritage Areas that have qualified for inclusion in this report are ranked according to their significance as areas of importance to the biological diversity and ecological integrity of Mercer County. The four significance ranks are: Exceptional, High, Notable, and County significance. These ranks have been used to prioritize all identified sites and suggest the relative attention that sites should receive for protection.

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 special concern or a rare natural community type that is of a good size and extent and is 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 special concern or natural communities that are highly ranked, and because of their size or extent, relatively undisturbed setting, or a combination of these factors, rate as areas with high potential for protecting ecological resources in the county. Sites of high significance merit strong protection in the future.

Notable: Sites that are important for the biological diversity and ecological integrity of the county or region. Sites in this category contain occurrences of species of special concern or natural communities that are either of lower rank (G and S rank) or smaller size and extent than exceptional or high ranked areas, or are compromised in quality by activity or disturbance. Sites of notable significance merit protection within the context of their quality and degree of disturbance.

County: Sites that have great potential for protecting biodiversity in the county but are not, as yet, known to contain species of special 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.

APPENDIX II: PENNSYLVANIA NATURAL HERITAGE PROGRAM (PNHP)

The Pennsylvania Natural Heritage Program (PNHP) was established in 1982 as a joint effort of the Western Pennsylvania Conservancy, the Pennsylvania Department of Conservation and Natural Resources (formerly the Pennsylvania Department of Environmental Resources), the Bureau of Forestry, and the Pennsylvania Science Office of The Nature Conservancy. PNHP is part of a network of "Natural Heritage Programs" that utilize common methodology developed by The Nature Conservancy and refined through NatureServe – the organization that represents the network of Natural Heritage Programs – and the individual programs themselves. 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 geographical and baseline ecological information about rare plants, rare animals, unique plant communities, significant habitats, and geologic features in Pennsylvania. Presently, the PNHP database is Pennsylvania's chief storehouse of such information with approximately 9,000 detailed occurrence records that are stored as computer files. Additional data are stored in extensive manual files documenting over 150 natural community types, more than 800 plant and animal species, and about 1100 managed areas. As part of its function, PNHP provides reviews of projects that require permits as issued by the Pennsylvania Department of Environmental Protection. This environmental review function of the PNHP is referred to as PNDI or the Pennsylvania Natural Diversity Inventory.

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 state rarity for resources that do not have official state status, such as invertebrate animals and natural communities of organisms. A summary of global and state ranks can be found in Appendix V.

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

APPENDIX III: GREENE COUNTY NATURAL HERITAGE INVENTORY SITE SURVEY FORM

Page _____ of _____

County: _____ Quad: _____ Date: _____ GPS'd?_____

Site #: _____ Site Name: _____ Photo? _____

Source Code: _____ Field Crew: _____

Site Description (incl snags, woody debris, scat, etc.):

Wildlife Observations:

Overstory Dominant(s): _____

Understory Dominant(s): _____

Herb Layer Dominant(s): _____

Impacts/Threats: _____

	Size Class						
Woody spp.	SE	SA	U	O	SH	**Herbs**	**Ferns & Fern Allies**
							Graminoids

SE = seedling SA = sapling U = understory O = overstory SH = shrub

Site #: _________ Source Code: ___________________ Date: ____________________

	Size Class						
Woody spp.	SE	SA	U	O	SH	**Herbs**	**Ferns & Fern Allies**
							Graminoids

APPENDIX IV: CLASSIFICATION OF NATURAL COMMUNITIES IN PENNSYLVANIA

CNHIs and the status of natural community classification 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 Diversity Inventory (PNDI) 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 Pennsylvania. Work is ongoing to improve the current classification system. 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 (early stages of forest regrowth, old agricultural fields, manmade wetlands, etc.), are not addressed in this classification. Until more extensive classification work can be completed to define these types of communities and incorporate them into a single state-wide 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.

Community Ranks

As with species that are of concern, ranks have been assigned to rate the rarity of each natural community type identified for Pennsylvania. Appendices Vc and Vd list criteria for global and state ranks. In most cases, the global extent of these communities has yet to be fully evaluated, and no global rarity rank has been assigned. Work is ongoing to refine these ranks and to further develop the ranking system to rate the relative quality of communities within a type.

FIKE 1999 TYPES

COMMUNITY NAME	GLOBAL RANK	STATE RANK
TERRESTRIAL FORESTS:		
Hemlock (white pine) forest	G5	S4
Serpentine pitch pine – oak forest	G2	S1
Serpentine Virginia pine – oak forest	G2	S1
Pitch Pine – mixed oak forest	G?	S4
Virginia pine – mixed hardwood forest	G?	S5
Dry white pine (hemlock) – oak forest	G?	S4
Hemlock (white pine) – northern hardwood forest	G?	S5
Hemlock (white pine) – red oak – mixed hardwood forest	G?	S4
Hemlock – tuliptree – birch forest	G?	S4
Rich hemlock – mesic hardwoods forest	G?	S2S3
Dry oak –heath forest	G?	S4S5
Dry oak – mixed hardwood forest	G?	S3
Red oak – mixed hardwood forest	G?	S5
Northern hardwood forest	G?	S4
Black cherry – northern hardwood forest	G?	S4
Tuliptree – beech – maple forest	G?	S4

COMMUNITY NAME	GLOBAL RANK	STATE RANK
TERRESTRIAL FORESTS (con't.):		
Sugar maple – basswood forest	G?	S4
Mixed mesophytic forest	G?	S1S2
Sweet gum – oak coastal plain forest	G?	S1
Red maple (terrestrial) forest	G?	S5
Black-gum ridgetop forest	G?	S3
Aspen/gray (paper) birch forest	G?	S?
Black locust forest	G?	SW
PALUSTRINE FORESTS:		
Black Spruce- tamarack peatland forest	G?	S3
Red Spruce palustrine forest	G?	S3
Hemlock palustrine forest	G5	S3
Hemlock – mixed hardwood palustrine forest	G?	S3S4
Red spruce – mixed hardwood palustrine forest	G?	S3
Bottomland oak – hardwood palustrine forest	G5	S2
Red maple – black-gum palustrine forest	G5	S3S4
Red maple – black ash palustrine forest	G?	S2S3
Red maple – magnolia Coastal Plain palustrine forest	G?	S1
Great Lakes Region lakeplain palustrine forest	G?	S1
Sycamore – (river birch)- box elder floodplain forest	G?	S3
Silver maple floodplain forest	G?	S3
Red maple – elm – willow floodplain swamp	G?	S2
TERRESTRIAL WOODLANDS:		
Pitch pine – heath woodland	G4	S2
Pitch pine – scrub oak woodland	G4	S2
Red spruce rocky summit	G?	S1
Pitch pine – rhodora – scrub oak woodland	G?	S1
Pitch pine – mixed hardwood woodland	G4	S2S3
Virginia pine – mixed hardwood shale woodland	G?	S2
Red-cedar – mixed hardwood rich shale woodland	G?	S1S2
Dry oak – heath woodland	G4	S3
Birch (black-gum) rocky slope woodland	G?	S2
Yellow oak – redbud woodland	G?	S2
Great Lakes Region scarp woodland	G?	S1S2
Great Lakes Region bayberry – cottonwood community	G?	S1
PALUSTRINE WOODLANDS:		
Pitch pine – leatherleaf woodland	G?	S2
Black spruce – tamarack palustrine woodland	G?	S2
Red spruce palustrine woodland	G?	S2S3
Red maple – highbush blueberry palustrine woodland	G5	S4
Red maple – sedge palustrine woodland	G5	S4
Red maple – mixed shrub palustrine woodland	G?	S4

COMMUNITY NAME	GLOBAL RANK	STATE RANK
TERRESTRIAL SHRUBLANDS:		
Red-cedar – prickly pear shale shrubland	G?	S2
Red-cedar – pine serpentine shrubland	G2	S1
Red-cedar – redbud shrubland	G?	S2
Low heath shrubland	G4	S1
Low heath – mountain ash shrubland	G?	S2
Scrub oak shrubland	G4	S3
Rhodora – mixed heath – scrub oak shrubland	G?	S1
PALUSTRINE SHRUBLANDS:		
Buttonbush wetland	G?	S4
Alder – ninebark wetland	G?	S3
Alder – sphagnum wetland	G5	S4
Highbush blueberry – meadow-sweet wetland	G5	S5
Highbush blueberry – sphagnum wetland	G?	S5
Leatherleaf – sedge wetland	G?	S3
Leatherleaf – bog rosemary	G?	S2
Leatherleaf – cranberry peatland	G?	S2S3
Water-willow (*Decodon verticillatus*) shrub wetland	G?	S3
River birch – sycamore floodplain scrub	G?	S4
Poison sumac – red-cedar – bayberry fen	G2	S1
Buckthorn – sedge (*Carex interior*) – golden ragwort fen	G2G3	S1
Great Lakes Region scarp seep	G?	S1
Great Lakes Region bayberry – mixed shrub palustrine shrubland	G?	S1
TERRESTRIAL HERBACEOUS OPENINGS:		
Side-oats gramma calcareous grassland	G2	S1
Calcareous opening/cliff	G?	S2
Serpentine grassland	G?	S1
Serpentine gravel forb community	G?	S1
Great Lakes Region dry sandplain	G?	S1
HERBACEOUS WETLANDS:		
Bluejoint – reed canary grass marsh	G?	S5
Cat-tail marsh	G?	S5
Tussock sedge marsh	G?	S3
Mixed forb marsh	G3G4	S3
Herbaceous vernal pond	G?	S3S4
Wet meadow	G?	S5
Bulrush marsh	G?	S3
Great Lakes Region palustrine sandplain	G?	S1
Prairie sedge – spotted joe – pye – weed marsh	G?	S1S2
Open sedge (*Carex stricta, C. prairea, C. lacustris*) fen	G?	S1
Golden Saxifrage – sedge rich seep	G?	S2
Skunk cabbage – golden saxifrage forest seep	G?	S4S5
Serpentine seepage wetland	G?	S1

COMMUNITY NAME	GLOBAL RANK	STATE RANK
HERBACEOUS WETLANDS (con't.):		
Golden saxifrage – Pennsylvania bitter-cress spring run	G?	S3S4
Sphagnum – beaked rush peatland	G?	S3
Many fruited sedge – bladderwort peatland	G?	S2
Water-willow (*Justicia americana*) – smartweed riverbed community	G?	S4
Riverside ice scour community	G?	S1S2
Big bluestem – Indian grass river grassland	G?	S3
Pickerel-weed – arrow-arum – arrowhead wetland	G3G4	S4
Spatterdock – water lily wetland	G?	S4
COMMUNITY COMPLEXES:	Complexes not ranked	
Acidic Glacial Peatland Complex		
Great Lakes Region Scarp Complex		
Erie Lakeshore Beach-Dune-Sandplain Complex		
Mesic Till Barrens Complex		
Serpentine Barrens Complex		
Ridgetop Acidic Barrens Complex		
River Bed-Bank-Floodplain Complex		

SMITH 1991 TYPES

COMMUNITY NAME	GLOBAL RANK	STATE RANK
SUBTERRANEAN COMMUNITIES:		
Solution Cave Terrestrial Community	G?	S3
Solution Cave Aquatic Community	G?	S3
Tectonic Cave Community	G?	S3S4
Talus Cave Community	G?	S2S4
DISTURBED COMMUNITIES:		
Bare Soil	G?	S?
Meadow/Pastureland	G?	S?
Cultivated Land	G?	S?
Successional Field	G?	S?
Young Miscellaneous Forest	G?	S?
Conifer Plantation	G?	S?
ESTUARINE COMMUNITIES:		
Deepwater Subtidal Community	G?	S1
Shallow-Water Subtidal Community	G?	S1
Freshwater Intertidal Mudflat	G3G4	S1
Freshwater Intertidal Marsh	G3G4	S1

COMMUNITY NAME	GLOBAL RANK	STATE RANK
RIVERINE COMMUNITIES:		
Low-Gradient Ephemeral/Intermittent Creek	G?	S5
Low-Gradient Clearwater Creek	G?	S3S4
Low-Gradient Clearwater River	G?	S2S3
Low-Gradient Brownwater Creek	G?	S2S3
Medium-Gradient Ephemeral/Intermittent Creek	G?	S5
Medium-Gradient Clearwater Creek	G?	S3
Medium-Gradient Clearwater River	G?	S?
Medium-Gradient Brownwater Creek	G?	S3
High-Gradient Ephemeral /Intermittent Creek	G?	S5
High-Gradient Clearwater Creek	G?	S3
High-Gradient Clearwater River	G?	S?
High-Gradient Brownwater Creek	G?	S?
Waterfall and Plungepool	G?	S3S4
Spring Community	G?	S1S2
Spring Run Community	G?	S1S2
LACUSTRINE COMMUNITIES:		
Glacial Lake	G?	S1
Nonglacial Lake	G?	S2
Artificial Lake	---	---
Natural Pond	G?	S2S3
Artificial Pond	---	---
Stable Natural Pool	G?	S?
Ephemeral/Fluctuating Natural Pool	G?	S1
Artificial Pool	---	---
Ephemeral/Fluctuating Limestone Sinkhole	G?	S1

APPENDIX V: FEDERAL AND STATE ENDANGERED SPECIES CATEGORIES, GLOBAL AND STATE ELEMENT RANKS

Several federal and state legislative acts have provided the authority and means for the designation of endangered, threatened, rare, etc. species lists. Those acts and status summaries follow. However, not all of the species or natural communities considered by conservation biologists (e.g., Pennsylvania Biological Survey) as "special concern resources" are included on the state or federal lists. In this county inventory report, "N" denotes those special concern species that are not officially recognized by state or federal agencies. Therefore: N = No current legal status, but is considered to be of special concern in Pennsylvania, or is under review for such consideration, by conservation biologists. Contact the Pennsylvania Natural Heritage Program for more information.

APPENDIX V_a: Federal Status

All Plants and Animals: Legislative Authority: U.S. Endangered Species Act (1973), U.S. Fish and Wildlife Service, February 21, 1990, Federal Register.

LE = Listed Endangered - Taxa in danger of extinction throughout all or a significant portion of their ranges.

LT = Listed Threatened - Taxa that are likely to become endangered within the foreseeable future throughout all or a significant portion of their ranges.

PE = Proposed Endangered - Taxa already proposed to be listed as endangered.

PT = Proposed Threatened - Taxa already proposed to be listed as threatened.

{N = No current legal status, but is considered to be of special concern in Pennsylvania, or is under review for such consideration, by conservation biologists. Contact the Pennsylvania Natural Diversity Inventory for more information.}

APPENDIX V_b: Pennsylvania Status

Native Plant Species: Legislative Authority: Title 25 Chapter 82, Conservation of Native Wild Plants, January 1, 1988; Pennsylvania Department of Environmental Resources.

PE = Pennsylvania Endangered - Plant species which are in danger of extinction throughout most or all of their natural range within this Commonwealth, if critical habitat is not maintained or if the species is greatly exploited by man. This classification shall also include any populations of plant species that are classified as Pennsylvania Extirpated, but which subsequently are found to exist in this Commonwealth.

PT = Pennsylvania Threatened - Plant species which may become endangered throughout most or all of their natural range within this Commonwealth, if critical habitat is not maintained to prevent their future decline, or if the species is greatly exploited by man.

PR = Pennsylvania Rare - Plant species which are uncommon within this Commonwealth because they may be found in restricted geographic areas or in low numbers throughout this Commonwealth.

PX = Pennsylvania Extirpated - Plant species believed by the Department to be extinct within this Commonwealth. These plants may or may not be in existence outside the Commonwealth.

PV = Pennsylvania Vulnerable - Plant species which are in danger of population decline within this Commonwealth because of their beauty, economic value, use as a cultivar, or other factors which indicate that persons may seek to remove these species from their native habitats.

TU = Tentatively Undetermined - A classification of plant species which are believed to be in danger of population decline, but which cannot presently be included within another classification due to taxonomic uncertainties, limited evidence within historical records, or insufficient data.

{N = No current legal status, but is considered to be of special concern in Pennsylvania, or is under review for such consideration, by conservation biologists. Contact the Pennsylvania Natural Heritage Program for more information.}

Animals - The following state statuses are used by the Pennsylvania Game Commission (Legislative Authority: Title 34, Chapter 133 pertaining to wild birds and mammals, Game and Wildlife Code, revised Dec. 1, 1990) and by the Pennsylvania Fish and Boat Commission (Legislative Authority: Title 30 Chapter 75 pertaining to fish, amphibians, reptiles and aquatic organisms, Fish and Boat Code, revised February 9, 1991):

PE = Pennsylvania Endangered

Birds & mammals - Species in imminent danger of extinction or extirpation throughout their range in Pennsylvania if the deleterious factors affecting them continue to operate. These are: 1) species whose numbers have already been reduced to a critically low level or whose habitat is so drastically reduced or degraded that immediate action is required to prevent their extirpation from

the Commonwealth; or 2) species whose extreme rarity or peripherality places them in potential danger of precipitous declines or sudden extirpation throughout their range in Pennsylvania; or 3) species that are classified as "Pennsylvania Extirpated", but which are subsequently found to exist in Pennsylvania as long as the above conditions 1 or 2 are met; or 4) species determined to be "Endangered" pursuant to the Endangered Species Act of 1973, Public Law 93-205 (87 Stat. 884), as amended.

Fish, amphibians, reptiles & aquatic organisms - All species declared by: 1) the Secretary of the United States Department of the Interior to be threatened with extinction and appear on the Endangered Species List or the Native Endangered Species List published in the Federal Register; or 2) are declared by the Pennsylvania Fish and Boat Commission, Executive Director to be threatened with extinction and appear on the Pennsylvania Endangered Species List published by the Pennsylvania Bulletin.

PT = Pennsylvania Threatened

Birds & mammals - Species that may become endangered within the foreseeable future throughout their range in Pennsylvania unless the casual factors affecting the organism are abated. These are: 1) species whose populations within the Commonwealth are decreasing or are heavily depleted by adverse factors and while not actually endangered, are still in critical condition; 2) species whose populations may be relatively abundant in the Commonwealth but are under severe threat from serious adverse factors that are identified and documented; or 3) species whose populations are rare or peripheral and in possible danger of severe decline throughout their range in Pennsylvania; or 4) species determined to be "Threatened" pursuant to the Endangered Species Act of 1973, Public Law 93-205 (87 Stat. 884), as amended, that are not listed as "Pennsylvania Endangered."

Fish, amphibians, reptiles & aquatic organisms - All species declared by: 1) the Secretary of the United States Department of the Interior to be in such small numbers throughout their range that they may become endangered if their environment worsens, and appear on a Threatened Species List published in the Federal Register; or 2) are declared by the Pennsylvania Fish and Boat Commission Executive Director to be in such small numbers throughout their range that they may become endangered if their environment worsens and appear on the Pennsylvania Threatened Species List published in the Pennsylvania Bulletin.

{N = No current legal status, but is considered to be of special concern in Pennsylvania, or is under review for such consideration, by conservation biologists. Contact the Pennsylvania Natural Heritage Program for more information.}

Internal Fish and Boat Commission Status Category:

PC = Pennsylvania Candidate - Species that exhibit the potential to become Endangered or Threatened in the future. Pennsylvania populations of these taxa are: 1) "rare" due to their decline, distribution, restricted habitat, etc.; 2) are "at risk" due to aspects of their biology, certain types of human exploitation, or environmental modification; or, 3) are considered "undetermined" because adequate data is not available to assign an accurate status.

This category is unofficial and has no basis in any law (i.e., Chapter 75, Fish and Boat

Code), as do the Endangered and Threatened categories.

Invertebrates - Pennsylvania Status: No state agency is assigned to develop regulations to protect terrestrial invertebrates, although a federal status may exist for some species. Aquatic invertebrates are regulated by the Pennsylvania Fish And Boat Commission, but have not been listed to date.

Although no invertebrate species are presently state listed, conservation biologists unofficially assign numerous state status and/or state rank designations. NOTE: Invertebrate species are regularly considered under the U.S. Endangered Species Act for federal status assignments.

APPENDIX V_c: Global and State Ranking

Global and State Ranking is a system utilized by the network of 50 state natural heritage programs in the United States. Although similar to the federal and state status designations, the ranking scheme allows the use of one comparative system to rank all species in a relative format. Unlike state or federal status designation guidelines, the heritage ranking procedures are also applied to natural community resources. Global ranks consider the imperilment of a species or community throughout its range, while state ranks provide the same assessment within each state. Although there is only one global rank used by the heritage network, state ranks are developed by each state and allow a "one-system" comparison of a species or communities imperilment state by state. For more information, contact the Pennsylvania Natural Heritage Program.

Global Element Ranks

G1 = Critically imperiled globally because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.

G2 = Imperiled globally because of rarity (6 to 20 occurrences or few remaining individuals or acres)or because of some factor(s) making it very vulnerable to extinction throughout its range.

G3 = Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range or because of other factors making it vulnerable to extinction throughout its range; in terms of occurrences, in the range of 21 to 100.

G4 = Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.

G5 = Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.

GH = Of historical occurrence throughout its range, i.e., formerly part of the established biota, with the expectation that it may be rediscovered (e.g., Bachman's Warbler).

GU = Possibly in peril range-wide but status uncertain; need more information.

GX = Believed to be extinct throughout its range (e.g., Passenger Pigeon) with virtually no likelihood that it will be rediscovered.

G? = Not ranked to date.

State Element Ranks

S1 = Critically imperiled in state because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extirpation from the state.

S2 = Imperiled in state because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it vulnerable to extirpation from the state.

S3 = Rare or uncommon in state (on the order of 21 to 100 occurrences).

S4 = Apparently secure in state, with many occurrences.

S5 = Demonstrably secure in state and essentially ineradicable under present conditions.

SA = Accidental (occurring only once or a few times) or casual (occurring more regularly But not every year) in state, including species which only sporadically breed in the state.

SE = An exotic established in state; may be native elsewhere in North America (e.g., house finch or catalpa in eastern states).

SH = Of historical occurrence in the state, perhaps having not been verified in the past 20 years, and suspected to be still extant.

SN = Regularly occurring, usually migratory and typically nonbreeding species for which no significant or effective habitat conservation measures can be taken in the state.

SR = Reported from the state, but without persuasive documentation which would provide a basis for either accepting or rejecting (e.g., misidentified specimen) the report.

SU = Possibly in peril in state but status uncertain; need more information.

SX = Apparently extirpated from the state.

SZ= Not of significant conservation concern in the state, invariably because there are no (zero) definable element occurrences in the state, although the taxon is native and appears regularly in the state.

S? = Not ranked to date.

NOTE: The study of naturally occurring biological communities is complex and natural community classification is unresolved both regionally and within Pennsylvania. The Global and State Ranking of natural communities also remains difficult and incomplete. Although many natural community types are clearly identifiable and are ranked, others are still under review and appear as G? and/or S?

APPENDIX VI: PLANTS AND ANIMALS OF SPECIAL CONCERN IN GREENE COUNTY

Documented in the Pennsylvania Natural Diversity Inventory database since 1984

Scientific Name	Common Name	State Rank	Global Rank
Animals			
Amblema plicata	Three-Ridge Mussel	S2S3	G5
Ardeas herodia	Great Blue Heron	N	N
Celithemis eponina	Halloween Pennant	N	G5
Citheronia regalis	Regal Moth	SU	G5
Epioblasma triquetra	Snuffbox Mussel	S1	G3
Fusconaia flava	Wabash Pigtoe	S2	G5
Simpsonaias ambigua	Salamander Mussel	S1?	G3
Tritogonia verrucosa	Pistolgrip Mussel	S1	G4
Plants			
Aconitum uncinatum	Blue Monkshood	S2	G4
Antennaria solitaria	Solitary Pussytoes	S1	G5
Aplectrum hyemale	Puttyroot	S3	G5
Asplenium pinnatifidum	Broad-leaved Spleenwort	S3	G4
Delphinium exaltattum	Purple Larkspur	S1	G3
Erigenia bulbosa	Harbinger-of-Spring	S2	G5
Erythronium albidum	White Trout Lily	S3	G5
Helianthus microcephalus	Small Woodland Sunflower	S3	G5
Iris cristata	Crested Dwarf Iris	S1	G5
Isotria medeloides	Small Whorled Pogonia	S1	G2
Meehania cordata	Heartleaf Meehania	S1	G5
Oxydendrum arboreum	Sourwood	S3S4	G5
Passiflora lutea	Passionflower	S1	G5
Polymnia uvedalia	Yellow Leafcup	SR	G4G5
Scutellaria saxatilis	Rock Skullcap	S1	G3
Stachys nuttallii	Nuttall's Hedge Nettle	S1	G5?
Tipularia discolor	Crane-fly Orchid	S3	G4G5
Vitis cinerea var. baileyanna	Pigeon Grape	SH	G4G5T?
Woodwardia aerolata	Netted Chainfern	S2	G5

APPENDIX VII: 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:

Forest Stewardship Program
DCNR - Bureau of Forestry
Rachel Carson State Office Building
400 Market Street
P.O. Box 8552
Harrisburg, PA 17105-8552
(717) 787-2106

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
Rachel Carson State Office Building
400 Market Street
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. For more information, contact:

S.W. Pennsylvania Woodland Owners Association
195 E. High Street
Waynesburg, PA 15370
(724) 627-6624

The *Forest Stewards Volunteer Program* has an excellent web site providing general information and links to publications on sustainable forestry.
http://vip.cas.psu.edu/index.html (link to PA Forest Stewards.cas.psu.edu)

APPENDIX VIII: GIS DATA SOURCES

Bedrock geologic units of Pennsylvania, scale 1:250,000. Digital datasets prepared by C.E. Miles, T.G. Whitfield, from published 1980 state geologic map. 2001. Pennsylvania Bureau of Topographic and Geologic Survey, DCNR. Available online: http://www.dcnr.state.pa.us/topogeo/gismaps/digital.aspx. Accessed: 2001.

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Local roadways in Greene County, Pennsylvania. 2003. Pennsylvania Department of Transportation, Bureau of Planning and Research, Geographic Information Division.

National Elevation Dataset for Greene County, Pennsylvania, U.S. Geological Survey, EROS Data Center 1999 (Hill shade map).

National Land Cover Data Set for Pennsylvania; Albers Grid. Compiled from Landsat satellite TM imagery (circa 1992) with spatial resolution of 30 m. USGS 1999.

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Pennsylvania Minor Civil Divisions: PA Explorer CD-ROM Edition, Environmental Resources Research Institute, from the Pennsylvania Department of Transportation's civil divisions data set 1996.

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Pennsylvania's Physiographic Regions: PA Explorer CD-ROM Edition, Environmental Resources Research Institute, 1996. (see Sevon in references for map authorship).

Pennsylvania-Small Watershed, Environmental Resources Research Institute, Pennsylvania Department of Environmental Protection, 5/3/1997.

State maintained roadway centerlines of Pennsylvania, 2003. Pennsylvania Department of Transportation, Bureau of Planning and Research, Geographic Information Division.

USGS 1:24,000 Topographic quadrangles. Pennsylvania Spatial Data Access (PASDA), downloaded 2000. http://www.pasda.psu.edu/

APPENDIX IX: PLANT AND ANIMAL FACT SHEETS

River oats
Chasmanthium latifolium

What it looks like:

River oats are a colonial grass growing from stout rhizomes, underground stems. Individual plants, or culms, grow from one to one and a half meters tall.

Leaves are about 10 centimeters long and one or two centimeters wide, with slightly pronounced middle veins.

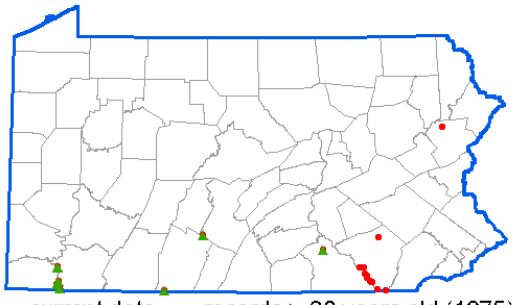
Flowers are borne in flat, wide spikelets growing on slender pedicels in drooping inflorescences.

J. S. Peterson, USDA-NRCS PLANTS Database

Where it is found:

River oats grow on river- and stream banks and in moist woodlands. It may grow in marshy conditions, but seems to do better in well-drained, loamy soils. Its range extends from New Jersey west to Nebraska and Arizona and south to Florida.

Pennsylvania Distribution by County



▲ current data • records > 30 years old (1975)

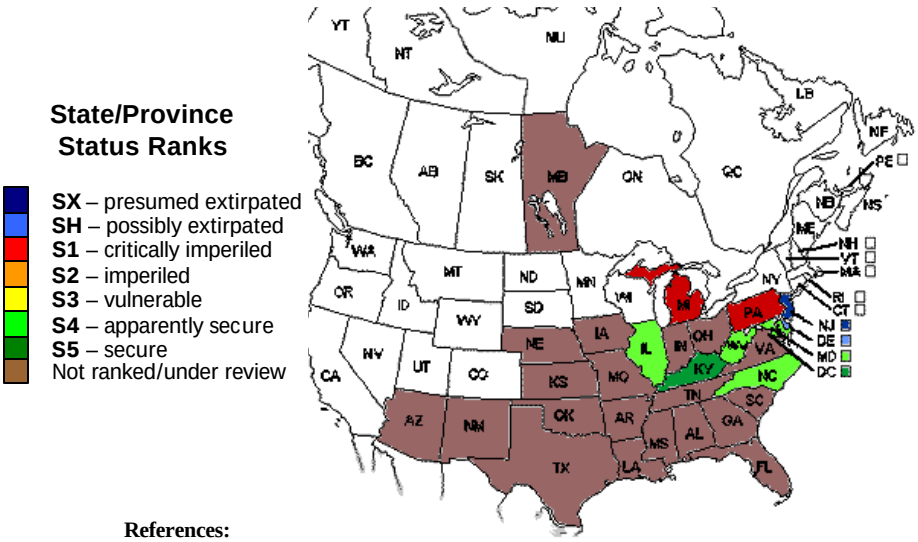
Pennsylvania Natural Heritage Program data 2005

Why it is rare:

Though river oats are extirpated or critically imperiled in states at the northeastern edge of their natural range, the species is more secure to the south and west. In Pennsylvania it is represented in only a few places in the southern part of the commonwealth, and has been ranked as critically imperiled.

North American State/Province Conservation Status

Map by NatureServe



NatureServe conservation status ranks:

G5 – apparently secure worldwide

S1 – critically imperiled within Pennsylvania

Conservation considerations:

River oat colonies may be impacted by wetlands and flood regime modifications and lumber harvesting. Native grasses such as river oats are also threatened by competition from exotic plant species invading their habitat.

References:

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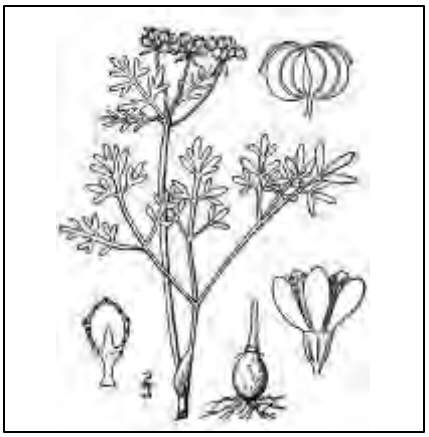
Harbinger-of-Spring
Erigenia bulbosa

What it looks like:

Harbinger of spring is a small (5 to 15 centimeter, or two to six inches tall) herb in the carrot family

Leaves are delicate and compound, divided irregularly into oval leaflets
Flowers are small and white, clustered in two to four small umbels; flowering occurs in March and April



USDA-NRCS PLANTS Database - from *Illustrated flora of the northern states and Canada*. (Britton, N.L., and A. Brown. 1913.) Vol. 3: 109.

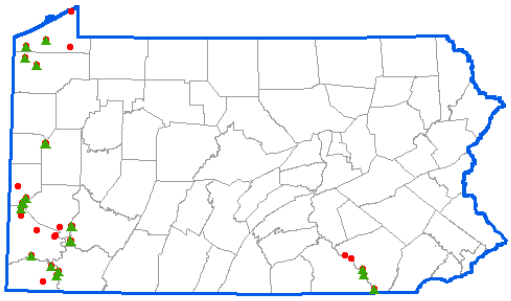
Where it is found:

Rich, mixed hardwood forests in lowlands, costal plains, and mountain valleys from Ontario south to Georgia and New York west to Kansas and Oklahoma.

Why it is rare:

Harbinger-of-spring's lowland forest habitats have been fragmented by logging and invaded by exotic species. Although the species' worldwide population is considered secure, it is quite rare in Pennsylvania and other states at the edge of its range (see maps).

Pennsylvania Distribution by County



Pennsylvania Natural Heritage Program data 2005

North American State/Province Conservation Status

Map by NatureServe

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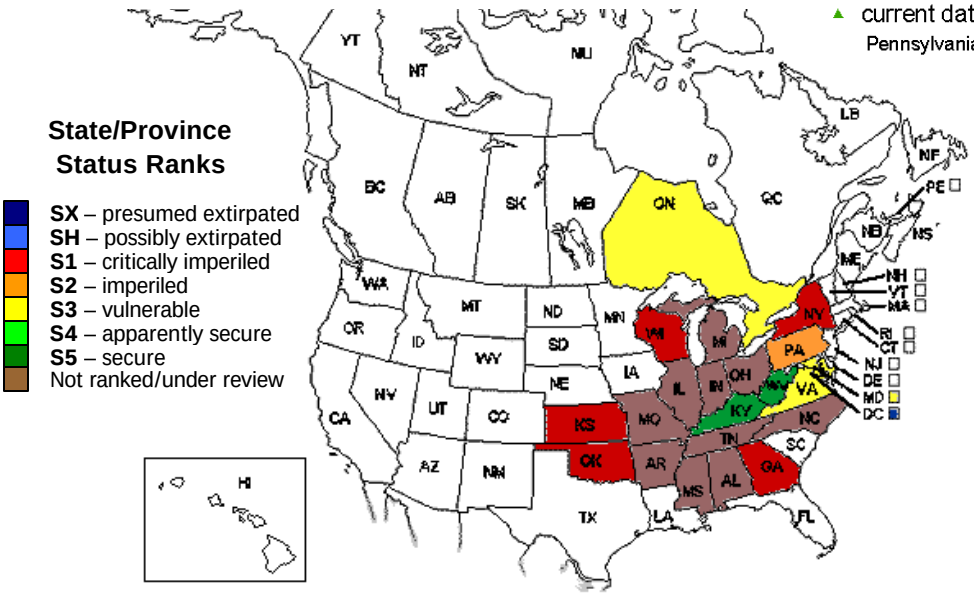

NatureServe conservation status ranks:

G5 – secure worldwide; on a global scale, common, widespread, and abundant

S2 – imperiled in Pennsylvania; highly vulnerable to extinction due to restricted range, few populations, or other factors

Conservation considerations:

Loss of bottomland forest to agriculture and unsustainable forestry has severely impacted many of the forests where this plant may have existed. Conserving high-quality bottomland forests where this plant normally grows is key to the protection of this species.

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. 385.
- Holmgren, Noel H. 1998. *The Illustrated Companion to Gleason and Cronquist's Manual.* New York: The New York Botanical Garden. 361.
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Yellow passionflower
Passiflora lutea

What it looks like:

Yellow passionflower is a perennial herbaceous vine, climbing or trailing to lengths of around three meters (ten feet).

Leaves have three palmate lobes tapering to rounded points; they are hairless, with no teeth at the margins.

Flowers have five stamens surrounding a central pistil in the middle of a two-centimeter fringe of long, slender yellow-white petals.

Edward E. Chester, TENN Vascular Plant Herbarium

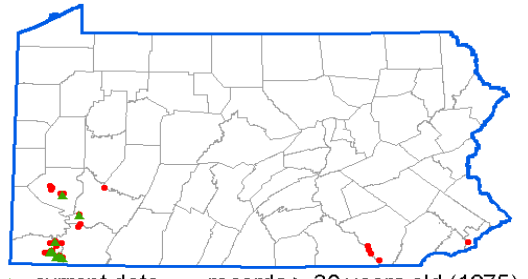
Where it is found:

Yellow passionflower grows in wet conditions; it is considered a national wetland indicator species. Pennsylvania is at the northeastern corner of its range, which runs south to Florida and west to Kansas and Texas.

Why it is rare:

The two states in which yellow passionflower is classified as critically imperiled, Kansas and Pennsylvania, are both at the edges of its range. It is possible, then, that populations in these states are small and scattered in part because they are at the edge of the species' ecological tolerances. However, yellow passionflower's wetland habitat is frequently the target of human disturbance, including drainage and indirect modification by flood-control regimes. Probably yellow passionflower would be more abundant given more wetland habitat, even at the edges of its natural range.

Pennsylvania Distribution by County



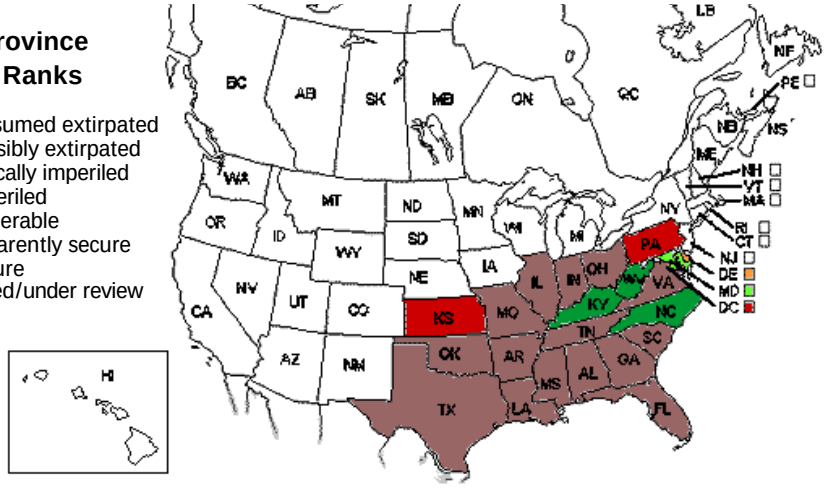
▲ current data • records > 30 years old (1975)

Pennsylvania Natural Heritage Program data 2005

NatureServe conservation status ranks:

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



G5 – secure worldwide
S1 – critically imperiled within Pennsylvania

Conservation considerations:

Yellow passionflower's status has yet to be determined through the majority of its natural range; further study of this species' abundance, especially in states at the edges of its range, would be invaluable in planning its conservation. Generally speaking, yellow passionflower will benefit from preservation of its wetland habitat and management of invasive competitors.

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. 164.
- Griggs, Robert F. 1914. "Observations on the behavior of some species at the edges of their ranges."
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Snow trillium
Trillium nivale

What it looks like:

Snow trillium is a small member of the lily family, growing only up to 15 centimeters (about 6 inches) tall. Its structure is very simple: a single stem rises from a short, thick rhizome (underground stem) to a single whorl of leaves, then a single flower. The seeds bear fatty elaiosomes, which attract ants to carry seeds away from the parent plant. Individual plants may live more than eight years.

The **flower** has three white, oval-shaped petals above three slenderer sepals; they are about 4 cm (2 in) across or smaller. Flowering occurs during late February and March.

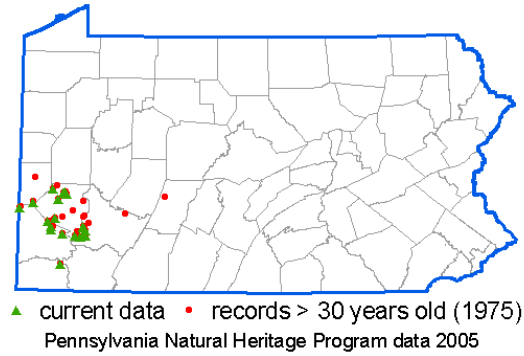
Three **leaves** are arranged in a single whorl below the flower. They are oval to triangular with a few prominent parallel veins, and from 3 to 5 cm (1.5 to 2 in) long.

Thomas G. Barnes @ USDA-NRCS PLANTS Database - Barnes, T.G. & S.W. Francis. 2004. *Wildflowers and ferns of Kentucky*. University Press of Kentucky.

Where it is found:

Snow trillium grows in wet, fertile woodlands from Pennsylvania west to North Dakota and Nebraska and south to Virginia. It is a calciphile, prefering soil with high limestone content.

Pennsylvania Distribution by County



Pennsylvania Natural Heritage Program data 2005

Why it is rare:

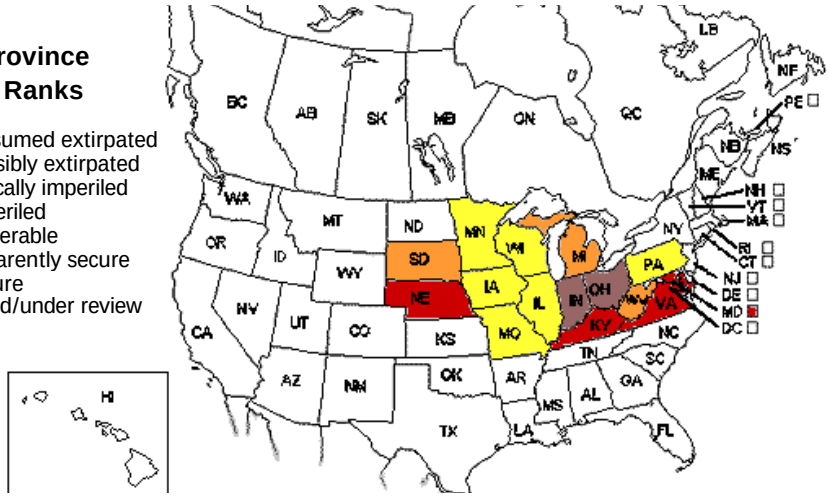
Threats to snow trillium include habitat destruction by logging and quarrying, grazing in the Midwest, and competition from invasive species in some areas. Its populations are often small and widely scattered across its range.

North American State/Province Conservation Status

Map by NatureServe

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



NatureServe conservation status ranks:

G4 – apparently secure worldwide

S3 – vulnerable in Pennsylvania, either due to restricted range or small population size

Conservation considerations:

Snow trillium can most benefit from preservation of undisturbed habitat, with consideration given to save areas large enough for population expansion. Control or removal of invasive exotic competitors will also help.

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. 834.
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Great Blue Heron (*Ardea herodias*) Rookery

What it is:
A rookery is a colony of nesting birds, and few rookeries in Pennsylvania offer as dramatic a sight as those of the largest bird to breed in the state, the Great Blue Heron.

Western Pennsylvania Conservancy

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. Great Blue Herons may also nest in mixed-species rookeries with other heron species, other waterbirds, or even raptors such as owls and hawks.

Life in the rookery:
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.

Larry Master, NatureServe

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. Broods usually contain two or three chicks. The parents share the tasks of incubating the eggs and feeding the chicks, catching more than 20 percent of their own body weight in fish every day.

Young Great Blue Herons are altricial, or helpless at hatching, born unable to walk and with a light coat of gray down. Initially they are unable to control their body temperature, but they may thermoregulate by moving in and out of sunlight until they develop more complete plumage. Chicks require the most food between 26 and 41 days after hatching, when they may eat 270 grams (about 0.6 pounds) of fish each day. They usually compete for food, with the largest ones receiving more than their smaller siblings, but because heron parents usually bring back portions of fish too large for one chick to monopolize, it is rare for Great Blue Heron chicks to kill each other fighting over food, as happens in some other bird species. The chicks are ready to leave the nest by the end of the summer.

Threats to heron rookeries:
Protection of breeding grounds is one of the keys to conserving bird species. Great Blue Herons tolerate less disturbance to their breeding colonies than most waterbirds. It is recommended that human activity be excluded from a buffer zone of 300 meters (a little less than 1000 feet) around heron rookeries to prevent people from scaring the herons off their nests. Sufficient and 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.

Saving the places we care about

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- Weseloh, D. Vaughn and Robert T. Brown. 1971. "Plant distribution within a heron rookery." *American Midland Naturalist*, 86(1): 57-64.

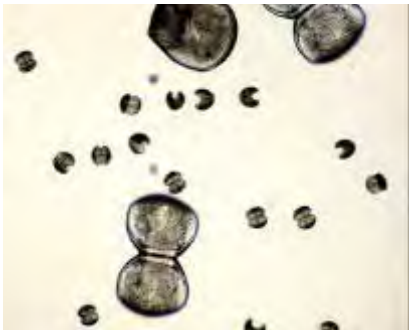
Freshwater mussels
Family Unionidae

What they are:

The northern riffleshell, *Epioblasma torulosa rangiana*
USFWS, Digital Library System.

Freshwater mussels are bivalves, or two-shelled mollusks – evolutionary relatives of clams, oysters, and scallops. They are largely immobile creatures, burrowing into streambeds and feeding by filtering microscopic plants called phytoplankton out of the surrounding water.

North America is home to 297 species of freshwater mussels, the Unionids, which are distinguished by their unique dispersal strategy. Unionid mussels hatch in a special larval form called glochidia, which attach themselves to the gills of passing fish. After a sufficient period of attachment, the glochidia metamorphose into immature mussels and drop off the host fish in a new location. Female freshwater mussels have evolved a wide variety of strategies to lure host fish close enough for glochidia to attach, including waving specially shaped appendages that resemble the fish's prey.



The larger glochidia of the fatmucket, *Lampsilis siliquoidea*, and the tiny glochidia of a species not found in Pennsylvania
M.C. Barnhart, Unio Gallery, 2000.

Where they are found:

Freshwater mussels are found throughout the streams, rivers, and lakes of North America, which is home to 297 species of mussel – more than anywhere else in the world.

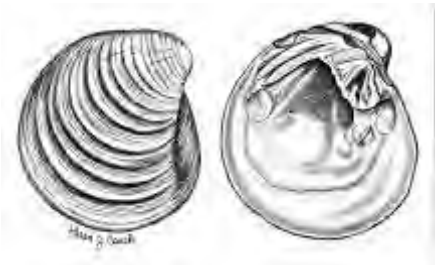
Endangered mussel species native to Pennsylvania include

The northern riffleshell (*Epioblasma torulosa rangiana*) – a mussel growing up to 7.6 centimeters long, with a brown or yellowish shell marked by fine greenish rays. The shell interior is white or occasionally pink. Males are told from females by a broad, shallow sulcus, or groove, in their shell (see topmost image).

The clubshell (*Pleurobema clava*) – a mussel growing up to 7.6 centimeters long, with a bright yellow to brown exterior marked by blotchy, bright green rays and a white interior. The shell is wedge-shaped with a high umbo, or hinge area.

Threats to Pennsylvania's freshwater mussels:

Since 1900, freshwater mussel species have been going extinct faster than any other group of animals in North America. Nineteen North American mussel species are extinct, 62 are listed as endangered by the federal government, and 130 are at risk. The U.S. Fish and Wildlife Service estimates that 45 species of freshwater mussel will go extinct in the next decade.



The ring pink mussel (*Obovaria retusa*) a species now extirpated from Pennsylvania.
Karen J. Couch, Digital Library System.

Freshwater mussels are endangered by almost every change humans have made to their habitats. Until the early twentieth century many species were harvested for their shells; now filter-feeding mussels come into direct contact with water pollutants such as pesticides and herbicides washed off of agricultural fields. Mussels' long lifespan means they reproduce late in life, which together with their poor dispersal ability (due to dependence on specific host fish species) and poor juvenile survival rates makes them unable to quickly re-colonize areas from which they have been extirpated.

Dams and other flow-altering structures can dramatically impact mussel populations. Mussels below dams may stop reproducing; and if they are still able to reproduce, dams restrict the movement of host fish and prevent the upstream transport of glochidia. One study (Vaughn and Taylor 1999) documents a sharp "extinction gradient" downstream of dams, with mussel species richness and overall abundance dropping immediately below arti-

ficial impoundments, then gradually recovering farther downstream where conditions are less affected by the dams. Large releases of water through dams can severely disturb stream- and riverbeds, stressing embedded mussels.

North America's freshwater mussels are most recently threatened by the invasion of the zebra mussel, *Dreissena polymorpha*, from Europe and Asia. Unlike unionid species, Zebra mussels do not require fish hosts to spread their larvae through river systems. Though individually small, zebra mussels are so prolific that their colonies can significantly increase the clarity of surrounding water, depriving native mussels of food. Further, because they are able to attach directly to solid surfaces, zebra mussels are able to exploit habitats that native mussels cannot colonize, and even grow on native mussels' shells. Native mussels have evolved no mechanism for removing infestations of zebra mussels, which can be significant sources of stress.

A native freshwater mussel covered with zebra mussels.
USFWS, Digital Library System.

Conservation considerations:

Protection of freshwater mussel populations will require attention to a number of factors. Mussel habitat quality can be improved by elimination of water pollution and, where possible, the removal of man-made structures that impede host fish movement, like lowhead dams. Sometimes mussel populations will benefit from translocation to better-quality habitat. Conservation of host fish species is essential for recovering mussel populations to spread. Effective ways to eliminate zebra mussel infestations without harming native mussels have not yet been developed, but manual removal of zebra mussels from native mussel shells can be beneficial. Preventive measures can be taken to reduce the spread of zebra mussels to new bodies of water: for instance, recreational boats should be thoroughly cleaned when transported from one lake to another to assure that they don't carry zebra mussels with them.

PNHP
Pennsylvania Natural Heritage Program

Western Pennsylvania Conservancy

Saving the places we care about

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