BLAIR COUNTY
NATURAL HERITAGE INVENTORY

Prepared for:

The Blair County Planning Commission
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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 Blair 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 through an international network of member programs (known as natural heritage programs or conservation data centers), operating in all 50 U.S. states, Canada, Latin America and the Caribbean.

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 Blair 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 Blair 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 Blair 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 Blair 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 a reference in encouraging good management practices.

Environmental and Development Consultants. Environmental consultants are called upon to plan for a multitude of development projects including road construction, housing developments, commercial enterprises and infrastructure expansion. Design of these projects requires that all resources impacted be known and understood. Decisions made with inadequate information can lead to substantial and costly delays. County Natural Heritage Inventories 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. River Conservation Plans) that must integrate a variety of biological, physical and social information. County Natural Heritage Inventories can help define watershed-level resources and priorities for conservation.

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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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 National Fish and Wildlife Foundation Chesapeake Bay Small Grants Program for providing the funding to make this report possible, and we owe a very special thank-you to the people of Blair 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 for providing the basis for improved ways to represent conservation information in the County Natural Heritage Inventory reports.

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

Jessica McPherson
Ecologist
Western Pennsylvania Conservancy

EXECUTIVE SUMMARY

Introduction

A healthy natural landscape is vital to the quality of life in human communities and to the survival of the native biodiversity that is our natural heritage, connecting us to the past and the future of our communities and our cultural identity. For all of us, the natural landscape and the ecosystem processes it supports provide many services, such as clean water and clean air, and renew the resources from which we draw food, raw materials, and economic vitality. Industries that include forest products, fishing, outdoor recreation, and nature tourism depend upon a natural landscape that is well-stewarded and positioned for long-term sustainability.

The first steps in working towards stewardship of ecological health in our landscape are to characterize the ecosystems it hosts, understand how they function, and assess how they may be sensitive to human impacts. This report contributes to this endeavor by mapping the location and describing the character of many of the county's most significant ecological areas. Additionally, it provides information regarding their sensitivity to various land use activities.

The report focuses on identifying and documenting areas that support exemplary natural communities, broad expanses of intact natural ecosystems, and species of special concern. Its aim is to provide information to help county, state, and municipal governments, private individuals, and business interests plan development with the preservation of an ecologically healthy landscape for future generations in mind.

Maps are a key feature of the inventory, outlining the areas identified as supporting important ecological elements. The maps do not pinpoint the exact location of species of concern or natural communities but rather represent critical habitat and the surrounding area or landscape necessary to support critical habitats and the elements (plants, animals, natural communities) of concern. A summary table and a written description of the sites accompany each map. Potential threats and recommendations for protection of the sites are included for each of the individual site descriptions.

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):

Definition: 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):

Definition: A large contiguous area that is important because of its size, open space,

habitats, and/or inclusion of one or more BDAs. Although an LCA includes a variety of land uses, it typically has not been heavily disturbed and thus retains much of its natural character.

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

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 Blair 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 Blair 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 Blair 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. 127) 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

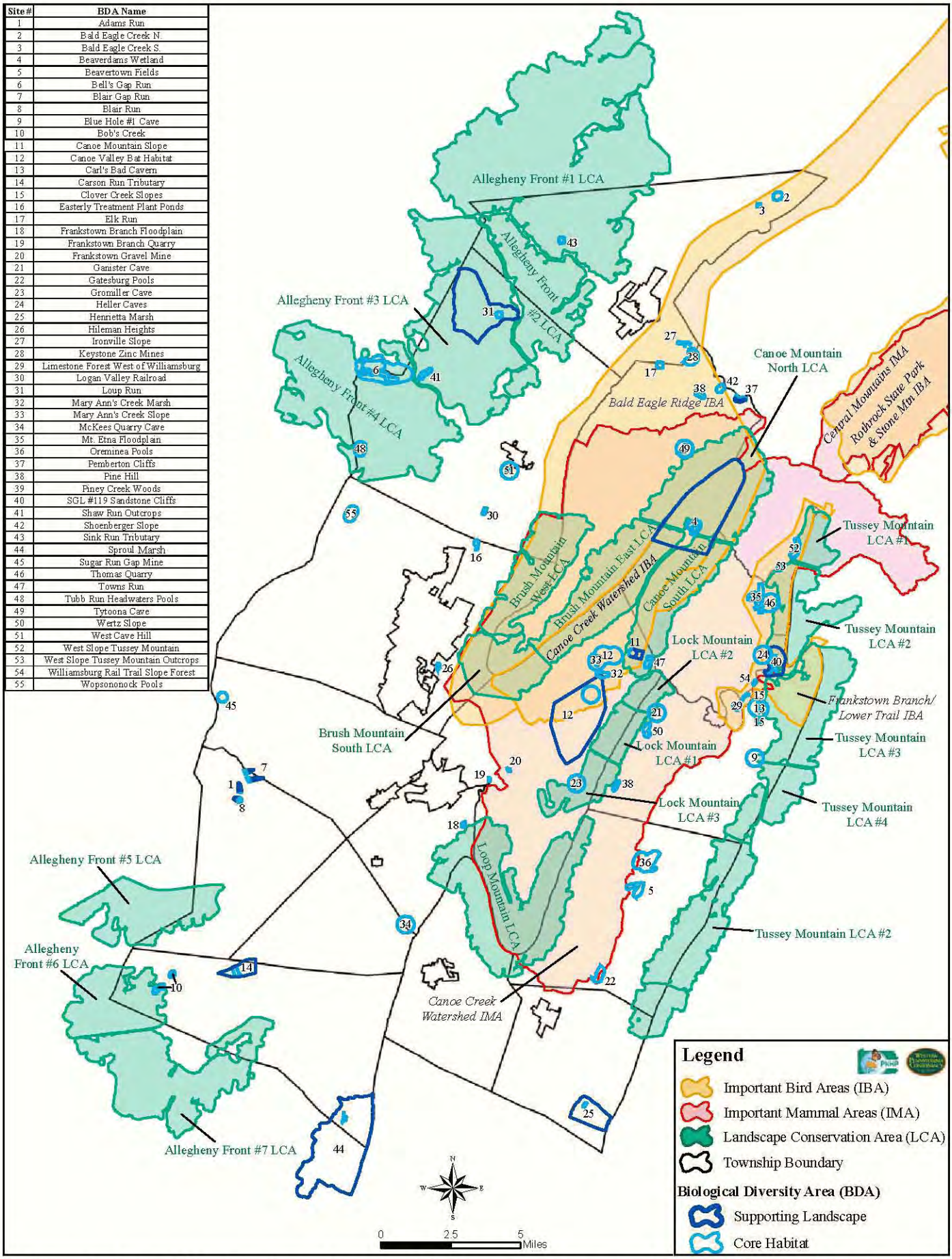
Data obtained during the 2002 and 2003 field seasons was combined with prior existing data and summarized. All sites with species or communities of statewide concern, as well as exceptional examples of more common natural communities were selected as Biological Diversity Areas (BDAs). Spatial data on 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. 123 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

Seventy-eight areas of ecological significance are recognized in the Blair County Natural Heritage Inventory (Table 1). This includes 57 Biological Diversity Areas and 21 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). Significance ranks are Exceptional, High, Notable, and County (for a full explanation of these ranks, see Appendix I, pg. 123.

*******see map and table 1, next page*******



Site #	BDA Name
1	Adams Run
2	Bald Eagle Creek N.
3	Bald Eagle Creek S.
4	Beaverdams Wetland
5	Beavertown Fields
6	Bell's Gap Run
7	Blair Gap Run
8	Blair Run
9	Blue Hole #1 Cave
10	Bob's Creek
11	Canoe Mountain Slope
12	Canoe Valley Bat Habitat
13	Carl's Bad Cavern
14	Carson Run Tributary
15	Clover Creek Slopes
16	Easterly Treatment Plant Ponds
17	Elk Run
18	Frankstown Branch Floodplain
19	Frankstown Branch Quarry
20	Frankstown Gravel Mine
21	Ganister Cave
22	Gatesburg Pools
23	Gromiller Cave
24	Heller Caves
25	Henrietta Marsh
26	Hileman Heights
27	Ironville Slope
28	Keystone Zinc Mines
29	Limestone Forest West of Williamsburg
30	Logan Valley Railroad
31	Loup Run
32	Mary Ann's Creek Marsh
33	Mary Ann's Creek Slope
34	McKees Quarry Cave
35	Mt. Etna Floodplain
36	Oreminea Pools
37	Pemberton Cliffs
38	Pine Hill
39	Piney Creek Woods
40	SGL #119 Sandstone Cliffs
41	Shaw Run Outcrops
42	Shoenberger Slope
43	Sink Run Tributary
44	Sproul Marsh
45	Sugar Run Gap Mine
46	Thomas Quarry
47	Towns Run
48	Tubb Run Headwaters Pools
49	Tytoona Cave
50	Wertz Slope
51	West Cave Hill
52	West Slope Tussey Mountain
53	West Slope Tussey Mountain Outcrops
54	Williamsburg Rail Trail Slope Forest
55	Wopsononock Pools

Figure 1. Natural Heritage Areas, Important Bird Areas, and Important Mammal Areas of Blair County

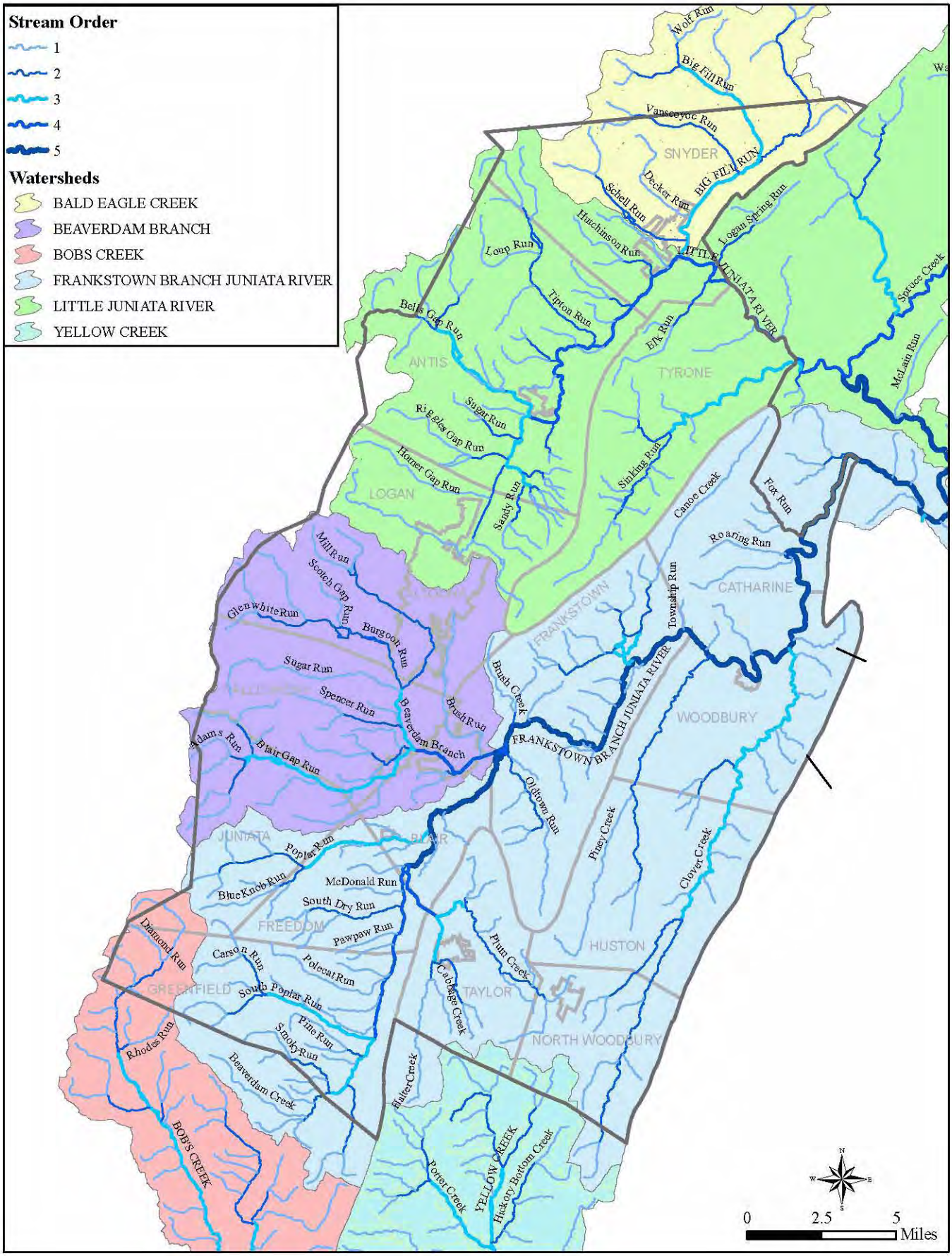


Figure 2. Watersheds of Blair County

Table 1. Natural Heritage Areas categorized by significance

Site	Municipality	Description	Page
Exceptional Significance			
Beaverdams Wetland BDA	Tyrone Twp Morris Twp Catharine Twp	The watershed of the headwaters of Canoe Creek, supporting a large wetland complex with unique natural communities, a plant species of special concern, and the water quality of the stream.	44
Bell's Gap Run BDA	Reade Twp Antis Twp	A portion of the Bell's Gap Run valley supporting a unique natural community on a calcareous sandstone outcrop formation, the slender rockbrake (a fern species of special concern in PA), the Allegheny woodrat, and an exceptionally mature, intact forest community.	31
Canoe Valley Bat Habitat BDA	Catharine Twp Frankstown Twp Woodbury Twp	Winter hibernation sites for bat colonies, including the federally Endangered Indiana Bat, and the summer habitat used by the Indiana bats.	54
Henrietta Marsh BDA	North Woodbury Twp	A calcareous marsh with a unique natural community and a species of state and global concern, the Schweinitz's sedge.	83
Oreminea Pools BDA	Huston Twp	A group of vernal pools, unique habitats that host several plant species of special concern.	72
Pemberton Cliffs BDA	Warriors Mark Twp Tyrone Twp	A limestone outcropping hosting the ebony sedge, a plant species of speical concern in PA, and a good example of a calcareous cliff community.	96
SGL #119 Sandstone Cliffs BDA	Porter Twp Woodbury Twp	A high, steep portion of the west slope of Tussey Mountain, with sandstone cliffs, a virginia pine-mixed hardwood shale woodland, Allegheny woodrats, and three plant species of special concern; plus the contiguous forest surrounding the site.	109
Sproul Marsh BDA	Greenfield Twp Bloomfield Twp Kimmel Twp	The watershed of Boiling Spring Run, which contains a wetland and two forested slopes hosting unique natural communities and several species of special concern.	67
Tytoona Cave BDA	Tyrone Twp	A natural area surrounding a cave and two sinkholes, hosting several plant and animal species of special concern.	99
West Slope Tussey Mountain BDA	Catharine Twp	A slope along Tussey Mountain that contains a good-quality oak-heath forest community & hosts a population of the Maryland hawkweed, a plant species of special concern in PA.	48
West Slope Tussey Mountain Outcrops BDA	Morris Twp Catharine Twp	Limestone outcrops on the west slope of Tussey Mountain inhabited by several plant species of special concern.	48
Allegheny Front #1 LCA	Rush Twp Woodward Twp Taylor Twp Gulich Twp Snyder Twp	A large contiguous forest block.	19
Allegheny Front #3 LCA	Gulich Twp Snyder Twp Reade Twp Antis Twp	A large contiguous forest block.	19
Allegheny Front #4 LCA	Reade Twp Antis Twp Dean Twp	A large contiguous forest block.	19
Brush Mountain East LCA	Tyrone Twp Catharine Twp Frankstown Twp	A large contiguous forest block that is also adjacent to a Biological Diversity Area hosting bat species of special concern, which depend on forests for summer habitat.	21

Table 1. Natural Heritage Areas categorized by significance

Site	Municipality	Description	Page
Canoe Mountain North LCA	Tyrone Twp Morris Twp Catharine Twp	A large contiguous forest block that is also adjacent to a Biological Diversity Area hosting bat species of special concern, which depend on forests for summer habitat.	21
Canoe Mountain South LCA	Morris Twp Catharine Twp Frankstown Twp	A moderate-sized contiguous forest block that is also adjacent to a Biological Diversity Area hosting bat species of special concern, which depend on forests for summer habitat.	21
Loop Mountain LCA	Frankstown Twp Blair Twp Huston Twp Taylor Twp	A large contiguous forest block.	20
High Significance			
Beavertown Fields BDA	Huston Twp	A dry, calcareous-soil area hosting several plant species of special concern.	71
Blair Gap Run BDA	Juniata Twp Allegheny Twp	A broad area of flooplain along the Blair Gap Run valley that hosts a plant species of special concern.	75
Blue Hole #1 Cave BDA	Woodbury Twp	Winter hibernation site for bat colonies, including the northern myotis, a bat species of special concern in PA.	104
Bob's Creek BDA	Greenfield Twp	A section of the Bob's Creek valley with a mature, high-quality forest community and habitat for mountain bugbane, a plant species of special concern in PA and globally.	65
Carl's Bad Cavern BDA	Woodbury Twp	Winter hibernation site for bat colonies, including two species of special concern in PA	104
Carson Run Tributary BDA	Freedom Twp Greenfield Twp	A section of Carson Run hosting the mountain bugbane, a plant species of global concern.	66
Clover Creek Slopes BDA	Woodbury Twp	Several slopes along Clover Creek that host unique calcareous forest communities.	105
Easterly Treatment Pland Ponds BDA	Logan Twp.	Marsh habitat near the Easterly Wastewater Treatment plant utilized by the Virginia rail, abird species of special concern in PA.	79
Elk Run BDA	Snyder Twp Tyrone Twp	Limestone outcroppings hosting several plant species of special concern in PA.	88
Heller Caves BDA	Catharine Twp Woodbury Twp	Winter hibernation site for bat colonies, including the state- and global- concern species eastern small footed myotis.	107
Mary Ann's Creek Slope BDA	Frankstown Twp	A slope, underlain by limestone, which contains several unique natural community types and species of special concern.	57
Shoenberger Slope BDA	Warriors Mark Twp Tyrone Twp	A calcareous forested slope hosting a population of drooping bluegrass, a plant species of global concern.	99
Sink Run Tributary BDA	Snyder Twp	A site where the Appalachian oak fern, a plant species of global concern, has been documented.	89
Tubb Run Headwaters Pools BDA	Antis Twp	A series of vernal pools in the headwaters of Tubb Run, hosting the federally threatened plant species the northeastern bulrush.	35
Tussey Mountain Bat Habitat BDA	Morris Twp Porter Twp Catharine Twp Woodbury Twp Penn Twp	Several bat hibernation sites that species of special concern have been documented to use, as well as an estimated range of summer habitat for the bats.	46

Table 1. Natural Heritage Areas categorized by significance

Site	Municipality	Description	Page
Wertz Slope BDA	Woodbury Twp	A steep slope and old quarry hosting two calcium-affiliated plant species of special concern.	110
West Cave Hill BDA	Antis Twp Bellwood Boro	A diverse calcareous forest that also provides winter habitat for bat species of special concern.	36
Allegheny Front #2 LCA	Gulich Twp Snyder Twp Reade Twp Antis Twp	A moderate-sized contiguous forest block.	19
Allegheny Front #8 LCA	Pavia Twp Summerhill Twp Greenfield Twp Kimmel Twp	A large contiguous forest block.	19
Tussey Mountain LCA #2	Porter Twp Catharine Twp Woodbury Twp	A forest block adjacent to a Biological Diversity Area hosting bat species of special concern, which depend on forests for summer habitat.	22
Tussey Mountain LCA #3	Porter Twp Woodbury Twp Walker Twp Penn Twp	A moderate-sized contiguous forest block that is also adjacent to a Biological Diversity Area hosting bat species of special concern, which depend on forests for summer habitat.	22
Notable Significance			
Adams Run BDA	Juniata Twp	A rich floodplain area near the mouth of Adams Run hosting a plant of special concern.	75
Bald Eagle Creek N. BDA	Snyder Twp	A section of Bald Eagle Creek inhabitated by intermediate spikerush, a plant species of special concern.	87
Bald Eagle Creek S. BDA	Snyder Twp	A section of Bald Eagle Creek inhabited by yellow water crowfoot, a plant species of special concern.	87
Blair Run BDA	Juniata Twp	A rich stream valley area hosting a plant species of special concern.	75
Easterly Wastewater Treatment Wetlands BDA	Logan Twp	Wetlands associated with the Easterly Wastewater Treatment Plant that are occupied by three bird species of special concern.	
Frankstown Branch Floodplain BDA	Blair Twp	A floodplain area where a population of the grass-leaved rush has been recorded.	
Frankstown Branch Quarry BDA	Frankstown Twp	An old quarry site that has been colonized by a shrub species of special concern, the roundleaf serviceberry.	55
Frankstown Gravel Mine BDA	Frankstown Twp	An old gravel mine that has been colonized by the Torrey's rush, a plant species of special concern in PA.	56
Ganister Cave BDA	Woodbury Twp	Winter hibernation species for bats, including two species of global concern.	104
Gatesburg Pools BDA	Huston Twp	A series of vernal pools in a forested setting.	72
Gromiller Cave BDA	Frankstown Twp Woodbury Twp Huston Twp	The site of Gromiller Cave, where bat species of special concern have been documented to hibernate, as well as an estimated summer habitat range for the bats.	56
Hileman Heights BDA	Logan Twp	A floodplain area hosting the Torrey's rush, a plant species of special concern in PA.	79
Keystone Zinc Mines BDA	Snyder Twp Tyrone Twp	Core area surrounding a winter hibernation site for a bat colony, including two species of global concern.	89

Table 1. Natural Heritage Areas categorized by significance

Site	Municipality	Description	Page
Limestone Forest West of Williamsburg BDA	Woodbury Twp	A hillside hosting several unique calcareous forest communities.	107
Logan Valley Railroad BDA	Antis Twp	A wetland adjacent to a railroad track that has been colonized by the Torrey's rush, a plant species of special concern in PA.	33
Loup Run BDA	Antis Twp	A section of Loup Run where a population of mountain starwort, a plant species of special concern in PA, has been documented; and its supporting watershed.	33
Mary Ann's Creek Slope BDA	Frankstown Twp	A marshy area above the Canoe Creek Reservior that hosts a plant species of special concern.	57
McKees Quarry Cave BDA	Blair Twp Freedom Twp Taylor Twp	The site of the McKees Quarry Cave, where bat species of special concern have been documented to hibernate, as well as an estimated summer habitat range for the bats.	40
Mt. Etna Floodplain BDA	Catharine Twp	A site inhabited by the thick-leaved meadow rue, a plant species of special concern in PA, as well as a butterfly species of special concern.	47
Pine Hill BDA	Tyrone Twp	An area hosting several plant species of special concern.	98
Piney Creek Woods BDA	Woodbury Twp	A forested slope hosting a population of a plant of special concern.	108
Shaw Run Outcrops BDA	Antis Twp	Calcareous sandstone outcrops hosting a calcareous opening/cliff natural community.	34
Sugar Run Gap Mine BDA	Allegheny Twp	A site where two plant species of special concern in PA have been documented growing.	27
Thomas Quarry BDA	Catharine Twp	Winter hibernation site for bats, including two species of concern, the northern myotis and the eastern small footed myotis.	46
Towns Run BDA	Frankstown Twp	A site hosting a population of thick-leaved meadow rue, a plant species of special concern in PA.	57
Wopsononock Pools BDA	Logan Twp	Several vernal pools hosting animal species of special concern.	80
Allegheny Front #5 LCA	Juniata Twp Washington Twp Portage Twp	A moderate-sized contiguous forest block.	19
Allegheny Front #7 LCA	Pavia Twp Portage Twp Summerhill Twp Greenfield Twp	A moderate-sized contiguous forest block.	19
Brush Mountain South LCA	Tyrone Twp Logan Twp Frankstown Twp	A forest block adjacent to other large contiguous forest blocks, with only minor fragmenting features intervening; potential to enhance forest contiguity.	21
Brush Mountain West LCA	Antis Twp Tyrone Twp Logan Twp	A moderate-sized contiguous forest block.	21
Lock Mountain LCA #1	Frankstown Twp Woodbury Twp	A forest block adjacent to a Biological Diversity Area hosting bat species of special concern, which depend on forests for summer habitat.	20
Lock Mountain LCA #2	Frankstown Twp Woodbury Twp	A forest block adjacent to a Biological Diversity Area hosting bat species of special concern, which depend on forests for summer habitat.	20

Table 1. Natural Heritage Areas categorized by significance

Site	Municipality	Description	Page
Lock Mountain LCA #3	Frankstown Twp Woodbury Twp	A forest block adjacent to a Biological Diversity Area hosting bat species of special concern, which depend on forests for summer habitat.	20
Tussey Mountain LCA #1	Porter Twp Catharine Twp	A forest block adjacent to a Biological Diversity Area hosting bat species of special concern, which depend on forests for summer habitat.	22
Tussey Mountain LCA #4	Woodbury Twp Penn Twp	A forest block adjacent to a Biological Diversity Area hosting bat species of special concern, which depend on forests for summer habitat.	22
Tussey Mountain LCA #5	Woodbury Twp Penn Twp Huston Twp Lincoln Twp	A moderate-sized contiguous forest block.	22
County Significance			
Canoe Mountain Slope BDA	Frankstown Twp	A slope along Canoe Mountain where American gromwell, a plant which is unusual in Blair County, has been documented to grow.	53
Ironville Slope BDA	Snyder Twp	A steep slope with a calcareous cliff community and a sugar maple-basswood forest community.	88
Williamsburg Rail Trail Slope Forest BDA	Catharine Twp	A forested slope hosting two plant species of special concern.	50

Discussion and Recommendations

Status of natural features today

The landscape and waterways of Blair County have undergone considerable change over the course of human settlement, most notably from agriculture, timber extraction, residential settlement, mining, and transportation infrastructure development. The condition of the natural landscape today closely reflects this history.

The valleys of Blair County were cleared for agriculture during the late 18th and early 19th centuries, and this landscape continues to be predominatly agricultural today. During the timber boom in the late 19th and early 20th centuries, much of the remaining forest on the ridges and along the Allegheny Front underwent general clear-cutting.

Through the construction of the City of Altoona, a significant portion of the county was converted to urban land use; today, a sprawling pattern of development continues to convert more valley land. Altoona has a major impact on water quality through stormwater and sewage runoff.

Many different forms of mining have been conducted in various parts of Blair County. The earliest large-scale extractive industry was iron ore in the early- to mid- 19th century, and while the iron industry collapsed by the end of the 19th century, scars remain on the landscape in some areas today in the form of deep pits. Sandstone was also mined from the ridgetops in early days, which has left rocky outcrops where forest does not regrow. Coal mining began along the Allegheny Front in the early twentieth century, and continues today on some parts of the Front. Coal mining left a legacy of water contamination in many of the streams flowing down from the Allegheny Front. Limestone quarrying has also been prevalent in the county, leaving steep slopes and deep pits, and large-scale extraction continues today.

Finally, transportation infrastructure construction has had a major impact on the landscape of Blair County, from the construction of the Pittsburgh-Harrisburg turnpike and the building of the railroads in the 19th century, to the recent completion of Interstate 99. These corridors, especially modern highway routes, seriously degrade forest habitat and are major fragmenting features impeding the passage of wildlife.

Forest Communities

Natural communities have redeveloped along the ridges and the Allegheny Front in the time since the timber boom at the beginning of last century. They now function as large areas of contiguous forest, providing abundant habitat for forest dwelling species. These forested areas also help to maintain water quality in streams.

The condition of forest communities varies across the county. While many areas have regenerated into a broad spectrum of natural forest communities, some areas remain fragmented by roads, surface mined areas, artificial clearings, and utility rights-of-way. Additionally, over-browsing by deer poses a threat to biological diversity and forest regeneration in many regions of the county.

Despite their variable condition today, the forests are a great asset to the ecological integrity of the county, and have the potential to offer even greater benefits with ecologically sensitive management into the future. 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. Today several such large, contiguous areas exist in the county, with potential to support species which are declining in other areas of the state and the continent due to lack of habitat. Furthermore, the ridgelines of the county and the Allegheny Front are landforms that naturally form regional corridors of forest. However, their value as corridors is diminished by fragmentation from rights-of-way and roads. With management to improve forest contiguity, greater ecological benefits can be realized.

There is also potential to benefit biodiversity by managing some areas to become old-growth forests. Some species can only find appropriate

habitat in old-growth forests, because the structures they need for shelter or the food sources they require are not present in younger forests. While there are few areas in Blair County today that are considered old growth, the large expanses of younger forests provide the potential for future development of this habitat type.

Wetlands

Within the matrix of forest along the ridgelines in the county, and along the streams and rivers in the valleys, unique wetland communities including forested seepages, headwaters shrub swamps, calcareous marshes, floodplain wetlands, and vernal pools occur in flat areas where soils and topography allow accumulation of water. Although these communities occupy a comparatively small portion of the natural landscape, they are of particular value to the county's biodiversity because of the species they support. Groups of specialist species—such as amphibians that breed only in vernal ponds, or plant species that live only in calcareous, high-pH wetlands—that would otherwise not be present in the county inhabit these communities. These habitats are especially important because they are regionally threatened: one-half of Pennsylvania's wetlands have been lost or substantially degraded, and wetland and aquatic species that depend on these habitats are correspondingly declining.

Aquatic communities

Blair County has great variation in aquatic habitat types. The physical settings range from small, steep, headwaters channels, to mid-sized streams, to broad, flat, flowing rivers. Water chemistry also varies from acidic in areas of sandstone bedrock to high-pH in the limestone valleys. The ecological potential of these habitats is not fully known, because many of the valley streams and the rivers have been degraded by pollution and physical alteration from the agriculture, industry, and urban development that has occurred over the last 150 years, while the streams along the forested ridges have accumulated fewer impacts and tend to be in better condition. Today, there is life in many of the streams, but pollution from agricultural runoff, mine drainage, and urban runoff remains an issue in many areas that impedes full biological recovery and can pose threats to human health. The larger rivers, a habitat which is imperiled throughout our region, have fared the worst, because they accumulate pollution from all upstream sources and because they are often subject to extensive physical modification.

Planning for biodiversity and ecological health tomorrow

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

Forests—maintain & increase contiguity

In the forested landscapes of the ridges and the Allegheny Front, objectives for large-scale planning should include maintaining and increasing contiguity and connectivity of natural land. Contiguity is important for the enhanced habitat values outlined above; however, for many species it is equally critical that natural corridors spanning between forest patches and connecting forests, wetlands, and waterways are maintained. The county's forested ridgelines are regionally significant migration routes for raptors and neotropical migrant bird species because they form corridors of unbroken forest. On a smaller scale, many species—examples abound among birds, amphibians, and dragonflies— use an aquatic or wetland habitat in one phase of their life, then migrate to an upland, forested habitat for their adult life. Either habitat alone cannot be utilized unless a corridor exists between them.

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.

Wetlands—worth saving

Natural wetlands that are in good condition are highlighted in this report; due to their scarcity and their high ecological importance, emphasis should be placed on conservation of wetland sites.

Valley landscapes—ecological regeneration, water quality

Broad-scale planning efforts for the ecological health of the valley landscapes should work towards the restoration of water quality in major streams and groundwater aquifers, and the development of an ecologically designed greenway network based along riparian corridors and associated areas of riparian hydrology. Natural areas remaining in the valley landscape are often isolated, and their potential to support wildlife and native biodiversity could be greatly enhanced by establishing connective corridors between them. Restoration of native vegetation to riparian corridors will help greatly in improving water quality and enhancing the habitat value of the waterways for various aquatic and semi-aquatic species. Furthermore, a riparian greenway network can also aid in reducing flooding damage, and improve the scenic beauty and recreational value of the waterways. Reduction in the release of pollutants into runoff, including sediments, nutrients, and chemical contaminants, will also be necessary to improve water quality. Attending to the basic ecological functions of streams and wetlands will pay dividends by ensuring the continued capacity of the land to support agriculture, maintain healthy fisheries, and provide the quality of the 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 Blair 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 Blair County Planning Office. The County Planning Office 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 can also 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 Office should then contact the Pennsylvania Natural Heritage Program (PNHP) - Western Pennsylvania Conservancy (WPC) office 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 will be determined on a case-by-case basis by the County and PNHP. In general, the responsibility for reviewing natural resources is partitioned among agencies in the following manner:

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

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 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 any of a variety of activities that require state permits will also require a Pennsylvania Natural Diversity Inventory (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.

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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 2001). Natural communities are usually defined by their dominant plant species or the geological features upon 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 Blair County

The climate, topography, geology and soils are particularly important in the development of ecosystems (forests, fields, wetlands) and physical features (streams, rivers, mountains) that occur in Blair County. Disturbance, both natural and anthropogenic, has been influential in forming and altering many of Blair County's ecosystems, causing extinction of some species and the introduction of others. 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 physiography, soils, surface water, and vegetation of Blair County.

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 influence 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 would be expected to occur within some provinces and not others.

Blair County lies mostly within the Appalachian Mountain section of the Ridge and Valley Physiographic Province, except for its western edge, which falls within the Allegheny Front section of the Appalachian Plateaus Province (Figure 1). The Ridge and Valley Province is distinguished by a belt of long, narrow forested ridges and broad agricultural valleys that sweep diagonally through central Pennsylvania. The ridges of this province are composed of sandstone with elevations ranging between 800-1200 feet above sea level. The valleys that dominate in this region, however, are variable depending on the type of rock that underlies them. In general, the broad valleys of the northwestern section of Blair County are characterized by limestone and shale bedrock, while the valleys of the central and southeastern sections are dominated by shale bedrock. 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 – mountain-building events) to form a plateau elevated above the surrounding regions. Unlike the Ridge and Valley 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 Allegheny Front is a long, steep slope that forms the eastern edge of the Appalachian Plateau with the Ridge and Valley region; it follows the curvature of the ridges from Maryland up through several Pennsylvania counties, and is frequently cut by stream channels.

A number of habitat types in Blair County are directly linked to the geology and geomorphic history of the Ridge and Valley Province; these include caves, sandstone cliffs, and limestone barrens. These habitat types occur as discrete patches within the surrounding landscape. Shale barrens are another discrete habitat type found in the Ridge and Valley Province, but no shale barrens have been found in Blair County. They typically form on steep south-facing shale slopes, and the slopes of Blair County's ridges face almost exclusively east-west.

Three types of caves occur within Pennsylvania: solution caves formed in limestone or dolomite by the dissolving action of water, talus caves formed within loose piles of scree and boulders on mountainsides, and tectonic caves resulting from the mechanical slippage of rock masses. The limestone valleys of the Appalachian Section of the Ridge and Valley Province host the greatest concentration of caves within the

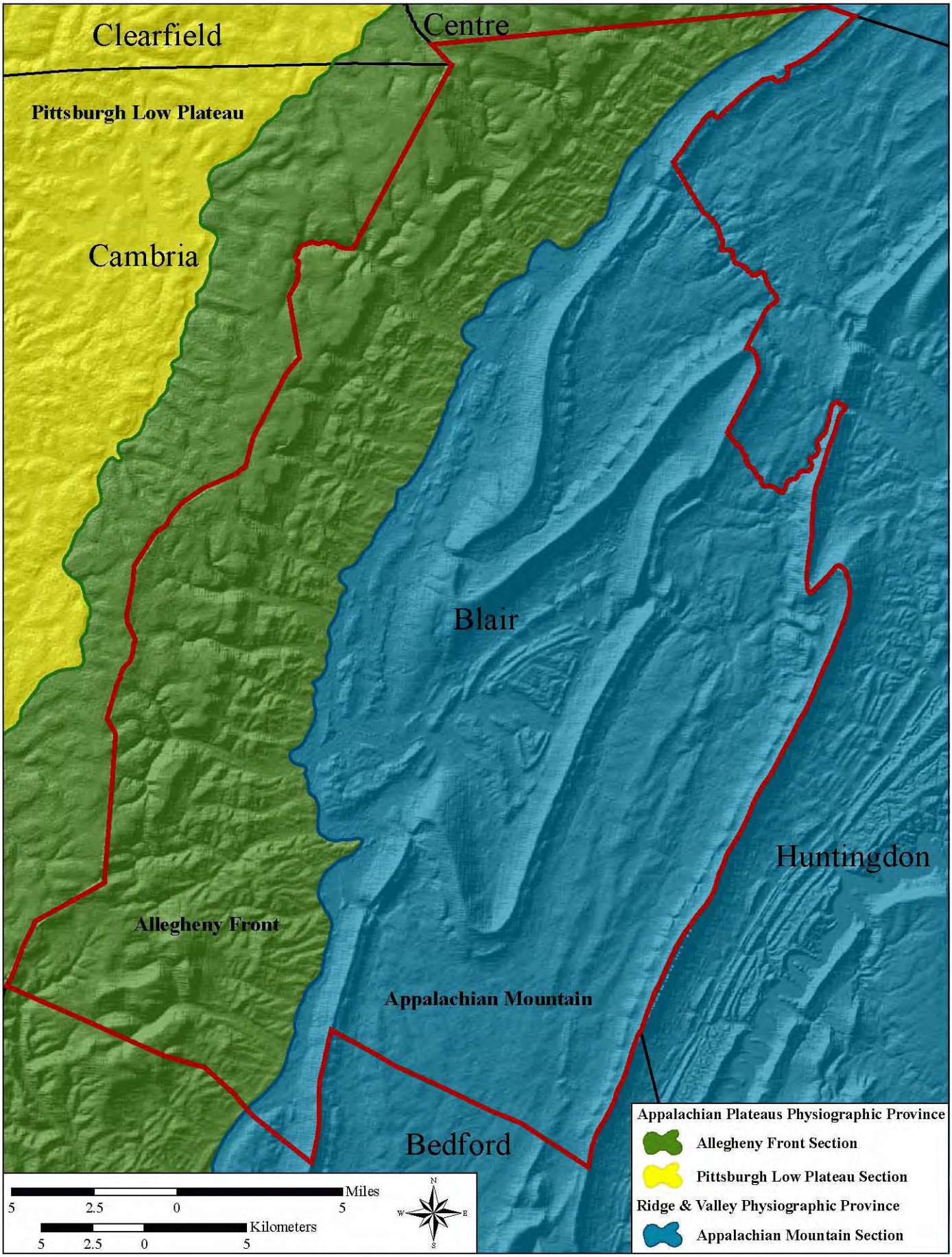


Figure 3. Physiographic Provinces of Blair County

state. Blair County has 97 documented caves, a number exceeded only by Huntingdon County, which has 104, and Centre County, which has 103 (White & White, 1999). Caves play an important ecological role by providing a necessary habitat component for a variety of wildlife. Snakes, woodrats, and other small mammals, along with an assortment of invertebrates, all utilize caves. Bats, the animals the general public most closely associates with caves, rely on undisturbed caverns for winter survival. Fish which dwell in underground waterways may represent special communities adapted to unique subterranean habitats (Goodrich et al. 2003).

Limestone barrens share a number of the physical characteristics of shale barrens. The shared features include: a similar elevation range of 400 to 800 meters, south-facing slopes, and vegetation tolerant of xeric conditions resulting from high surface temperatures (Bartgis 1993, Dix 1990). Limestone barrens support shale barren flora and endemics as well as endemic calciphilic species such as tall larkspur (*Delphinium exaltum*) and ebony sedge (*Carex eburnea*). As the names imply, geology is the primary distinguishing element separating limestone barrens from shale barrens.

Soils

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. The soils of Blair County have been described in Soil Survey of Blair County, Pennsylvania (USDA 1981). The eight soil associations recognized within the county are described in Table 2 and represented in Figure 4.

Vegetation

Forest Communities

The ridgelines hold the largest contiguous blocks of forest in the county. As is true for other sections of the Ridge and Valley, these forests are composed largely of second growth forest stands. However, on some of the steeper slopes, ravines, and scree (sandstone rock fields and slides) slopes, small sections of old growth forest exist. After the loss of the American Chestnut in the 1930's, oak (red, black, white, scarlet, and chestnut) came to dominate the forests on the ridges. Such is still the case in many areas, but with widespread tree loss due to gypsy moth infestation and second- and third- rounds of logging, forest compositions are again changing.

Typically, chestnut oak and scarlet oak along with pitch pine, black gum, sassafras, and a mix of heaths (blueberry, huckleberry, mountain laurel) occupy the driest sites, especially high elevation southern and western exposures (Braun 1950). These oak-pine communities often become dwarfed in the places where thin soils, extreme exposure to wind and sun, and low moisture combine. Although fairly extensive at high elevations in the southern Appalachians, only on several of the highest ridgetops in the county, and on extremely steep slopes, do communities approach this condition in Blair County.

Moving downslope from the highest elevations, the diversity of vegetation increases with higher moisture levels. Red, black and white oak, along with hickories (shagbark, pignut, bitternut), black birch, red maple, striped maple, and witch hazel become dominant. Herbaceous growth becomes more prominent where the heath layer thins. Massive rock slides or "talus" often occur at these intermediate elevations. Prominently visible from many highways in the county, blocks of Tuscarora sandstone, rich in quartzite, form these talus slopes. Typically, they are lacking in vegetation except for the moss and lichen that colonize the rock faces. On northern slopes, hemlock and fern (intermediate wood fern, especially) often surround these slopes, establishing where substrate becomes available. On southern slopes, black birch and chestnut oak grow around and occasionally clustered within these formations. On the lower slopes, the mesic forest communities of red and white oak, sugar maple, basswood, white ash, and tulip become established. Often on northern slopes and in water gaps, hemlock and white pine will mix with the usually

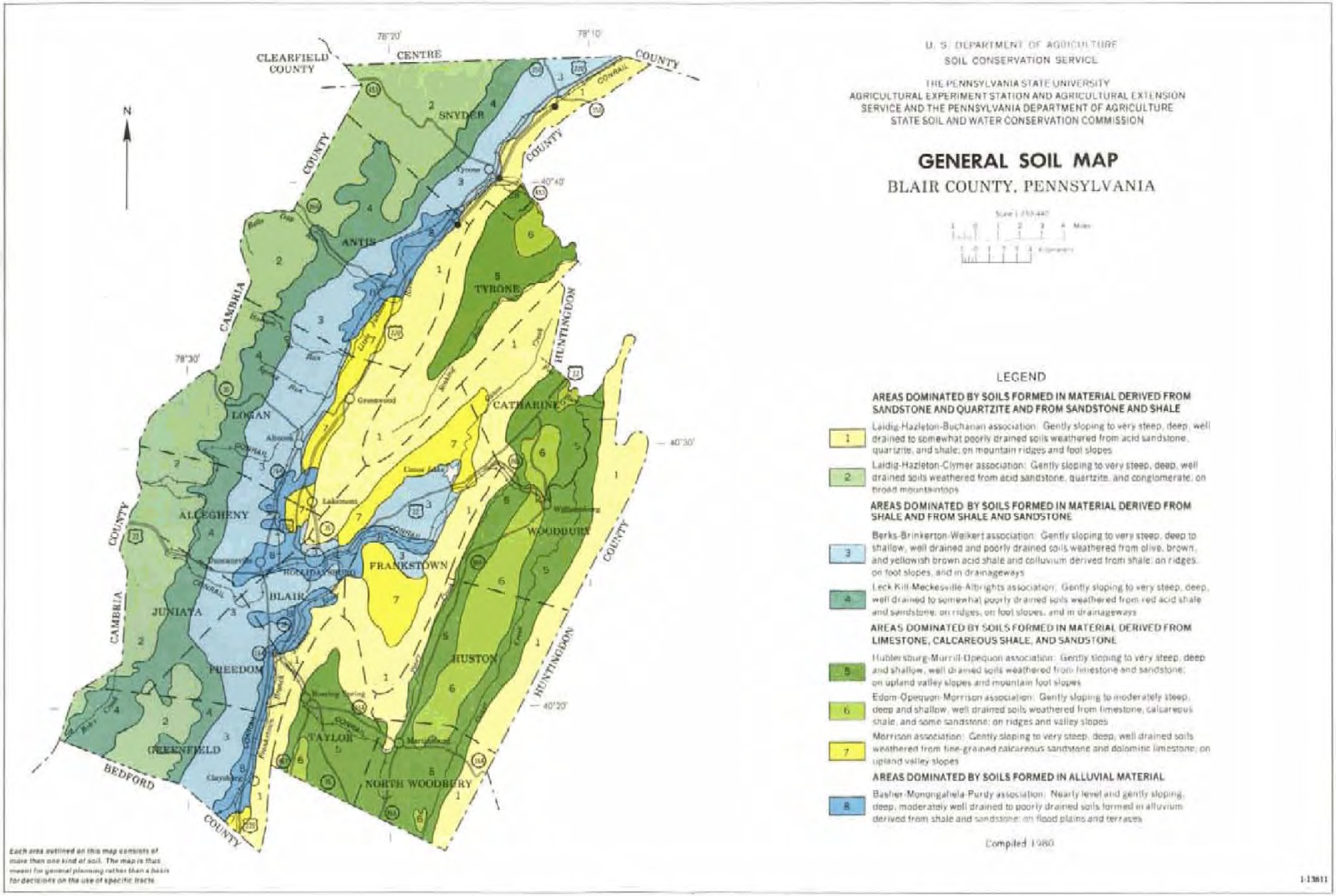


Figure 4. Soil Associations of Blair County.

Table 2. Soil Associations of Blair County

Soil Association	Parent Materials	Description	Percentage of County	Land Use
Laidig-Hazleton-Buchanan	Weathered from acid sandstone, quartzite, and shale.	Well-drained to somewhat poorly drained soils on mountain ridges and foot slopes, mainly in the eastern part of the county.	24	Primarily forest, a few small areas farmed or used for community development; large areas of state game lands. Use limitations are steep slopes and an extremely stony surface; some areas also have a seasonal high water table and slow permeability.
Laidig-Hazleton-Clymer	Weathered from acid sandstone, quartzite, and conglomerate.	Deep, well drained soils on the ridges, drainage basins, and side slopes of the Allegheny Plateau and the Allegheny Front	16	Most areas of this association are forested, with extensive areas in State Game Lands, and some strip-mined areas, and a few small areas farmed or used for homesites. Use limitations are stoniness and slow permeability.
Berks-Brinkerton_ Weikert	Residuum and colluvium weathered from olive, brown, and yellowish brown acid shale; colluvium derived from shale.	Gently sloping to very steep, deep to shallow, well drained and poorly drained soils on ridges, foot slopes, and in drainageways. Occurs in a wide band in the western part of the county.	17	Most areas of the association are wooded or in idle cropland. A few small areas are farmed, some areas in urban development. Limitations on uses are steep slopes, very low available water capacity, depth to bedrock, and a high water table
Leck Kill-Meckesville-Albrights	Residuum and colluvium weathered from acid red shale and sandstone.	Gently sloping to very steep, deep, well drained to somewhat poorly drained soils on ridges, on foot slopes, and in drainageways. In the western part of the county at the base of the Allegheny Front	12	Mostly in woodland, with some areas farmed or used for housing. Suited to farming where stoniness does not limit. Limitations on uses are stones on the surface, seasonal high water table, and moderately slow permeability.
Hublersburg-Murrill-Opequon	Residuum and colluvium weathered from limestone and sandstone.	Gently sloping to very steep foot slopes and hills in upland valleys; marked by sinkholes and drainageways.	14	Most areas are in cropland. Shallow depth to bedrock, hazard of groundwater contamination from septic systems, and slope are the main limitations for most uses.
Edom-Opequon-Morrison	Residuum weathered from limestone, calcareous shale, and some sandstone.	Gently sloping to moderately steep, deep and shallow, well drained soils on ridges and rolling, dissected hills and valleys mostly in the central part of the county.	8	Mostly in cropland. Limitation on use are a heavy-textured surface layer, shallow depth to bedrock, slope, and hazard of groundwater contamination from septic systems.
Morrison	Residuum weathered from fine-grained calcareous sandstone and dolomitic limestone	Gently sloping to very steep, deep, well drained soils; valley sides in the centers of limestone valleys in the central part of the county.	5	Most areas are wooded, while areas with few stones on the surface are in dairy farms, or used for orchards. The major limitations on uses are slope, stones on the surface, and hazard of ground-water contamination in areas used for septic systems.
Basher-Monongahela-Purdy	Alluvium formed from shale and sandstone	Nearly level and gently sloping, deep, moderately well drained to poorly drained soils on floodplains and terraces along the Little Juniata and Frankstown Branch of the Juniata River.	4	About half this association is in urban development. The remaining part is farmed or wooded. The main limitations of the soils are seasonal high water table, flooding, and moderately slow permeability.

deciduous slope forests. Yellow birch, beech, and rhododendron are very common in these cool, moist communities that are distinctly like the conifer-hardwood forests of the Northeast.

The extent of remaining forest within the valleys of Blair County, and within Pennsylvania as a whole, is very small. Rich, alluvial soils deposited from streams and deep colluvial soils from the erosion of the lower slopes of the ridges have made the valleys in the county prime agricultural areas. The remaining wooded groves and scattered individual trees indicate that white oak was clearly a dominant tree in these low elevation communities (Braun, 1950). Where limestone bedrock underlies the valleys, the soils are often rich in calcium. Because of their chemistry, these soils have the potential to host forest and wetland communities that are extremely diverse in comparison to the forest communities on the more acidic soils of the ridges. Today, very few examples of these diverse limestone communities remain. Valley areas today also demonstrate a higher prevalence of invasive species than along the ridges, which may be due to greater fragmentation of these areas and greater exposure to exotic seed sources, or also to the hospitable chemistry of the soil (Frappier & Eckert 2003; Silveri et al. 2001; Anderson & Kelly 1995). Today, the largest sections of forest in these valleys follow the rivers and streams of the county.

The forests along the Allegheny Front in the western part of the county are similar to those of the ridges, and follow similar patterns of gradual change in composition related to elevation. However, because of the high elevation at the top of the Allegheny Front, and the contiguity of the forests in many areas, these forests experience a cooler climate than the ridges. They develop later in the spring, and the community composition is similar to the northern hardwoods communities of the north. The slopes of the Allegheny Front are also often gentler than those of the ridges, leading to more mesic conditions than on the ridges, and thus the dry oak-heath community develops less often, and high-elevation communities often have substantial components of red maple, black birch, and black cherry in addition to oaks.

Wetland Communities

Wetlands include vegetation types important for the region, providing essential habitat for many plant and animal species. The type of wetland depends on soil type, disturbance, and length and duration of flooding. In Blair County, many of the wetlands are associated with streams or rivers and include floodplain forests, forested swamps, shrub swamps, and graminoid marshes. Two other important wetland types known from the area are seepage swamps and vernal pools.

Floodplain and Riparian Wetlands

Floodplain forests occur along rivers and streams in low-lying areas. These locations are periodically inundated by the floodwaters of spring runoff or runoff from intense storm events. In central Pennsylvania, these forests are characterized by a canopy containing some combination of silver maple (*Acer saccharinum*), sycamore (*Platanus occidentalis*), tulip poplar (*Liriodendron tulipifera*), black willow (*Salix nigra*), green ash (*Fraxinus pensylvanica*), American elm (*Ulmus americana*), or box-elder (*Acer negundo*). Shrubs and vines common to these forests include spicebush (*Lindera benzoin*), ninebark (*Physocarpus opulifolius*), silky dogwood (*Cornus amomum*), Virginia creeper (*Parthenocissus quinquefolia*), and poison ivy (*Toxicodendron radicans*). Floodplain forest communities receive severe disturbances from floodwaters including erosion, scouring by ice and debris, and/or deposition of considerable quantities of sediment and debris. Only species with adaptations or tolerance for these kinds of conditions can survive here.

Floodplains on smaller waterways receive less intense disturbances but are still periodically flooded, which limits the kinds of vegetation that can occur on them. Pin oak (*Quercus palustris*), swamp white oak (*Quercus bicolor*), silver maple, red maple, ash, sycamore, and black walnut (*Juglans nigra*) are frequent on wetter bottomland soils associated with smaller creeks. Understory species include spicebush, violets (*Viola* spp.), nettles (*Urtica dioica, Laportea canadensis*), cut-leaved coneflower (*Rudbeckia laciniata*), golden alexanders (*Zizea aurea*) and many other wildflowers. Several species of special concern are frequently found in these habitats. In addition, floodplain forests also serve as a protective buffer against erosion; help

provide cooling shade to the waterway; filter pollutants and excessive nutrients from runoff; and help alleviate flood damage along many of the area's creeks. Areas that have a history of flooding are poor choices for building sites, and are best left as natural floodplain.

Graminoid Marshes

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

Seepage Swamps

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

Vernal Pools

Ephemeral/fluctuating or vernal pools are wetlands that fill annually from precipitation, surface water runoff, and rising groundwater (Kenney and Burne, 2000). The pools typically become completely dry through evaporation by late spring or summer. Since these ponds dry up during a portion of the year, they cannot support fish populations. During the brief time the pools contain water, and in the absence of fish, they become important breeding areas for a multitude of amphibian species (e.g., spotted salamanders, *Ambystoma maculatum*), many of which breed solely in vernal pools. In Blair County, vernal pool communities are most often found in areas underlain by the Gatesburg geologic formation, and in broad, flat saddles along the Allegheny Front. Pools form where the Gatesburg formation is near the surface because the water-soluble limestone layers dissolve underground in places, causing the surface to subside. Along the Allegheny Front, pools form in the center of broad, flat areas because there is no drainage. They are often the origin point for stream tributaries.

As with the forest communities, the influence of bedrock geology on soil and water chemistry strongly influences the plant composition of wetland communities. Wetlands with inputs that flow through areas of limestone bedrock will be mineral-rich and high in pH, providing habitat for plants and animals which specifically require these conditions. These high-pH wetlands only occur in the valley landscapes, and few remain today. Wetlands with inputs that flow through sandstone or shale bedrock will have pH that is neutral or acidic, and host a different suite of plant and animal species. These wetlands occur more broadly in the county; in shale or sandstone valleys, and in the headwaters of streams along the ridges and the Allegheny Front.

Because wetlands are relatively rare in central Pennsylvania, they are an important refuge for plants as well as important habitat for nesting and migrating birds. Many other animals groups such as amphibians, reptiles, dragonflies, damselflies, moths, and butterflies also depend on specific wetland habitats for all or a portion of their life cycles. Calcareous wetlands are especially rare, and those that remain relatively undisturbed often provide refuges for calcium-loving species that have very little suitable habitat remaining in Pennsylvania.

METHODS

Forty-one county inventories have been completed in Pennsylvania to date. The methods used in the Blair County Natural Heritage Inventory followed established Pennsylvania Natural Heritage Program procedures, which are based on those used by 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 Blair County. Local citizens knowledgeable about the flora and fauna of Blair 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, contiguous blocks of forest, and limestone or sandstone cliffs were of primary interest during fly-overs in Blair County. Based on aerial photo interpretation and aerial surveys, some sites were eliminated from consideration if they proved to be highly disturbed, fragmented, lacking the targeted natural feature, or 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 Blair County during 2003 and 2004. 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 2003 and 2004 field seasons were combined with prior 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.

Biological Diversity Areas

All sites with rare species and/or natural communities, as well as sites with 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

Landscape Conservations Areas (LCAs) are delineated to include large areas of intact natural landscape, and to include areas important in large-scale ecological processes. LCAs may be large blocks of contiguous forest, extensive wetland complexes, areas linking ecologically significant features such as those recognized for BDAs, and otherwise comparatively (relative to an individual county) undisturbed, ecologically intact portions of the landscape.

In Blair County, contiguous forest blocks were identified, and LCAs were selected from among these blocks based on several criteria: 1) contiguously forested areas of exceptional size, 2) blocks which were part of a ridgeline and separated from other large blocks only by minor fragmenting features, and 3) blocks which were adjacent to Biological Diversity Areas hosting species which depend upon forest habitat.

Blocks of contiguous forest were identified by means of GIS analysis, refined through aerial photograph inspection, and selected based on size. Forested areas were identified though a classification of 1992 National Land Coverage Data (NLCD), compiled from Landsat TM (thematic mapping) satellite imagery with a resolution of 30 meters, downloaded from the Pennsylvania Spatial Data Access (PASDA) website (http://pasda.psu.edu). Land coverage types used in the analysis were transitional, deciduous forest, coniferous forest, mixed forest, woody wetlands, and emergent herbaceous wetlands. Roads, active railroads, and utility rights-of-way were considered fragmenting features. Existing GIS data for roads, which included interstates, US and state highways, state, county and township roads, and active railroads, were combined with utility right-of-way locations digitized from aerial photos. Analysis to identify contiguous blocks of forest (defined to include all land coverage types listed above) was conducted using the map calculator function of the Spatial Analyst Extension in ArcView 3.2. Contiguous forest blocks were defined as regions of forest at least 300 m wide at all points, such that they contain contiguous core forest habitat atleast 100 m wide at all points. Core forest is considered to be at least 100 m distant from an edge with non-forest land uses. The resulting blocks were then compared against aerial photos and any discernable non-forested areas were removed. Forest blocks less than 1 acre were then removed. Total acreage as well as core forest acreage were then calculated for all remaining blocks. A detailed description of the GIS analysis is available upon request from Data Manager, Western Pennsylvania Conservancy.

LANDSCAPE CONSERVATION AREAS

Background

Prior to European settlement, forest covered more than 90 percent of Pennsylvania (Goodrich et al. 2003). Today, 62 percent of the state is forested, comprising an area of over 17 million acres (Figure 5; Goodrich et al. 2003, Myers et al. 2000). However, much of this forest exists as relatively small islands isolated by surrounding linear features such as roads, utility right-of-ways, and railroads, as well as non-forest lands. A number of studies have looked at the effects of roads and other linear features on the landscape. Ecological impacts of these fragmenting features include: (1) direct mortality of wildlife from vehicles; (2) disruption of wildlife dispersal; (3) habitat fragmentation and loss; (4) imposition of edge effects; (5) spread of exotic species; (6) alteration of the chemical environment.

Roads can be a significant source of mortality for a variety of animals. Few if any terrestrial species are immune. Amphibians may be especially vulnerable to road-kill because their life histories often involve migration between wetland and upland habitats, and individuals are inconspicuous. One study conducted in southeastern Pennsylvania documented over 100 road-killed salamanders and frogs on a single-mile stretch of road during one rainy night in the spring breeding season (Goodrich et al. 2003). Large and mid-sized mammals are particularly susceptible to vehicle collisions on secondary roads, while birds and small mammals are most vulnerable on wider, high-speed highways (Forman & Alexander 1998). In Upper St. Clair Township, Pennsylvania, over the last four years, white-tailed deer mortality due to road-kills was approximately four times higher than mortality due to hunting (Upper St. Clair Township Department of Deer Management). A total of 637 bobcats (*Lynx rufus*) were reported as road-kills in Pennsylvania from 1985 to 2000 (Goodrich et al. 2003). A 10-year study of road mortality in New Jersey recorded 250 dead raptors representing 12 species along a 90-mile section of road (Loos & Kerlinger 1993, cited in Goodrich et al. 2003).

Animals may alter their behavior in the presence of a road. One study found that small forest mammals (e.g., eastern chipmunk, eastern gray squirrel, and deer mouse) were reluctant to venture onto road surfaces where the distance between forest margins exceeded 20 m. The same study concluded that a four-lane divided highway might be as effective a barrier to the dispersal of small forest mammals as a body of fresh water twice as wide (Oxley et al. 1974). A study conducted in North Carolina found that black bears shift their home ranges away from areas with high road densities (Brody & Pelton 1989). Songbirds seem to be especially sensitive to traffic noise; it interferes with their vocal communication and thus affects their territorial behavior and mating success (Seiler 2001).

Roads, wide trails, and grassy corridors can also function as barriers restricting the movement of invertebrates and amphibians. Populations of microhabitat-specific species like land snails and salamanders, that generally require moist habitats, may be isolated by inhospitable, xeric corridors (Williams 1995, Blaustein et al. 1994). Some forest butterflies, like the West Virginia white (*Pieris virginiensis*), will not cross open habitats and its current rarity may be a function of habitat fragmentation and isolation (Williams 1995). Consequences of the isolation of populations include reduced genetic diversity and low recruitment rates that can, in turn, result in local extinctions (Seiler 2001).

Fragmentation of formerly contiguous forested landscapes into smaller, isolated tracts has an effect on plant and animal distribution and community composition. When an extensive forest tract is fragmented, the resulting forest islands may lack the full range of microhabitats that existed in the original tract. If a habitat fragment lacks required microhabitat(s), or is smaller than the minimum area required by a given species, individuals of that species will not likely be found within that habitat fragment (Lynch & Whigham 1984). For example, the Louisiana waterthrush (*Seirus motacilla*) is rarely found in small woodlots because they require upland forest streams within their territory, and most small woodlots lack this necessary component (Robbins 1980, Robinson 1995). Area-sensitive species such as northern goshawk (*Accipiter gentilis*), barred owl (*Strix varia*), bobcat, and timber rattlesnake (*Crotalus horridus*) require interior forest areas in excess of 6,000 acres to accommodate breeding and foraging territories (Squires & Reynolds 1997, Mazur & James 2000, Ciszek 2002, Natureserve 2005).

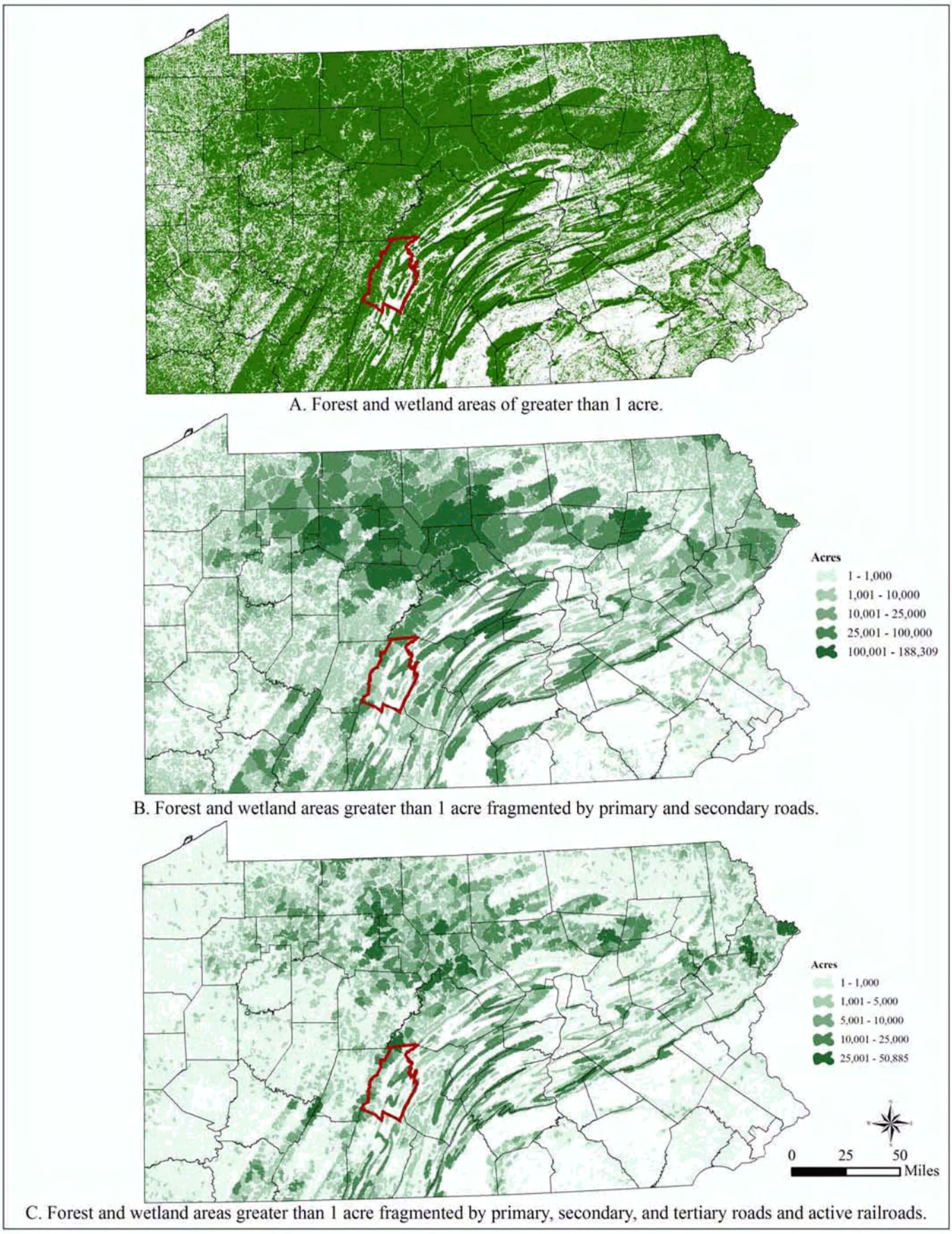


Figure 5. Forest Cover and Forest Fragmentation in Pennsylvania

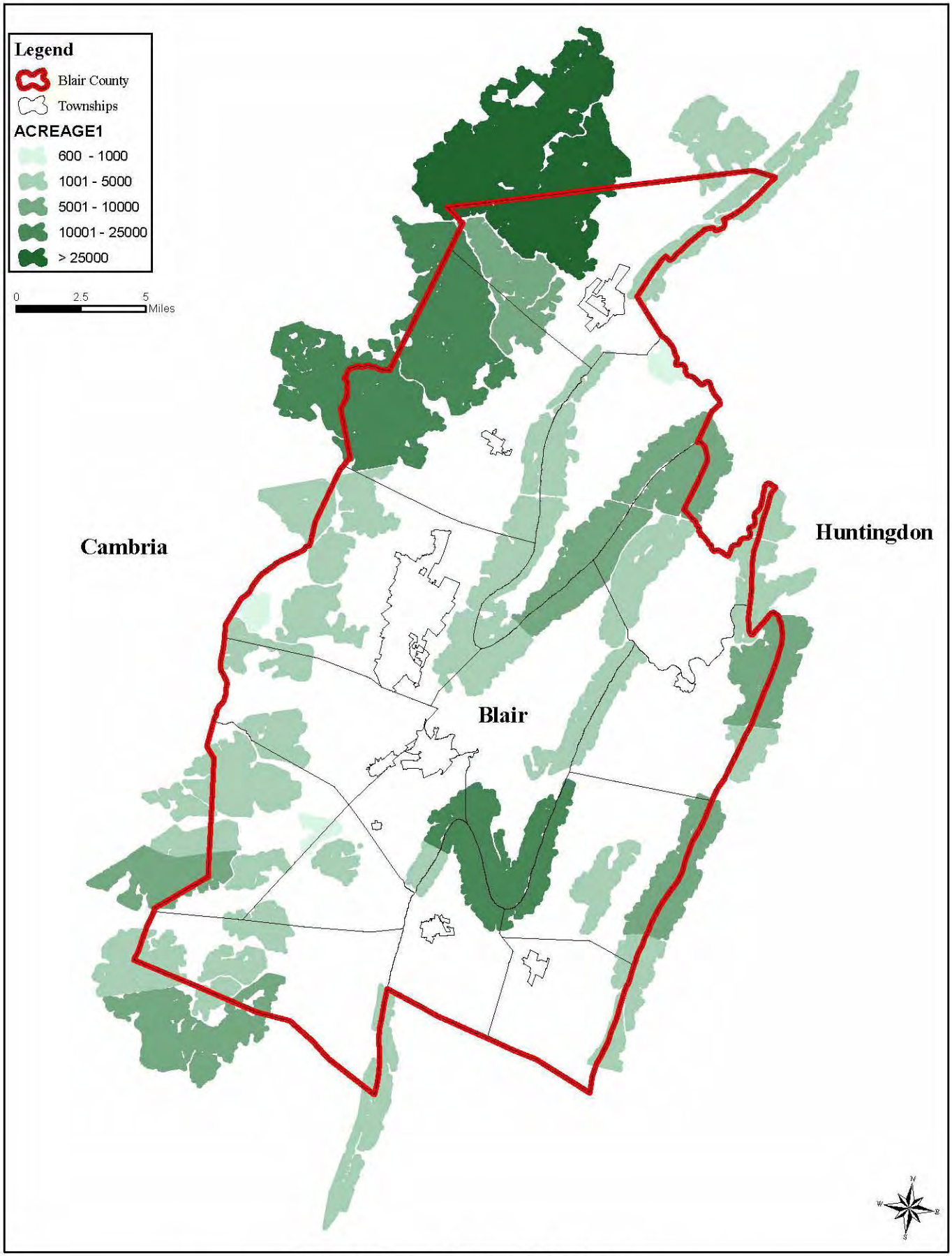


Figure 6. Forest Blocks of Blair County.
These areas contain at least 600 acres of contiguous interior forest habitat.

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

Roads can act as corridors for plant dispersal, and exotic species increase their range by spreading along roadsides (Watkins et al. 2003). Vehicles and road-fill operations transport exotic plant seeds into uninfested areas, and road construction and maintenance operations provide safe sites for seed germination and seedling establishment (Schmidt 1989; Greenberg et al. 1997; Trombulak & Frissell 2000). Unpaved road edges often have exposed areas of mineral soil and suitable light and moisture conditions that allow exotic seeds to become established (Parendes & Jones 2000, Trombulak & Frissell 2000).

Road traffic and maintenance of right-of-ways contribute at least six different classes of chemicals to the environment: heavy metals, salt, organic pollutants, ozone, nutrients, and herbicides (Forman & Alexander 1998, Trombulak & Frissell 2000). Heavy metals, which include lead, aluminum, iron, cadmium, copper, and manganese, contaminate soils, plants, and invertebrates up to 200 m from roads, as well as vertebrate fauna foraging within the affected zone (Trombulak & Frissell 2000). One study found elevated lead concentrations in tissue of several small mammal species in a narrow zone by roads (Getz et al. 1977, cited in Forman & Alexander 1998). Deicing salts contribute ions to the soil, altering pH and soil chemical composition, which affects plant growth (Forman & Alexander 1998, Trombulak & Frissell 2000). Airborne sodium chloride from snowplowing may cause leaf injury to trees (e.g., white pine) up to 120 m from a road, especially downwind and downslope (Forman & Alexander 1998). Organic pollutants such as dioxins and polychlorinated biphenyls (PCBs) are present in higher concentrations along roads and hydrocarbons may accumulate in aquatic ecosystems near roads (Trombulak & Frissell 2000). Vehicles produce ozone, which increases the concentration of this gas in the lower atmosphere where it acts as a greenhouse gas (Trombulak & Frissell 2000). Storm runoff from roads, particularly where roads abut or cross water bodies, results in the transport of nutrients and sediments into aquatic ecosystems (Trombulak & Frissell 2000). Herbicides are often applied to roadsides and utility right-of-ways to control woody plant growth. Forest edge and interior plant species can be damaged or destroyed by drifting or misapplied herbicide (Williams 1995, Forman & Frissell 2000).

Humans are an integral part of natural history, where we function as ecosystem engineers, altering the landscape around us to suit our needs. Some species benefit from human-induced changes, such as birds that inhabit the early successional and edge habitats provided by utility corridors or disturbance-adapted plants that colonize roadsides. But as is more often the case, species with specific habitat requirements tend to suffer declining numbers when faced with human encroachment. Given the pervasiveness of human influence throughout the northeastern United States, the ecological importance of large areas of relatively pristine habitat cannot be overestimated.

General Recommendations for LCA Conservation

LCAs are large areas with ownership typically divided among many entities, individual, corporate, and public. Because their unique value arises from large-scale contiguity of natural ecosystems, the greatest threat to their future viability is fragmentation of natural cover by interruptions in the forest landscape. Conservation of these areas' unique habitat value and their ability to continue providing ecosystem services will require coordinated efforts by the many landowners involved to preserve ecosystem health at the local scale and forest cover contiguity at the regional scale.

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. In Blair County, large areas of forest occur mainly along the ridgelines and along the Allegheny Front. These features have the potential to form corridors of natural landscape across the region. However, because they are long and linear, they are easily subject to fragmentation from roads and rights-of-way crossing them laterally.

Fragmentation can be minimized by utilizing existing disturbances for new projects rather than clearing additional forest, by consolidating roads and right-of-ways where multiple routes exist, and by restoring unused cleared areas such as abandoned roads, wells, or mined areas to forest. When planning the path of a fragmenting land use change, impact can be minimized by avoiding complete division of the LCA; any feature which cuts completely across the contiguous forested area will effectively create two separate, smaller communities, while preservation of a linkage at least several hundred meters wide preserves overall contiguity of the forest block. 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 reference pg 119 for road management, Appendix VII on pg. 143 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 other species, and conserving ecologically important aspects of the physical landscape such as soil structure, naturally decomposing dead wood, and structural diversity in forest composition. 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 in the environmental conditions that result after mining. Mining also causes water quality degradation that is difficult to remediate. A number of resources, listed in Appendix VII (pg 143), 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.

Bird's-eye view of forest fragmentation

Blair County LCAs

The landscape of Blair County is heavily forested along its prominent topographic features— the north-south ridges running through the center and along the eastern edge of the county, and the Allegheny Front at the western edge of the county (see Figure 6). The valley areas are mainly in agricultural or urban use, with little forest remaining. While the forests of the ridges and the Allegheny Front are extensive, their habitat value is impacted by fragmentation from roads and rights-of-way, and by degradation in some areas from past mining and timbering operations. The unique ecological value of large, contiguous forest ecosystems is that they have the capacity to be resilient to natural disturbances and to host a full range of native forest ecosystem biodiversity, including the most sensitive forest species that require interior forest conditions or large territories. These areas are crucial habitat for species such as neotropical migrant birds, bobcats, and bats. Portions of Blair County are especially important to bats, as the limestone geology of the valleys results in an abundance of caves, which provide winter hibernation sites, and the nearby forests provide summer habitat. Features such as ridgelines, which are typically heavily forested and unsuitable for intensive development or agriculture, also offer the potential to serve as corridors of natural landscape, providing regional connectivity between natural areas and providing migration routes for highly mobile and migratory species. Landscape Conservation Areas in Blair County (map Figure 1, pg. viii) are organized around these features, and highlight the areas within that are the largest remaining blocks of contiguous forest habitat, areas that are especially important in supporting unique ecological features, and small blocks of contiguous forest that have potential to be united into a larger blocks with relatively little effort to mitigate fragmentation.

The Allegheny Front

Descriptions

The Allegheny Front has the best potential of any of central Pennsylvania's large-scale features to serve as a regional corridor connecting the forests of West Virginia all the way up to the Allegheny National Forest. It remains largely forested, and includes large tracts of public land. Within Blair County, it is fragmented at regular intervals by roads and rights-of-way, but also includes the largest remaining contiguous blocks of forest habitat in the county. These areas are also the watersheds of drinking water supply for Tyrone, Bellwood, and Altoona, and the forested condition of the land maintains good water quality. The forest types tend towards northern hardwoods communities where they are at least moderately mature. Sugar maple, beech, and black cherry are prominent and often extend even to higher elevation regions typically occupied by oak forest types, due to heavy oak mortality from past gypsy moth infestations. Younger forests are generally dominated by black birch or red maple saplings.

Allegheny Front LCA #1

This northernmost forest block along the Allegheny Front in Blair County is also the largest in the county. This block, at 26,315 acres, is unique in meeting the estimated size requirement (25,000 acres) for a viable forest ecosystem that can absorb natural disturbances yet still sustain populations of typical and sensitive species (Anderson & Vickeray in press).

Allegheny Front LCA #2

This block, although smaller than its neighbors at 6,014 acres, is separated only by routes 453 and 885 from large blocks to the north and south, and thus forms part of a large area of minimally fragmented forest landscape.

Allegheny Front LCA #3 & #4

Both meet the estimated size necessary to sustain viable populations of neotropical migrant birds (9000 acres) and of the Northern Goshawk (10,500 acres), a bird of prey which has a very large individual home range territory. Several Biological Diversity Areas are embedded within these forest blocks (see Loup Run BDA, Shaw Run Outcrops BDA, Bell's Gap Run BDA, and Tubb Run Headwaters Pools BDA).

Below the southern boundary of Allegheny Front LCA #4, a very wide powerline right-of-way, the Allegheny Front in the west-central region of Blair County is more fragmented. Forest cover is broken by several small roads, mined areas, and residential extensions of Altoona and Cresson. U.S. Route 22 is a major fragmenting feature, and south of Rt. 22 the forest is regularly transected by several utility rights-of-way.

Allegheny Front LCA #5

Near the southern boundary of Blair County, a moderately large block of contiguous forest remains. It is separated only by relatively minor fragmenting features, two small roads, from smaller blocks to the north and east.

Threats and Stresses

The soil along the Allegheny Front is naturally somewhat acidic and nutrient poor, and terrain is often very steeply sloped. Due to these factors, long-term forest ecosystem health in the region is especially vulnerable to soil erosion from forest disturbances and to soil depletion from overharvesting and acid rain. Mined areas high along the Allegheny Front have left a legacy of acid discharge into some of the otherwise relatively pristine high mountain streams along the Allegheny Front. In some areas, past timber management practices have degraded forest quality. Encroachments on forest contiguity through developments extending out from road corridors or expansion of rights-of-way will threaten the unique habitat value of the Allegheny Front LCAs, currently the largest contiguous forested regions in Blair County.

Recommendations

One step towards the maintenance and improvement of the health of these forest ecosystems is to conduct all forestry practices in the area according to a forest management plan which emphasizes long-term forest ecosystem health and employs best management practices for sustainable forestry.

Forest contiguity along the Allegheny Front can be enhanced by careful management of existing fragmenting features. Where possible, the width of the cleared areas associated with roads and rights-of-way should be minimized. Preservation of a closed or nearly-closed tree canopy over roads and rights-of-way will greatly enhance the ability of bird species to traverse these features and minimize impacts on the habitat value of adjacent forest. Care should be taken that management practices along roads, rights-of-way, mines, or developments adjacent to the LCAs do not introduce non-native species into these relatively intact native forest ecosystems.

Lock & Loop Mountain LCAs

Description

Lock Mountain is transected at regular intervals by roads and rights-of-way, and thus the areas of contiguous forest habitat it currently contains are relatively small in comparison to others in Blair County. However, the Lock Mountain forest blocks were selected because there are several bat hibernation areas in the valley directly west of the ridge, and the forest along the ridge likely serves as summer habitat supporting the bats.

The Loop Mountain LCA is a large block of fairly contiguous forest. It has ~8,900 acres of core forest area—nearly the size (9,000 acres) estimated to be necessary to sustain viable populations of neotropical migrant birds (Anderson & Vickeray 2000). As the forest occurs across a mountain ridge it contains an elevational gradation of different forest types, ranging from mesic types near the base of the slopes to a dry, acidic oak-heath forest type along the ridgeline. The ridgeline forest is mature and in good condition and appears to have had little disturbance from quarrying in the past. There are also several natural scree boulder fields along the upper slopes.

Threats and Stresses

Several small roads wind through the Loop Mountain LCA. Although they do not transect the entire block, they do create a degree of fragmentation and edge habitat. The LCA is actually ~10,700 acres in size, but only ~8,900 acres of this area is core forest habitat. Lock Mountain is transected at the northern end of the area delineated as the Loop Mountain LCA by a road and a pipeline right-of-way, which interrupt the contiguity of this large forest block with the rest of the ridgeline. Further north several large right-of-ways cross the ridge as well.

Recommendations

Reduction in the mileage of small roads in the Loop Mountain LCA will improve its habitat value for forest specialist species. Reduction of the number of roads and right-of-ways that transect Lock Mountain will improve the contiguity of the ridgeline, enhancing its value as wildlife habitat. The impact of rights-of-way and small roads as fragmenting features can be reduced by minimizing the width of these features, maintaining natural forest as close to the edge as possible, and allowing the tree canopy to extend out across the features.

Brush Mountain & Canoe Mountain LCAs

Description

Canoe Mountain and Brush Mountain together are a folded but continuous ridgeline. The ridge is almost contiguously forested, except for a few roads and a large right-of-way which cuts across it. In the eastern-most fold of the ridgeline, there is a large natural wetland complex that gives rise to Canoe Creek. On either side of Canoe Creek, the ridge is forested with a fairly high degree of contiguity and maturity in most areas. This forested area and the wetland likely serve as important summer habitat for several bat species. The upper end of the Canoe Creek Valley and its surrounding ridges—The Canoe Mountain South LCA, the Canoe Mountain North LCA, and the Brush Mountain East LCA—together form an extensive natural area including the most intact valley landscape in Blair County.

The upper end of Sinking Valley—bounded by the Brush Mountain East, Brush Mountain South, and Brush Mountain West LCAs—also retains a large amount of forest cover, although it is somewhat more fragmented and is less mature in many areas due to more intensive timbering.

Threats and Stresses

An extremely wide powerline right-of-way cuts across Brush Mountain and Canoe Mountain, creating a major barrier to habitat contiguity. It crosses Canoe Mountain through the large wetland complex in the headwaters of Canoe Creek, which is a sensitive habitat. If chemicals are used in the maintenance of the right-of-way, it is highly likely they are entering the wetland and Canoe Creek through runoff.

The Brush Mountain East LCA is cut into a steep hillside and has a fairly wide area of cleared vegetation along its sides; invasive species, including tree-of-heaven (*Ailanthus altissimma*) are colonizing the roadside.

Recommendations

There are relatively few features interrupting the contiguity of the natural forest landscape along Canoe Mountain and Brush Mountain—Kettle Road, which crosses the west ridge of Brush Mountain to connect Altoona and Sinking Valley; a small road extending from Sinking Valley across the east ridge of Brush Mountain to Canoe Valley; the road extending up Canoe Creek valley; and the large powerline right-of-way that cuts across all three ridges. Because there are few fragmenting features in an otherwise largely contiguous forested ridge, efforts to mitigate the impacts of these features could have a large payoff in increased habitat value. The State Game Lands road up Canoe Creek Valley, which is already closed to general traffic, could be reduced in width and converted to a trail. The road connecting Sinking Valley and Canoe Valley could also potentially be closed and removed if traffic is light. For all roads, minimizing width, allowing natural vegetation to extend up to the road edge, and allowing a tree canopy to form across some or all of the road will minimize the impact on surrounding forest habitat and enhance the ability of bats and birds to cross the roads. These mitigation measures may also help prevent the spread of invasive species along the steep section of road extending up the east ridge of Brush Mountain from Sinking Valley, as well as in other areas. The powerline right-of-way is the largest fragmenting feature; while its removal would be ideal from the perspective of habitat contiguity, its impact could also be reduced by: a) reducing the width of the cleared area, b) allowing native vegetation to grow higher beneath the lines and surrounding the towers, c) using manual rather than chemical vegetation control methods, especially nearby to the wetland in the headwaters of Canoe Creek, or d) re-routing the line to avoid the wetland area.

Tussey Mountain LCAs

Description

Tussey Mountain is a long, straight ridge that extends for several counties. In Blair County the ridge is separated into several blocks by powerline right of ways and roads that cross the ridge. Within the blocks, though, there is relatively little fragmentation. The forest along much of the ridge is in fairly good condition, with especially mature or diverse areas intermixed with younger, typical second growth. The steepness of the ridge in some areas, and varied underlying geology including sandstone and limestone outcrops, results in a diverse suite of natural communities and habitats along the ridge. Several exceptional examples of natural communities along the ridge have been highlighted as Biological Diversity Areas—the West Slope Tussey Mountain BDA, the West Slope Tussey Mountain Outcrops BDA, and the SGL #119 Sandstone Outcrops BDA. The forest along Tussey Mountain also likely provides important summer habitat for bats, as several winter hibernation sites are located directly west of the ridge. The areas selected as LCAs along the ridge were those that are especially close to bat hibernation sites and thereby important in supporting the bats, and those which are the largest remaining contiguous blocks along the ridge. Tussey Mountain LCA #3 and #5 are moderate-sized contiguous blocks, while #1, #2, and #4 are currently relatively small contiguous areas but are likely important in supporting the bats. The ridge generally has good potential as a regional habitat corridor, if the existing fragmenting features that cross it can be removed or minimized to join the smaller blocks.

Threats and Stresses

Tree-of-Heaven, an invasive tree species, is sprouting in some areas along the ridge. It appears to be most successful in disturbed areas such as timber clearings, right-of-ways, and roadsides. Japanese stiltgrass (*Microstegium vimineum*), an invasive grass species, is also colonizing roads and may potentially spread into forested areas. Lower-slope and floodplain areas have garlic mustard (*Alliaria petiolata*) and dame's rocket (*Hesperis matronalis*) in the herbaceous layer.

Recommendations

The generally good condition of the ridge as a forest ecosystem can be maintained and enhanced by preserving the existing forest contiguity and managing any timber removal activities according to an ecosystem-oriented forestry

plan that specifies best management practices for sustainability. The contiguity of the ridge can be enhanced by removing or minimizing the fragmenting features that cross the ridge, following the same techniques mentioned in above LCA recommendations. Minimizing disturbances to the forest canopy, especially along roadside areas, will help to prevent the establishment and spread of invasive plant species, which have already gained a foothold on the ridge.

Mountain bugbane
Cimicifuga americana

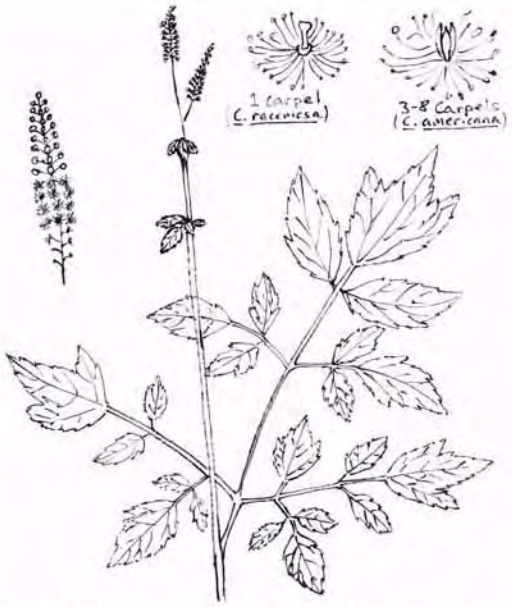
What it looks like:

Mountain bugbane, *Cimicifuga americana*, is a perennial herb that grows from one to one and a half meters (three to four feet) tall.

Leaves are compound, with terminal leaflets large, toothed, and deeply cleft; other leaflets oval to wedge-shaped with sharply defined teeth. All leaflets are less than 10 centimeters (four inches) long.

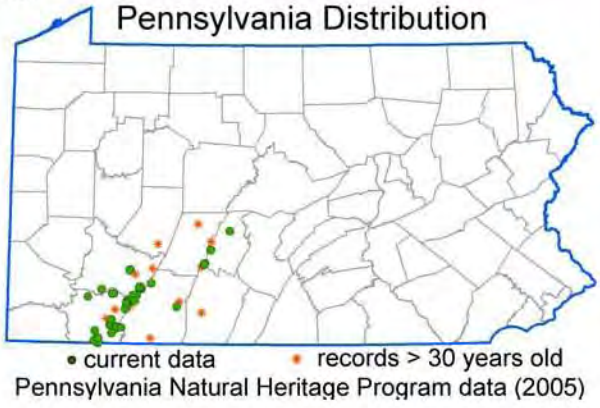
Flowers: a slender raceme (up to 1 ft. tall) of tiny white flowers; no petals; short-lived sepals; most conspicuous feature is the spray of many white stamens; strong foul odor attracts flies for pollination; flowers open from base upward on spike.

Can be distinguished from the very similar looking species black cohosh (*Cimicifuga racemosa*) because it has three or more carpels instead of only one, and its seed pods are stalked.



Where it is found:

Mountain bugbane grows in rich hardwood forests, often in the same habitat as hemlock, on north-facing mountainsides or the wooded corridors that follow mountain streams. It is restricted to the central Appalachians, from Pennsylvania south to Georgia and as far west as Illinois.

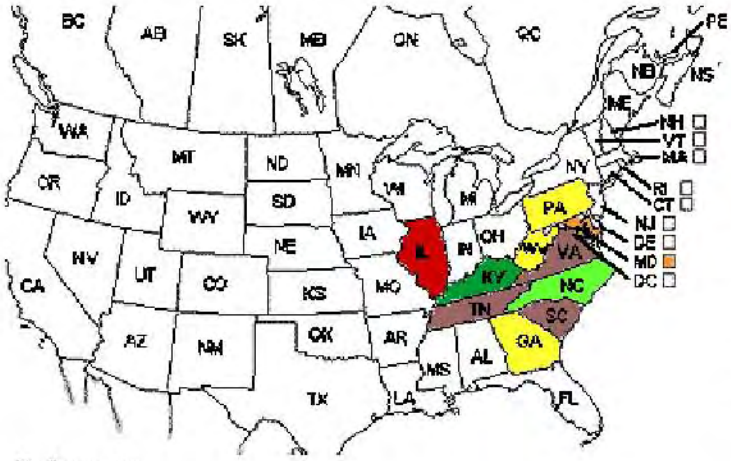


Why it is rare:

Mountain bugbane is primarily endangered by development and clearcutting of its habitat, but populations have also suffered from harvesting pressure. Although mountain bugbane is not particularly valuable in itself, its similar-looking relative black cohosh is a highly sought-after medicinal herb. Between 300,000 and 500,000 pounds of black bugbane were collected from the wild for sale in 1999, and some of this was almost certainly mountain bugbane.

North American State/Province Conservation Status

Map by NatureServe



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 within Pennsylvania

Conservation considerations:

Much is still unknown about where mountain bugbane grows and how secure its existing populations are. Information about how often it is collected with black bugbane would greatly aid conservation efforts. Given present information, habitat conservation is what this species most requires.

References

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- United States Department of Agriculture-Natural Resources Conservation Service. 2005. The PLANTS Database [web application]. National Plant Data Center, Baton Rouge, LA 70874-4490 USA. Available at http://plants.usda.gov. Accessed 23 February 2005.