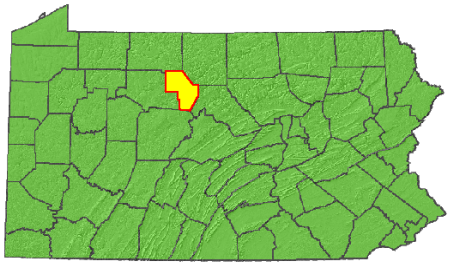
Cameron County
Natural Heritage Inventory



clockwise-top right to center: Allegheny woodrat, netted chain fern, northern myotis, timber rattlesnakes, mountain earthsnake, northern water shrew, creeping snowberry, common claybank tiger beetle, background: a Cameron County deciduous forest (all photos PNHP)

CAMERON COUNTY
NATURAL HERITAGE INVENTORY

2012

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

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Charlie Eichelberger (PNHP)

A pair of combating male timber rattlesnakes (*Crotalus horridus*) in Cameron County. When a female is receptive to two similarly sized male snakes, the males will compete by raising their heads high into the air and then attempting to pin the opponent to the ground. Sometimes lasting several hours, these competitions end when one snake clearly shows dominance, and the loser moves off.

PREFACE

The Pennsylvania Natural Heritage Program (PNHP) is a partnership between the Western Pennsylvania Conservancy (WPC), the Pennsylvania Department of Conservation and Natural Resources (DCNR), the Pennsylvania Game Commission (PGC), and the Pennsylvania Fish and Boat Commission (PFBC). PNHP is a member of NatureServe, which coordinates natural heritage efforts through an international network of member programs-known as natural heritage programs, or conservation data centers, operating in all 50 U.S. states, Canada, Latin America, and the Caribbean. The Pennsylvania Natural Heritage Program is responsible for collecting, tracking, and interpreting the information regarding the Commonwealth's biological diversity. County Natural Heritage Inventories (CNHIs) are an important part of the work of the PNHP. Since 1988, the PNHP has conducted CNHIs as a means to both gather new information about natural resources and to pass this information along to those responsible for making decisions about the resources in the county. The Cameron CNHI focuses on the best examples of living ecological resources within the county. Historic, cultural, educational, water supply, agricultural and scenic resources should be addressed through other projects and programs. Although the CNHI was conducted using a tested and proven methodology, it is best viewed as a preliminary report on the county's natural heritage. Further investigations could, and likely will, uncover previously unidentified areas of significance. Likewise, in-depth investigations of sites listed in this report could reveal features of further or greater significance than have been documented. We encourage additional inventory work across the county to further the efforts begun with this study. Keep in mind that there will be more places to add to those identified within this report and that this document can be updated as necessary to accommodate new information.

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

Planners and Government Staff: Typically, the planning office in a county administers county inventory projects. Often, the inventories are used in conjunction with other resource information (agricultural areas, slope and soil overlays, floodplain maps, etc.) in review for various projects and in comprehensive planning. Natural Heritage Areas 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 county, state, or federal lands. Agencies such as the Pennsylvania Game Commission (PGC), the Department of Conservation and Natural Resources (DCNR), and the Army Corps of Engineers (USACE) can use the inventory to understand the extent of the resource. Agencies can also learn the requirements of the individual plant, animal or community elements, and the general approach that protection could assume. County Conservation Districts may use the inventories to focus attention on resources (high diversity streams or wetlands) and as a reference in encouraging good management practices.

Environmental and Development Consultants: Environmental consultants are called upon to plan for a multitude of development projects including road construction, housing developments, commercial enterprises, and infrastructure expansion. Design of these projects requires that all the resources impacted be known and understood. Decisions made with inadequate information can lead to substantial and costly

delays. County Natural Heritage Inventories (CNHIs) provide a first look at biological resources, including plants and animals listed as rare, threatened, or endangered in Pennsylvania and/or at the federal level. Consultants can then see potential conflicts long before establishing footprints or developing detailed plans and before applying for permits. This allows projects to be changed early on when flexibility is at a maximum.

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

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

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

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

County Natural Heritage Inventories and environmental review

The results presented in this report represent a snapshot in time, highlighting the sensitive natural areas within Cameron County. The sites in the Cameron County Natural Heritage Inventory have been identified to help guide land use and county planning. The Cameron County Natural Heritage Inventory is a planning tool, but is *not* a substitute for the environmental review process (PNDI), as information is constantly being updated as natural resources are both destroyed and discovered. Applicants for building permits and planning commissions can conduct free, online, environmental reviews to inform them of project-specific potential conflicts with sensitive natural resources. Environmental reviews can be conducted by visiting the Pennsylvania Natural Heritage Program's website, at http://www.naturalheritage.state.pa.us/. If conflicts are noted during the environmental review process, the applicant is informed of the steps to take to minimize negative effects on the county's sensitive natural resources. If additional information on species of concern becomes available during environmental review, the review may be reconsidered by the jurisdictional agency.

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 would also like to thank the Pennsylvania Department of Conservation and Natural Resources for providing the funding to make this report possible. Special thanks goes to the people of Cameron County for their interest and hospitality. A big thank you goes to those who suggested areas of interest and assisted with field surveys, including Lisa Bainey (DCNR), Randy Cassell, Jim Chestney (PFBC), Janet Colwell, Jeff Colwell (PFBC), Bill Crisp (PFBC), Tom Diez, Bob Martin, Ralph Harrison, Tom Pluto, Joe Wilson, Matt Wilson, Jeanne Wambaugh (DCNR) and Jim Zoschg (CCCD).

We want to recognize the Pennsylvania Natural Heritage Program and NatureServe for providing the foundation for the work that we perform for these studies. Current and former PNHP staff that contributed to this report include JoAnn Albert, Karen Bosco, Jake Boyle, Kierstin Carlson, Tony Davis, Jeremy Deeds, Alice Doolittle, Rocky Gleason, Steve Grund, Jim Hart, Susan Klugman, Matt Kowalski, John Kunsman, Betsy Leppo, Beth Meyer, Ryan Miller, Sally Ray, Erika Schoen, Andrew Strassman, Christopher Tracey, Jeff Wagner, Mary Walsh, Denise Watts, Peter Woods, and Ephraim Zimmerman.

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.

Charlie Eichelberger, Herpetologist
Pennsylvania Natural Heritage Program

How to use this document

The Cameron County Natural Heritage Inventory is designed to provide information about the biodiversity of Cameron County. The *Introduction* of the report has an overview of the natural features and history of Cameron County and the *Methods* section has an overview of the process behind this inventory. *Results* are presented at the broad landscape view, and then move into finer scale results which are broken down by municipality. Finally, the results are followed by some *Conclusions and General Recommendations* for Cameron County.

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EXECUTIVE SUMMARY

Preface

The ability of a community to bring its vision for the future to fruition depends on its capacity to assemble information that will enable it to act effectively and wisely. Since 1989, County Natural Heritage Inventories (CNHIs) have served as a way to both gather and pass along new and existing information to those responsible for land use decisions, as well as to all residents who wish to know more about the natural heritage of their county. County Natural Heritage Inventories focus on the best examples of living ecological resources in Cameron County. This inventory presents the known outstanding natural features in the county. The Western Pennsylvania Conservancy (WPC) served as the principal investigator, prepared the report, and created the maps for this study. The Pennsylvania Natural Heritage Program (PNHP), of which WPC is a partner, is responsible for collecting, tracking, and interpreting information regarding the Commonwealth's biological diversity.

Introduction

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

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

Natural Heritage Inventories and Environmental Review

The results presented in this report represent a snapshot in time, highlighting the sensitive natural areas within Cameron County. The sites in the Cameron County Natural Heritage Inventory have been identified to help guide wise landuse and county planning. The Cameron County Natural Heritage Inventory is a planning tool, but is *not* a substitute for the environmental review process (PNDI), as information is constantly being updated as natural resources are both destroyed and discovered. Applicants for building permits and Planning Commissions can conduct free, online, environmental reviews to inform them of project-specific potential conflicts with sensitive natural resources. Environmental reviews can be conducted by visiting the Pennsylvania Natural Heritage Program's website, at http://www.naturalheritage.state.pa.us/. If conflicts are noted during the environmental review process, the applicant is informed of the steps to take to minimize negative effects on the county's sensitive natural resources. If additional information on species of concern becomes available during environmental review, the review may be reconsidered by the jurisdictional agency.

Methods

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

Site Selection

Inventory site selection is guided by information from a variety of sources. A review of the Pennsylvania Natural Heritage Program database determined what locations were previously known for species of concern and important natural communities in Cameron County. Local citizens

knowledgeable about the flora and fauna of Cameron County were contacted for site suggestions. Individuals from academic institutions and state and federal agencies that steward natural resources (e.g. Pennsylvania Game Commission, Pennsylvania Bureau of Forestry, Carnegie Museum of Natural History) were also contacted to obtain information about lands or resources they manage. National Wetland Inventory data, compiled by the U.S. Fish and Wildlife Service, was used to locate wetlands of potential ecological significance within the county. General information from other sources such as soil maps, geologic maps, earlier field studies, and published materials on the natural history of the area helped to provide a better understanding of the area's natural environment.

Aerial photographs were reviewed to identify sites for ground survey. Initial study of aerial photographs revealed large-scale natural features (e.g. contiguous forest, wetlands) and disturbances (e.g. utility line rights-of-way, surface mines, timbered areas. Information concerning extent, quality, and context within the landscape can be gathered easily from air photos. Based on aerial photo interpretation, some sites were eliminated from consideration if they proved to be highly disturbed, fragmented, or lacked the targeted natural feature.

Ground Surveys

Areas identified as inventory sites were scheduled for ground surveys. Ecologists conducted field surveys throughout Cameron County from 2008 through 2011. After obtaining permission from landowners, sites were examined to evaluate the condition and quality of the habitat and to classify the communities present. Field survey forms were completed for each site. Using location data collected with Global Positioning Systems (GPS), boundaries for each site were determined using USGS 1:24,000 topographic maps and PAMAP aerial photography. The flora, fauna, level of disturbance, approximate age of forest community and local threats were among the most important data recorded for each site. Voucher specimens collected as part of this project were processed and have been archived in various museum collections including the Carnegie Museum of Natural History, the State Museum of Pennsylvania, the Academy of Natural Sciences, and the Cleveland Museum of Natural History among others. In cases where landowner permission for site visits could not be obtained or enough existing information was available from other sources, sites were not ground surveyed.

Data Analysis and Mapping

Data on species of concern and natural communities obtained during the field work for this inventory were combined with existing data and summarized. Plant and animal nomenclature follows that adopted by the Pennsylvania Biological Survey (PABS). Natural community descriptions primarily follow Fike (1999). All sites with rare species and/or natural communities of concern were selected for inclusion in Natural Heritage Areas. Spatial data on the elements of concern was compiled in a Geographic Information System (GIS; ESRI ArcGIS 10.0). Boundaries defining core habitats and supporting landscapes for each Natural Heritage Area were delineated using PNHP conservation planning specifications for the species of concern. These specifications are based on scientific literature and professional judgment for individual species or animal assemblages and may incorporate physical factors (e.g., slope, aspect, hydrology), ecological factors (e.g., species composition, disturbance regime), and input provided by agency biologists. Boundaries tend to vary in size and extent depending on the physical characteristics of a given Natural Heritage Area and the ecological requirements of its unique natural elements. For instance, two wetlands may require very different areas to support their functions if one receives mostly ground water and the other receives mostly surface water. The Natural Heritage Areas were then assigned a significance rank based on their importance to the biological diversity and ecological integrity of Cameron County. These ranks can be used to help prioritize future conservation efforts.

Natural Heritage Areas & Conservation Planning Categories

To provide the information necessary to plan for conservation of biodiversity at the species, community and ecosystem levels, two types of Natural Heritage Areas, (see below) are included in the report.

Natural Heritage Areas

A Natural Heritage Area is a location containing one or more plants or animals of concern at state or federal levels, exemplary natural communities, or exceptional native diversity. Natural Heritage Areas include both the immediate habitat and surrounding lands important in the support of these elements. They are mapped according to their sensitivity to human activities, with designations of Core Habitat and Supporting Landscape.

Conservation Planning Application:

Core Habitat delineates the essential habitat that cannot absorb significant levels of activity without substantial impact to the elements of concern.

Supporting Landscape indicates the habitat needed to maintain vital ecological processes or secondary habitat that may be able to accommodate some types of low-impact activities.

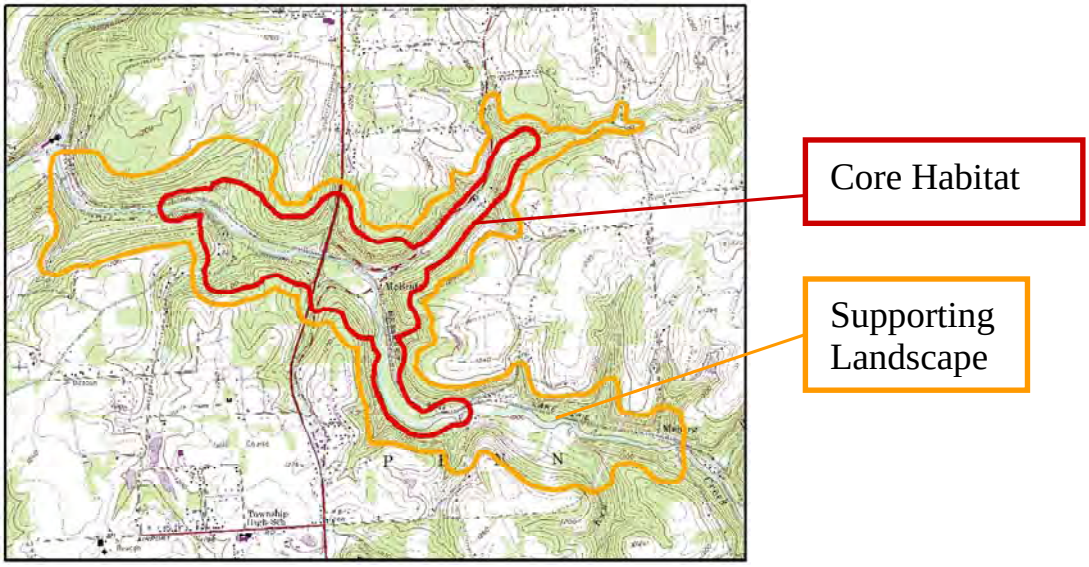


Figure 1. Core and Supporting Landscape designations

*A note about sensitive species

Although most species of concern are indicated by name, several species are considered "sensitive species" by the jurisdictional agency overseeing their protection (i.e. DCNR, PGC, PFBC, and/or the USFWS). Reasons for sensitive species status include extreme rarity, collection for the pet or nursery trade, disturbance due to public observation, or deliberate poaching and killing. Therefore, these species are referred to simply as 'sensitive species of concern'. In certain cases, some species (e.g. timber rattlesnakes, bald eagles) are not mapped due to large home ranges and high sensitivity to disturbance. For this reason, the environmental review process (PNDI) may pick up a "hit" for species not presented in this report.

Results

The preparation of this report has resulted in the identification of 29 Natural Heritage Areas. Natural Heritage Areas are categorized by significance (exceptional, high, notable, and local) based on their contribution to the protection of the biological diversity and ecological integrity of the region.

Table 1. County Natural Heritage Inventory significance ranks.

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

Natural Heritage Areas are discussed in turn in the Results section of the report, arranged alphabetically by Township. To conserve the native biological diversity of Cameron County, we recommend the use of a two-tiered approach to selecting areas for their contribution to conservation. The fine-filter/coarse-filter approach focuses attention on both the immediate habitat of the at-risk species, as well as the larger landscape scale processes that help to keep common species common.

- The fine-filter approach targets protection of uncommon species that generally occur in specialized and discrete habitats. Focusing conservation efforts on these smaller habitats will help defend these species from local, or in some cases global, extinction. This fine-filter approach has been the focus of our field studies to find locations of these unique species and their habitats, and to draw attention to the potential for their inadvertent destruction. These at-risk species and their habitats are described in the section describing Natural Heritage Areas.

- The coarse-filter approach suggests that whole suites of species as well as general ecological and environmental processes can be offered protection by focusing conservation efforts on large expanses of quality habitats of all types. We address the coarse filter approach by highlighting the largest unfragmented forest and natural habitats as well as riparian corridors.

The fine filter approach is characterized on the township maps by highlighting the species of concern core habitats and supporting landscapes. The coarse filter approach to conservation is characterized on the maps by

highlighting the large forested blocks and all riparian corridors for that township. Through a combined effort of these two approaches, we can help to assure that uncommon species avoid local or global extinction, and that common species remain common in Cameron County.

Conclusions And General Recommendations

Through the work required to complete the Natural Heritage Inventory, ecologists, botanists, and zoologists, have explored many of the natural areas of Cameron County. Although many field hours over several field seasons were spent surveying to produce this biological resource inventory, this report should not be viewed as the final work on Cameron County's biodiversity. Therefore, additional explorations of the county will very likely yield additional populations of the species listed in this report, as well as species previously unknown to the county.

This work represents an organized effort to inventory the biodiversity present throughout the county. Some of the earliest survey work in this area was completed by botanists and other naturalists during the middle part of the 19th century. These early explorers documented many species in the region, including some early records that have been updated in this report. Much of the modern work has concentrated on ecologically significant area and other sites that harbor rare species. In the surveys conducted through the NHI, we have not only identified rare and endangered plants and animals, but also many common species, for which no formal records previously existed in museum and agency records.

How does Cameron County contribute to the known biodiversity in Pennsylvania?

Cameron County harbors 61 extant occurrences of species and communities of concern, ranking 60th out of the Commonwealth's 67 counties. Municipal breakdowns of these data are presented below.

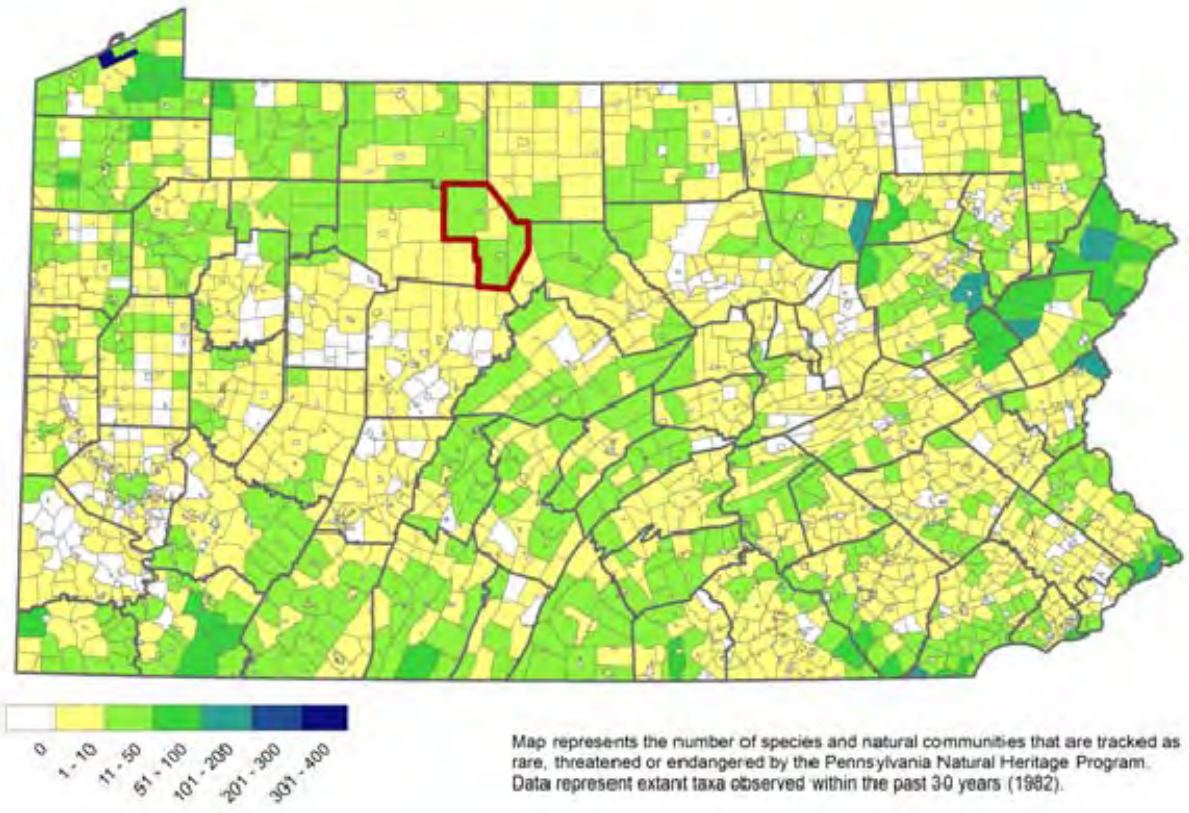


Figure 2. Number of species of concern by municipality.

In this analysis, Cameron County does not stand out as one of the top counties in terms of biodiversity in the state. However, it contains a number of species which are found in few other places in the state. A breakdown

of the rare, threatened, and endangered species found in Cameron County by their official state legal status is presented below. Please refer to Appendix II for an explanation of PNHP ranks and legal status

Table 2. Species and natural communities of concern occurring in Cameron County

Scientific Name	Common Name	Global Rank[1]	State Rank[1]	State Legal Status[1] (proposed)
Mammals				
Myotis septentrionalis	Northern myotis	G4	S1	N(CR)
Sorex palustris albibarbis	Northern water shrew	G5T5	S3	(CR)
Neotoma magister	Allegheny Woodrat	G3G4	S3	PT (PT)
Birds				
Accipiter gentilis	Northern Goshawk	G5	S2S3B,S3N	CR
Ardea herodias	Great blue heron (rookery)	G5	S3S4B,S4N	N
Haliaeetus leucocephalus	Bald eagle	G5	S2B	PT(PT)
Herptiles				
Crotalus horridus	Timber Rattlesnake	G4	S3S4	PC(CA)
Cryptobranchus alleganiensis	Hellbender	G3G4	S3	N
Glyptemys insculpta	Wood turtle	G3	S3S4	N (watch)
Liochlorophis vernalis	Smooth green snake	G5	S3S4	N (watch)
Plestiodon anthracinus	Northern coal skink	G5	S3	N
Virginia pulchra	Mountain earthsnake	G5T3T4	S3	N
Freshwater Mussels				
Lasmigona subviridis	Green Floater	G3	S2	(CU)
Insects				
Aplectoides condita	A Noctuid Moth	G4	S2S3	N
Cicindela limbalis	Common claybank tiger beetle	G5	S3	N
Chlosyne harrisii	Harris's Checkerspot	G4	S3	N
Enallagma aspersum	Azure Bluet	G5	S3S4	N
Epiglaea apiata	Pointed Sallow	G5	S3S4	N
Papaipema sp. 1	Flypoison Borer Moth	G2G3	S2	N
Sideridis maryx	A moth	G4	S1S3	N
Somatochlora elongata	Ski-tailed Emerald	G5	S2	N
Speyeria atlantis	Atlantis Fritillary	G5	S3	N
Sympetrum obtrusum	White-faced meadowhawk	G5	S3S4	N
Xylotype capax	Barrens Xylotype	G4	S3	N
Plants				
Bartonia paniculata	Screw-stem	G5	S3	P (NR)
Elymus trachycaulus	Slender wheatgrass	G5	S3	N (TU)
Gaultheria hispidula	Creeping snowberry	G5	S3	PR (PR)
Lactuca hirsuta	Downy lettuce	G5?	S3	N (TU)
Taxus canadensis	American yew	G5	S3S4	TU(watch)
Woodwardia areolata	Netted chainfern	G5	S2	N (PT)
Natural Community				
Ephemeral/fluctuating natural pool		GNR	S3	N
Hemlock – mixed hardwood palustrine forest		GNR	S3S4	N
Cotton-grass poor fen		GNR	S3	N

[1] Please refer to Appendix II for an explanation of PNHP ranks, legal status and quality ranks

The data presented in this report represents a snapshot of the species and ecological conditions present in Cameron County. Natural systems are constantly changing due to variations in climate as well as impacts from human disturbance. Lack of access to some sites of interest prevented surveys that may have yielded additional information about the county. Therefore, this report focuses on the current conditions of the county. We hope that this report can be used as a working document and a guide for conservation of known rare, threatened, and endangered species and habitats of importance, while also working to identify important natural resources previously undocumented in the county.

A Final Note on Rare, Threatened, and Endangered Species

The rare and endangered species highlighted in this report are some of the several hundred species in Pennsylvania that are threatened with extirpation or extinction. If a species becomes extinct, or is lost from a portion of its native range as happens with extirpation, the ecosystem in which it lived will lose an important element. Often the repercussions of extinctions are not known until the species is gone, and more often than not the species is not replaceable in the system. This may be because the habitat has been altered to the point that the species and the ecosystem cycles upon which its survival depends are no longer intact. Rare species are often indicative of fragile ecosystems that may have become degraded - protection of rare species may help monitor the quality of local ecosystems. A great example of a rare species acting as an indicator of environmental quality is the osprey - a bird species which indicated the deleterious effects of the pesticide DDT in our environment.

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

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

General Recommendations

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

1. **Incorporate CNHI information and recommendations into planning efforts.**
   Cameron County is a member of the North Central Pennsylvania Regional Planning and Development Commission, in partnership with Clearfield, Elk, Jefferson, McKean and Potter Counties in an effort to pool resources and responsibilities for this sparsely populated part of the state. Through internal planning, decision making related to land use development, and participation in regional planning initiatives, counties, and municipalities could profoundly shape the land and landscapes of Pennsylvania. Sites delineated in the Cameron County Natural Heritage Inventory can be readily included in comprehensive plans, greenway and open space plans, parks and recreation plans, and regional planning initiatives. DCNR funded greenway and open space plans, Heritage Region plans, and River Conservation plans are good examples of planning efforts that reach beyond county boundaries.

   Planning and zoning initiatives can help achieve a balance of growth and open space preservation within the municipalities. The following are specific recommendations that will serve to incorporate the information in this report into planning and land conservation activities in Cameron County.

   Adopt the Cameron County Natural Heritage Inventory (CNHI) by resolution. The CNHI report should be used as one of the primary sources of information on the location of sensitive natural features within the county.

Cameron County's Comprehensive Plan was adopted in 1969, which was augmented by County Zoning Ordinances that were last updated in 1987. Implementation of several of the goals in the Cameron County Comprehensive Plan can help lead to conservation of sensitive natural features within the county.

- Within Section I of the County Comprehensive Plan, under "Important development factors related to the long-range comprehensive plan" is expressed the prime goal of preserving the wilderness aspect for certain parts of the county:

  "The County is one of the seven "Wilderness counties" not yet spoiled by human activities in northern Pennsylvania. However, rapid development from 1970 through 1985 could reverse or destroy this natural resource. The retention of a "Wilderness" status for certain parts of the County is considered to be a prime goal in the future development planning."
  The comprehensive plan indicates that over 50% of the area of the County is in public ownership and most of the remainder is in very large private landholdings which has had the unintended consequence of focusing development into roadside and stream-side locations (Section I #4 & #5).

- The Land Use Policy Goals outlined in the Comprehensive Plan suggest regulating land use along streams and highways to preserve the scenic and natural characteristics of the county.

  "Cameron County shall make every attempt to regulate the use of land along the principal highways and stream-beds, thus preserving the natural and scenic characteristics of the county….The obvious tool required is a properly prepared and adopted Zoning Ordinance with supplementary Subdivision and Land Development Regulations." (Section J #1)
  Within Cameron County, only Emporium Borough, out of its five townships and two boroughs currently has zoning ordinances in place to help guide land use decisions. As expressed in the comprehensive plan, lack of planning and control over the siting of development within the municipalities can result in "…blighting effects…and shoddy development" (Section I #9). Continued lack of planning regulations will likely result in haphazard growth patterns with costly infrastructure demands and discontinuous open space. Future municipal plans and zoning initiatives should be developed for all municipalities and incorporate the CNHI information of this report into future land use decisions.

- The Comprehensive Plan makes clear its commitment to preserve water quality within the County and suggests zoning regulations and enforcement as tools for its protection within two goals of Section J:

  "The County shall make every attempt to reduce or eliminate stream pollution by enforcing the flood plain zoning concept and by requiring adequate sewage facilities (public or private) in all major watersheds and for population concentrations….Good zoning with supporting regulatory measures are recommended devices in attempting to control future stream pollution. The regulatory controls contained in the flood plain district preclude encroachment of stream beds by …any development proposals which would contribute significantly to the overall pollution of any important waterway within the County." (Section J #2)

  "The County shall actively support all conservation measures and legislation geared to the prohibition of stripping of land when such operations will scar the county scenery and possibly contribute to future surface water pollution." (Section J #4)

- In addition to the general recommendations within the Comprehensive Plan to protect streams, floodplains and water quality and to concentrate development activities within defined growth areas, these specific recommended amendments to the Comprehensive Plan can help assure the continued viability of sensitive natural features within the county:

  - The Cameron County Comprehensive Plan currently does not have a section to specifically encourage the conservation of environmentally sensitive areas within the County. The Comprehensive Plan should be amended to encourage the establishment of "Resource Protection Areas" which would identify land areas worthy of significant local protection in

local zoning and land use regulations such as wetlands, floodplains, areas of steep slopes, scenic vistas, prime agricultural lands, and areas identified as "Core Habitat" in the Cameron County Natural Heritage Inventory.

- Section I, Goal 1 in the Cameron County Comprehensive Plan encourages the County to *"…make every attempt to regulate the use of land along the principal highways and stream-beds, thus preserving the natural and scenic characteristics of the county."* An amendment to include specific language regarding the potential establishment of riparian buffer zones would be consistent with the recommendations in the Cameron CNHI report. Many of the Natural Heritage Areas presented in this report include floodplain and riparian areas and can serve as a basis for the most important areas to prioritize in floodplain ordinances. Action should be taken to amend the Comprehensive Plan to promote the establishment of a minimum 100-meter riparian floodplain setback/buffer to Section I, Goal 1.

- Section J, Goal 4 in the Cameron County Comprehensive Plan encourages the County to "*actively support all conservation measures and legislation geared to the prohibition of stripping of land when such operations will scar the county scenery and possibly contribute to future surface water pollution."* This goal should be amended to include disturbances that would negatively impact the areas identified as "Core Habitat" in the Cameron County Natural Heritage Inventory.

- Amend the Comprehensive Plan to add the Cameron CNHI overview map to the series of maps associated with the Comprehensive Plan.

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

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

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

   Fee simple acquisition is when a buyer purchases land outright and has maximum control over the use and management of the property and its resources. This conservation initiative is appropriate when the property's resources are highly sensitive and protection cannot be guaranteed using other conservation approaches.

Unrestricted donations of land are welcomed by land trusts. The donation of land entitles the donor to a charitable deduction for the full market value, as well as a release from the responsibility of managing the land. If the land is donated because of its conservation value, the land will be permanently protected. A donation of land that is not of high biological significance may be sold, with or without restrictions, to a conservation buyer and the funds used to further the land trust's conservation mission.

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

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

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

4. **Protect bodies of water.**
Protection of creeks, rivers, wetlands, and reservoirs is vital for ensuring the health of human communities and natural ecosystems, especially those that protect biodiversity, supply drinking water, and are attractive recreation resources. Many rare species, unique natural communities, or locally significant habitats occur in wetlands and water bodies and are directly dependent on natural hydrological patterns and water quality for their continued existence. Ecosystem processes also provide clean water supplies for human communities and do so at significant cost savings in comparison to water treatment facilities. Hence, protection of high quality watersheds is the only way to ensure the viability of natural habitats and water quality. Scrutinize development proposals for their impact on entire watersheds, not just the immediate project area. Cooperative efforts in land use planning among municipal, county, state, and federal agencies, developers, and residents can lessen the impact of development on watersheds.

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

Watersheds or subwatersheds where natural communities and species of concern occur (outlined on the township maps in this report) should be viewed as areas of sensitivity. As an example, conserving natural areas around municipal water supply watersheds provides an additional protective buffer around the water supply, habitat for wildlife, and may also provide low-impact recreational opportunities.

6. **Increase natural connectivity of the landscape surrounding the areas delineated in the Cameron County Natural Heritage Inventory.**
Encourage development in sites that have already seen past disturbances. The reclamation of previously disturbed areas, or brownfield development, for commercial and industrial projects presents one way to encourage economic growth while allowing ecologically sensitive areas to remain undisturbed. Cluster development can be used to allow the same amount of development on much less land and leave much of the remaining land intact for wildlife and native plants. By compressing development into already disturbed areas with existing infrastructure (villages, roads, existing right-of-way's), large pieces of the landscape can be maintained intact. If possible, networks or corridors of woodlands or green-space should be preserved linking sensitive natural areas to each other.

   Care should be taken to ensure that protected natural areas do not become biological islands, patches of unconnected habitats surrounded by development. In these situations, the site is effectively isolated and its value to wildlife is severely reduced. Careful planning can maintain natural environments and plants and animals associated with them. A balance between growth and the conservation of natural resources can be achieved by guiding development away from the most environmentally sensitive areas.

7. **Encourage the formation of grassroots organizations.**
County and municipal governments can do much of the work necessary to plan for the protection and management of natural areas identified in this report. However, grassroots organizations are needed to assist with obtaining funding, identifying landowners who wish to protect their land, and providing information about easements, land acquisitions, and management and stewardship of protected sites. Increasingly, local watershed organizations and land trusts are taking proactive steps to accomplish conservation at the local level. When activities threaten to impact ecological features, the responsible agency should be contacted. If no agency exists, private groups such as conservancies, land trusts and watershed associations should be sought for ecological consultation and specific protection recommendations.

8. **Manage for invasive species.**
Invasive species threaten native diversity by dominating habitat used by native species and disrupting the integrity of the ecosystems they occupy. Management for invasives depends upon the extent of establishment of the species. Small infestations may be easily controlled or eliminated, but more well established populations might present difficult management challenges. Below is a list of sources for invasive species information.
   - The Mid-Atlantic Invasive Plant Council (MAIPC) is a non-profit (501c3) organization dedicated to addressing the problem of invasive exotic plants and their threat to the Mid-Atlantic region's economy, environment, and human health by: providing leadership; representing the Mid-Atlantic region at national meetings and conferences; monitoring and disseminating research on impacts and control methods; facilitating information development and exchange; and coordinating on-the-ground removal and training. A membership brochure is available as a PDF file at http://www.maipc.org.
   - Several excellent websites exist to provide information about invasive exotic species. The following sources provide individual species profiles for the most troublesome invaders, with information such as the species' country of origin, ecological impact, geographic distribution, as well as an evaluation of possible control techniques.
     - The Virginia Natural Heritage Program's invasive plant page at http://www.dcr.virginia.gov/natural_heritage/invspinfo.shtml

- The Missouri Department of Conservation's Missouri Vegetation Management Manual at http://mdc.mo.gov/sites/default/files/resources/2010/05/5398_3326.pdf
- The following site is a national invasive species information clearinghouse listing numerous other resources on a variety of related topics: http://www.invasivespecies.gov/
-

Evaluating proposed activity within Natural Heritage Areas

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

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

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

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

- *U.S. Fish and Wildlife Service* for federally listed plants and animals.
- *Pennsylvania Game Commission* for mammals and birds.
- *Pennsylvania Fish and Boat Commission* for aquatic animals, reptiles and amphibians.
- *Pennsylvania Department of Conservation and Natural Resources (DCNR)* for plants, natural communities, terrestrial invertebrates, and other species not falling under the above jurisdictions.

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

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

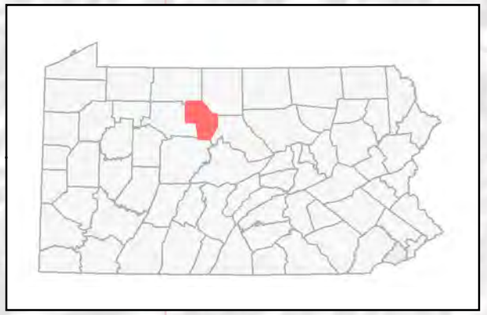
Table 3. Natural Heritage Areas categorized by significance.

Site Name	Municipality(ies)	Description	Page
Exceptional			
First Fork Floodplain at Sinnemahoning Reservoir	Grove Twp.	Floodplain meadows and wetlands created by the reservoir provide habitat for a number of species of concern, including three plant species of concern, 10 invertebrates of concern including dragonflies, damselflies, moths and butterflies, and three other species of concern not named at the request of the agencies overseeing their protection.	69
Red Run and Wycoff Run Headwaters	Gibson Twp.	Habitat supports five plant species of concern, one invertebrate species of concern and two natural communities of concern.	58
Sinnemahoning Creek Cliffs	Grove Twp. & Clinton Co.	The outcrops along the north side of Sinnemahoning Creek support a population of Allegheny woodrats (*Neotoma magister*), a mammal species of concern.	69
High			
Bobby Run	Shippen Twp.	Cold, high-quality waters surrounded by forest provide prime habitat for the northern water shrew (*Sorex palustris albibarbis*), a mammal species of concern and the turtle head borer moth (*Papaipema nepheleptena*), an insect species of concern.	92
Brooks Run	Grove & Lumber Twps.	Cold, high-quality waters surrounded by forest provide prime habitat for the northern water shrew (*Sorex palustris albibarbis*), and the northern myotis (*Myotis septentrionalis*), two mammal species of concern.	69
Finley Run	Lumber & Shippen Twps.	Cold, high-quality waters surrounded by forest provide prime habitat for the northern water shrew (*Sorex palustris albibarbis*), a mammal species of concern.	80, 92
Fourmile Run at Hickok Hollow	Shippen Twp. & McKean Co.	Cold, high-quality waters surrounded by forest provide prime habitat for the northern water shrew (*Sorex palustris albibarbis*), a mammal species of concern.	92
Opening between East and West Branch Hicks Run	Shippen Twp. & Elk Co.	Habitat supports a population of the northern barrens tiger beetle (*Cicindela patruela*), an insect species of concern.	92
Short Bend Run	Grove Twp.	Cold, high-quality waters surrounded by forest provide prime habitat for the northern water shrew (*Sorex palustris albibarbis*), and the northern myotis (*Myotis septentrionalis*), two mammal species of concern.	69
Wykoff Run Tributaries	Gibson Twp.	Cold, high-quality waters surrounded by forest provide prime habitat for the northern water shrew (*Sorex palustris albibarbis*), a mammal species of concern.	58
Whitehead Run	Lumber Twp.	Cold, high-quality waters surrounded by forest provide prime habitat for the northern water shrew (*Sorex palustris albibarbis*), a mammal species of concern.	80

High (continued)			
Woodland east of Short Bend Run	Grove Twp.	Habitat supports three insect species of concern.	69
Notable			
Canoe Run Headwaters	Shippen Twp.	Habitat supports a population of common claybank tiger beetle (*Cicindela limbalis*), an insect species of concern.	92
Driftwood Branch Sinnemahoning Creek at Indian Camp Run	Shippen Twp.	Habitat supports the green-patched looper moth (*Diachrysia balluca*), an insect species of concern.	92
East Branch Hicks Run at Bell Run	Shippen Twp.	Habitat supports a population of common claybank tiger beetle (*Cicindela limbalis*), an insect species of concern and downy lettuce (*Lactuca hirsuta*), a plant species of concern.	92
Fred Woods Trail	Gibson Twp.	Habitat supports an insect species of concern and a unique geologic feature.	58
Frenchman's Branch Hicks Run	Shippen Twp.	Habitat supports a population of common claybank tiger beetle (*Cicindela limbalis*), an insect species of concern.	92
Laurel Draft Headwaters	Gibson Twp.	Habitat supports two insect species of concern.	58
Laurel Draft Headwaters Vernal Pool	Gibson Twp.	An ephemeral/fluctuating pool natural community is located atop this plateau.	58
Meeker Run Headwaters	Gibson Twp.	Habitat supports an excellent population of creeping snowberry (*Gaultheria hispidula),* a plant species of concern.	58
Pitch Pine Woodland East of Moore Draft	Lumber Twp.	Habitat supports two insect species of concern.	80
Ridgeline between East Branch Hicks Run and Whippoorwill Hollow	Shippen Twp.	Habitat supports a population of common claybank tiger beetle (*Cicindela limbalis*), an insect species of concern.	92
Ridgeline between Grove Run and Lick Island Run	Gibson & Grove Twps.	Habitat supports a population of common claybank tiger beetle (*Cicindela limbalis*), an insect species of concern.	58, 69
Ridgeline between Lick Island Run and Gravelly Run	Gibson, Grove & Lumber Twps.	Habitat supports a population of common claybank tiger beetle (*Cicindela limbalis*), an insect species of concern, and an ephemeral/fluctuating pool natural community.	58, 69, 80
Ridgeline between Wycoff Run and Upper Jerry Run	Gibson Twp.	Habitat supports bracken borer moth (*Papaipema pterisii*), an insect species of concern.	58

Notable (continued)			
Ridgeline west of Hunting Shanty Branch	Lumber & Portage Twps.	Habitat supports a population of common claybank tiger beetle (*Cicindela limbalis*), an insect species of concern.	80, 88
Sterling Run Tributaries	Lumber & Shippen Twps.	Aquatic and riparian habitats support a species of concern.	80, 92
West Branch Hicks Run at Middle Branch	Shippen Twp.	Habitat supports a population of population ski-tailed emerald (*Somatochlora elongata*), a dragonfly species of concern.	92
Local			
Upper Jerry Run Slopes	Grove Twp.	This habitat supports a population of American yew (*Taxus canadensis*), a plant species of concern.	69

Cameron County Natural Heritage Inventory Site Index



#	Natural Heritage Area Name	#	Natural Heritage Area Name
1	Driftwood Branch Sinnamahoning Creek at Indian Camp Run	16	Ridgeline between Grove Run and Lick Island Run
2	Bobby Run	17	Ridgeline between Lick Island Run and Gravelly Run
3	Fourmile Run at Hickok Hollow	18	Brooks Run
4	Ridgeline west of Hunting Shanty Branch	19	First Fork Floodplain at Sinnemahoning Reservoir
5	Pitch Pine Woodland East of Moore Draft	20	Woodland east of Short Bend Run
6	Whitehead Run	21	Short Bend Run
7	Canoe Run Headwaters	22	Sinnemahoning Creek Cliffs
8	Finley Run	23	Wycoff Run Tributaries
9	East Branch Hicks Run at Bell Run	24	Laurel Draft Headwaters
10	Frenchman's Branch Hicks Run	25	Laurel Draft Headwaters Vernal Pool
11	West Branch Hicks Run at Middle Branch	26	Red Run and Wycoff Run Headwaters
12	Opening between East and West Branch Hicks Run	27	Meeker Run Headwaters
13	Ridgeline between East Branch Hicks Run and Whippoorwill Hollow	28	Ridgeline between Wycoff Run and Upper Jerry Run
14	Sterling Run Tributaries	29	Upper Jerry Run Slopes
15	Fred Woods Trail		

SHIPPEN TOWNSHIP
PORTAGE TOWNSHIP
LUMBER TOWNSHIP
GROVE TOWNSHIP
GIBSON TOWNSHIP

WILDWOOD FIRE TOWER
RICH VALLEY
EMPORIUM
WHARTON
RATHBUN
WEST CREEK
HAMMERSLEY FORK
CAMERON
DRIFTWOOD
SINNEMAHONING
FIRST FORK
KEATING
DENT'S RUN
DEVILS ELBOW
POTTERSDALE

0 2.5 5 10 Miles
0 2.5 5 10 Kilometers

Site Identification # and Significance

- *exceptional significance*
- *high significance*
- *notable significance*
- *local significance*

Core Habitat
Supporting Landscape

PNHP

TOWNSHIP BOUNDARIES
USGS Quadrangles

INTRODUCTION

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

An **ecosystem** is the complex of interconnected living organisms inhabiting a particular area or unit of space, together with their environment and all their interrelationships and relationships with the environment (Ostroumov 2002). All the parts of an ecosystem are interconnected--the survival of any species or the continuation of a given natural process depends upon the system as a whole, and in turn, these species and processes contribute to maintaining the system. An important consideration in assessing ecosystem health is the concept of biodiversity. **Biodiversity** can be defined as the full variety of life that occurs in a given place, and is measured at several scales: genetic diversity, species diversity, 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, such as a red maple swamp (Massachusetts Executive Office of Environmental Affairs 2001). Each type of natural community represents habitat for a different assemblage of species, hence identification and stewardship of the full range of native community types is needed to meet the challenge of conserving habitat for all species.

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

Pennsylvania's natural heritage is rich in biodiversity and the Commonwealth includes many examples of high-quality natural communities and large expanses of natural landscapes. Over 20,000 species are known to occur in the state, and the extensive tracts of forest in the northern and central parts of the state represent a large portion of the remaining areas of suitable habitat in the mid-Atlantic region for many forest-dependent species of mammals, birds, and reptiles. Unfortunately, biodiversity and ecosystem health are seriously threatened in many parts of the state by pollution and habitat loss. Of all the animals and vascular plants that have been documented in the state, more than one in ten are imperiled; 156 have

been lost entirely since European settlement and 351 are threatened or endangered (PA 21st Century Environment Commission 1998). Many of these species are imperiled because available habitat has been reduced and/or degraded.

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

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

The Pennsylvania Natural Heritage Program (PNHP) assesses the conservation status of species of vascular plants, vertebrates, and a few of the invertebrate species native to Pennsylvania. While Pennsylvania hosts a diversity of other life forms, such as mosses, lichens and fungi, too little information is known of these species to assess their conservation status at this time. Without information about all of the species, it is possible to protect at least some rare species by conserving rare natural communities. Species tend to occur in specific habitats or natural communities, and by conserving examples of all natural community types we will also conserve many of the associated species, whether or not we even know what those species are. Thus the natural community approach is a coarse filter for biodiversity protection, but PNHP uses the fine filter of individual species identification for those species for which it is feasible. The goals of the CNHI are to identify areas important in sustaining biodiversity at the species, natural community, and landscape levels and to provide that information to more fully inform land use decisions. CNHIs identify areas in the state that support Pennsylvania's rare, threatened, or endangered species as well as natural communities that are considered to be rare in the state or exceptional examples of the more common community types. The areas that support these features are identified as Natural Heritage Areas.

A description of each area's natural features and recommendations for maintaining their viability are provided for each Natural Heritage Area. Also, in an effort to provide information 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 information from other conservation planning efforts such as the Pennsylvania Audubon's Important Bird Area (IBA) project, and the Important Mammal Areas project (IMAP). Together, with the other land use information, this report can help guide the planning and land management necessary to maintain the ecosystems on which our natural heritage depends.

County Overview

Formed in 1860 from portions of Clinton, Elk, McKean, and Potter Counties, Cameron County (figure 3) is situated in the northcentral portion of the Commonwealth. Today, this region is primarily forested, and superficially represents how much of Pennsylvania appeared before the widespread agriculture and development transformed other portions of "Penn's Woods" to a largely agrarian landscape. Cameron County has consistently been known for its wild country, characterized by towering forested mountains flanking cool, clear streams, and large tracts of forest filled with abundant wildlife. These features have led to the region becoming a destination for sportsmen and sportswomen, hikers, mountain bikers, canoeists, and probably most famously for the elk viewing. The low human population, centered around the boroughs of Emporium and Driftwood, adds to the remote feel of the county.

Plants, terrestrial invertebrates, and natural communities are under the jurisdiction of the PA Department of Conservation and Natural Resources (DCNR); mammals and birds are under the jurisdiction of the PA Game Commission (PGC); and aquatic animals, reptiles, and amphibians are under the jurisdiction of the PA Fish and Boat Commission (PFBC). Certain species are subject to unauthorized collection and are therefore not identified in the text of this report, at the request of the jurisdictional agencies, in order to provide some measure of protection.

Cameron County is the twelfth smallest of Pennsylvania's counties, being approximately 399 mi^2 (1,035 km^2, 255,969 ac, 103,387 ha). To the north of Cameron County lie McKean and Potter Counties, Clinton and Potter to the east, Clearfield, Clinton and Elk to the south, and Elk and McKean Counties to the west. Cameron County is composed of 5 townships and 2 boroughs.

Cameron County's population was estimated at 5,163 (2009 census), spread among 2,465 households (2000 census), making a population density of just over 15 persons per square mile. This makes Cameron County the third least densely populated county in the Commonwealth. From the 2000 to 2009 census data, the population has declined by just over 13.6%, a trend typical to many of the Commonwealth's more rural counties. This drop in the population led to a decrease in private nonfarm employment by 1.7% between 2000 and 2008 (U.S. Census Bureau 2009).

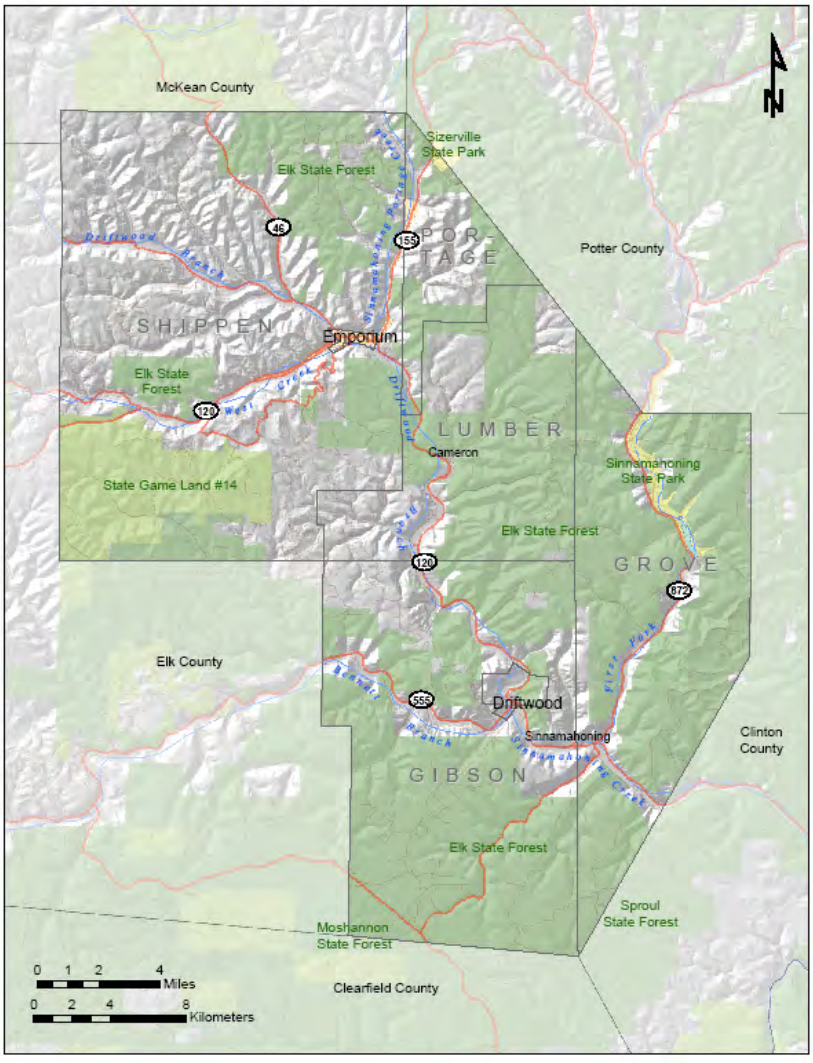


Figure 3. An overview of Cameron County's infrastructure, waterways, and public lands

While still thought of as one of the most untouched counties in

Pennsylvania, Cameron County had its history of resource extraction. The boom of the timber industry in the mid-to-late 1800's cleared nearly all of Cameron County, and the forests are today quite different from the towering old-growth forests of yesteryear. Mining in Cameron County was not as prevalent as in other areas of the state, but relicts of mines still exist, and a number of waterways in the county show the scars of this activity and are classified as "impaired" by the DEP due to abandoned mine drainage (AMD).

Like the forests, the assemblage of wildlife found in the region has been altered from what the pioneers would have found. The northern forests of Pennsylvania once housed the grey wolf (extirpated 1892), bison (extirpated 1801), mountain lion (late 1800's), marten (extirpated 1900), wolverine (last record 1858), lynx (last record 1923), and the native subspecies of elk (extinct 1867). Reintroduction programs have been successful at establishing populations of the once extirpated beaver, fisher, and the subspecies of elk seen in Cameron County today.

The aforementioned mammals were not the only species which were lost to the settler's gun. The passenger pigeon was once the most abundant bird species in North American, and historical accounts reference the sky darkening as flocks passed overhead. This seemingly inexhaustible supply of pigeons led to widespread market hunting and eventually led to the extinction of the species. The north-central portion of Pennsylvania was the last area in the Commonwealth to support widespread breeding colonies of the species (Warren 1890).

The following excerpt comes from Warren's 1890 publication on the birds of Pennsylvania:

> *"Wild Pigeons about eight or ten years ago were found in great numbers in… Cameron count[y]. In the region about Emporium… immense quantities of these birds were killed, packed in barrels, and shipped in car loads, to the New York market. Mr. M.M. Larrabee, of Emporium, who frequently visited their nesting places or roosts… says that they often covered an area of several miles in the depths of the forests. …in 1888, in the northern part of Cameron county, a flock of about one hundred… were breeding in that locality. [Today, only] small flocks and scattered birds are now seen"*

By 1910, Passenger Pigeons were completely gone from Pennsylvania, and the species was extinct by 1914 (McWilliams & Brauning 2000).

The existing land use patterns within the county are influenced and shaped by the region's natural features such as high mountain flats, steep, deep valleys, and waterways. Approximately 93% of Cameron County is forested, 4% in agriculture, and 3% is urban or suburban (figure 4).

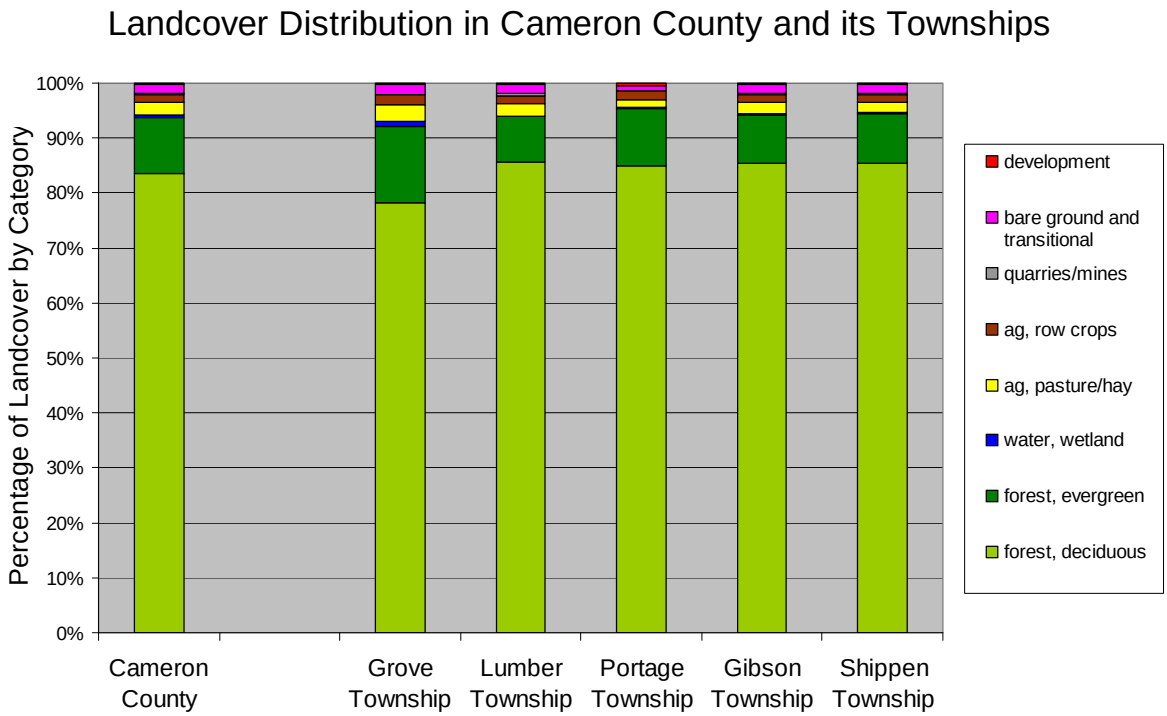


Figure 4. Landcover distribution of Cameron County. Over 90% of the land within each township is under forested cover (Homer et al. 2004). The boroughs have been clustered with the adjoining townships as is expressed throughout the CNHI.

It is important that the county and municipal governments, the public, developers, and planners know the location of such environmentally sensitive areas in order to maintain and protect these areas. Knowing where these areas are located can help prevent potential land-use conflicts, and help focus conservation efforts and limited funds on the most valuable areas.

The Pennsylvania Natural Heritage Program, in cooperation with the Cameron County Planning Commission, has undertaken this project to provide a document and maps that will aid in the identification of these important areas.

The Cameron County Natural Heritage Inventory presents the known outstanding natural features, including plants, animals and selected geologic features in Cameron County. The inventory provides maps of the best natural communites (habitats) and the locations of animal and plant species of concern (rare, threatened, and endangered) in Cameron County. Due to budget, access, and time constraints, some high-quality areas in the county have likely been overlooked. These maps do not pinpoint the site of the species of concern, but rather represent a conservation zone that is critical to the preservation of the site (core habitat), and a zone of potential impacts within the sites watershed (supporting landscape).

Accompanying each map is a written description including observed and potential threats and stresses, conservation recommendations, and a summary table of the sites, including degree of rarity, last observed date, and quality rank. Selected geologic features of statewide significance are also noted. In addition, the inventory describes locations of areas that are significant, but have not been ranked in this inventory because no species of concern were documented at these sites. These sites have great potential for high biological value but were not surveyed during the field season due to time constraints, or are

representative of habitats that are relatively rare in the county, support an uncommon diversity of native species, and/or provide particularly valuable wildlife habitat.

The information and maps presented in this report provide a useful guide for planning residential and commercial developments, for siting recreational parks or trails, for conserving natural areas, and for setting priorities for the preservation of the most vulnerable natural areas. An overall summary identifies the highest quality sites in the county. All of the sites in this report were evaluated for their importance in protecting biological diversity on a state and local level, but many also have scenic value, provide water quality protection, and are potential sites for low-impact passive recreation, nature observation, and/or environmental education.

The Cameron County Natural Heritage Inventory will be provided to each municipality through the Cameron County Planning Commission. The CNHI is a conservation tool that will aid in the creation of municipal, county, and comprehensive plans. Its emphasis on the biological diversity should inform county and regional open space plans already underway, or updates to those plans already completed. Cameron County, its municipalities, land trusts, and other organizations can also use the County Natural Heritage Inventory to identify potential protection projects that may be eligible for funding through state or community grant programs.

Landowners will also find this inventory useful in managing and planning for the use of their land; it gives them the opportunity to explore alternatives that will provide for their needs and still protect the species and habitats that occur on their land. For example, the Forest Stewardship Program, coordinated by the Pennsylvania Department of Conservation and Natural Resource's Bureau of Forestry, assists landowners in creating management plans. These plans incorporate landowner objectives (e.g. wildlife or timber management). Other programs include the USDA's Forest Legacy Program (III) and the Pennsylvania Department of Agriculture's Agricultural Land Preservation Program. Land managers may wish to consult with this report and the environmental review tool found on the Pennsylvania Natural Heritage Program's website (www.naturalheritage.state.pa.us) in an effort to avoid potential conflicts in areas with species of concern and/or identify ways of enhancing or protecting these resources. Users of this document are encouraged to contact the Middletown office of the Pennsylvania Natural Heritage Program at (717) 948-3962 for additional information.

OVERVIEW OF THE NATURAL FEATURES OF CAMERON COUNTY

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

Physiography and Geology

Characteristic landscapes and distinctive geological formations classify Physiographic Provinces (figure 5). 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 regime, certain plant communities would be expected to occur within some provinces and not in others.

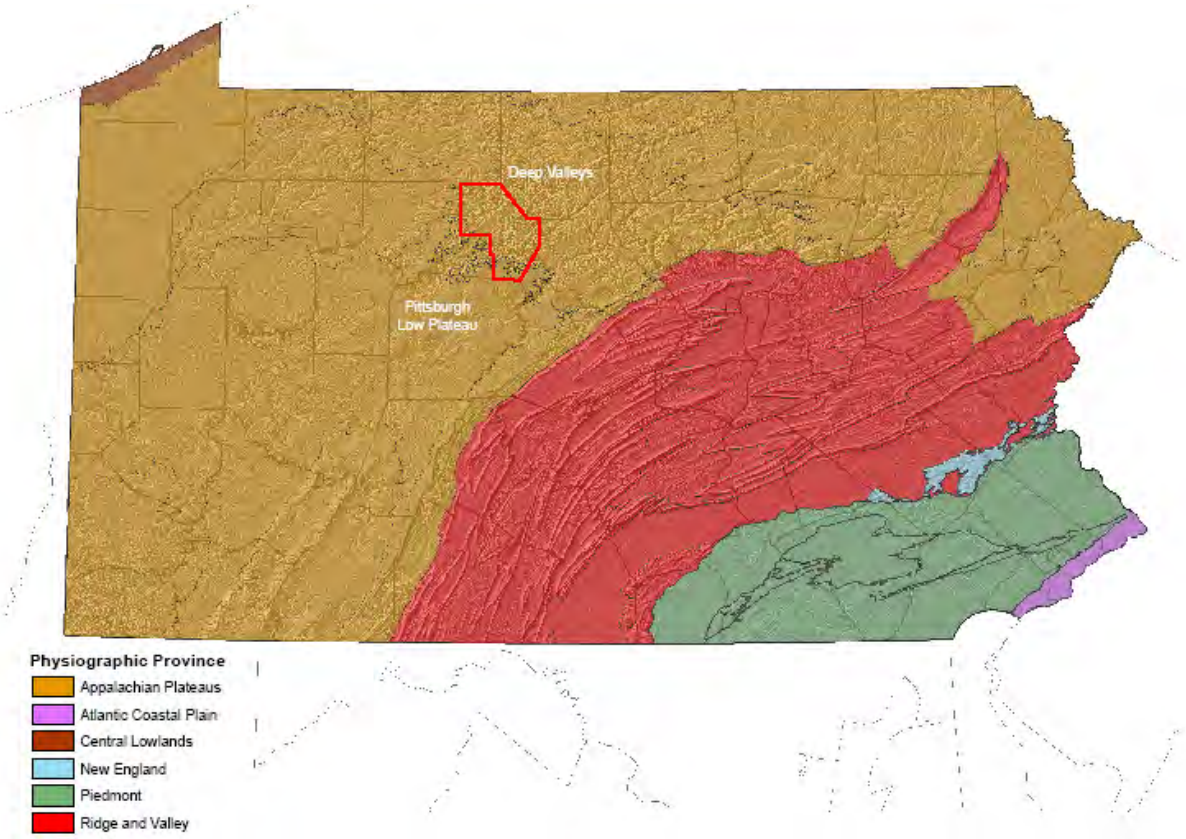


Figure 5. Physiographic Provinces of Pennsylvania. Sections of the physiographic provinces are listed for those occurring in Cameron County.

Cameron County lies entirely within the Appalachian Plateau Physiographic Province, and is primarily within the Deep Valleys section, with the Pittsburgh Low Plateau section making up small portions of the southern and western parts of the county (Cuff et al. 1989). The Appalachian Plateaus Physiographic Province covers the majority of the western and northern portions of Pennsylvania, and is characterized as a high table-land, deeply dissected by waterways which have cut through bedrock underlying the region. The bedrock of Cameron County is primarily sandstone, and is largely from the Pennsylvanian through the Devonian Periods (figure 6). The highest point in the county, at over 2,360 feet, is within the Pottsville Formation in Shippen Township. The lowest point is around 760 feet within the Catskill Formation in Grove Township where the Sinnemahoning Creek flows into Clinton County.

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

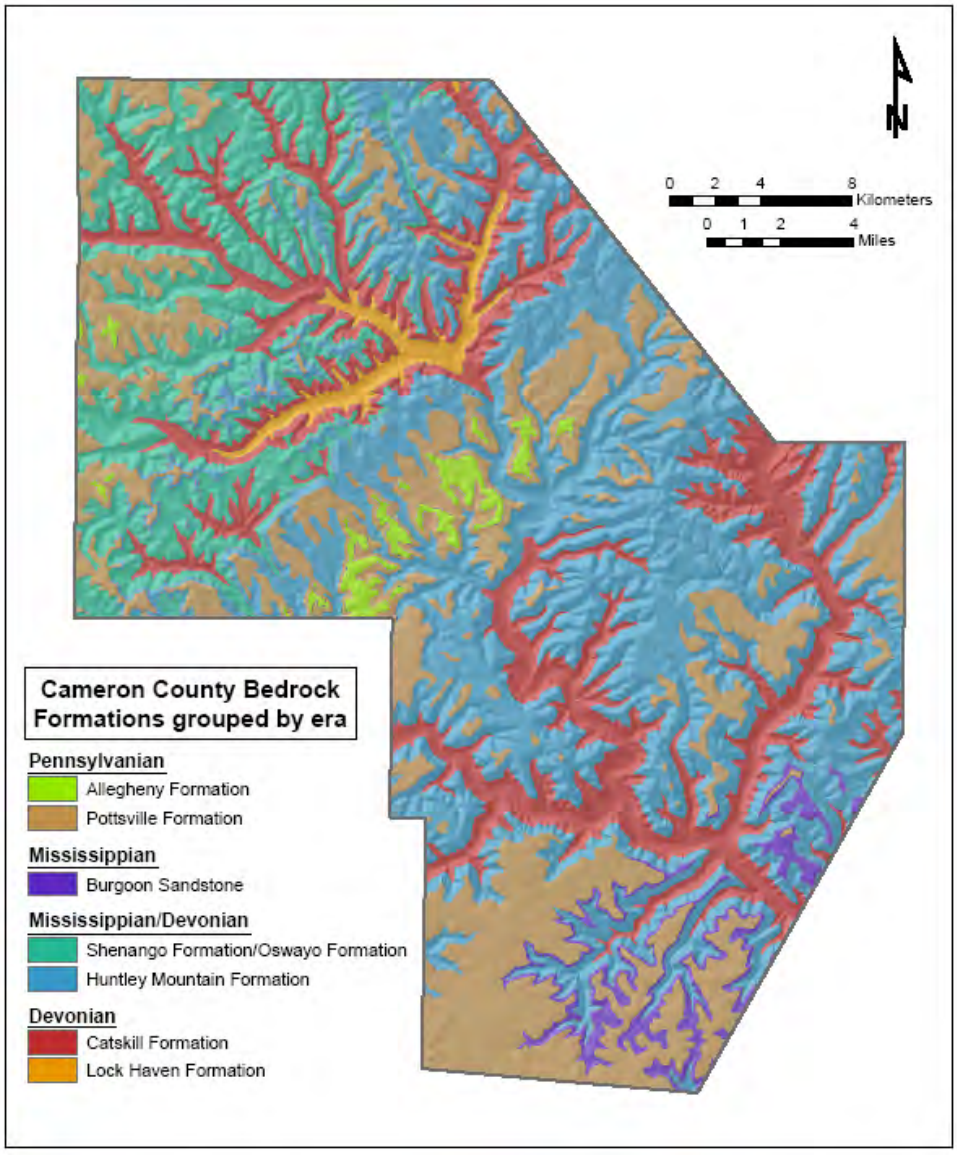


Figure 6. Cameron County's bedrock formations and their corresponding age.

Soils

Cameron County's soils are relatively homogenous, given the relative uniformity of the bedrock and the lack of glacial activity in the county. The soils are derived from sedimentary origins and are characteristically well-drained sandy loams with large amounts of stone among the soil. These soils are typically marginal for crop farming and the historic and current land-use of the county reflects this, remaining primarily forested.

A soil association is a group of soils with a distinctive, proportional pattern of occurrence in the landscape. This description of the soils of Cameron County comes from *Soil Survey of Cameron and Elk Counties, Pennsylvania* (Kopas 1993) and more recent information provided by the NRCS. Four soil associations have been mapped for Cameron County (figure 7, table 4). Finer scale soil information is available, but for graphical simplicity only the associations have been mapped within this inventory.

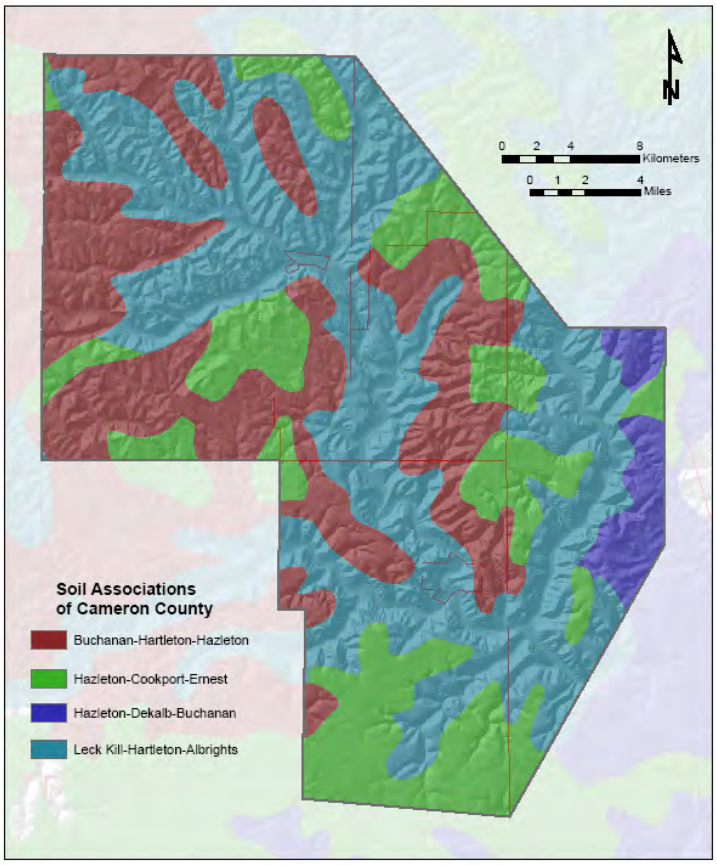


Figure 7. Soil Associations of Cameron County.

Table 4. Soil Associations of Cameron County

Soil Association	**Description**	**Land Use**
Buchanan-Hartleton-Hazleton	Very deep and deep, moderately well drained and well drained, gently sloping to very steep soils; formed in materials weathered from siltstone and shale; on uplands	Mostly woodlands, with fair potential for farming and urban uses.
Hazleton-Cookport-Ernest	Very deep and deep, moderately well drained and well drained, nearly level to very steep soils; formed in materials weathered from sandstone and siltstone; on uplands.	Primarily woodlands, with fair potential for urban and farm uses.
Hazleton-Dekalb-Buchanan	Very deep and deep, moderately well drained and well drained, nearly level to steep soils; formed in materials weathered from sandstone and siltstone; on uplands.	Best suited for woodlands, with fair potential for urban and farm uses.
Leck Kill-Harleton-Albrights	Very deep and deep, somewhat poorly drained to well drained, nearly level to very steep soils; formed in materials weathered from shale, sandstone and siltstone; on uplands	Primarily woodlands. Sometimes formerly farmed, urban and industrial sites around Emporium

Vegetation

The interaction of geology and climate produces several critical functions in the landscape including the regulation of biogeochemical cycles (water, carbon, and nitrogen), soil formation, and ultimately wildlife habitat. The classification of vegetation communities typically revolves around the dominant species, habitat, and growth form. Boundaries between community types in the field are generally less distinct. A sampling of community types is presented below, with a more complete description of community types found in *Terrestrial and Palustrine Communities of Pennsylvania* (Fike 1999), a publication by the Pennsylvania Department of Conservation and Natural Resources. Print copies of this publication are no longer available, but the entire document is available in Adobe pdf format on the Pennsylvania Natural Heritage Program's website (www.naturalheritage.pa.state.us).

Charlie Eichelberger (PNHP)

This poor-quality forest in Cameron County is the result of a combination of factors. The number one culprit is the overabundant deer population which has transformed the forest at the expense of the ecology of the rest of the forest. Overbrowsing by deer has occurred here for so long that scattered mature trees are separated by species of plants unpalatable to deer. Plant diversity in a forest in this condition is shockingly low. In turn, this forest contains little food or cover for small mammals, birds, reptiles, amphibians, invertebrates, and ironically deer.

Forest Communities

Cameron County lies within the Hemlock-White Pine-Northern Hardwoods forest region, described by Braun (1950). The boundaries between Forest Regions actually are zones of integration between the different Forest Region types, leading to a mix of species which can make it difficult to classify particular forests into these defined regions. The Hemlock-White Pine-Northern Hardwood Region, was dominated by eastern hemlock (*Tsuga canadensis*), beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), with smaller components of black cherry (*Prunus serotina*) and black birch (*Betula lenta*). This forest has been greatly altered by logging and fire, and today, representatives of this forest can only be found in small patches of virgin timber. Only two small patches of virgin forest still occur in Cameron County within Johnson Run Natural Area and Lower Jerry Run Natural Area.

Before the introduction of the chestnut blight (*Cryphonectria parasitica*), which appeared in the early 1900's from Asia, American chestnut (*Castanea dentata*) was found as a widespread member of the canopies of Pennsylvania's forests. By 1930, all American chestnuts were infected with the blight and by 1960, there were virtually no mature American chestnuts left standing. Today, some young sprouts and shoots still remain, but due to the blight very few will ever reach maturity.

The loss of the mature specimens of American chestnut, and the intense clear cutting which occurred from the mid-to-late 19th century, caused a fundamental shift in the composition of Pennsylvania's forests. Replacing the lost chestnuts, oaks and hickories rebounded with vigor, becoming the dominant species across much of the state. The more recent infestations of gypsy moths combined with today's forestry

practices, overbrowsing by deer, and acid deposition are causing another shift in the composition of our forests. Red maple (*Acer rubrum*) was formerly a minor component of Penn's Woods and usually only found in numbers in swampy areas. Not a preferred food source for deer, red maple is now invading other natural communities and is becoming a dominant species across much of Pennsylvania forests.

Wetland Communities

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

Charlie Eichelberger (PNHP)

Vernal pools, such as the one above in the Quehanna Wild Area, are oases in the forest, drawing animals as watering holes, but also as critical breeding habitat for a number of amphibian species adapted to breed in these fishless temporary pools. These small wetlands are important for certain species of invertebrates and plants which also rely on the annual wet/dry cycle.

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

Floodplain forests occur along rivers and streams in low lying areas. These locations are periodically inundated by floodwaters resulting from spring runoff and intense storm events. Floodplain forest communities can receive severe disturbances from floodwaters including erosion, scouring by ice and debris, and the deposition of considerable quantities of sediment. Only species with adaptations or tolerance for these kinds of conditions can survive here. Floodplains on smaller waterways receive less intense disturbances but are still periodically flooded. Pin oak (*Quercus palustris*), swamp white oak (*Quercus bicolor*), silver maple (*Acer saccharinum*), red maple (*Acer rubrum*), ash (*Fraxinus* spp.), sycamore (*Platanus occidentalis*), and black walnut (*Juglans nigra*), are frequent on the wetter bottomland soils associated with these smaller creeks. Understory species include spicebush (*Lindera benzoin*), violets (*Viola* spp.), nettles (*Urtica dioica*, *Laportea canadensis*), cutleaf coneflower (*Rudbeckia laciniata*), golden alexanders (*Zizia aurea*), and many other wildflowers.

Graminoid marshes are wetlands dominated by plants such as cattails (*Typha latifolia*), sedges (*Carex* spp.), and grasses (Fike 1999). These wetlands may be found in association with streams or in areas with groundwater 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, invertebrates, and birds.

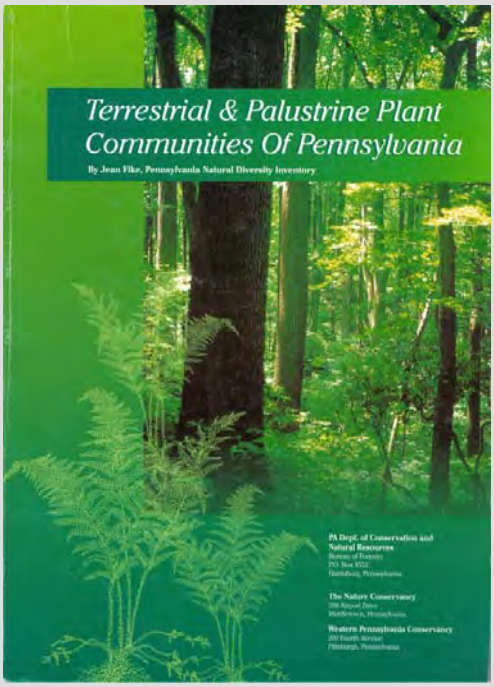
Seepage swamps are relatively small, forested or shrub dominated wetlands found on lower slopes where water emerges at the surface as a diffuse flow. These seep areas are frequently dominated by hemlock, yellow birch (*Betula alleganiensis*) and red maple, with a thick understory of rhododendron (*Rhododendron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

Vernal pools, also known as seasonal/ephemeral or fluctuating pools are wetlands that fill annually from precipitation, surface runoff, and/or rising groundwater (Kenney and Burne 2000). The pools typically become completely dry, through evaporation, by late summer. Since these ponds dry up, they cannot support fish populations. During the brief window when the pools contain water, they serve as important breeding grounds for a multitude of species of amphibians, invertebrates, and plants, many of which breed solely in these small woodland wetlands.

Overall, wetlands make up a very small percentage of the landscape in Pennsylvania. Today, only about 2.5% of the Commonwealth's landscape is wetlands, a loss of about half of the wetlands that occurred prior to European colonization. In addition to providing us with aesthetic beauty, our remaining wetlands serve as important refugia for plants and animals, both common and rare. Some birds live in or migrate through wetlands, and a host of amphibians and reptiles inhabit wetlands during portions or for all of their life cycles. Wetlands also play a major role in the life cycles of many mammal and invertebrate species.

Classification of Natural Plant Communities in Pennsylvania

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



Flowing Water Systems

Flowing water forms aquatic systems of great diversity. These systems begin as high mountain brooks which form from surface runoff, springs, and seeps, later uniting to become the headwaters of much larger waterways lower in the watershed basins. These mountain waters serve as a home to numerous organisms, from tiny diatoms and algae to insects that provide food for the small fish and amphibians that also inhabit these waterways.

As mountain brooks coalesce into streams and creeks at lower elevations, they form larger aquatic systems that have a diversity of microhabitats. These support a large diversity of stream-dwelling organisms within two major types of stream habitats--riffles and pools. Riffles are the shallower, fast-flowing, well aerated rapids over rocky sections of the stream bottom. These riffles support diverse animal assembleges including insects, crustaceans, amphibians, and fish. Interspersed between riffle sections are quiet pools with deeper water habitats that tend to support a less diverse stream biota. Streams in northcentral Pennsylvania tend to be flashy; this means they are nearly dry for much of the year with frequent and significant rises in water level immediately following rainstorms. Thus, these pools become important habitat during the dry portions of the year. The stream systems, in turn, feed into larger flowing water systems such as Sinnemahoning Creek.

Watersheds

Cameron County is primarily within the Susquehanna River drainage basin. The major watersheds (Hydrologic Unit Code 10-HUC 10) of Cameron County are mapped in figure 8. More complete information on the biological characteristics and importance of Cameron County's subwatersheds can be found in the Aquatic Community Classification section, found in Appendix VI.

Floodplains are flat, often flooded, areas along streams and rivers. They are important terrestrial habitat areas tied to the flowing water system. Floodplains are typically inundated by water during the spring runoff and then remain dry after these floodwaters recede. The effects of water on these systems influence the vegetation communities that can persist with the cyclic hydrology. Forested floodplains also serve as a protective buffer against erosion, provide cooling shade to the waterway, filter pollutants and excessive nutrients from runoff, and help alleviate flood damage along many of the area's creeks.

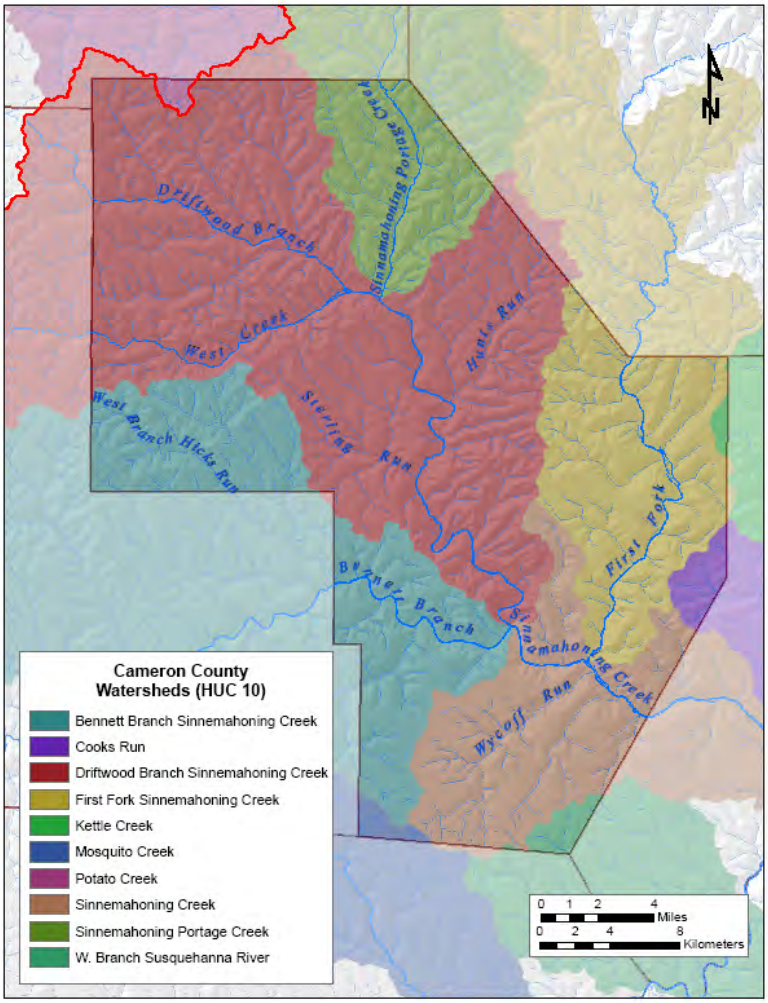


Figure 8. Watersheds (HUC10) of Cameron County. The red line demarcates the division between the Susquehanna (majority of Cameron County) and Allegheny (small portion in the northwestern corner of the county) drainage basins.

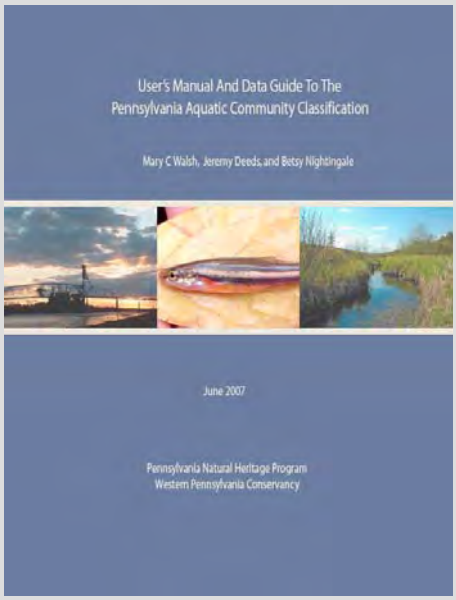
In addition to naturally vegetated floodplains, vegetated riparian buffers along streams and other bodies of water provide vital benefits including: protection of water quality, reduced erosion, flood control and wildlife habitat. Elimination of riparian vegetation removes the capacity of this region to buffer the effects of the surrounding landscape and consequently reduces the water quality in the stream. Two major effects of the loss of riparian buffers are sedimentation and nutrient enrichment. Please see page 55 of this report for more specific riparian buffer recommendations.

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

Aquatic Community Classification

In 2007, PNHP completed an Aquatic Community Classification which describes predicted communities for all the waterways within Pennsylvania. Descriptions of the background, methodologies, and priority aquatic communities determined through this project, with fact sheets showing a more in depth perspective on each of those aquatic communities identified in Cameron County, can be found in Appendix VI.

The full versions of **Classifying Lotic Systems for Conservation: Project Methods and Results of the Pennsylvania Aquatic Community Classification Project** and **User's manual and data guide to the Pennsylvania Aquatic Community Classification** are available for download at: http://www.naturalheritage.state.pa.us/aquaticsIntro.aspx



Disturbance

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

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

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

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

Natural Disturbances

Natural disturbances, such as fire and flooding, can benefit certain natural communities and species. For example, periodic fires are needed to maintain pitch pine-scrub oak barrens. Burns in such areas stimulate new growth in these species and exclude other successional species. Floodplain forests benefit from the periodic scouring and deposition of sediments that occur when streams, creeks and rivers flood their banks. This scouring action has been shown to be important for a number of species of concern and natural communities along the shores of the West Branch of the Susquehanna River. At the same time, streamside wetland communities hold excess water, thus reducing the scale of downstream flooding.

Another natural disturbance (exacerbated by past mismanagement), over-browsing by white-tailed deer, can have detrimental effects on natural communities and species (Rhoads and Klein, 1993). Excessive deer browse can decrease the understory of some forests and halt regeneration of new growth of the canopy and understory by preferential feeding. For example, forests that were once dominated by oak are now converting to red maple, due to deer pressure on the oak seedlings and saplings (Abrams 1998). Deer feeding preferences can have a direct effect on rare plants and severely decrease essential habitat for other animal species including birds, mammals, reptiles, amphibians, and invertebrates. Over-browsing can result in a lack of forest regeneration, a reduction in the diversity and density of forest understory, a decrease in songbird diversity and direct loss of rare plants (Yahner 2000). Private landowners can be encouraged to control deer populations by allowing hunting on their lands, and take advantage of existing programs to reduce deer numbers, such as Deer Assistance Management Program (DMAP).

Disturbances caused by beaver may be beneficial or detrimental to wetland habitats within Cameron County. On one hand, thinning the canopy and flooding by beavers can eventually create open wetland meadows upon which many unique species rely. One the other hand, damming by beavers can alter habitats to a degree that renders the sites no longer suitable for some of the rare species inhabiting these wetlands. For example, peatlands support an array of rare plants and animals, but flooding by beavers can degrade these natural communities until they no longer support the unique species adapted to this specialized habitat. Beaver activity in the long term is critical to the cyclic pattern of wetland disturbance, but in the short term, beaver activity can threaten the integrity of now rare wetland habitats and jeopardize many of the unique species of these natural communities. This creates

difficulty in assessing how beavers should be managed. The long-term benefit of habitat creation must be weighed against the potential short-term threat to the existing plants and animals. In certain situations, beaver removal is preferred and implementation of management practices with regard to beaver must be considered on a case-by-case basis.

Human Disturbances

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

In Cameron County, logging and mining have played major roles in altering the landscape. Repeated timbering of the forests has restricted the presence of older forests to steep slopes that are less accessible to logging equipment. Mining, which has altered topography, vegetation, and in some cases water quality, is active in limited amounts in the county. Mining can expose certain layers of rock that lead to a chemical reaction which alters the pH of waters emitting from these mine lands. These waters are often so acidic, that little plant and animal life can inhabit these polluted waters. In some cases properly reclaimed strip mines containing a diverse mix of native grass species can provide valuable nesting and wintering habitat for a number of species of grassland birds.

Wetlands have been intentionally flooded or drained, resulting in loss of biodiversity at a given site. In less than 25 years Pennsylvania lost 50% of its natural wetlands through draining and mitigation; a process whereby artificial wetlands are created to replace those that are destroyed. From a biological standpoint, mitigated wetlands are typically of poor quality and do not provide the diversity of species and functioning food webs that natural wetlands provide.

Farming represents only a modest component of Cameron County's economy. While farming is limited in northcentral Pennsylvania, some farm practices and abandoned farmland can be beneficial for some grassland birds. Birds such as the barn owl, eastern meadowlark, bobolink, Henslow's sparrow, vesper sparrow, and upland sandpiper have benefitted from human created and managed early successional habitats. While it is unlikely that these species would ever become common in Cameron County, proper management of the limited open areas could lead to these species breeding here in the future.

Pennsylvania has thousands of known dams on its waterways, and many that still remain unknown. Some of these dams currently serve important purposes, but many of these dams no longer serve their intended uses and have fallen into a state of disrepair. These unnecessary structures can be a liability to their owners, as many run-of-the-river dams create dangerous hydraulic conditions at their base, making them a threat to river users in the area. Besides acting as liabilities and maintenance headaches, dams cause numerous environmental impacts including reduced water quality, thermal pollution, disrupted sediment transport processes that increase sedimentation in impounded areas and increase streambed and streambank erosion in downstream areas, altered flow regimes, and habitat destruction and fragmentation. By removing the unused, unnecessary dams from our rivers and streams, we can re-establish natural free-flowing dynamics which support diverse ecosystems, reduce localized flooding and erosion, improve water quality, and restore habitat and access to upstream habitat for aquatic organisms. To address the impacts to resources under their management, the PFBC has authority (PA Code Chapter 57, section 22) to request that

Dam Removal

Pennsylvania currently leads the nation in dam removal and its commitment to dam safety. Numerous agencies, nonprofit organizations, and engineering firms have experience with dam removal in Pennsylvania. For more information on dam safety, dam owner requirements, and dam removal, please contact the DEP Division of Dam Safety, at: http://www.depweb.state.pa.us/waterwaysengng/cwp/view.asp?a=1274&q=533592&waterwaysengNav=|

dam owners install fish passage structures on dams to benefit migratory or resident fish species. The DEP Division of Dam Safety maintains databases of dam locations and further information can be acquired by contacting them at (717) 787-8568.

The recent exploitation of deep natural gas reserves in the Marcellus Shale rock formation is rapidly changing formerly large, unbroken tracts of forest land in Cameron County. The infrastructure developed for Marcellus Shale gas extraction can lead to a number of habitat changes resulting from the fragmenting of forests, changes in water quality and quantity, alteration in local hydrology, increase in forest road traffic, spread of invasive species, and elevated light and noise levels. These changes in habitat can impact many species, both common and rare, in Cameron County. Habitat fragmentation from roads, forestry cuts, pipeline and powerline rights-of-ways (ROWs) can create biological islands, where large blocks of habitat are severed into smaller blocks of habitat. This can have the effect of isolating wildlife and plant species, inhibiting the gene flow between populations, eventually leading to a decrease in the fitness of populations.

Landscape Scale Conservation

Prior to European settlement, forest covered more than 90% of Pennsylvania (Goodrich et al. 2003). Today, 62 percent of the state is forested, comprising an area of over 17 million acres (figure 9a). Figure 9b shows the fragmentation of these forests by major fragmenting features such as interstate highways and major rivers. However, much of this forest exists as relatively small islands isolated by surrounding linear features such as roads, utility rights-of-ways, all-terrain vehicle trails, snowmobile trails and railroads, as well as patches of non-forested lands such as oil and gas wells and associated access roads. Figure 9c shows forested areas greater than one acre that remain after fragmentation by interstates and highways, state and local roads, public forest roads, utility rights-of-ways and active railroads. These forest blocks represent potential contiguous habitat for animals sensitive to all scales of fragmenting features, such as interior forest birds.

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) habitat fragmentation and loss; 2) disruption of wildlife dispersal and the resulting loss of gene flow; 3) imposition of edge effects; 4) spread of exotic species; and 5) alteration of the chemical environment.

Roads can be a significant cause of mortality for a variety of animals. Amphibians may be especially vulnerable to road-kill because their life histories often involve migration between wetland and upland habitats, and individuals are inconspicuous and are not readily seen. One study conducted in southeastern Pennsylvania documented over 100 road-killed salamanders and frogs on a single one-mile stretch of road during one rainy night during the spring migration (Goodrich et al. 2003). Large and mid-sized animals are particularly susceptible to vehicle collisions on secondary roads, while birds and small mammals are most vulnerable on wider, high-speed highways (Forman and Alexander 1998). In Upper St. Clair Township, Pennsylvania (Allegheny County), over a recent four year period, white-tailed deer mortality due to road-kills was approximately four times higher than mortality due to hunting (Upper St. Clair Township Department of Deer Management). Six hundred and thirty seven bobcats (*Lynx rufus*) were reported as road kills in Pennsylvania from 1985-2000 (Goodrich et al. 2003).

Animals may also alter their behavior in the presence of a road. One study found that small forest mammals (e.g. eastern chipmunk, eastern gray squirrels, and deer mice) were reluctant to venture onto road surfaces where the distance between forest margins exceeded 60 feet (Oxley et al. 1974). The same study concluded that a four-lane divided highway might be as effective a barrier to the dispersal of small forest mammals as a body of freshwater twice as wide. A study conducted in North Carolina found that black bears shift their home ranges away from areas with high road densities (Brody and Pelton 1989). Traffic noise has been shown to interfere with songbird vocal communication, which affects their territorial behavior and their mating success (Seiler 2001). Roads, wide trails, and grass corridors can also function as barriers restricting the movements of invertebrates and amphibians. Populations of microhabitat-specific species like land snails and salamanders that generally require moist habitats,

may be isolated by inhospitable, xeric corridors (Williams 1995, Blaustein et al. 1994). Some forest butterflies, such as the West Virginia white (*Pieris virginiensis*), will not cross open habitats and its current rarity may be a function of habitat fragmentation and isolation (Williams 1995).

Just as habitat fragmentation disrupts dispersal and isolates species on islands of habitat, the gene pool becomes isolated as well. When plants and animals cannot make contact with other populations, the resulting limited gene flow between populations on other habitat patches leads to an eventual loss of genetic diversity. As genetic diversity is lost, the offspring become less healthy and the ability of that population to adapt to changes in the environment is reduced. Reduced genetic diversity and low recruitment rates that can, in turn, result in local extinctions (Seiler 2001).

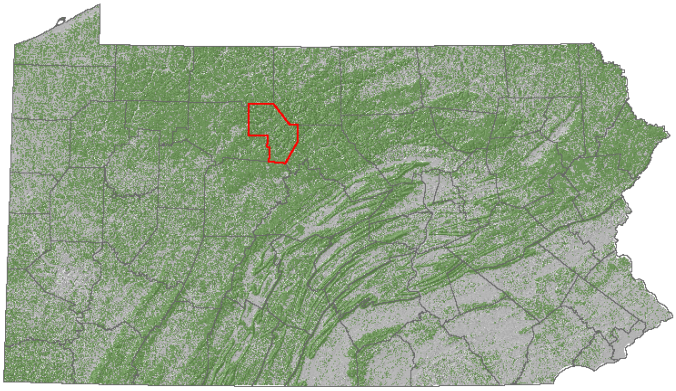
Fragmentation of contiguous forested landscapes into smaller, isolated tracts has an effect on plant and animal distribution and community composition. When an extensive forest tract is fragmented, the resulting forest islands may lack the full range of microhabitats that existed in the original tract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

Along with a reduction in total forested area, forest fragmentation creates a suite of 'edge effects' which can extend more than 984 feet (~300m) into the remaining fragment (Forman and Deblinger 2000). Edge forest is composed of a zone of altered microclimate and contrasting community structure distinct from the interior or core forest (Matlack 1993). Edges experience increased light intensity, altered plant and insect abundance, a depressed abundance and number of species in the macroinvertebrate soil fauna and a reduced depth of the leaf-litter layer (Yahner 2000, Haskell 2000, Watkins et al. 2003). The macroinvertebrate fauna of the leaf litter is significant for the pivotal role it plays in energy and nutrient cycling; these macroinvertebrates also provide prey for salamanders and ground-feeding birds. A number of studies have shown that the nesting success of forest-interior songbirds is lower near forest edges than in the interior because of increased densities of nest predators and brooding parasites.

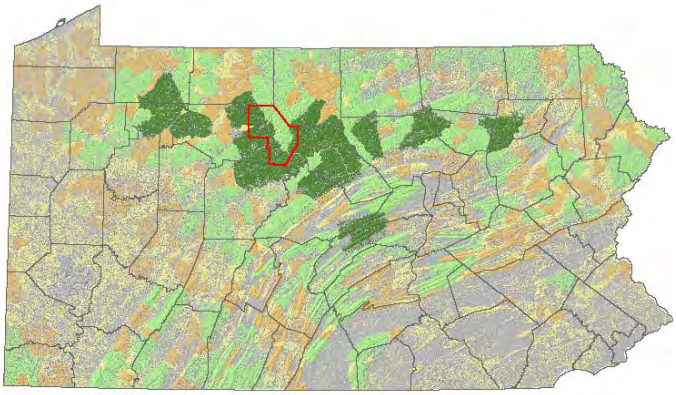
Roads can act as corridors for plant dispersal and exotic species can increase their range by spreading along roadsides. Vehicles and road fill operations transport exotic plant seeds into previously uninfested areas while road construction and maintenance operations can create sites for seed germination and seedling establishment. Additionally, road traffic and maintenance of rights-of-way contribute at least six different classes of chemicals to the environment: heavy metals, salt, organic pollutants, ozone, nutrients, and herbicides. Heavy metals such as lead, aluminum, and iron contaminate soils, plants, and invertebrates up to 656 feet (~200m) from roads, as well as vertebrate fauna foraging within the affected zone. Deicing salts contribute ions to the soil, altering pH and soil chemical composition, which affects plant growth. Airborne sodium chloride from snowplowing may cause leaf injury to trees up to 394 feet (120m) from a road. Organic pollutants such as dioxins and polychlorinated biphenyls (PCBs) are present in higher concentrations along roads, and hydrocarbons may accumulate in aquatic ecosystems near roads. Storm runoff from roads, particularly where roads abut or cross water bodies, results in the transport of nutrients and sediments into aquatic ecosystems. Finally, drifting or misapplied herbicides applied to roadsides and utility rights-of-ways to control woody plant growth may damage forest edge and interior plant species (Forman et al. 2000, Formen and Alexander 1998, Schmidt 1989, Greenberg et al. 1997, Trombulak and Frissell 2000, Watkins et al. 2003, Williams 1995).

Humans are an integral part of natural history, where we function as ecosystem engineers, altering the landscape around us to suit our needs. Some species benefit from human-induced changes, such as birds that inhabit the early successional and edge habitats provided by utility corridors or disturbance-adapted plants that colonize roadsides, but as is more often the case species with specific habitat requirements suffer declining numbers when

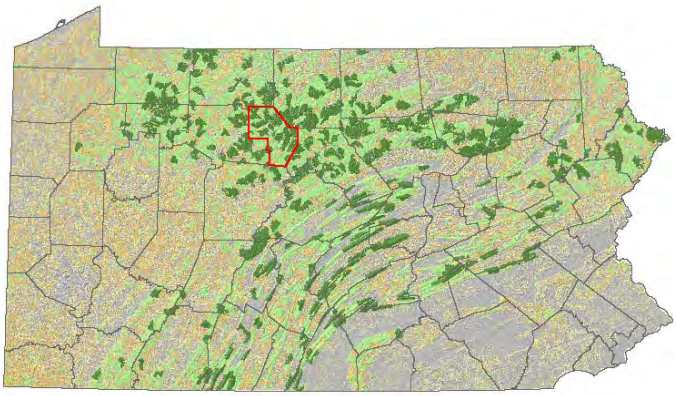
faced with human encroachment. Given the pervasiveness of human influence throughout the northeastern U.S., the ecological importance of large areas of relatively pristine habitat cannot be overestimated. Not only are they potential habitat for a number of areas-sensitive species, but they are also important for the maintenance of vital ecosystem processes and services such as nutrient cycling, pollination, predator-prey interactions and natural disturbance regimes (Heilman et al. 2002). Additionally, large forested areas also serve to filter and regulate stream flow within watersheds and store large quantities of carbon as biomass.



a. Forest and wetland areas in Pennsylvania derived from the National Land Cover Data Set for Pennsylvania (Homer et al. 2004).



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



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

Figure 9. Forest and wetland areas of Pennsylvania, showing the effects of habitat fragmentation by human –created linear landscape features.

Invasive Species in Cameron County

Natural habitats within Cameron County are threatened by invasions of exotic plant and animal species. Invasive species include plants, animals or other organisms that do not naturally occur in the area and are likely to cause harm to the natural environment, the economy, or to human health. Because they often

Table 6. Invasive plants commonly encountered in Cameron County, or that will likely arrive soon.

Species	Description and Threat
Tree-of-heaven (*Ailanthus altissima*)	Introduced to Philadelphia from China in the late 1700's, it is present along roadsides, old fields, and timber cuts. This fast growing tree is a prolific seeder and can also proliferate through vegetative means, outcompeting native species. The odor this tree produces has been likened to rotten peanut butter.
Japanese stiltgrass (*Microstegium vimineum*)	A fast spreading grass that is typically found along forest roads, streambanks, and other cool moist habitats. Outcompetes native vegetation and may affect animal species that use streamside microhabitats.
Japanese knotweed (*Fallopia japonica*) and **Giant knotweed** (*Fallopia sachalinese*)	These large fast-growing exotics displace natural vegetation and alter natural ecosystems. Typically found along stream banks and other low-lying areas, as well as old home sites and waste areas.
Purple loosestrife (*Lythrum salicaria*) and **Garden loosestrife** (*Lysimachia vulgaris*)	Herbaceous wetland invasives that are present at scattered sites throughout the county. Once established in a wetland, these species are difficult to eradicate and will displace native species.
Garlic mustard (*Alliaria petiolata*)	An increasingly common invasive biennial herb spreading through natural areas throughout Pennsylvania. Recent scientific evidence has shown that this species can disrupt micorrhizal relationships that trees depend on for their growth
Japanese honeysuckle (*Lonicera japonica*) and **Oriental bittersweet** (*Celastrus orbiculatus*)	These vines cover and outcompete native vegetation as well as girdle trees by winding up them.
Bush honeysuckles (*Lonicera tatarica*, *L. morrowii*, and *L. maackii*)	Found in a variety of environments from wetlands to uplands. Competes with native plants for moisture, nutrients, and pollinators. Fruits do not provide high energy food for migrating birds.
Spotted knapweed (*Centaurea biebersteinii*)	Competes with native species by capturing moisture and nutrients. Poses a high threat to dry habitats.
Autumn olive (*Elaeagnus umbellata*)	A drought-tolerant species that thrives in many soil conditions. It threatens native ecosystems through competition and alteration of natural succession patterns and nutrient cycling.
Japanese barberry (*Berberis thunbergii*)	Commonly planted ornamental that escapes and forms dense stands in a variety of habitats, including forests and wetlands, displacing native vegetation.
Winged burning bush (*Euonymus alata*)	A shrub that can form dense thickets that displace native woody and herbaceous plants.
Multiflora rose (*Rosa multiflora*)	Widely planted shrub that invades a variety of habitats excluding most native shrubs and herbs. May be detrimental to the nests of native birds.
Jetbead (*Rhodotypos scandens*)	A shrub that forms dense thickets that displace native woody plants and shades out herbaceous groundcover.
Privet (*Ligustrum* spp.)	These shrubs form dense thickets in floodplains, forests, wetlands, and fields that can outcompete native vegetation.
Alder buckthorn (*Rhamnus frangula*)	A widely planted ornamental plant, alder buckthorn has been observed spreading into natural areas in the county.
Mile-a-Minute weed (*Polygonum perfoliatum*)	This herbaceous trailing vine quickly envelops anything it grows beside. The barbed thorns form thick interconnected webs, which even dead will persist for years. This species is particularly a problem at Sinnemahoning State Park.
Goatsrue (*Galega officinalis*)	Sitting on the Federal Noxious Weed list, Goatsrue is an aggressive herbaceous, perennial plant growing up to two meters tall. Capable of forming dense thickets, Goatsrue is toxic to livestock.

have no natural enemies to limit their reproduction, they usually spread rampantly. Once established, it can be extremely difficult to remove them or even control their spread. Invasive species are recognized as one of the leading threats to biodiversity and impose enormous economic costs to agriculture, forestry, fisheries, and other enterprises, as well as to human health (Swearingen et al. 2002).

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

Invasive Plants

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

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

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

Rocky Gleason (PNHP)

Goatsrue (*Galega officinalis*) has the status of a federal noxious weed, and has recently shown up in Cameron County. Efforts to eradicate this species should be made immediately.

Significant invasive plant species found, or those which could be found in Cameron County, are listed in table 6.

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

Invasive Animal Species

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

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

Connecticut Agricultural Experiment Station Archives

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

Hemlock decline and mortality typically occurs within four to ten years of initial infestation. The adelgid can cause up to 90% mortality in eastern hemlocks, which are important for shading trout streams, and provide habitat for about 90 species of birds and mammals. The adelgid has the potential to drastically alter the Pennsylvania landscape, and while several control options are currently being tested, so far a cost-effective treatment has not been found.

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

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

The European starling (*Sturnus vulgaris*) is an exotic bird species established in North America in the 1890s as part of a plan to introduce all of the birds mentioned in the works of Shakespeare to New York City's Central Park. It has since spread throughout the United States. In addition to competing with native bird species for food and space, large flocks of this species destroy fields of crops. The house sparrow (*Passer domesticus*) was introduced to several places in the United States in the mid and late 1800's and has become widely distributed. In addition to causing crop damage, house sparrows will often kill native adult cavity nesters and their young or smash the eggs. The house sparrow is partially responsible for a decline in eastern bluebirds (*Sialia sialis*) in the United States.

Table 7. Significant invasive animal species found (or with colonization potential) for Cameron County

Species	Description and Threat
Hemlock woolly adelgid (*Adelges tsugae*)	This species is causing severe damage to eastern hemlock (*Tsuga canadensis*), killing up to 90% of infected trees, and thus greatly modifying ecosystems.
Gypsy moth (*Lymantria dispar*)	Feeding preferentially on oak trees (*Quercus* spp.) and their relatives, this species will eat almost any plant when forced and can cause severe environmental and economic damage.
Emerald Ash Borer (*Agrilus planipennis*)	As of writing, Emerald Ash Borer has not been detected in Cameron County, but is assumed. This introduced pest kills all Pennsylvania ash tree species in 3 to 4 years.
Common pine shoot beetle (*Tomicus piniperda*)	A pest of pine trees (*Pinus* spp.), this species damages terminal shoots, stunting the growth of trees and thus weakening the trees and increasing their susceptibility to other pests.
Sirex woodwasp (*Sirex noctilio*)	A recent invader, this species attacks living pines and is likely to cause great amounts of damage to both native pine stands and pulpwood pine plantations.
Multicolored Asian ladybird beetle (*Harmonia axyridis*)	Preying on native insects and invading houses each winter, this species was likely introduced in an attempt to control non-native aphids.
Zebra mussel and Quagga mussel (*Dreissena polymorpha*, and *D. rostriformis bugensis*)	Introduced from dumped ballast water, this species is not yet known from Cameron County. It is known for having disastrous effects on ecosystems, and can limit the ability for infested waters to be utilized for recreational and industry.
Asian clam (*Corbicula fluminea*)	Found in extremely high densities along major tributaries and rivers, this species is directly competing with native mussels for food and habitat.
Rusty crayfish (*Orconectes rusticus*)	Found in many of our streams, this recent invader is displacing native crayfish, reducing fish populations by feeding on young fish, and generally disrupting aquatic systems.
Round and tubenose gobies (*Neogobius melanostomus* and *Proterothinus marmoratus*)	These predatory fish prefer cobbly bottoms in slow moving water. Introduced from dumped ballast water, they feed on macroinvertebrates, small clams and mussels, and fish eggs, and are a direct competitor with many of our small native darters and minnows.
Grass carp (*Ctnopharyngodon idella*)	A voracious herbivore, this species was introduced to control weeds in eutrophied lakes. It now causes significant damage to native wetland vegetation that is important for reducing nutrients in water bodies.
Common carp (*Cyprinus carpio*)	Introduced as a food fish, this species is now found anywhere with warm, slow-moving water. As a bottom feeder, it greatly increases turbidity and mobilizes large amounts of sediment.
Snakehead (*Channa* spp.)	Prized as a food species in Asia, this species was recently introduced to the east coast and has quickly taken root. Currently not found in Cameron County, it should be monitored for.
Feral swine (*Sus scrofa*)	Wild hogs should be monitored for due to their negative impact on livestock, property, and natural areas.
House sparrow (*Passer domesticus*)	Generally found any place humans are, this species can cause crop damage, but mainly competes with small cavity nesting birds.
European starling (*Sturnus vulgaris*)	Competing directly with native cavity-nesting birds, this species also causes severe crop damage.
Rock dove/European pigeon (*Columba livia*)	Generally found around human structures, this species can cause crop damage, is a known carrier for several serious human diseases, and causes a general mess where it nests and roosts.
Mute swan (*Cygnus olor*)	While considered pretty by some, this European invader causes significant damage to wetland vegetation that it pulls out during feeding. Additionally, it is fiercely competitive and will exclude native waterfowl from its nesting territory to the point of killing intruders.
Norway rat (*Rattus norvegicus*)	Generally a pest of human infrastructure, the Norway rat is also found around rivers and other water systems. Known as a carrier of many diseases, this species is a threat to a host of native taxa anywhere it occurs.
House mouse (*Mus musculus*)	Ubiquitous throughout the world, this species carries many diseases, competes directly with many native species, and can cause significant damage to crops and structures.
House cat (*Felis domesticus*)	House cats, both domestic and feral, can each kill several small animals in a day, causing the death of many birds, amphibians, reptiles, small mammals, and invertebrates each year.

Feral swine (*Sus scrofa*), also called wild hogs, are potentially one of the most influential upcoming invasive species for nearly all of Pennsylvania's habitats and species of concern. Escaped or deliberately released swine now exist in several counties in Pennsylvania. Feral swine can impact livestock and cause significant ecological and property damage.

Several other invasive animal species are spreading throughout the streams, rivers, and lakes of Pennsylvania. In many cases the impact of invasive species is unknown. Two invasive bivalves that no doubt have massive impacts on the Commonwealth's waterways are the zebra mussel (*Dreissena polymorpha*) and Asian clam (*Corbicula fluminea*). The zebra mussel was accidentally introduced to the Great Lakes in the 1980's and has been spreading in Pennsylvania's waters. Another invasive bivalve, the Asian clam, has spread throughout most of Pennsylvania's waterways. This clam has the capacity to alter the ecology of our aquatic systems, making them less hospitable to the native assemblage of freshwater mussels, fish, aquatic invertebrates, and aquatic plants. Another Aquatic Invasive Species (AIS, see Appendix IV), the rusty crayfish (*Orconectes rusticus*), was first documented in Pennsylvania in 1976. Thought to have been brought in by fishermen who use these crustaceans as bait, the rusty crayfish is a large and very aggressive species. They can reproduce in large numbers and reduce lake and stream vegetation, depriving native fish and their prey of needed cover and food. The rusty crayfish's large size and aggressive nature keeps many fish species from feeding on them. Rusty crayfish may also reduce populations of native crayfish, freshwater mussels, other aquatic invertebrates, and amphibians and reptiles, by outcompeting them for food and habitat or by preying on young individuals.

Table 7 presents an overview of the significant potential invasive animal species that do, or may soon occur in Cameron County.

Overall Invasive Recommendations

Much of Cameron County is free of invasive non-native species and the county is in surprisingly better condition than PNHP staff expected before we had conducted ground surveys. However, there still are many areas within the county that are being invaded and will require management if the character of these sites is to remain. Areas along Sinnemahoning Creek have been invaded by Japanese knotweed, purple loosestrife, and garden loosestrife, and the understory of some of the slopes in portions of the county has been overtaken by Japanese barberry, Multiflora rose, privet, and the non-native honeysuckles. Still, invasions of non-natives have not been on the scale seen in the lower Allegheny, Susquehanna, and Delaware drainages, where the invasive species often outnumber the natives. Successful control of invasive plant and animal species is a time, labor, and resource intensive process. Prevention or control during the early stages of invasion is the best strategy. In areas where invasive plants and animals are well established, multiple control strategies and follow-up treatments may be necessary.

Additional references on invasive plant species and using native plant species in plantings include two PA Department of Conservation and Natural Resources publications:

http://www.dcnr.state.pa.us/forestry/wildplant/invasive.aspx
http://www.dcnr.state.pa.us/forestry/wildplant/native.aspx

Specific treatment depends on the target species' biological characteristics and population size. Invasive plants can be controlled using biological, mechanical, or chemical methods.

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

- The Natural Heritage Areas identified in this report can serve as a useful high conservation value focus areas for the priority control of invasive species.

- Many educational resources are available regarding invasive exotic species. Regional groups such as the Mid-Atlantic Exotic Pest Plant Council (MA-EPPC http://www.ma-eppc.org/) can help with funding opportunities and educational outreach on invasive species.

- Pennsylvania has a Noxious Weed Control Law that prevents the propagation, sale, or transport of thirteen weed species within the Commonwealth. The primary emphasis of the PA Noxious Weed list are agricultural weeds that rarely threaten natural areas, however purple loosestrife (*Lythrum salicaria*), giant hogweed (*Heracleum mantegazzianum*), kudzu (*Pueraria lobata*), mile-a-minute (*Polygonum perfoliatum*), Canada thistle (*Cirsium arvense*), and multiflora rose (*Rosa multiflora*) pose significant threats to native biodiversity. The Pennsylvania Fish and Boat Commission maintains a list of Aquatic Invasive Species (AIS) that are prohibited from possession, sale, barter, or distribution within the Commonwealth (PA Code 58.71.6). This includes the zebra mussel, rusty crayfish, and many others. More information can be found in Appendix IV.

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

A REVIEW OF THE ANIMALS OF CAMERON COUNTY

Although the Cameron County Natural Heritage Inventory focuses on the rare, threatened, and endangered plants, animals and natural communties, the region is home to a great number of more common species which collectively make up the biodiversity of the county. The following sections provide an overview of these species and makes general conservation recommendations for these taxa.

Mammals of Cameron County

Cameron County's geographic location within the Commonwealth, its expansive tracts of forested land, and its mix of wetland habitats supports a unique array of mammals. Some of these species are secretive and their presence is largely unknown to the general public, while other more conspicuous species are frequently seen by the public and are in some cases, managed as game species. These species, including deer, elk and bear, provide excellent recreational hunting opportunities which in turn support numerous businesses within the county. Cameron County still serves as the heart of Pennsylvania's destination "deer camp" region.

PGC 2009

As a result of the antler restrictions implemented in 2003, large wily bucks roam the county like this 10-½ year old harvested near Wycoff Run in Cameron County in 2007. An exceptionally old buck, deer rarely reach this age in the wild.

Throughout Cameron County, white-tailed deer (*Odocoileus virginianus*) populations remain healthy despite many hunters claiming the population has crashed as a result of mismanagement by the Pennsylvania Game Commission (PGC). The PGC has in the last 10 years dramatically altered their management plan for deer harvest across the state in order to set target deer densities based on the health of the deer herd, the health of the habitat, and the number of deer-human conflicts in a given area. Today, the PGC annually alters the number of permits issued for antlerless deer within their Wildlife Management Units (WMUs) in order to bring the population to a level that the habitat can sustain. The northcentral portion of the state, including Cameron County, received an increase in the number of antlerless licenses issued, which has been over the years bringing the deer population in check with the habitat. Some hunters accustomed to the elevated deer populations seen in the 1950's through the 1990's, claim that the PGC has severely reduced the population of deer in the state to levels well below their target densities. Despite these arguments, surveys conducted by the PGC as well as independent auditors indicate that the deer densities remain elevated across much of the state. In 2007, the WMU (2G) that covers Cameron County housed an estimated 55,000 deer, down approximately half from 2002. The targeted deer densities for each WMU are modified according to the health of the habitat, and these reduced numbers are necessary for the forest to recover from the dramatic overpopulations of the past. The deer overpopulation is not a recent occurrence as noted in the Mammal Survey of Northcentral Pennsylvania (Roslund 1951):

> *"In most of north central Pennsylvania, however, the deer herd is at present consuming every bit of available browse of all species… Woody plants under six feet in height are represented today only by seedlings small enough to be completely covered by snow during the winter, and in most of the region even these are scarce since most of them are consumed by deer*

during the summer…. Many species of herbaceous plants have been eliminated from large areas with the result that in extensive woodlands food shortage is a year-round problem…. State Game Lands 14 in Cameron County…. [is a] prime example[-] of overbrowsing in this forest type… Yew appears to have disappeared unnoticed from vast areas… It is entirely possible that the virtual elimination of deer for several years may be required for initial recovery of the range in areas where the population is already low, but still consuming all available food."

The overabundance of deer has negatively impacted much of Cameron County's native species, both plant and animal. Despite much of the public's perception that deer numbers are dwindling in this portion of the state, a number of scientific studies have shown that deer populations in the region are now strong, in control, and stable… a vast ecological improvement over the unhealthy high densities which led to the chronic condition of the forests where deer proof fences are necessary for the forest to regenerate. "Latham's Acre", just outside of Emporium showcases the dramatic impact of deer overpopulations. Fenced to exclude deer over 60 years ago, spring wildflowers abound in this microcosm which represents how many of Cameron County's forests appeared before the explosion of the deer population.

Cameron County contains populations of elk (*Cervus canadensis nelsoni*); the progeny of western elk introduced in the 1910's and 1920's to replace the eastern elk (*Cervus canadensis canadensis*) which was hunted to extinction in the late 1800's. Cameron County is centrally located within the Commonwealth's elk range and the tourist industry, particularly during the fall rut, supports many of the businesses in the county. The elk are considered a vital part of the "PA Wilds" experience, and the tourist industry in the region is expected to continue growing in the coming years.

Black bear (*Ursus americanus*) provide many hunting opportunities in Pennsylvania, including Cameron County. Today, the bear population in Pennsylvania is around 15,000, up from the estimated 4,400 in the early 1980's. One hundred and thirty-eight bear were harvested in Cameron County during the 2010 hunt. Bobcat (*Lynx rufus*) populations are also on the rise in Pennsylvania and are healthy in Cameron County and hunting and trapping opportunities in the state have been expanded by the PGC.

Charlie Eichelberger (PNHP)

This younger bull elk (*Cervus canadensis nelsoni*) may draw scores of wildlife enthusiasts and photographers to Cameron County, but he has not yet established a harem due to the larger bulls in the area. Many of these larger bulls are considered world class trophies and are the primary quarry of the annual limited elk hunting season, one of the only elk hunting opportunities east of the Mississippi River.

Many other mammal species occurring throughout Cameron County are quite unremarkable in that they possess abilities that ensure their survival in a wide range of habitat types and are well represented throughout the county. These species are termed generalists and include the northern short-tailed shrew (*Blarina brevicauda*), gray squirrel (*Sciurus carolinensis*), raccoon (*Procyon lotor*), white-footed mouse (*Peromyscus leucopus*), striped skunk (*Mephitis mephitis*), Virginia opossum (*Didelphis virginiana*), red fox (*Vulpes vulpes*), coyote (*Canis latrans*), and the ubiquitous chipmunk (*Tamias striatus*). All of these species occur

throughout the many and diverse habitats within Cameron County, and the rest of Pennsylvania, and are in no jeopardy of disappearing from the landscape.

Other species have fairly restricted habitat needs and are termed habitat specialists. They may be restricted to grassland habitats, the forest interior, upper elevation ridgelines, wetlands and streams or caves and mines. Examples of these species include the meadow vole (*Microtus pennsylvanicus*) which relies on grasslands and meadows, bats which hibernate in caves and mines, and muskrats (*Ondatra zibethicus*) and beaver (*Castor canadensis*) both of which are specialized to live in wetlands and streams. Beaver were extirpated from Pennsylvania by 1912, but reintroduction efforts were underway within a few years (Merritt 1987) and were restocked to East Cowley Run in Cameron County (Doutt et al. 1977). Today, beavers have rebounded remarkably, and while not nearly as common as before European settlement, several hundred are harvested annually from Cameron County's WMU (2G) (PGC data). The Allegheny woodrat (*Neotoma magister*) is a resident of upper elevation ridges, rock outcrops, as well as caves. This state threatened species has suffered dramatic declines across its entire range in the United States. Still found in Cameron County, the Allegheny Woodrat is surviving in pockets along the rocky forested ridges of the county.

Charlie Eichelberger (PNHP)

Second only to the short-tailed shrew (*Blarina brevicauda*) in size, the northern water shrew (*Sorex palustris albibarbis*) lives along Cameron County's high quality streams, where it forages for aquatic insects by diving into the water and rapidly expelling and inhaling bubbles which trap the scent of prey items. The northern water shrew is well adapted for aquatic life with a coat that traps air, and stiff prevalent hairs on the hind foot which aid its swimming (below).

Charlie Eichelberger (PNHP)

Wetlands and streams play a major role in providing habitat for mammals as well as serving as corridors for dispersal throughout the county. Whenever biologists research mammals, one of the first environs investigated are marshes and streams, as these habitats are often sites where mammalian diversity is highest. It is not uncommon to find multiple species of shrews, rodents, weasels, and bats as well as sign of the various medium-sized carnivores and deer along these habitats. Some of the weasels, including the ermine (*Mustela erminea*), mink (*Neovison. vison*), least weasel (*M. nivalis*), and long-tailed weasel (*M. frenata*), can be found in a variety of habitats, but are frequently associated with these wetlands and waterways where prey items are abundant. An extremely secretive species, the star-nosed mole (*Condylura cristata*), is also associated with wetlands and is an adept swimmer and diver.

The largest member of Pennsylvania's extant weasels (the mustelids), the river otter (*Lontra canadensis*), has been reintroduced to many regions of Pennsylvania where it was previously trapped to near extirpation. Following an initial reintroduction program during the 1980's, the species has made an outstanding comeback. Not yet documented in Cameron County, the river otter population may expand into the county in the coming years. Another weasel species found in Cameron County is the fisher (*Martes pennanti*) which has shown extensive dispersal in recent years from its original reintroduction sites. A resident of large forest tracts, the fisher dwells in limited, but increasing numbers in Cameron County.

Open land, in the form of meadows and grasslands, are found in limited areas along the floodplains of Cameron County where dairy farming and hay production make up much of the agriculture. Species of mammals known to occur within open lands include the eastern cottontail rabbit (*Sylvilagus floridanus*), woodchuck (*Marmota monax*), and meadow jumping mouse (*Zapus hudsonius*). Also found in this habitat, the southern bog lemming (*Synaptomys cooperi*) may exist in very low densities, unlike many other small rodents whose populations are consistently large.

The hairy-tailed mole (*Parascalops breweri*) and eastern mole (*Scalopus aquaticus*) can be found in well drained soils throughout habitats harboring a wealth of subterranean invertebrates, including earthworms. These mammals offer invaluable benefits to humans by turning over soils and keeping some invertebrate pest species in check. Another inhabitant of these well drained areas is the woodland vole (*Microtus pinetorum*), a common species which lives in cool forests with rocky substrates and an abundance of mosses and ferns.

Charlie Eichelberger (PNHP)

One of the most prevalent rodents in Cameron County is the woodland jumping mouse (*Napaeozapus insignis*)

The forested tracts of Cameron County are also important habitat for the region's mammals. The gray fox (*Urocyon cinereoargenteus*) is primarily a denizen of forests, though it may also be found foraging in more open habitats. This native fox is known to be an adept tree climber, and feeds on rabbits and other small mammals. Snowshoe hares (*Lepus americanus*) once roamed throughout the county, but changes in habitat and competition with deer for food have caused declines of this species. Forested habitats are also important for the native deer mouse (*Peromyscus maniculatus*), a very important species to the ecology of Pennsylvania's ecosytems, being a main food source for a host of other vertebrates. Often persecuted for the damage they can do to wooden structures and trees, the porcupine (*Erethizon dorsatum*) does chew the bark and may eventually kill some trees. It is important to note that the trees killed by porcupines may serve as important habitat for a host of other species. Porcupines are also a primary food source of the fisher.

Also living in forested habitats is the woodland jumping mouse (*Napaeozapus insignis*) and the southern red-backed vole (*Myodes gapperi*), both of which serve as an important food source for many other mammals, as well as birds of prey. The masked shrew (*Sorex cinereus*) and smoky shrew (*S. fumeus*) are found in a number of different habitats, but tend to prefer cool, moist forests and woodlands. These shrews can also be found close to waterways where insect populations, the major food source for these species, are healthy. Pygmy shrews (*S. hoyi*) are the smallest mammals in North America, and one of the

Charlie Eichelberger (PNHP)

The Northern Myotis (*Myotis septentrionalis*), also known as the Northern Long-ear is a species of concern found in Cameron County. All of Pennsylvania's bats, including this species, are efficient and effective predators of pest insects. The most distinguishing characteristic of the Northern Myotis is its exceptionally long ears, and straight, dagger-like tragus, a structure protruding from the base of the ear which aids in echolocation.

smallest in the world. About the weight of a dime, pygmy shrews live under logs and stumps in many of the states forests, from low wet areas to upper elevation dryer habitats. The rock shrew (*S. dispar*), as the name implies, can be found living on rocky slopes or along waterways with subterranean rocky retreats. Not collected in Cameron County, the species likely exists since ample habitat is available and the species has been captured in some of the surrounding counties.

Favoring conifer patches, the red squirrel (*Tamiasciurus hudsonicus*) is much smaller than the more common widespread gray squirrel. Though much smaller than it's larger gray cousin, the red squirrel is highly territorial, and it's loud staccato "cherr" is used to fend off potential predators. The red-bellied fox squirrel (*Sciurus niger rufiventer*) prefers more open woodlands, and is found throughout the county. The nocturnal southern flying squirrel (*Glaucomys volans*) is also known from Cameron County, living in mixed forests with adequate tree cavities, in which they nest. The northern flying squirrel (*G. sabrinus*), a state endangered species, was recorded from the county in the 1940's, but despite focused surveys for this species in Cameron County, PNHP staff were unable to detect if the northern flying squirrel still roams the county.

Bats are common residents of Cameron County, most often encountered during the summer months along the streams and open bodies of water. The little brown bat (*Myotis lucifugus*), big brown bat (*Eptesicus fuscus*), northern myotis (*M. septentrionalis*), and tricolored bat (*Perimyotis subflavus*) spend the active season foraging along waterways and rearing young in forested areas with dead woody timber, or in some cases in man made structures like attics, garages, barns, sheds and old country churches. During the winter, these species are known to hibernate in caves and mines. The state threatened eastern small-footed bat (*Myotis leibii*) may occur in Cameron and rears its young among rocky hillsides and boulder fields where crevices provide ample cover to avoid predators. Recently, this species has been found in association with the talus that occurs along woodrat habitats. While most of Cameron County's bats disappear into the many caves and mines to hibernate during the winter, several species such as the hoary bat (*Lasiurus cinereus*), red bat (*Lasiurus borealis*), and silver-haired bat (*Lasionycteris noctivagans*)

Charlie Eichelberger (PNHP)

The tricolored bat (*Perimyotis subflavus*) is one of our smallest species of bat, as well as an exceptionally slow flier. In fact, some people confuse them for a slow flying moth.

don't over-winter in the state at all and migrate further south to states like the Carolinas and Florida and are thought to spend their winter months in hibernation under deep patches of leaf and forest floor litter.

Charlie Eichelberger (PNHP)

The Allegheny woodrat (*Neotoma magister)* is a state threatened species residing in rocky forested areas in Cameron County.

Unfortunately, several invasive mammal species are widespread throughout Cameron County. Frequently encountered in urban and suburban areas, the Norway rat (*Rattus norvegicus*) and house mouse (*Mus musculus*); both old world species, have become well established. These two introduced species are the true pests of the county, being a nuisance to residents, causing much damage to farmer's crops, competing with native species, and altering natural food webs. These conflicts with the natural environment primarily occur where natural areas border the urban and suburban areas where Norway rats and house mice can thrive.

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

A loss of those species considered incompatible with human land use has occurred in Cameron County. Lost from the county's mammalian fauna were the bison, elk, martin, mountain lion, and gray wolf. Monitoring of existing populations of the mammal species of the county could provide a better picture of the conservation needs of Cameron County's mammals as well as where and when reintroductions may be possible for lost or declining species. Of utmost importance to the diversity of Cameron County's mammals, is the avoidance of fragmentation of the remaining forest, protection of existing wetlands, and maintenance of acreage of fallow fields (instead of row crops). The potential restoration of previously destroyed wetlands is needed to secure those mammal species that live in these declining environs. Though humans can provide this type of habitat restoration, the long term effects that beavers may play in modifying wetland systems may naturally allow for this restoration over time. These restored habitats would serve a multitude of mammal species, as well as many other species of plants and animals, both common and rare, in the county. Expanded conservation programs such as the Conservation Reserve Enhancement Program (CREP) and Landowner Incentive Program (LIP) may provide the opportunities for landowners to become directly involved with the conservation of Cameron County mammals.

Important Mammal Areas (IMAs)

Cameron County is an incredibly unique county as far as mammal diversity and the available expansive mammal habitats. The county has the distinction for being entirely within the designated Northern Allegheny Plateau Important Mammal Area (IMA).

Note: The following information is adapted from the Important Mammal Areas Assessment Reports, 2005.

This large area of northcentral Pennsylvania is the state's largest IMA, spanning nine counties and covering approximately 4 million acres. Given the size of this IMA, it includes a full range of habitats and types of human disturbance. Nonetheless, it represents the last large block of unfragmented forest habitat (mostly northern hardwoods) remaining in the state. Within this region, there are specific focal areas that are important for specific mammal species. Numerous State Game Lands are included. The region is home to many moderate-to large-sized mammals, including fisher (Fish Dam Wild Area reintroduction site), elk, black bear, bobcat, porcupine, mink, coyote, snowshoe hare, Appalachian cottontail, northern river otter, and beaver. Small mammals include northern water shrews, northern flying squirrels, Allegheny woodrats, and least weasels. Fox squirrels are likely to occur here. Focal areas include West Branch Susquehanna River (northern water shrew, Allegheny woodrat, elk), Pine Creek Gorge (northern water shrew, Allegheny woodrat, northern river otter, fisher), Two Rock Run fire area (Appalachian cottontail), Fish Dam Wild Area (black bear, coyote, first reintroduction site of fisher), and the Benezette elk viewing area.

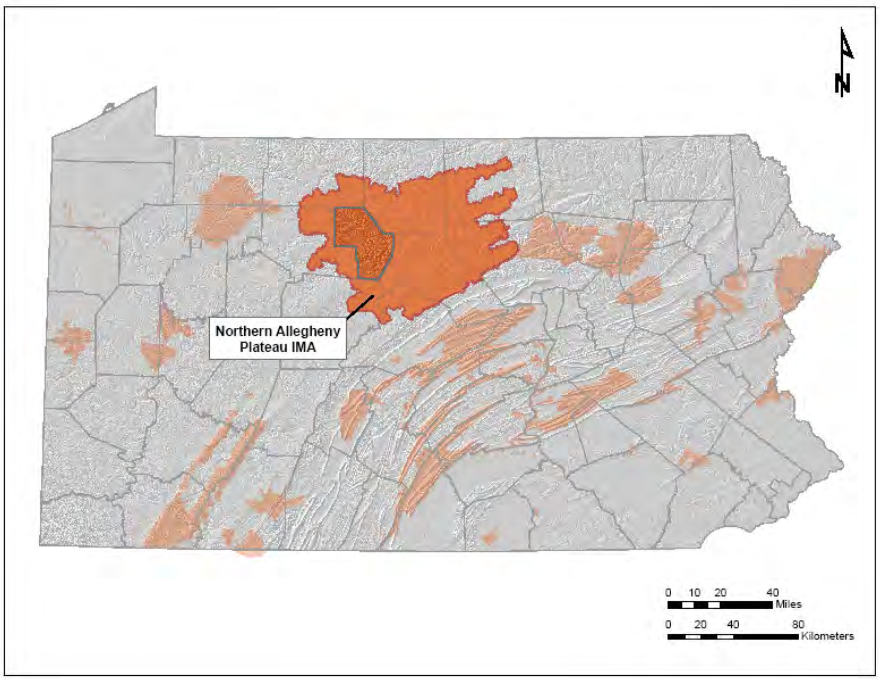


Figure 10. Important Mammal Areas of Pennsylvania, focusing on Cameron County.

This area satisfies the following IMA criteria:

- The site supports diverse or unique communities of mammals.
- The site supports high-density mammal populations.
- The site supports species or subspecies listed as endangered or threatened by the Pennsylvania Biological Survey.
- The site supports species or subspecies that are declining or vulnerable nationally or listed as candidate species by the Pennsylvania Biological Survey.
- The site is important for public education.

Conservation Concerns

Major threats to the mammals and their habitats are overbrowsing by white-tailed deer and natural diseases.

Birds of Cameron County

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

Forest Bird Communities

Being within the most remote portion in the Commonwealth, Cameron County has a large portion of the state's interior forest tracts, which support a variety of bird species that require interior forest habitat. Cameron County's largest block of intact forest is just under 32,000 acres and lies along the Cameron/Elk County border. This forested block is the second largest in the Commonwealth. Other Cameron County forests have been divided into smaller patches. As forested landscapes are fragmented into smaller patches by development, roads, and timber harvesting, many bird populations are declining (Askins et al. 1991). Birds requiring large blocks of contiguous interior forest (300 feet from an edge) in order to breed are considered forest interior species (Robbins, Dawson, and Dowell 1989). Forest fragmentation negatively affects their nesting success because of increased predation from animals that use forest edges for hunting (raccoon, skunk, opossum) and brood parasitism by Brown-headed Cowbirds (*Molothrus ater*). Brown-headed cowbirds use perches along forest edges to look for nests of other species in which to lay their eggs (Robinson 1994). Forest interior species include a variety of owls, hawks, woodpeckers, thrushes, vireos, and warblers.

Markus Varesvuo/naturepl.com

The Northern Goshawk (*Accipiter gentilis*) is a large raptor which depends on expansive tracts of interior forest. Known for being a reclusive species of the deep woods, Northern Goshawks will fervently defend nesting territories if intruded upon.

Several species of forest interior birds occupy a special niche within the interior forest. The Acadian Flycatcher (*Empidonax virescens*), Cerulean Warbler (*Setophaga cerulea*), Louisiana Waterthrush (Seiurus motacilla), and Red-shouldered Hawk (*Buteo lineatus*) all specialize in riparian corridors and wetlands in interior forest. These habitats, formerly common in Pennsylvania, are elsewhere in the state being converted to other uses and habitat types at an alarming rate. In riparian areas, floodplain forests should be maintained by limiting development and harvesting within the riparian zone per Pennsylvania Bureau of Forestry aquatic habitat buffer guidelines (http://www.dcnr.state.pa.us/forestry/sfrmp/documents/Water_Aquatic_Buffer_Guidelines.pdf). These forests typically have larger, older trees that provide habitat for cavity-dependent and bark-utilizing species, provide nesting sites for raptor species and colonial water birds.

Whenever possible, fragmentation of large contiguous forest tracts (at least 750 acres in size) should be avoided. Naturally uneven-aged forests with a well-developed woody and herbaceous understory should be maintained. To minimize parasitizing opportunities from Cowbirds, roads, trails, and other fragmenting features should be narrow, with the edges of the openings covered in brush or long grass over

6 inches tall (no mowing). Dead trees (called snags) serve many wildlife functions including foraging sites, nesting cavities, hunting perches, and shelter, and should be preserved.

Wetland Bird Communities

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

Bob Moul

The unmistakable Scarlet Tanager (*Piranga olivacea*) is a forest interior specialist, and Pennsylvania houses an estimated 17% of the global breeding population (Rosenberg et al. 1999). Forest fragmentation, such as that resulting from energy development, could threaten Pennsylvania's populations of this now common species.

The southwestern portion of Cameron County contains a series of sizable, high elevation wetlands that provide suitable habitat for many bird species. Along with the natural wetlands, man-made ponds and reservoirs may provide wetland habitat for both rare and common species. Although few intact wetlands remain in Cameron County today, what does remain provides an important habitat refuge for many declining species. Wetland areas provide breeding and foraging habitat for various raptors such as Osprey (*Pandion haliaetus*) and Bald Eagle (*Haliaeetus leucocephalus*). Other wetland species, such as waterfowl, shorebirds, and wading birds require these habitats for nesting and foraging. Wading birds, such as Great Blue Herons (*Ardea herodias*), prefer clumps of dead, water surrounded trees to place their rookeries. Unfortunately, many of these wetland species are secretive, cryptic, and difficult to flush, making these habitats a challenge to survey, limiting our knowledge of the range and status of these species.

The conservation and proper management of wetland habitat is crucial to sustaining healthy populations of these bird species, in addition to maintaining general ecosystem viability and a reliable water supply. Immediate needs include the preservation of emergent wetlands that provide nesting, feeding, and wintering habitats for both breeding and migratory species. Wetlands must be protected from hydrologic changes (draining, flooding, filling, etc.), unnatural siltation, pollution, and invasion by non-native species.

Important Bird Areas (IBAs)

Across the state, a number of organizations have undertaken conservation planning efforts at a landscape scale. The areas identified through these efforts frequently overlap with Natural Heritage Areas identified by County Natural Heritage Inventories and serve to emphasize the importance of focusing conservation efforts in those areas. One such program is the Important Bird Areas project (IBA).

The Pennsylvania Audubon Society administers the state's IBA Program and defines an IBA as "a site that is part of a global network of places recognized for their outstanding value to bird conservation." An IBA must meet one of several criteria developed by the Ornithological Technical Committee of the Pennsylvania Biological Survey (http://pa.audubon.org/iba/). Planning for these areas should consider how to best maintain their value as bird habitat. The value of some large-scale IBAs may be due to the forest interior habitat contained within them. Natural communities that have a particular habitat value for birds (e.g., wetlands) 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. To date, 85 IBAs have been identified in Pennsylvania, encompassing over two million acres of public and private lands. These areas include migratory staging areas, winter roost sites, and prime breeding areas for songbirds, wading birds, shorebirds, and other species.

Cameron County contains portions of the Quehanna Wild Area IBA. More information can be found on the Pennsylvania Chapter of the National Audubon Society website. Note: the following information is adapted from the Audubon Society of Pennsylvania IBA site descriptions (Audubon 2002).

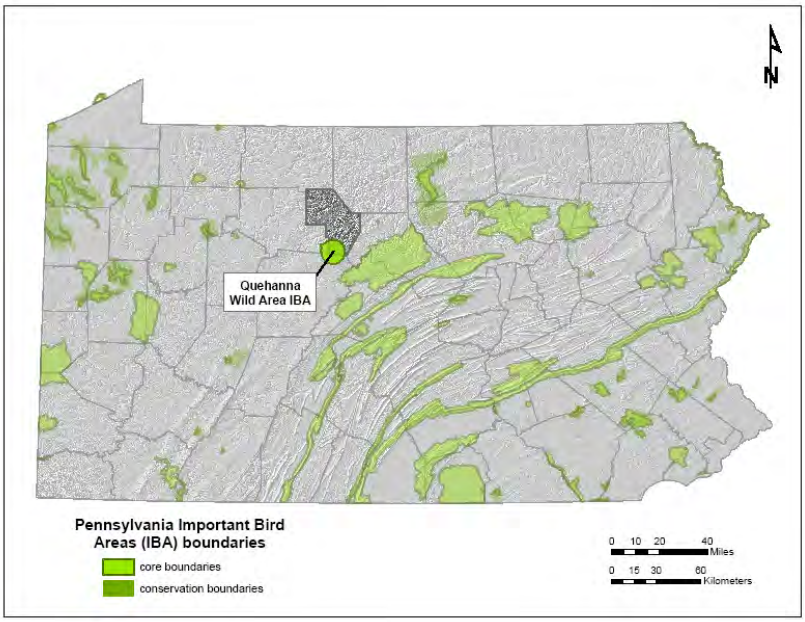


Figure 11. Important Bird Areas of Pennsylvania, focusing on Cameron County.

<u>Quehanna Wild Area IBA</u>
Quehanna Wild Area is an extensive forest area set aside to maintain the undeveloped character of the forest environment. The tract was originally state forest land that was sold and leased to the Curtiss Wright Corp. for jet engine and nuclear research in 1955. It was returned to the Commonwealth in 1966. The forest has been influenced by oak leaf roller and gypsy moth and experience tornado damage in 1985. Timber rattlesnake, black bear, and elk rely on the varying forest types and low human density for prime habitat. Wykoff Run Natural Area supports stands of pines and hemlock that add to the diversity of vegetation and birds.

The Quehanna Wild Area satisfies the following IBA criteria:

- The site consists of large, unfragmented forest with exceptional diversity of forest nesting bird species including the Cerulean (*Setophaga cerulea*), Prairie (*Setophaga discolor*), Black-and-white (*Mniotilta varia*), Black-throated Green (*Setophaga nigrescens*), Pine (*Setophaga pinus*), Black-throated Blue (*Setophaga caerulescens*), and Chestnut-sided Warblers (*Setophaga pensylvanica*), as well as the Whip-poor-will (*Caprimulgus vociferus*), Eastern Wood-pewee (*Contopus virens*), Least Flycatcher (*Empidonax minimus*), Eastern Phoebe (*Sayornis phoebe*), Eastern Bluebird (*Sialia sialis*), Hermit Thrush (*Catharus guttatus*), Cedar Waxwing (*Bombycilla cedrorum*), Ovenbird (*Seiurus aurocapilla*), Rose-breasted Grosbeak (*Pheucticus ludovicianus*), Indigo Bunting (*Passerina cyanea*), Eastern Towhee (*Pipilo erythrophthalmus*), and Golden (*Aquila chrysaetos*) and Bald Eagles (*Haliaeetus leucocephalus*).
- The forest contains a variety of age classes and forest types, including mixed oak, northern hardwood, red maple, aspen, gray birch, white pine, hemlock, and spruce.

Conservation Recommendations – Threats to this IBA include over-grazing by deer and pests like the gypsy moth. The area contains part of the popular Quehanna Trail and is used by hikers and backpackers. Designated by DCNR as a Wild Area, the tract was set aside to maintain the undeveloped character of the forest environment. There is restricted land use: no new public access roads, no off-road motorized vehicles, no commercial harvests, no new camps allowed. Salvage logging is still permitted. DCNR maintains "fix-up" areas with insect mortality, regenerates areas to higher quality canopy forest, maintains deer fencing, and conducts elk studies.

Reptiles and Amphibians of Cameron County

Pennsylvania's mixed landscapes provide a great diversity of habitats for a wide range of reptile and amphibian species. Pennsylvania's reptile and amphibian makeup, known as the herpetofauna, is quite unique. The ranges of most Pennsylvania reptiles and amphibians are restricted to certain regions of the state, a testament to the varied topography and physiographic provinces within the region. Today, the Commonwealth is home to 76 native herptile species, including those common in the glaciated regions of the Canadian Shield, many of the southern species from the lower regions of the Appalachians, several associated with western prairies, and a few connected with the coastal plain.

Cameron County is home to many common, generalist species, such as the eastern garter snake (*Thamnophis sirtalis*), the red-spotted newt (*Notophthalmus viridescens*), the bull and green frogs (*Lithobates catesbeianus, L. clamitans*), and the painted and snapping turtles (*Chrysemys picta, Chelydra serpentina*). These species occur in many different habitats, exist throughout the entire state, and are the most commonly encountered reptiles and amphibians in the Commonwealth. Along with these common species, Cameron County includes several less common species of herptiles. Many of these species have restricted ranges or are considered specialists, meaning their life histories have more specific habitat requirements.

Salamanders

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

Ryan Miller (PNHP)

Eastern hellbender (*Cryptobranchus alleganiensis*)

The numerous waterways and streams of Cameron County provide habitat for the streamside salamanders, including the northern and mountain dusky salamanders (*Desmognathus fuscus, D. ochrophaeus*), the northern two-lined and long-tailed salamanders (*Eurycea bislineata, E. longicauda*) and the northern spring salamander (*Gyrinophilus porphyriticus*). In the cold-water drainages of the county, the brilliant northern red salamander (*Pseudotriton ruber*) can be found under the litter and rocks in seeps and spring heads. All of the streamside salamanders require high water quality.

The largest salamander on the continent, the eastern hellbender (*Cryptobranchus alleganiensis*) can be found in the West Branch Susquehanna River drainage. Able to reach well over two feet in length, this bizarre-looking harmless salamander is rarely seen, as it spends the majority of the time under large flat rocks in swift moving, high quality waters. Hellbender populations have been declining very rapidly due to decreases in water quality, introductions of aggressive non-native crayfish, and competition with non native fish species. Amphibians as a whole are particularly sensitive to pollution. Consequently, pollutants and heavy sediments loads can be detrimental to the hellbenders inhabiting affected streams.

Temporary wetlands and vernal pools are critical to a group of amphibians that rely on the wet/dry annual cycle that eliminates the possibility of fish populations being established. The spotted salamander (*Ambystoma maculatum*), which is a vernal pool obligate, is known from Cameron County and one historical record exists for the Jefferson salamander (*A. jeffersonianum*). These species cannot reproduce without the presence of fish free ephemeral wetlands. The four-toed salamander (*Hemidactylium scutatum*) is not a vernal pool obligate but can be

found in association with these habitats. This diminutive salamander lays its eggs in peat mosses (*Sphagnum* spp.) and can be found in the margins of seeps, springs, and streamsides where sphagnum moss is found above cool, clear water. The four-toed salamander tends its clutch, which is laid in vertical mats of sphagnum, until the young hatch.

Frogs and Toads

The wood frog (*Lithobates sylvaticus*), like the Ambystomatid salamanders discussed earlier, is considered a vernal pool obligate species, however wood frogs are one of the more liberal vernal pool species and can also be found breeding in shallow marshes and ditches. The American toad (*Anaxyrus americanus*), spring peeper (*Pseudacris crucifer*), and grey tree frog (*Hyla versicolor*) are regular visitors to many different types of wetlands where they breed and forage.

Charlie Eichelberger (PNHP)

Spring peeper (*Pseudacris crucifer*)

The pickerel frog (*Lithobates palustris*) and northern leopard frog (*L. pipiens*) require heavily vegetated streams and creeks. Once Pennsylvania's most common species of frog, the northern leopard frog has rapidly disappeared from much of its range for mysterious reasons and there is now concern for the future of this species.

Turtles

The semi-aquatic wood turtle (*Glyptemys insculpta*) relies on wooded creeks and rivers, and while it can be locally common in areas, the species is becoming increasingly rare across its range. The eastern box turtle (*Terrapene carolina*) is an easily recognized, generalist species which may be found in the county. While this species is still considered common, with a lifespan that may reach beyond a century, many biologists believe that box turtle populations have been in a steady decline due to road mortality and predation on nests and juveniles. Turtle nests are laid in suitable substrates with sun exposure, frequently along waterways. These sites are used by many nesting females and are easily targeted by overpopulations of raccoons, skunks, and opossums. There is growing concern for many of Pennsylvania's turtles, because numerous populations are nearly void of juvenile turtles, indicating that there is little successful reproduction occurring.

Charlie Eichelberger (PNHP)

Wood turtle (*Glyptemys insculpta*)

Lizards and Snakes

The northern coal skink (*Plestiodon anthracinus*) and the five-lined skink (*P. fasciatus*) are known from Cameron County. These species occur in relatively small, isolated populations in dry habitats with an abundance of cover objects and basking areas. These habitats often include many sun-exposed rocks and dead woody debris. These species are particularly susceptible to localized extinction because of their populations' small sizes and isolation from other lizard populations.

The black racer (*Coluber constrictor*) and the black rat snake (*Pantherophis alleghaniensis*), two fairly common species in the state, can be found in many different habitats across the county. These two species prey upon small mammals including mice and squirrels. The brilliantly patterned eastern milk snake (*Lampropeltis triangulum*) can be found in a variety of habitats and though it is common, this species is rather secretive and is rarely seen. A more frequently observed snake, northern watersnake (*Nerodia sipedon*) is a widespread resident of Cameron County. This species hunts along open waterways, searching for amphibians and small fish

Charlie Eichelberger (PNHP)

Northern coal skink (*Plestiodon anthracinus*)

The shorthead garter snake (*Thamnophis brachystoma*) may be common where it exists, but this species has an extremely limited range, only found in a handful of counties in Pennsylvania and New York State. Pennsylvania is thought to have roughly 90% of the global population of this species. The smooth green snake (*Liochlorophis vernalis*) is likely common in grassy areas but is difficult to locate, because its camouflage allows it to virtually disappear into vegetation. This snake is rarely seen, and the species is considered vulnerable to apparently secure in the state.

Several small and secretive snake species in the county include the northern red-bellied snake (*S. occipitomaculata*), the ringneck snake (*Diadophis punctatus*), the mountain earthsnake (*Virginia pulchra*), and the eastern wormsnake (*Carphophis amoenus*). The northern red-bellied snake, and ringneck snake are common residents and can be found beneath rocks and decaying wood and bark. Mountain earthsnakes and wormsnakes are exclusively fossorial, meaning they spend their lives underground. Little is known about these species in Pennsylvania even though we house around 80% of the global population of mountain earthsnakes. More survey work needs to be conducted to determine the status of both of these species.

Charlie Eichelberger (PNHP)

About the size of a pencil, the mountain earthsnake (*Virginia pulchra*) is infrequently encountered given its fossorial life history. It spends most of its life under cover, feeding on earthworms and salamanders. This harmless species is considered "globally vulnerable" to extinction, and is known from Portage Township.

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

Being at the heart of its range, the forests of Cameron County house healthy populations of timber rattlesnakes. Rattlesnakes are able to use a wide range of habitats and may be encountered throughout the county, primarily occurring on rocky slopes where they can find refuge in spaces between the boulders as well as thermoregulate in the sunny openings. This species forages in a variety of habitats, but favor forested areas with healthy small

mammal populations. Hibernacula, or dens, often are found under canopy cover but are usually located within several hundred feet of an open basking site. Persistence of these sites relies on forestry practices that maintain a diversity of open areas adjacent to forested foraging habitat. Copperheads are able to use a wide range of habitats and may be encountered in the southern portion of the county and can be found from mountaintops to valley floors in dry settings as well as wetland edges. Copperheads may forage in a variety of habitats with healthy small mammal populations.

Timber rattlesnakes are still considered a game species by the Pennsylvania Fish and Boat Commission and can be collected with an appropriate PFBC permit. Despite the allowance of rattlesnake hunting, the timber rattlesnake is considered a species of concern because it is declining due to human persecution. Timber rattlesnakes are a protected species in every surrounding state where the snake occurs and are considered during environmental review in Pennsylvania.

Charlie Eichelberger (PNHP)

A yellow phase and black phase timber rattlesnake (*Crotalus horridus*)

Cameron County is a significant spot in the state for the Commonwealth's reptiles and amphibians. The forested tracts and numerous waterways and wetlands provide critical habitat for the reptiles and amphibians. Of utmost importance to the conservation of the county's herpetofauna is the protection of the region's forests, streams, marshes, and wet meadows. The past half century has seen a dramatic change in agricultural practices. The rich and diverse herpetofauna of Cameron County is unique to Pennsylvania and should be considered in the long term plan of the region.

Fish of Cameron County

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

Fish can be voracious eaters of other fish or gentle grazers of plants. Some fish are parasitic, like adults of the Ohio lamprey (*Ichthyomyzon bdellium*). Many fish are predators of insects, while others eat mollusks, crayfish, salamanders, or frogs. Some fish, like the northern redbelly dace (*Phoxinus eos*), eat only algae throughout their lives.

Many fish species migrate to spawn. American eels (*Anguilla rostrata*) live in the freshwaters of coastal watersheds, but swim to the Atlantic Ocean to reproduce. Other fish like American shad (*Alosa sapidissima*), swim upstream in freshwater environments to find nursery waters for their next generation.

PNHP

Northern hogsucker (*Hypentelium nigricans*)

Upstream habitats are important for spawning and the development of young fish. Access to spawning habitats is inhibited by dams along the migratory paths of fish, despite fish ladders on some large dams. Populations of the once common American shad (*Alosa sapidissima*) declined greatly from historic levels after dams were constructed on the Susquehanna River. Nests are created by some fish to protect their young. River chubs (*Nocomis micropogon*) assemble piles of gravel up to 2 feet across, while brook trout (*Salvelinus fontinalis*) make redds, which are trough-like depressions in the stream bottom, oriented to supply oxygen to the developing fish. Channel catfish (*Ictalurus punctatus*) lay their eggs in undercut banks, sunken logs, or even abandoned muskrat holes. Sunfish, such as bluegills (*Lepomis macrochirus*) and redbreast sunfish (*Lepomis auritus*), create depressions in sand and gravel on the stream bottom. In some species fish guard the developing eggs from predators and later defend their young.

PNHP

Shaded headwater stream

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

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

- Headwater streams are the smallest streams, and water temperatures are often cold (<70°F). The water is fast-moving, well-oxygenated, and usually slightly acidic. These streams often hold "Coldwater Communities," and hold species such as brook trout and brown trout.

- Mid-reach streams are slightly warmer (65-75°F) and have a mixture of stream habitat types, such as pools, riffles (fast-flowing, turbulent waters) and runs (moderately flowing, but calm waters). These streams usually have "Coolwater Communities," with creek chubs and a variety of shiner, sucker, and dace species.
- Large streams and small rivers often have warmer waters (>75°F) and slower flows. Pools and runs become more prominent than riffles. These streams usually have "Warmwater Communities," with smallmouth bass, bluegill, and different species of darters.

PNHP

Longnose dace (*Rhinichthys cataractae*)

Much of Cameron County's fish diversity is contained within the minnow family. These minnows and other small fish are found in a variety of waterways. Some of the commonly encountered species include common shiner (*Luxilis cornutus*), longnose dace (*Rhinichthys cataractae*), fallfish (*Semotilus corporalis*), and tessellated darter (*Ethostoma olmstedi*). Additionally, sculpins, suckers, darters, catfish, and sunfish are common groups occuring in the waterways of Cameron County. The Aquatic Community Classification has identified several fish communities (table 8). Fact sheets detailing these communities can be found in Appendix VI).

Table 8. Common fish communities of Cameron County determined by the PNHP Aquatic Community Classification.

Fish Community	**Indicator Species**
Coldwater Community*	Brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), rainbow trout (*Oncorhynchus mykiss*)
Coolwater Stream Community	Slimy sculpin (*Cottus cognatus*), stocked brown trout (*Salmo trutta*), fathead minnow (*Pimephales promelas*), pearl dace (*Margariscus margarita*)
Warmwater Community	Central stoneroller (*Campostoma anomalum*), northern hogsucker (*Hypentelium nigricans*), river chub (*Nocomis micropogon*), longnose dace (*Rhinichthys cataractae*), cutlips minnow (*Exoglossum maxillingua*), mottled sculpin (*Cottus bairdii*), margined madtom (*Noturus insignis*), creek chub (*Semotilus atromaculatus*), rosyface shiner (*Notropis rubellus*), fantail darter (*Etheostoma flabellare*), greenside darter (*Etheostoma blennioides*)
River and Impoundment Community	Walleye (*Sander vitreus*), yellow perch (*Perca flavescens*), black crappie (*Pomoxis nigromaculatus*), goldfish (*Carassius auratus*)

Conservation Recommendations

Preservation of water quality in rivers and streams starts in the headwaters and mid-reach streams. Well-vegetated, wide riparian zones, (the corridors surrounding waterbodies), provide the leaves and woody debris that sustain the headwater food chain and lead to properly functioning stream ecosystems. The riparian zone shades streams, keeping water temperatures cool and filters sediments and other pollutants in runoff flowing from the uplands into streams.

Runoff from agriculture and impervious surfaces, such as roads and parking lots, is the most common source of habitat and water quality decline. Pollutants like excess nutrients, sediment, petrochemicals, and metals wash into waterways that are not adequately protected. Erodable sediments are transported into streams or are rapidly eroded from stream banks. Soils can erode from improperly managed agriculture, timber harvest, and other earth disturbances. Suspended sediments cloud the waters to levels that are intolerable to some organisms. The excess sediment fills in the spaces between gravel and rocks, smothering habitat for the invertebrates on which fish feed, for spawning and for nesting habitats. In addition, sediments can carry large amounts of nutrients that over-stimulate plant growth and bacteria causing alterations in the food web. Erosion on the streambanks can be controlled by establishing or maintaining buffers of native vegetation.

With a natural gas boom in the Marcellus shale formation, water resource managers are challenged with regulating water withdrawals supplying the drilling process and the subsequent well waste water. Although water regulations are currently evolving, more protections will be needed to ensure water levels can be maintained for aquatic life and that water quality and habitats are not harmed during drilling and the life span of the wells.

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

For more information on Pennsylvania's fish species, see the PA Fish & Boat Commission's "Gallery of Pennsylvania Fishes" web page: http://www.fish.state.pa.us/pafish/fishhtms/chapindx.htm

Freshwater Mussels of Cameron County

North America has the highest diversity of freshwater mussels in the world with nearly 300 species (Williams et al. 1993). Historically, nearly 70 species were known from Pennsylvania (PNHP data). Freshwater mussels are found in waterways throughout Pennsylvania, from medium-sized streams to large rivers where they bury themselves in the substrate and blend in with cobble and gravel. Freshwater mussels are an important part of aquatic ecosystems, filtering and removing particles, as well as making nutrients more available for other aquatic life (Vaughn and Hakenkamp 2001).

PNHP

Brook floater (*Alasmidonta varicosa*)

Native freshwater mussels have a unique life cycle that is well adapted to flowing waters and aids the dispersal of these relatively immobile organisms. Most species of freshwater mussels depend on a host fish to complete their reproductive cycle. A larval mussel, called a glochidium, must attach to fish gills or fins to grow for several weeks. The glochidia are small and are believed not to harm their host. Once transforming into a juvenile mussel, they fall off into the substrate and grow there by feeding on nutrients in the substrate and plankton in the water. The host fish may transport the glochidia long distances, enabling the mussels to colonize new habitats. There is an amazing range of adaptations that exist in freshwater mussels to ensure that the glochidia can successfully find and attach to a host fish. In some species a portion of the mussel's internal tissue has been modified to mimic particular species of minnows. The female mussel opens its shell and displays the minnow-like lure to attract predator fish and then expels the glochidia onto any fish that is attracted to the lure.

PNHP

Yellow lampmussel (*Lampsilis cariosa*)

Waterways in Cameron County flow into the West Branch Susquehanna River and eventually to the Chesapeake Bay. The Susquehanna River watershed historically had 13 mussel species, of which four species have been found in the county. Known populations of mussels in Cameron County occurred in the First Fork of Sinnemahoning Creek at Sinnemahoning State Park, and in the Driftwood Branch of the Sinnemahoning Creek. Acid mine drainage from abandoned coal mines caused large declines or eliminated mussels from parts of the watershed. Additionally, the 2006 Norfolk Southern train derailment and the sodium hydroxide spill that occurred along Portage Creek and the Driftwood Branch may have killed freshwaters mussels from these creeks, though mussels were not addressed in the investigative report (Hartle 2006).

Freshwater mussels are one of the most imperiled groups of organisms. In North America approximately 70 percent of the species are considered endangered, threatened or of concern (Williams et al. 1993). In Pennsylvania, 17 species (representing about one-fourth of the species recorded from the state) have been extirpated from the commonwealth, and another 24 species are considered threatened or endangered by the Pennsylvania Biological Survey (PABS) and the Pennsylvania Natural Heritage Program (PNHP).

Mussel richness generally increases with increasing watershed size (Strayer and Jirka 1997). Therefore the largest rivers in Pennsylvania, like the Ohio, Allegheny, Susquehanna and Delaware Rivers generally have the most rich mussel communities. However, most of these large streams and rivers have a history of poor water quality and major alterations such as large dams or channelization, which leads to declines in mussel populations. Although water quality has greatly improved in recent decades, mussels are slow to make a return in much of their historical habitat.

PNHP

Orange iron precipitate from mine drainage coats the stream bottom

Threats to native mussels include the construction of dams, invasive species, such as the zebra mussel (*Dreissena polymorpha*) and the Asian clam (*Corbicula fluminea*), stream channelization, water pollution, sedimentation from poor agriculture and forestry practices, bridge and road construction, and habitat loss through dredging (Richter et al. 1997). Zebra mussels grow on hard surfaces including the shells of native mussels. They compete with native mussels for food, and in high densities they can starve and suffocate native mussels by covering their shells completely. Zebra mussels have not yet been found in Cameron County, but they are found in other parts of the Susquehanna River watershed.

As filter feeders, mussels are sensitive to water quality, making the presence of a healthy mussel community an indicator of good water quality. Most imperiled mussels are riverine species, which require flowing, well-oxygenated water. Dams create lake-like habitats, with slow moving water and lower levels of dissolved oxygen and may prevent access to fish hosts. In many cases riverine species have lost major portions of their habitats due to damming of the rivers.

Conservation Recommendations

Protecting and enhancing habitats and water quality where mussels are currently occurring is a first step to ensuring the persistence of a mussel resource in the long-term. The need for new bridges, dams, and dredging projects that damage aquatic resources should be carefully weighed against harm to aquatic habitats. Reducing sediment, nutrient and other pollution inputs to streams and rivers will be favorable to mussels and other aquatic organisms. Legacy mine drainage continues to influence many waterways in the West Branch Susquehanna River watershed. Remediation of acid mine drainage to normalize acidity and remove toxic metals improves water quality for mussels and other aquatic organisms. Regulating the effects of storm water by controlling runoff quality and quantity will also help protect aquatic habitats.

Effective conservation of mussel populations will result only from conserving and restoring aquatic systems as a whole. Conserving entire biological communities is a proactive approach to biodiversity conservation because focuses on complete assemblages of species and including the common, the rare, and those not yet discovered (Higgins et al. 1998). In some cases, targeted conservation of rare freshwater mussels is necessary, particularly for those considered globally rare. Working to conserve the mussel habitat and also its watershed, we protect the ecosystem that supports the habitat. For these reasons, it is important to protect rare species, mussel communities and the watersheds that contain them.

Insects of Cameron County

Pennsylvania is home to over ten thousand insect species (Rawlins & Bier, in Hassinger et al. 1998). We know very little about most of these species, but there are three groups of insects that have been studied well enough to allow the Pennsylvania Biological Survey to assign state ranks to all the species occurring in the Commonwealth: the dragonflies and damselflies (Odonata), the butterflies and moths (Lepidoptera), and the tiger beetles (Cicindelidae).

Dragonflies and Damselflies of Cameron County

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

Adult odonates can fly with exceptional maneuverability and speed, allowing them to be efficient predators. Larval odonates are also predators of aquatic insects, often eating the larvae of the same species they prey upon as adults. As predators, odonates can have significant effects on populations of mosquitoes, flies and other prey sources.

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

Rocky Gleason (PNHP)

Common whitetail (*Libellula lydia*) - female

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

Clearing of forests, wetlands and other natural habitats for development creates biological islands of isolated natural areas. It can be difficult for animals to move long distances across unsuitable habitat and navigate large obstacles such as highways and developed areas. Some stronger flying odonates are able to evade these obstacles; however other species are not strong flyers or are disinclined to fly any great distance from their preferred type of habitat. For those species that can travel large distances, there is increased risk that they will not be able to find suitable habitat at the end of their journey in a fragmented landscape with diminished habitat.

Butterflies and Moths of Cameron County

There are an estimated 765 species of butterflies and 10,500 moths in the United States and Canada (Covell 1984). The varied habitats present within Pennsylvania support 154 species of butterflies, and up to 1,200 species of moths (PNHP data).

Butterflies and moths are characterized by a coiled, tubular mouthpart called the proboscis which is used to drink nectar. Under magnification, each wing reveals thousands of neatly arranged scales of different colors. While identification of species can be challenging, like birding, many people now enjoy the challenge of tracking down life-list species. Butterflies and moths undergo a complete metamorphosis.

Sally Ray (PNHP)

Gray Hairstreak (*Strymon melinus*)

Their life cycles begin with a specific host plant, onto which the egg is laid. The egg then hatches and a tiny caterpillar (larva) emerges. As the caterpillar feeds and grows larger, it will shed its skin several times to allow for growth. The pupa stage emerges when a fully-grown caterpillar sheds its skin and exposes a protective shell. Inside this shell the transformation from caterpillar to adult takes place. After a period of time that varies from species to species, the adult emerges and the moth or butterfly takes off on its maiden flight.

Butterflies and moths are closely related insects, and they share many common features. They have similar life histories, and they utilize a similar suite of habitats. However, there are important differences between the two groups. Moths typically land and spread their wings open flat, while butterflies will often land and close their wings together over their back, or at 45-degree angles (the skippers). Moths are typically most active at night and butterflies fly during the day. Butterfly pupae have a smooth exterior called a chrysalis, while moth pupae form a cocoon, which is typically wrapped in silky fibers. Many butterflies and moths depend not only on specific habitat, but also on a single species of plant within that habitat. For example, the monarch butterfly (*Danaus plexippus*) only uses milkweeds (*Asclepias* spp.) as its larval food plant. Therefore, maintenance of populations of the host plants for these insects is vital for the continued success of these species.

Tiger Beetles of Cameron County

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

Table 9. Tiger beetle species documented in Cameron County by PNHP staff during the 2008 and 2009 field seasons

Cicindela limbalis	Common Claybank Tiger Beetle
Cicindela patruela	Northern Barrens Tiger Beetle
Cicindela punctulata	Punctured Tiger Beetle
Cicindela purpurea	Cow Path Tiger Beetle
Cicindela rufiventris	Eastern Red-bellied Tiger Beetle
Cicindela sexguttata	Six-spotted Tiger Beetle

Tiger beetles come in a variety of colors, including brilliant green, orange, brown, grayish black, and often have white spots on the wing covers. They are approximately one-half inch (10-21 mm) long. Tiger beetles are predators, generally eating smaller insects such as flies and ants. They move swiftly over the ground, and, unlike most other beetles, take flight without a split second's hesitation when approached. Because they hunt by running, they are usually restricted to areas with exposed substrate such as soil, sand, or small rocks, without dense vegetation. Different species have highly specific preferences for habitat, and these exposed habitats are usually created by disturbance. Some species use habitat created by human disturbance, such as quarries or the compacted soil along foot trails, but many other species live along streams and rivers in habitats created by natural disturbance. These riverine habitats, including vertical clay banks, cobble scours, and sand bars, are created and maintained by the fast-flowing water of natural flooding regimes. Protection of tiger beetles revolves around the maintenance of natural flooding regimes and streamside riparian vegetation in watersheds where these species occur. Reduction of these floods by dam construction allows vegetation to grow on previously scoured areas, and prevents the formation of new sandbars. Exotic invasive plants such as Japanese stiltgrass (*Microstegium vimineum*) can quickly colonize bare sand sites and thus prevent tiger beetles from using them. The presence of a diverse assemblage of tiger beetle species along a waterway is an indicator of a healthy stream, that is, a stream with a natural disturbance regime that creates a diversity of bare soil features.

Rocky Gleason (PNHP)

Eastern Red-bellied Tiger Beetle (*Cicindela rufiventris*)

"Orphan Taxa" of Cameron County

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

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

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

In Pennsylvania, shell diameters of adult land snails range from 1 to 25 mm (1/25 to 1-1/8 inch). We are more likely to notice the larger snails, particularly during moist weather when the mollusks are most active, but the Commonwealth is also home to many of the less conspicuous micro-snails of which half of the species are 1-3 mm (1/25 to 1/8 inch) as adults. Despite their diminutive size, even these micro-snails play critical roles in Pennsylvania's food webs.

Marla Coppolino

Eight species of native snails placed on a penny for scale

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

Land snail populations are declining across North America with habitat destruction and change being the primary threat (Lydeard et al. 2004). Because land snails are strongly influenced by moisture, changes in hydrology can alter snail populations. Activities such as wall mining, damming, road building and vegetation changes are just a few of those noted in causing land snail declines. Invasive plants can alter microhabitats, and exotic animals such as Norway rats and terrestrial flatworms directly prey on our native land snails. Invasive snails and slugs can compete with, and sometimes outcompete, native land snail species (Rollo 1983a, b). Other threats to land snails include acid precipitation, which can interfere with their ability to acquire calcium for their shells, and global climate change which will alter temperatures and moisture patterns. The quintessentially slow moving snails might be unable to cope with these shifting habitats.

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

Summary of the Animals of Cameron County and Conservation Planning Application

This text has been created by examining the range maps, museum records, databases, various monographs and publications, as well as on the ground observations by Pennsylvania Natural Heritage Program scientists. While this information has been based on decades of scientific research and inventories, the secretive and reclusive nature of many of these animals makes surveying for them difficult, and therefore this description of the faunal diversity of Cameron County is likely not complete.

Cameron County is highly diverse in terms of the habitats available to mammals, birds, reptiles, amphibians, fish, and terrestrial and aquatic invertebrates. Here, as in many other portions of the state, most habitats are fragmented, and the ecosystems necessary for the survival of many species have become small blocks within a matrix of inhospitable habitat. Development of land, splitting of habitats by impassable barriers such as roads and highways, drainage of wetland areas, and environmental degradation have all served to confine many animal species to very localized populations. This reduces their ability to survive any major change in food resources, availability of nesting habitat or increased predation. These populations may be doomed to what is termed as localized extinction. If enough of these populations disappear from the landscape, these species' existence in Pennsylvania may be in jeopardy.

Today, Cameron County is a destination for a number of recreational and tourism interests, including many that rely on the natural resources of the county such as hunting, fishing, hiking, biking, canoeing and boating, and wildlife observation and photography. At present, the county does not appear to be affected by uncontrolled and unplanned growth, as is the case in many other Pennsylvania counties. Large blocks of forest land, and vegetated stream corridors serve as avenues of dispersal to the diverse list of animals noted to occur in the county. Enlightened management and continued vigilance will ensure that the list of animal species occurring in Cameron County will not be shortened and may provide opportunities to all Pennsylvanians to enjoy the state's wildlife. This in turn will enhance the county's wealth as the ecotourism industry beginning to flourish in Pennsylvania gains strength.

METHODS

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

Site Selection

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

Ground surveys were scheduled for sites identified as potential inventory sites. Initial study of aerial photographs revealed large-scale natural features (e.g. contiguous forest, wetlands) and disturbances (e.g., utility line rights –of-way, surface mines, timbered areas). Information concerning extent, quality, and context within the landscape can be gathered easily from the air. Based on aerial photo interpretation and aerial surveys, some sites were eliminated from consideration if they proved to be highly disturbed, fragmented, or lacked the targeted natural feature.

Ground Surveys

Areas identified as inventory sites were scheduled for ground surveys. Ecologists conducted field surveys throughout Cameron County from 2008 through 2011. After obtaining permission from landowners, sites were examined to evaluate the condition and quality of the habitat and to classify the communities present. Field survey forms were completed for each site. Using location data collected with Global Positioning Systems (GPS), boundaries for each site were determined using USGS 1:24,000 topographic maps and PAMAP aerial photography. Voucher specimens collected as part of this project were processed and have been archived in various museum collections including the Carnegie Museum of Natural History, the State Museum of Pennsylvania, the Academy of Natural Sciences, and the Cleveland Museum of Natural History among others. The flora, fauna, level of disturbance, approximate age of forest community and local threats were among the most important data recorded for each site. In cases where landowner permission for site visits could not be obtained or enough existing information was available from other sources, sites were not ground surveyed.

Data Analysis and Mapping

Data on species of concern and natural communities obtained during the field work for this inventory were combined with existing data and summarized. Plant and animal nomenclature follows that adopted by the Pennsylvania Biological Survey (PABS). Natural community descriptions primarily follow Fike (1999). All sites with rare species and/or natural communities of concern were selected for inclusion in Natural Heritage Areas. Spatial data on the elements of concern was compiled in a Geographic Information System (GIS; ESRI ArcGIS 10.0). Boundaries defining core habitats and supporting landscapes for each Natural Heritage Area were delineated using PNHP conservation planning specifications for the species of concern. These specifications are based on scientific literature and professional judgment for individual species or animal assemblages and may incorporate physical factors (e.g., slope, aspect, hydrology), ecological factors (e.g.,

species composition, disturbance regime), and input provided by agency biologists. Boundaries tend to vary in size and extent depending on the physical characteristics of a given Natural Heritage Area and the ecological requirements of its unique natural elements. For instance, two wetlands may require very different areas to support their functions if one receives mostly ground water and the other receives mostly surface water. The Natural Heritage Areas were then assigned a significance rank based on their importance to the biological diversity and ecological integrity of Cameron County. These ranks can be used to help prioritize future conservation efforts.

Natural Heritage Areas & Conservation Planning Categories

To provide the information necessary to plan for conservation of biodiversity at the species, community and ecosystem levels, two types of Natural Heritage Areas, (see below) are included in the report.

Natural Heritage Areas

A Natural Heritage Area is a location containing one or more plants or animals of concern at state or federal levels, exemplary natural communities, or exceptional native diversity. Natural Heritage Areas include both the immediate habitat and surrounding lands important in the support of these elements. They are mapped according to their sensitivity to human activities, with designations of Core Habitat and Supporting Landscape.

Conservation Planning Application:

Core Habitat delineates the essential habitat that cannot absorb significant levels of activity without substantial impact to the elements of concern.

Supporting Landscape indicates the habitat needed to maintain vital ecological processes or secondary habitat that may be able to accommodate some types of low-impact activities.

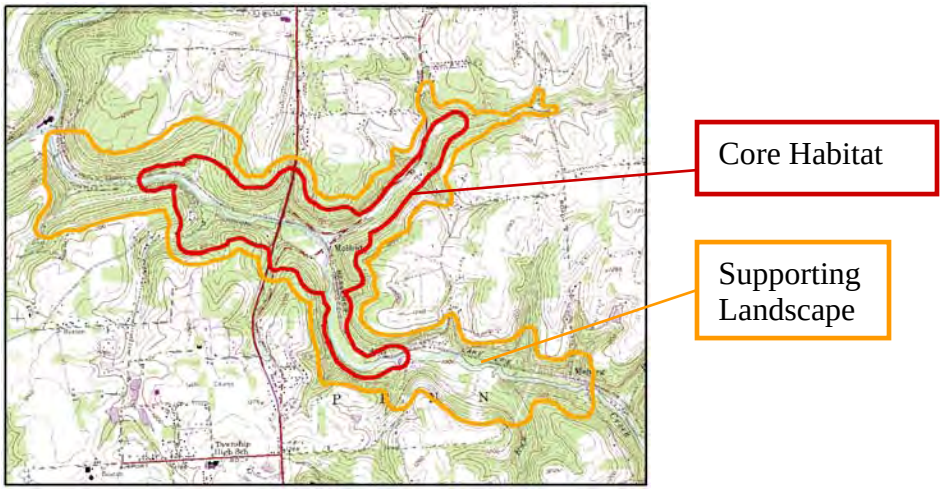


Table 1. Natural Heritage Area significance ranks.	
Significance Rank	**Description**
exceptional significance	Natural Heritage Areas that are of exceptional importance for the biological diversity and ecological integrity of the county or region contain one or more occurrences of state or global species of concern with the highest NatureServe ranks (G and S rank; see Appendix I) or a rare natural community type that is of a relatively large size and undisturbed condition. Natural Heritage Areas of exceptional significance merit quick, strong, and complete protection.
high significance	Natural Heritage Areas that are of high importance for the biological diversity and ecological integrity of the county or region contain one or more occurrences of state or global species of concern with moderate NatureServe ranks (G and S rank; see Appendix I) or a rare natural community type that because of its size, and/or relatively undisturbed setting, rate as areas with high potential for protecting ecological resources in the county. Natural Heritage Areas of high significance merit strong protection within the context of their quality and degree of disturbance.
notable significance	Natural Heritage Areas that are important for the biological diversity and ecological integrity of the county or region contain occurrences of species of concern or natural communities that are either of lower NatureServe rank (G and S rank; see Appendix I) or smaller size and extent than exceptional or high ranked areas, or are compromised in quality by activity or disturbance. Natural Heritage Areas of notable significance merit protection within the context of their quality and degree of disturbance.
local significance	Natural Heritage Areas that have great potential for protecting biodiversity in the county but are not currently, known to contain species of concern or state significant natural communities. Often recognized because of their size, undisturbed character, or proximity to areas of known significance, these sites are in need of further survey and investigation. In some cases, these Natural Heritage Areas could be revealed as high or exceptional sites.

RESULTS

The preparation of this report has resulted in the identification of 29 Natural Heritage Areas. These are discussed in turn, arranged alphabetically by Township. To conserve the native biological diversity of Cameron County, we recommend the use of a two-tiered approach to selecting areas for their contribution to conservation. The fine-filter/coarse-filter approach focuses attention on both the immediate habitat of the at-risk species, as well as the larger landscape scale processes that help to keep common species common.

- The fine-filter approach targets protection of uncommon species that generally occur in specialized and discrete habitats. Focusing conservation efforts on these smaller habitats will help defend these species from local, or in some cases global, extinction. This fine-filter approach has been the focus of our field studies to find locations of these unique species and their habitats, and to draw attention to the potential for their inadvertent destruction. These at-risk species and their habitats are described in the section describing Natural Heritage Areas.

- The coarse-filter approach suggests that whole suites of species as well as general ecological and environmental processes can be offered protection by focusing conservation efforts on large expanses of quality habitats of all types. We address the coarse filter approach by highlighting the largest unfragmented forest and natural habitats as well as riparian corridors.

The fine filter approach is characterized on the township maps by highlighting the species or natural communities of concern core habitats and supporting landscapes. The coarse filter approach to conservation is characterized on the maps by highlighting the large forested blocks and all riparian corridors for that township. Through a combined effort of these two approaches, we can help to assure that uncommon species avoid local or global extinction, and that common species remain common in Cameron County.

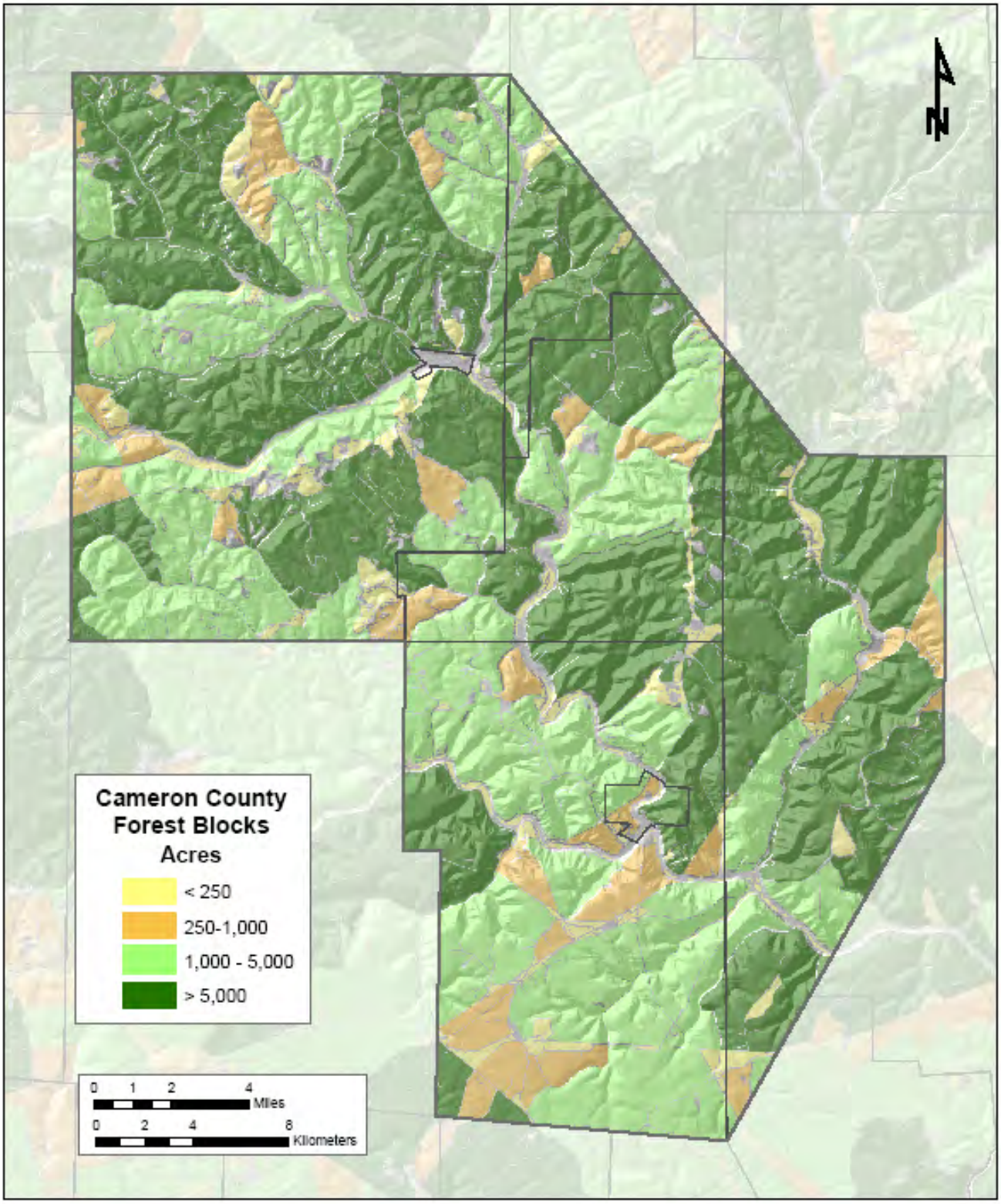


Figure 12. Contiguous forested blocks of Cameron County ranked by size.

Riparian Area Recommendations

Land use adjacent to waterways and wetlands has a direct influence on water quality and aquatic habitat. Riparian areas are lands directly adjacent to and upslope of streams, creeks, and rivers. Forested and other natural vegetation typically provides the greatest water quality benefits by trapping and filtering pollutants including sediments and nutrients. In addition to the direct effects on streams, naturally vegetated riparian areas provide terrestrial habitat to many animal and plant species. Establishing riparian buffers to protect and restore stream and associated stream habitat will benefit the environment and human health.

Charlie Eichelberger (PNHP)

Creek and river channels are dynamic, and move over time. When this cabin was built the location was undoubtedly thought to be a safe distance from the creek. As the creek channel naturally shifted over the years, the foundation was undercut and the home was destroyed. Careful planning which incorporates riparian buffers could avoid problems such as this. Land use changes should maintain a respectful wide berth to Cameron County's floodplains and waterways.

The literature varies with regard to buffer distances. Wetland buffers of 35-100 feet (~10-30m) are thought to be sufficient for maintenance of water quality (Wenger 1999); however, many of these buffer recommendations do not take wildlife habitat into account. Recent studies have increased our knowledge of the relationship between wildlife and their use of riparian buffers. For example, wetland buffers of 50-100 feet (~15-30m) were once thought to be sufficient to protect vernal pool amphibians, however, recent research concludes that buffers of this size are inadequate to protect terrestrial habitats for amphibians and reptiles (Semlitsch & Brodie 2003). As the size of a buffer increases, the effectiveness of that buffer to provide for water quality, flow, and wildlife habitat expand (Wenger 1999, Palone & Todd 1997).

To best account for the variety of corridor width related to ecological function, we suggest a general width of 330 feet (~100m) from each side of the creek bank to maintain the water quality of the stream as well as to support many of the species of wildlife found in these sites. Using this method, buffer zones are uniform in width and therefore easy to apply. Areas within this buffer should remain as undisturbed as possible, including limiting timber harvesting.

Another approach that can be tailored to a particular location involves calculating buffer width based on site specific variables (Wenger 1999). The basic methodology is as follows:

- Base width: 100 feet (~30.5m) from stream edge plus 2 feet per 1% of slope;
- Extend to edge of the floodplain if the floodplain is larger than 100 feet (~30.5m);
- Include adjacent wetlands. The buffer width is extended by the width of the wetlands, which guarantees that the entire wetland and an additional buffer are protected;
- Existing impervious surfaces in the riparian zone do not count towards the buffer width (i.e. the width is extended by the width of the impervious surface, just as it is for wetlands);

- Slopes over 25% do not count towards the width (buffer width is increased by the length of the slope >25%);
- The buffer should be applied to all perennial and intermittent streams

This analysis results in buffer zones that may be wider or narrow than uniform buffers described above, as the topography and land use determine width of these buffers. These buffers were not created for any one particular species but are thought to overlap the habitats used by both common and rare species found at these sites. Certainly, expanding these buffers further will still provide water quality protection while increasing habitat for species requiring larger forested buffers.

These modeled riparian buffers are presented on the township maps later in this report. Where riparian buffers coincide with patches of forest, that segment of the riparian buffers should be considered a priority for conservation. Conversely, where unforested land intersects the recommended riparian buffer, these represent areas that may be considered priorities for restoration to a forested condition.

Many local governing bodies at the county, municipal, or district level provide additional guidance or regulation regarding riparian buffers. Wenger and Fowler (2000) indicated that establishing and enforcing regulations for variable-width buffers contingent upon local land use, slope, soil type, etc. are most difficult and instead suggest a fixed-width buffer ordinance for clarity and ease of enforcement.

Rocky Gleason (PNHP)

In addition to housing habitat for both common and rare species, Cameron County's stretches of Sinnemahoning Creek are quite picturesque.

Natural Heritage Areas

Detailed maps and descriptions of Cameron County's Natural Heritage Areas are presented in the following sections, each organized by township. For each township, a map, a summary table, and a full description, including threats and disturbances and conservation recommendations, are provided. State Public Lands are indicated on the maps as public properties established and managed to a large extent for natural resources and/or those that have the potential to manage such resources in order to maintain or enhance important ecological assets in the county. Examples include State Game Lands (PGC), State Forests and State Parks (DCNR), and County Parks. Townships are arranged alphabetically, and boroughs and cities have typically been lumped with the surrounding or adjoining township due to their small size.

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

- A categorical designation of a Natural Heritage Area's significance relative to other Natural Heritage Areas in the county is listed after the name of the Natural Heritage Area. Definitions of the significance categories are outlined in table 1.
- Listed under each Natural Heritage Area name are any species of concern and state-significant natural communities that have been documented within the delineated Natural Heritage Area.
    - See *Terrestrial and Palustrine Communities of Pennsylvania* for a list of natural communities recognized in Pennsylvania, available in Adobe PDF at: www.naturalheritage.state.pa.us.
    - Some species perceived to be highly vulnerable to intentional disturbance are simply referred to as "sensitive species of concern" rather than by their species names to avoid the potential direct harm to these occurrences.*
    - The PNHP (Pennsylvania Natural Heritage Program) rarity ranks and current legal status (detailed in Appendix II) are listed for each species or natural community of concern.
- The text that follows each table discusses the natural qualities of the Natural Heritage Area and includes descriptions, threats and stresses, and conservation recommendations.

*A note about sensitive species

As stated above, several species are considered "sensitive species" by a jurisdictional agency overseeing their protection (i.e. DCNR, PGC, PFBC, and/or the USFWS). Reasons for sensitive species status include extreme rarity, collection for the pet or nursery trade, disturbance due to public observation, or deliberate poaching and killing. Therefore, these species are referred to simply as 'species of concern'. In certain cases, some species (e.g. timber rattlesnakes, bald eagles) are not mapped due to large home ranges and high sensitivity to disturbance. For this reason, the environmental review process may pick up a "hit" for species not presented in this report.

NATURAL HERITAGE AREAS:	PNHP rank[1]		State Legal Status[1]	Last Seen	Quality Rank[1]
	Global	State	(proposed)		
Fred Woods Trail			*Notable significance*		
A Noctuid Moth (*Lemmeria digitalis*) - lepidoptera	G4	S2S4	--	2009Sep24	E
Erosional remnant – geologic feature	GNR	SNR	--	N/A	E
Laurel Draft Headwaters			*Notable significance*		
Atlantis Fritillary (*Speyeria atlantis*) - lepidoptera	G5	S3	--	2009Aug13	E
Azure Bluet (*Enallagma aspersum*) - odonate	G5	S3S4	--	2009Aug13	E
Laurel Draft Headwaters Vernal Pool			*Notable significance*		
Ephemeral/fluctuating natural pool – natural community	GNR	S3	--	2008May2	E
Meeker Run Headwaters			*Notable significance*		
Creeping snowberry (*Gaultheria hispidula*) - plant	G5	S3	PR (PR)	2008Jul24	AB
Red Run and Wycoff Run Headwaters			*Exceptional significance*		
White-faced meadowhawk (*Sympetrum obtrusum*) - odonate	G5	S3S4	--	2007Sep5	E
Screw-stem (*Bartonia paniculata*) - plant	G5	S3	P (NR)	2008Sep11	C
Slender wheatgrass (*Elymus trachycaulus*) - plant	G5	S3	N (TU)	2008Sep11	C
Creeping snowberry (*Gaultheria hispidula*) - plant	G5	S3	PR (PR)	2008Sep11	B
Downy lettuce (*Lactuca hirsuta*) - plant	G5?	S3	N (TU)	2009Jul23	BC
Netted chainfern (*Woodwardia areolata*) - plant	G5	S2	N (PT)	2009Jul23	B
Sensitive species of concern [2]	--	--	--	2009May19	E
Hemlock - mixed hardwood palustrine forest – natural community	--	--	--	1984Jul25	E
Cotton-grass poor fen – natural community	--	--	--	1984Jul25	E
Ridgeline between Grove Run and Lick Island Run			*Notable significance*		
Common Claybank Tiger Beetle (*Cicindela limbalis*) - beetle	G5	S3	--	2009Sep3	E
Ridgeline between Lick Island Run and Gravelly Run			*Notable significance*		
Common Claybank Tiger Beetle (*Cicindela limbalis*) - beetle	G5	S3	--	2009Sep3	E
Ephemeral/fluctuating natural pool – natural community	GNR	S3	--	2008May2	E
Ridgeline between Wycoff Run and Upper Jerry Run			*Notable significance*		
Bracken Borer Moth (*Papaipema pterisii*) - lepidoptera	G5	SNR	--	2009Aug25	E
Wykoff Run Tributaries			*High significance*		
Northern water shrew (*Sorex palustris albibarbis*) - mammal	G5T5	S3	(CR)	2009Jun2	E

PUBLICLY MANAGED LANDS: Elk State Forest, Moshannon State Forest, Bucktail State Park, Johnson Run Natural Area, Quehanna Wild Area, Square Timber / Big Run Proposed Wild Area, Wycoff Run Natural Area

OTHER CONSERVATION AREAS: Northern Allegheny Plateau IMA; Quehanna Wild Area IBA

EXCEPTIONAL VALUE/HIGH QUALITY STREAMS: *EV*: Twelve Mile Run; *HQ*: Dry Run, Foley Branch, Gravel Lick, Grove Run, Hicks Run, John Mason Run, Johnson Run, Left Fork Grove Run, Left Fork Miller Run, Lick Island Run, Lower Three Runs, Mason Grove Run, Mecker Run, Miller Run, Mix Run, Nelson Run, Panther Run, Pepperhill Run, Red Run, Right Fork Big Run, Tanglefoot Run, Trout Hole Run, Twelvemile Run, Upper Jerry Run, Wykoff Run.

[1] Please refer to Appendix II for an explanation of PNHP ranks, legal status and quality ranks
[2] This species is not named at the request of the agency overseeing its protection

Cameron County
Natural Heritage Inventory

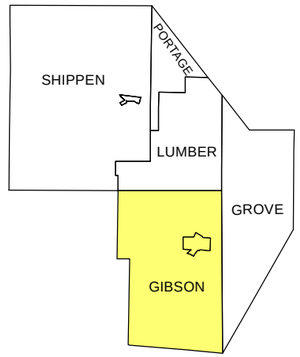
Gibson Township & Driftwood Borough

Natural Heritage Areas

- Fred Woods Trail
- Laurel Draft Headwaters
- Laurel Draft Headwaters Vernal Pool
- Meeker Run Headwaters
- Red Run and Wycoff Run Headwaters
- Ridgeline between Grove Run and Lick Island Run
- Ridgeline between Lick Island Run and Gravelly Run
- Ridgeline between Wycoff Run and Upper Jerry Run
- Wycoff Run Tributaries

State Public Land

- Bucktail State Park Natural Area
- Elk State Forest
- Johnson Run Natural Area
- Moshannon State Forest
- Quehanna Wild Area
- Square Timber / Big Run Proposed Wild Area
- Wykoff Run Natural Area



Legend

Natural Heritage Areas

- Core Habitat
- Supporting Landscape

Streams

National Wetland Inventory

100-year Floodplain

Recommended Riparian Buffer

Forest Blocks by Acre

- < 250
- 250 - 1000
- 1000 - 5000
- > 5000

- Municipal Boundary
- PA DCNR
- PA Game Commission
- 200 Ft. Contour Line

0 0.5 1 2 3 4 5 Kilometers

0 0.5 1 2 3 4 5 Miles

Gibson Township completely surrounds the borough of Driftwood, and for mapping simplicity, Driftwood Borough has been grouped with Gibson Township. These two municipalities make up 62,502 acres (25,294 ha, 97.7 square miles). The highest mountaintops in the township peak at over 2,220 feet and are underlain by Pottsville sandstone and associated conglomerate. The lowest point in Gibson Township is at 780 feet, where the Sinnemahoning Creek exits the township to the east. The bedrock of the township is primarily sandstone, with portions of conglomerate and some thinner beds of shale, siltstone, claystone, limestone and coal. The Burgoon Sandstone, along the upper slopes in the southeastern portion of the township, is known to contain plant fossils.

Less than 1% of Gibson Township is developed, under 6% is in agriculture, and the remaining portions of the township are forested. The majority of the land in Gibson Township is owned by DCNR Bureau of Forestry and is split between the Moshannon and Elk forest districts.

Bennett's Branch and a small stretch of the Sinnemahoning Creek are classified as "impaired" for aquatic life by DEP because of abandoned mine drainage.

Rocky Gleason (PNHP)

These impressive slot canyons, resembling outdoor hallways, are found along "Fred Woods Trail" in Gibson Township. Chiseled inscriptions in the walls of the outcrops indicate the esteem this unique place has had to its visitors for many years.

Fred Woods Trail

About 1 mile directly north of the village of Mix Run is a series of weathered sandstone outcrops which have weathered in such a way that deep, narrow hallways now exist between large blocks of the stone. These "hallways" have been formed and expanded by the repeated action of freezing and thawing. The chiseled inscriptions on the walls of the sandstone are evidence that this place has served as a place of wonder for centuries. This place is not only special for this impressive **unique geologic feature**, which is the only one of its type listed in the two volumes of the *Outstanding Scenic and Geologic Features of Pennsylvania* (Geyer & Bolles 1979, 1987), but also serves as critical habitat to a moth species of concern. Known simply as "a Noctuid moth", little is known about the life history of ***Lemmeria digitalis***.

Threats and Stresses:

During recent surveys of this site, no active threats were noted, however, the site is situated within Elk State Forest, and timbering of the area could alter the habitat in the future. Additionally, the site could be compromised by forest fragmentation, decreases in air and water quality, and elevated light and noise levels associated with shale gas development.

Conservation Recommendations:

Being that the site is on Elk State Forest land, the conservation of the unique features found at the site will depend on sound forestry practices which keep the needs of these elements in mind. Other non-forestry related development or infrastructure will require careful planning to avoid complications with the species of concern, and the unique geologic feature found at this site to be sure that natural character and value to biodiversity conservation is not affected.

Laurel Draft Headwaters

Populations of two species of concern were recently noted from this site, a butterfly the **Atlantis fritillary (*Speyeria atlantis*)**, and a damselfly the **azure bluet (*Enallagma aspersum*)**. The Atlantis fritillary is known as a boreal species of the north, favoring boggy glades, forest openings, and wet meadows along stream corridors. Females deposit eggs in the fall, which hatch in just a few weeks. After overwintering as instars, they develop into caterpillars and feed on species of violets (*Viola* spp.), often at night, until metamorphosing into adults in early summer. The azure bluet is a moderately sized damselfly which can be seen cruising many different types of water bodies and waterways as it forages for flies, midges, and mosquitoes. The species depends on high water quality for reproduction, as the aquatic larvae and intricate food webs they depend upon, are vulnerable to pollution events.

Threats and Stresses:

Careful planning for spraying for gypsy moth control in the area will be needed to avoid negatively impacting the population of Atlantis fritillary at this site given that some of the compounds used for gypsy moth control affect all species of moths and butterflies.

Conservation Recommendations:

In order to protect the populations of species of concern found at this site, maintaining the high water quality of the stream corridor should be paramount given the reliance of the azure bluet population on the pristine waters of Laurel Draft. Additionally, spraying for gypsy moth control should observe a wide berth to the site to minimize impact on the Atlantis fritillary population at the Laurel Draft Headwaters site.

Rocky Gleason (PNHP)

The Atlantis fritillary (*Speyeria atlantis*) is a striking species more common to the north.

Laurel Draft Headwaters Vernal Pool

Perched atop the plateau between Laurel Run and Foley Draft is a single **ephemeral/fluctuating natural pool**, also known as a vernal pool. These wetlands are seasonal, and often dry completely in the hot summer months. This cyclic drying pattern keeps fish populations from becoming established. Without predatory fish, many species of amphibians can successfully breed and the young develop in relatively safe waters. Some of these species, such as the wood frog (*Lithobates sylvaticus*) and the spotted salamander (*Ambystoma maculatum*) are specially adapted to breed in vernal pools. While these particular species are not considered species of concern, the unique natural communities they depend on are considered vulnerable in the Commonwealth. Vernal pools serve not only the breeding amphibians, but a host of other organisms including plants, invertebrates, and are important habitats used by mammals, birds, and reptiles. During the most recent survey of the site, the turbidity of the water and lopped vegetation suggested that the pool is used by elk and deer.

Charlie Eichelberger (PNHP)

The Laurel Draft Headwaters Vernal Pool serves as an oasis water source for many species of wildlife on the largely dry plateau.

Threats and Stresses:

Any disturbance within the watershed of the pool could impact the flora and fauna that depend upon this habitat including changes in the pattern of drainage, creation of clearings or rights-of-way, or loss of cover and tree canopy.

Conservation Recommendations:

More survey work is needed at this site to assess the flora of the pool. Vernal pools are quite uncommon in Cameron County. They often occur in clusters, with some pools annually being more critical for the amphibian populations to breed. When the pools are isolated, like the Laurel Draft Headwaters Vernal Pool site, the amphibians have no other options for breeding and concentrate in these single pools. It is also important to remember that the pool itself is critical for the breeding amphibians, but these species migrate to the pools and frequently move hundreds or more meters from the pools into the uplands for the rest of the year. Therefore, keeping the upland habitats intact around these unique wetlands is just as important for the persistence of these amphibian populations. The siting of any infrastructure associated with development must proceed with extreme caution to avoid disturbance to this unique natural community.

Meeker Run Headwaters

Recent surveys at the headwaters of Meeker Run, found where Cameron, Clearfield, and Elk Counties meet, uncovered an excellent population of **creeping snowberry (*Gaultheria hispidula*)**. This small shrub is characteristic of high-elevation, bog-like habitats, and grows in a sprawling mat-like fashion. It could be confused with the common and widespread partridge berry (*Mitchella repens*), but can be distinguished because the berries of snowberry are white and the leaves are alternate instead of opposite.

Threats and Stresses:

Changes to the hydrology of Meeker Run pose the greatest threat to the creeping snowberry population found in the wetlands at this site.

Conservation Recommendations:
Avoid forest fragmentation, decreases in water quality, hydrologic alterations, and elevated light and noise pollution associated with any form of development.


Charlie Eichelberger (PNHP)

Downy Lettuce (*Lactuca hirsuta*)

Red Run and Wycoff Run Headwaters

The complex of wetlands in this portion of the county comprises some of the most botanically interesting habitats in Cameron County. These high elevation expansive wetlands contain a mix of unique plants and animals. Two natural communities of concern occur in this area: **Cotton-grass poor fen** and **Hemlock – mixed hardwood palustrine forest**. These wetlands are dominated by Sphagnum mosses and the plants found here are noted for being acidic-loving "bog" species. While none of the wetlands in Cameron County are considered true bogs, the expansive wetlands provide specialized habitats for numerous plant and animal species, including several species considered rare in Pennsylvania. This Natural Heritage Area serves as critical habitat for **screw-stem (*Bartonia paniculata*)**, **slender wheatgrass (*Elymus trachycaulus*)**, **creeping snowberry (*Gaultheria hispidula*)**, **downy lettuce (*Lactuca hirsuta*)**, and **netted chainfern (*Woodwardia areolata*).** Also found in these wetlands was the **white-faced meadowhawk (*Sympetrum obtrusum*)**, a dragonfly of concern which utilizes wetlands, usually surrounded by forest, for breeding and foraging. This species is noted for being tolerant of more acidic waters, which is a good descriptor of the wetlands found at this site. An additional **sensitive species of concern**, which is not named at the request of the jurisdictional agency overseeing its protection, also occurs in this area.


John Kunsman (PNHP)

Netted Chainfern (*Woodwardia areolata*)


Charlie Eichelberger (PNHP)

Creeping Snowberry (*Gaultheria hispidula*)

Threats and Stresses:
This site is completely within the bounds of the Quehanna Wild Area, and the Wykoff Run Natural Area, and is therefore granted more stringent restrictions on management. No management by humans is permitted in State Forest Natural Areas, while Wild Areas can receive management and are typically large areas managed as havens for their wild character and to provide backcountry recreational opportunities. For the most part, both of these designations are in harmony with the needs of the species of concern at the site. However, beavers have the capacity to greatly alter their habitat, and although they are not known from this site currently, their colonization of the wetlands could negatively affect the species of concern found at the site. By inundating shallower wetlands, beavers can flood out areas which now harbor species of concern which may lead to the loss of these species from the site.


Andrew Strassman (PNHP)

Screw-stem (*Bartonia paniculata*)

Conservation Recommendations:
The species of concern found at this site could be negatively impacted by disturbances associated with habitat alterations such as forest fragmentation, decreases in water quality and quantity, hydrologic alterations, and elevated light and noise pollution levels that can negatively impact the viability of populations of species both common and rare.

Ridgeline between Grove Run and Lick Island Run

Recent surveys just east of Grove Hill uncovered a population of the **common claybank tiger beetle (*Cicindela limbalis*)**, a species considered vulnerable in the Commonwealth. This relatively large tiger beetle inhabits open eroded shale outcrops and slopes, as well as dry open areas with little vegetation. This species of beetle has a three-year life cycle, overwintering beneath rocks or in loose soils, and becomes active during the early spring and then again in the late summer and early fall.

Threats and Stresses:
The common claybank tiger beetle relies on open, sparsely-vegetated habitats. Even manmade disturbances and clearings can serve as habitat for this species, and they are relatively tolerant of minor habitat alterations.

Conservation Recommendations:
This species is relatively tolerant of habitat disturbances. However, the common claybank tiger beetle is also a habitat specialist, and the known occupied habitats should remain as they currently exist to avoid direct loss of these populations and patchy habitats.

Ridgeline between Lick Island Run and Gravelly Run

About a mile to the northeast of Grove Hill is a manmade opening, likely created for elk habitat. While most of the opening is planted with forbs, patches of this opening have exposed soils, providing habitat for a population of the **common claybank tiger beetle (*Cicindela limbalis*)**. This species inhabits sparsely vegetated areas with loose stony or sandy soils. In addition to this occurrence, two relatively small **ephemeral/fluctuating natural pools**, more commonly known as vernal pools, are situated within the forest surrounding the food plot. These pools are important for a number of species of amphibians, specialized to breed in these fish-free habitats. Vernal pools are also important habitats for a number of invertebrates species, as well as some plants which can thrive in these seasonally flooded wetlands. Vernal pools are not only important for these breeding amphibians, but the pools are also used by many mammals, birds, and reptiles.

Threats and Stresses:
Changes in hydrology, loss of forest buffer, or direct disturbance to the pools could impact the species that depend upon this specialized habitat. Currently, there are no apparent activities that would result in such changes.


Charlie Eichelberger (PNHP)

A view of one of the vernal pools found at the Ridgeline between Lick Island Run and Gravelly Run site.

Conservation Recommendations:
Any future development or resource extraction must proceed with extreme caution to avoid impacting the population of the common claybank tiger beetle, as well as the vernal pool natural community. The forest surrounding the pools should be left to regenerate and a 300 meter upland buffer established around the wetlands themselves to provide the terrestrial habitat needed by the amphibians which use the pool to breed.

Ridgeline between Wycoff Run and Upper Jerry Run

Recent invertebrate surveys of the site using a blacklight, a tool developed to sample nocturnal invertebrates, uncovered a population of the **bracken borer moth (*Papaipema pterisii*)**. Bracken borer moths favor dry, open woodlands with the host plant, bracken fern (*Pteridium aquilinum*). Known for being a late flyer, the bracken borer moth is typically only observed from August through October. Colonies of this species may cover large areas of ground, given the relative commonness of the host plant.

Threats and Stresses:
Being on State Forest land, this site is safe from land use changes for the most part. Indiscriminate spraying for gypsy moth control to alleviate defoliation of timber has negative impacts on all of the species of Lepidoptera (the moths and butterflies), including non-target species of concern. Spraying for gypsy moth control in this area would likely impact this population of bracken borer moths.

Conservation Recommendations:
Land use changes that lead to an increase in forest fragmentation, decrease in water quality and quantity, cause hydrologic alterations, and elevate light and noise pollution levels should be carefully planned to ensure no negative effects occur to the population of bracken borer moth found at this site. Spraying for gypsy moth control should keep a generous distance from this site to avoid direct mortality of this species of concern.

Wykoff Run Tributaries

The tumbling waters of Wykoff Run Tributaries are cold, high-quality waters surrounded by forest. The ample streamside crevices are prime habitat for the **northern water shrew (*Sorex palustris albibarbis*)** which was documented here by PNHP biologists in 2009. This insectivorous species, which actually dives to forage on aquatic invertebrates such as caddisfly, mayfly and stonefly nymphs, has similar food and habitat requirements to Pennsylvania's only native stream trout species, the brook trout (*Salvelinus fontinalis*). Like the brook trout, the northern water shrew is an excellent indicator of high water quality because the food webs that the shrew relies on are so fragile to pollution events.

Threats and Stresses:
During the most recent surveys of the site, no threats were noted. Habitat changes such as forest fragmentation, decreases in air and water quality, hydrologic alterations, increased forest road traffic, and elevated light and noise levels could all impact populations of species of concern. As an aquatic invertebrate specialist, the northern water shrew is particularly sensitive to changes in water quality.

Conservation Recommendations:
Land use changes that lead to an increase in forest fragmentation, decrease in water quality and quantity, cause hydrologic alterations, and elevate light and noise pollution levels should be carefully planned to ensure that the population of northern water shrews found in this area is able to persist.

Grove Township

NATURAL HERITAGE AREAS:	PNHP rank[1]		State Legal Status[1] (proposed)	Last Seen	Quality Rank[1]
	Global	State			
Brooks Run			*High significance*		
Northern myotis (*Myotis septentrionalis*) - mammal	G4	S1	(CR)	2009Jun4	E
Northern water shrew (*Sorex palustris albibarbis*) - mammal	G5T5	S3	(CR)	2011Jun7	E
First Fork Floodplain at Sinnemahoning Reservoir			*Exceptional significance*		
Ocellated darner (*Boyeria grafiana*) - odonate	G5	S3	--	2005Jun1	AB
Superb jewelwing (*Calopteryx amata*) - odonate	G4	S2S3	--	2005Jun1	B
American emerald (*Cordulia shurtleffi*) - odonate	G5	S3S4	--	2007Jun17	BC
Spinecrowned clubtail (*Gomphus abbreviatus*) - odonate	G3G4	S2	--	2005Jun1	AB
Mustached clubtail (*Gomphus adelphus*) - odonate	G4	S3S4	--	2007Jun17	BC
Harpoon clubtail (*Gomphus descriptus*) - odonate	G4	S1S2	--	2007Jun17	BC
Speckled Snout Moth (*Hypena atomaria*) - lepidoptera	GNR	SNR	--	2007Jun15	B
Northern pygmy clubtail (*Lanthus parvulus*) - odonate	G4	S3S4	--	2005Jun1	A
Skitailed emerald (*Somatochlora elongata*) - odonate	G5	S2	--	2007Jun16	E
Atlantis fritillary (*Speyeria atlantis*) - lepidoptera	G5	S3	--	2007Jun16	B
Northern water-plantain (*Alisma triviale*) - plant	G5	S1	PE (PE)	2007Jul31	CD
Large Toothwort (*Cardamine maxima*) - plant	G5	S2	(PT)	2007May31	B
Stalked bulrush (*Scirpus pedicellatus*) - plant	G4	S1	PT (PT)	2007Jul31	CD
Sensitive species of concern [2]	--	--	--	2008May1	E
Sensitive species of concern [2]	--	--	--	2009	E
Sensitive species of concern [2]	--	--	--	2007Jun16	E
Ridgeline between Grove Run and Lick Island Run			*Notable significance*		
Common Claybank Tiger Beetle (*Cicindela limbalis*) - beetle	G5	S3	--	2009Sep3	E
Ridgeline between Lick Island Run and Gravelley Run			*Notable significance*		
Common Claybank Tiger Beetle (*Cicindela limbalis*) - beetle	G5	S3	--	2009Sep3	E
Ephemeral/fluctuating natural pool – natural community	GNR	S3	--	2008May2	E
Short Bend Run			*High significance*		
Northern myotis (*Myotis septentrionalis*) - mammal	G4	S1	(CR)	2007Jul11	
Northern water shrew (*Sorex palustris albibarbis*) - mammal	G5T5	S3	(CR)	2007Jul10	

Sinnemahoning Creek Cliffs			*Exceptional significance*		
Allegheny Woodrat (*Neotoma magister*) - mammal	G3G4	S3	PT (PT)	1998Feb24	
Upper Jerry Run Slopes			*Local significance*		
American yew (*Taxus canadensis*) - plant	G5	S3S4	TU (watch)	2009Jun4	E
Wykoff Run Tributaries			*High significance*		
Northern water shrew (*Sorex palustris albibarbis*) - mammal	G5T5	S3	(CR)	2009Jun2	E
Woodland east of Short Bend Run			*High significance*		
Broad sallow moth (*Xylotype capax*) - lepidoptera	G4	S3	--	2008Oct1	E
Flypoison borer moth (*Papaipema* sp. 1) - lepidoptera	G2G3	S2	--	2008Oct1	E
Pointed sallow (*Epiglaea apiata*) - lepidoptera	G5	S3S4	--	2008Oct1	E

PUBLICLY MANAGED LANDS: Elk State Forest, Moshannon State Forest, Sproul State Forest, Sinnemahoning State Park, Bucktail State Park Natural Area, Lower Jerry Run Natural Area, M.K. Goddard Wild Area, Quehanna Wild Area

OTHER CONSERVATION AREAS: Northern Allegheny Plateau IMA

EXCEPTIONAL VALUE/HIGH QUALITY STREAMS: *EV*: Cook Run, First Fork Sinnemahoning Creek, Lebo Branch, Lushbaugh Run, Right Fork Beaverdam Run; *HQ*: Arksill Run, Berge Run, Birch Island Run, Bronson Run, Brooks Run, Commissioners Run, Ellicott Run, First Fork Sinnemahoning Creek, Gravelly Run, Joes Run, Left Branch Montour Run, Left Fork Brooks Run, Lick Island Run, Little Bailey Run, Logue Run, Lower Jerry Run, Middle Jerry Run, Mill Run, Montour Run, Muley Run, Norcross Run, Owl Run, Pfoutz Run, Rattlesnake Run, Right Fork Brooks Run, Short Bend Run, Thayer Run, Upper Jerry Run, Upper Logue Run, White Run, Woodrock Run, Wykoff Run

[1] Please refer to Appendix II for an explanation of PNHP ranks, legal status and quality ranks
[2] This species is not named at the request of the agency overseeing its protection

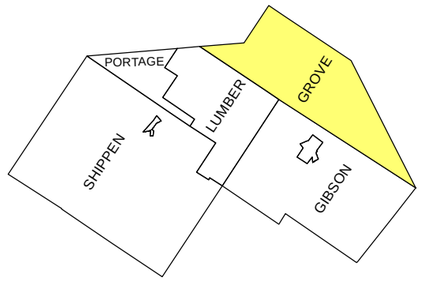
Cameron County
Natural Heritage Inventory
Grove Township

Natural Heritage Areas

- Brooks Run
- First Fork Floodplain at Sinnemahoning Reservoir
- Ridgeline between Grove Run and Lick Island Run
- Ridgeline between Lick Island Run and Gravelly Run
- Short Bend Run
- Sinnemahoning Creek Cliffs
- Upper Jerry Run Slopes
- Wycoff Run Tributaries
- Woodland east of Short Bend Run

State Public Land

- Bucktail State Park Natural Area
- Elk State Forest
- Lower Jerry Run Natural Area
- M.K.Goddard Wild Area
- Moshannon State Forest
- Quehanna Wild Area
- Sinnemahoning State Park
- Sproul State Forest



Legend

Natural Heritage Areas

- Core Habitat
- Supporting Landscape

Streams

National Wetland Inventory

100-year Floodplain

Recommended Riparian Buffer

Forest Blocks by Acre

- < 250
- 250 - 1000
- 1000 - 5000
- > 5000

Municipal Boundary

PA DCNR

PA Game Commission

200 Ft. Contour Line

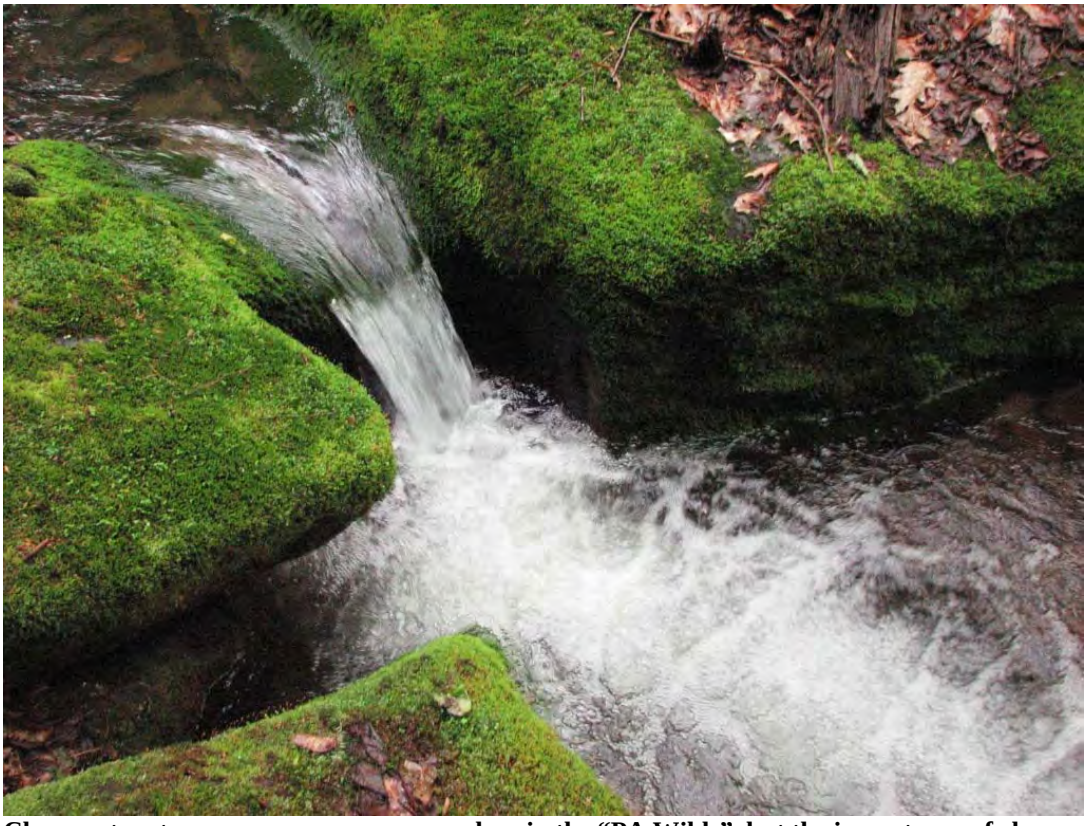
0 0.5 1 2 3 4 5 Kilometers

0 0.5 1 2 3 4 5 Miles

Grove Township covers 48,533 acres (19,641 ha, 75.8 square miles). The tallest peaks in Grove Township, at just over 2,300 feet, are underlain by Pottsville sandstone and conglomerate. The lowest portion of the township is 760 feet where the Sinnemahoning Creek has cut through the bedrock and exits the township and county to the east. The over 1,500 vertical feet in Grove Township have exposed thick layers of sandstone, with portions of conglomerate and some thinner beds of shale, siltstone, claystone, limestone and coal. The Burgoon Sandstone, along the upper slopes in the southeastern portion of the township, is known to contain plant fossils.

Under 1% of Grove Township is developed, less than 5% is in agriculture, and the remaining land is forested. Most of the Township is publicly owned by DCNR Bureau of Forestry. Elk, Moshannon and Sproul State Forests can be found within Grove Township. Bucktail State Park, which flanks the Sinnemahoning Creek is found in the southern part of the township, and Sinnemahoning State Park encompasses the First Fork of Sinnemahoning Creek and is found in the northern portion of the township. The George B. Stevenson Dam at Sinnemahoning State Park is the only remaining dammed impoundment in Cameron County.

The stretch of the Sinnemahoning Creek upstream of the confluence with the First Fork is classified as "impaired" for aquatic life because of abandoned mine drainage. Additionally, the First Fork below the George B. Stevenson Dam is classified as "impaired" for fish consumption because of mercury contamination.



Rocky Gleason (PNHP)

Clean water streams may seem commonplace in the "PA Wilds", but the importance of clean waterways to biodiversity conservation in this region cannot be overestimated. These streams, creeks, and rivers are part of the wild character of the region, which supports an eco-tourism industry that much of Cameron County's economy relies upon.

Brooks Run

Brooks Run is a shaded, cool, clean stream tumbling approximately 1000 feet to the confluence with the First Fork Sinnemahoning Creek at the reservoir. Surveys along this waterway have uncovered a population of the **northern water shrew (*Sorex palustris albibarbis*)** and **the northern myotis (*Myotis septentrionalis*)** a bat species of concern in the Commonwealth. The northern water shrew is an insectivore, specialized to feed on aquatic insects on the bottom of rock lined streams. The northern water shrew depends on healthy populations of prey items, which in turn depend on high water quality. Therefore, northern water shrews are a good indicator of high water quality and Brooks Run is known for its clean, cool waters. Some of the same species of insects that the northern water shrew feeds upon as larvae, will also feed the northern myotis when they hatch. This species of bat primarily lives in large forested areas, and frequently forages for aerial insects along clean mountain stream corridors.

Charlie Eichelberger (PNHP)

Manmade structures can serve as critical habitat for colonies of bats. Excluding bats from a house or outbuilding can be a very time consuming and costly endeavor. Building optimal structures for the bats to move to can be an alternative to attempting exclusion. While not every bat will move to these built structures, like this bat condo at Sinnemahoning State Park, creation of this additional habitat can provide the best mix between having bats around for their beneficial insect control, while reducing the negative effects caused by bats living in attics.

Threats and Stresses:
Forest fragmentation, decreases in air and water quality, hydrologic alterations, increases in forest road traffic, the spread of invasive plant species, and elevated light and noise levels can all impact populations of species of concern. Any future forestry practices in the Brooks Run watershed should afford the stream a substantial, untouched forested buffer to protect the population of northern water shrews and northern myotis foraging territory.

Conservation Recommendations:
At present, the northern water shrew population and northern myotis population at Brooks Run do not need management. However, forestry practices, watershed management, and development of any additional infrastructure should be well planned to avoid affecting the species of concern known to inhabit and forage along Brooks Run.

First Fork Floodplain at Sinnemahoning Reservoir

This portion of the First Fork of Sinnemahoning Creek has been greatly manipulated, primarily by the construction of the George B. Stevenson Dam and reservoir. Constructed in 1955, the reservoir covers 142 acres (~57ha) and is approximately 0.2 miles (~350m) wide and 1.7 miles (~2,800m) long. Typically, constructed reservoirs contain lower value to biodiversity conservation, but in this case, the rarity of open water habitats in Cameron County, and the substantial floodplain meadows and wetlands created by the reservoir provide habitat for a number of species of concern, including three plant species of concern: **large toothwort (*Cardamine maxima*), stalked bulrush (*Scirpus pedicellatus*)**, **northern water-plantain (*Alisma triviale*)**; **10 invertebrates of concern** including dragonflies, damselflies, moths and butterflies; and **three other species of concern** not named at the request of the agencies overseeing their protection.

Stresses and Threats:
Invasive plant species are a large threat to the biological integrity of this portion of the creek. The greatest offender is mile-a-minute weed (*Polygonum perfoliatum*), a prolific tangled annual vine which engulfs native vegetation in open canopied areas. This invasive exotic vine is particularly a problem in the open meadow portions of the floodplain. Mile-a-minute weed, as the name implies spreads very quickly and is unfortunately difficult to control. An effective, but time intensive way to control this invasive is to continually pull the stems. The plant is an annual, but unfortunately can maintain a seed bank which will last for several years, and requires diligent and frequent attention for successful eradication. Increased forest fragmentation, decreases in air and water quality, hydrologic alterations, increased forest road traffic, and elevated light and noise levels would pose a serious threat to the aquatic habitats within this Natural Heritage Area. The dragonflies and damselflies require clean waters for breeding and development of their aquatic larvae. These species are particularly sensitive to water pollution events, especially catastrophic spills and discharges of chemicals and waste water.

Charlie Eichelberger (PNHP)

Northern Myotis (*Myotis septentrionalis*)

Conservation Recommendations:
It is important that the current habitats along this stretch of the creek remain as they are to support the various species of concern inhabiting the floodplain and reservoir.

Ridgeline between Lick Island Run and Gravelly Run

About a mile to the northeast of Grove Hill is a manmade opening, likely created for elk habitat. While most of the opening is planted with forbs, patches of this opening have exposed soils, providing habitat for a population of the **common claybank tiger beetle (*Cicindela limbalis*)**. This species inhabits sparsely vegetated areas with loose stony or sandy soils. In addition to this occurrence, two relatively small **ephemeral/fluctuating natural pools**, more commonly known as vernal pools, are situated within the forest surrounding the food plot. These pools are important for a number of species of amphibians, specialized to breed in these fish-free habitats. Vernal pools are also important habitats for a number of invertebrate species, as well as some plants which can thrive in these seasonally flooded wetlands. Vernal pools are not only important for these breeding amphibians, but the pools are also used by many mammals, birds, and reptiles.

Threats and Stresses:
Changes in hydrology, loss of forest buffer, or direct disturbance to the pools could impact the species that depend upon this specialized habitat. Currently, there are no apparent activities that would result in such changes.

Conservation Recommendations:
Any future development or resource extraction must proceed with extreme caution to avoid impacting the population of the common claybank tiger beetle, as well as the vernal pool natural community. The forest surrounding the pools should be left to regenerate and a 300 meter upland buffer established around the wetlands themselves to provide the terrestrial habitat needed by the amphibians which use the pool to breed.

Short Bend Run

Recent surveys along Short Bend Run uncovered two mammal species of concern, the **northern water shrew (*Sorex palustris albibarbis*)** and the **northern myotis (*Myotis septentrionalis*)**. Cool flowing waters flanked by subterranean crevices in rock or root balls serve as habitat for the northern water shrew, which relies on aquatic food sources supported by high water quality tumbling streams. Here, the northern water shrew feeds on caddisfly, mayfly and stonefly larvae. As the larvae of these insects metamorphose into adults, the northern myotis, a bat species of concern, feeds on the adults as they hatch.

Threats and Stresses:

The biggest threat to the northern water shrew population at Short Bend Run would be a decrease in the water quality of the run. Disturbances associated with any development that increase forest fragmentation, decrease air and water quality, alter hydrology, increase forest road traffic, or elevate light and noise levels could impact the northern water shrew population at the site. The most critical threat to bat populations in the eastern U.S. is a fungus, termed White-nose Syndrome (WNS) which attacks the bats when they are hibernating. Additionally, forestry practices can impact bat maternity sites, and should be conducted with the needs of the bats in mind.

Conservation Recommendations:

A 300 meter no-cut forested buffer should be established around Short Bend Run. Any future development activities in the area will have to be conducted with extreme caution to avoid impacts to the populations of species of concern found at Short Bend Run.

Sinnemahoning Creek Cliffs

The outcrops along the north side of Sinnemahoning Creek support a population of **Allegheny woodrats (*Neotoma magister*)**, a mammal species of concern. The Allegheny woodrat is closely related to the well known pack rats of the west, and is known for some of the same unique behaviors as their western cousins. Allegheny woodrats build caches of dried foods to enable them to survive the winter months. When caching food items, woodrats will often place them under sheltered rocks to allow them to dry and avoid spoilage from precipitation. Allegheny woodrats are apparently intrigued by manmade items, and food caches often contain aluminum foil, shotgun shells, and lengths of flagging. The purpose of this odd behavior remains unknown. This speices is also distinguished from the invasive exotic Norway rat (*Rattus norvegicus*) by its heavily furred tail, creamy belly, and long whiskers which help it navigate through dark crevices deep within outcrops, talus, and even caves. This species has declined over much of its range, and is currently under review for Federal listing by the US Fish and Wildlife Service.

Threats and Stresses:
The Allegheny Woodrat is sensitive to habitat fragmentation for a number of reasons. First, the species functions in metapopulations, where clusters of active populations move between patches of suitable habitat. If the connection between these habitats is severed, the population would likely be adversely affected. Secondly, the Allegheny Woodrat can be affected by a parasite carried by raccoons. Raccoons favor edge habitat, and their populations may expand if the forest is further fragmented in this area.

Charlie Eichelberger (PNHP)

Allegheny Woodrat (*Neotoma magister*)

Conservation Recommendations:
Any activities involving rock outcrops or the areas immediately linking outcrops could directly impact the populations of woodrat in this area. Disturbance of the surrounding forest, especially alterations that would fragment habitat and create pathways or linkages to more extensive openings could invite predators into remote, interior areas that support woodrat. Maintaining large patches of undisturbed habitat is perhaps the best management approach to supporting the population of Allegheny woodrats known to inhabit the forested rock outcrops overlooking the Sinnemahoning Creek.

Upper Jerry Run Slopes

During recent surveys along Upper Jerry Run, a lone specimen of **American yew (*Taxus canadensis*)** was found growing along some rock outcrops. This evergreen shrub which closely resembles the cultivated yew had declined dramatically in much of Pennsylvania with the elevated deer populations. Deer favor American yew as a food source. Today, remnant populations of this species exist, usually growing on steep hillsides and rock outcrops that are inaccessible to deer browse. American yew is considered a "watchlist" species, meaning we are gathering information on the current distribution of the species in order to better determine its status. During the habitat assessment of the regional mammal survey in the 1940's, researchers noted: "*Yew appears to have disappeared unnoticed from vast areas"* (Roslund 1951). Evidence that this species is hanging on, albeit in a much reduced condition, is a positive sign that recovery of American yew can be had in Cameron County. This occurrence of this species is the only known extant location for this species in the county.

Threats and Stresses:
The only noted threat to this species is the elevated deer population.

Conservation Recommendations:
While a temporary solution to protect the American yew population would be to erect a deer exclosure around the population, the long-term recovery of this species in Cameron County will require continual management of the deer herd that brings it in check with the condition and capacity of the habitat.

Charlie Eichelberger (PNHP)

Expansive stands of American yew (*Taxus canadensis*), like this one in Snyder County, were once common throughout Pennsylvania including Cameron County. A favored food source of deer, decades of deer over population has caused the American yew to primarily be restricted to steep cliffs where deer are unable to browse.

Woodland east of Short Bend Run

Invertebrate surveys on the ridgeline east of Sinnamanhoning State Park using a blacklight, a device used for sampling nocturnal moths, uncovered populations of three species of concern, the **broad sallow moth (*Xylotype capax*)**, **flypoison borer moth (*Papaipema* sp. 1)**, and the **pointed sallow (*Epiglaea apiata*)**. All three species are typically known as a "barrens species", relying on areas with harsh soil, climate, or disturbance events that leads to stunted vegetation. The presence of pitch pine (*Pinus rigida*), which is a fire tolerant species, indicates that this portion of the county has periodically burned in the past. The nectar plants and food plants for the developing larvae of these species include flypoison (*Amianthium muscaetoxicum*), black cherry (*Prunus serotina*), cranberries (*Vaccinium macrocarpon, V. oxycoccos*), high bush blueberry (*V. corymbosum*), and red oak (*Quercus rubra*).

Threats and Stresses:

One of the main threats to these species of concern is habitat degradation and succession of the barrens habitat types. These habitats often rely on disturbance regimes, such as periodic natural fire, which has been suppressed in Pennsylvania.

Conservation Recommendations:

Small, patchy prescribed burns along the ridgeline would improve the habitat for these three species of concern noted from this site.

Wykoff Run Tributaries

The tumbling waters of Wykoff Run Tributaries are cold, high-quality waters surrounded by forest. The ample streamside crevices are prime habitat for the **northern water shrew (*Sorex palustris albibarbis*)** which was documented here by PNHP biologists in 2009. This insectivorous species, which actually dives to forage on aquatic invertebrates such as caddisfly, mayfly and stonefly nymphs, has similar food and habitat requirements to Pennsylvania's only native stream trout species, the brook trout (*Salvelinus fontinalis*). Like the brook trout, the northern water shrew is an excellent indicator of high water quality because the food webs that the shrew relies on are so fragile to pollution events.

Threats and Stresses:

During the most recent surveys of the site, no threats were noted. Habitat management or disturbance that increases forest fragmentation, decreases air and water quality, alters hydrology, increases forest road traffic, or elevates light and noise levels can impact populations of species of concern. As an aquatic invertebrate specialist, the northern water shrew is particularly sensitive to changes in water quality.

Conservation Recommendations:

Maintaining good water quality and intact riparian habitat is very important in supporting the population of water shrew at this site and within Wykoff Run. Disturbances or management that could potentially increase water temperature, change the flow patterns of the stream, or alter microhabitats should be carefully evaluated.

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Lumber Township

NATURAL HERITAGE AREAS:	PNHP rank[1]		State Legal Status[1] (proposed)	Last Seen	Quality Rank[1]
	Global	State			
Brooks Run			*High significance*		
Northern myotis (*Myotis septentrionalis*) - mammal	G4	S1	(CR)	2009Jun4	E
Northern water shrew (*Sorex palustris albibarbis*) - mammal	G5T5	S3	(CR)	2011Jun7	E
Finley Run			*High significance*		
Northern water shrew (*Sorex palustris albibarbis*) - mammal	G5T5	S3	(CR)	2009Sep16	E
Pitch Pine Woodland East of Moore Draft			*Notable significance*		
A Noctuid Moth (*Aplectoides condita*) - lepidoptera	G4	S2S3	--	2009Jun3	E
Maroonwing (*Sideridis maryx*) - lepidoptera	G4	S1S3	--	2009Jun3	E
Ridgeline between Lick Island Run and Gravelly Run			*Notable significance*		
Common Claybank Tiger Beetle (*Cicindela limbalis*) - beetle	G5	S3	--	2009Sep3	E
Ephemeral/fluctuating natural pool – natural community	GNR	S3	--	2008May2	E
Ridgeline west of Hunting Shanty Branch			*Notable significance*		
Common Claybank Tiger Beetle (*Cicindela limbalis*) - beetle	G5	S3	--	2009Aug26	E
Sterling Run Tributaries			*Notable significance*		
Sensitive species of concern[3]	--	--	--	2010May28	E
Whitehead Run			*High significance*		
Northern water shrew (*Sorex palustris albibarbis*) - mammal	G5T5	S3	(CR)	2009Jun5	B

PUBLICLY MANAGED LANDS: Elk State Forest, Bucktail State Park Natural Area, Square Timber / Big Run Proposed Wild Area

OTHER CONSERVATION AREAS: Northern Allegheny Plateau IMA

HIGH QUALITY STREAMS: Canoe Run, Hunting Shanty Branch, Hunts Run, John Mason Run, Left Fork Brooks Run, Logue Run, McKinnon Branch, McNuff Branch, Mooley Hollow Run, Norcross Run, Right Fork Brooks Run, Rock Run, Russell Hollow Run, Shanty Branch, Square Timber Run, Steam Mill Branch, Stillhouse Run, Wash Mason Run, Whitehead Run

[1] Please refer to Appendix II for an explanation of PNHP ranks, legal status and quality ranks
[2] This species is not named at the request of the agency overseeing its protection

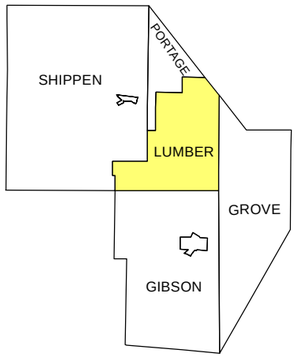
Cameron County
Natural Heritage Inventory
Lumber Township

Natural Heritage Areas

Brooks Run
Finley Run
Pitch Pine Woodland East of Moore Draft
Ridgeline between Lick Island Run and Gravelly Run
Ridgeline west of Hunting Shanty Branch
Sterling Run Tributaries
Whitehead Run

State Public Land

Bucktail State Park Natural Area
Elk State Forest
Square Timber / Big Run Proposed Wild Area



Legend

Natural Heritage Areas
- Core Habitat
- Supporting Landscape

Streams
National Wetland Inventory
100-year Floodplain
Recommended Riparian Buffer

Forest Blocks by Acre
- **< 250**
- **250 - 1000**
- **1000 - 5000**
- **> 5000**

Municipal Boundary
PA DCNR
PA Game Commission
200 Ft. Contour Line

The second smallest of Cameron County's townships, Lumber Township is composed of 32,491 acres (13,149 ha, 50.8 square miles). Lumber Township has a few peaks that are just over 2,340 feet, and drops to a low of 900 feet where the Driftwood Branch of the Sinnemahoning Creek flows into Gibson Township to the south. The geology is primarily sandstone and conglomerate, with some thin exposed beds of shale, limestone, clay, claystone, siltstone and coal.

Lumber Township has less than 1% of its area developed, less than 4% in agriculture, and the remaining area in forest.

May Hollow Run and its headwaters, Finley Run and its headwaters, and portions of Sterling Run are classified as "impaired" by DEP primarily because of abandoned mine drainage.

Charlie Eichelberger (PNHP)

Lumber Township contains a portion of Cameron County's elk population, as well as habitat for a number of species of concern.

Brooks Run

Brooks Run is a shaded, cool, clean stream tumbling approximately 1000 feet to the confluence with the First Fork Sinnemahoning Creek at the reservoir. Surveys along this waterway have uncovered a population of the **northern water shrew (*Sorex palustris albibarbis*)** and **the northern myotis (*Myotis septentrionalis*)** a bat species of concern in the Commonwealth. The northern water shrew is an insectivore, specialized to feed on aquatic insects on the bottom of rock lined streams. The northern water shrew depends on healthy populations of prey items, which in turn depend on high water quality. Therefore, northern water shrews are a good indicator of high water quality and Brooks Run is known for its clean, cool waters. Some of the same species of insects that the northern water shrew feeds upon as larvae, will also feed the northern myotis when they hatch. This species of bat primarily lives in large forested areas, and frequently forages for aerial insects along clean mountain stream corridors.

Threats and Stresses:
Disturbances that would increase forest fragmentation, decrease air and water quality, alter hydrology, increase forest road traffic, spread invasive plant species, or elevate light and noise levels could impact populations of species of concern. Any future forestry practices in the Brooks Run watershed should afford the stream a substantial, untouched forested buffer to protect the population of northern water shrews and northern myotis foraging territory.

Conservation Recommendations:
At present, the northern water shrew population and northern myotis population at Brooks Run do not require active management. Any future management or development should proceed with careful planning to avoid impacts to the species of concern known to inhabit and forage along Brooks Run.

Finley Run

Recent surveys along Finley Run documented a population of the seldom seen **northern water shrew (*Sorex palustris albibarbis*)**, a species of concern in the Commonwealth. When foraging for aquatic invertebrates on the bottom of clean, cool streams, the northern water shrew, with its water-repelling fur, appears as an underwater bubble moving on the stream bottom. While foraging, the northern water shrew rapidly exhales and reinhales air bubbles, using its sense of smell to track down prey.

Charlie Eichelberger (PNHP)

The northern water shrew is the largest member of the genus *Sorex* in Pennsylvania, and because of its large size and exceptionally long tail, cannot be confused with the other shrews found in the Commonwealth.

Threats and Stresses:
The portion of Finley Run surveyed is on private forest land, and the surrounding forest has been cut in the past. Some of the forest treatments have apparently occurred within the last 10 years. It appears that an adequate forested buffer was retained along the stream corridor, as the character of the stream superficially does not appear to be impacted by the forestry practices. Downstream of this portion of Finley Run, abandoned mine drainage (AMD), has severely degraded the water quality. Despite this, several of the higher order streams in the watershed, including Finley Run, have not been affected by this pollution, have good water quality, and are in overall good condition. During the survey effort, preparations were being made to develop a Marcellus Shale gas well at the

headwaters of Finley Run. Any development that negatively affects water quality in Finley Run could impact the northern water shrew given that it is dependent on a healthy aquatic prey base.

Conservation Recommendations:
Maintaining overall water quality and even improving water quality in sections of Finley Run will help to support the population of water shrew using this watershed. Substantial, forested riparian buffers will help to maintain water quality and stabilize microhabitats important to the water shrew. Careful planning and adherence to Best Management Practices (BMPs) of any development in the watershed will be important.

Pitch Pine Woodland East of Moore Draft

Invertebrate surveys using a blacklight, a device used to collect moths, by PNHP staff uncovered populations of two moth species of concern, **a noctuid moth (*Aplectoides condita*)** and the **maroonwing (*Sideridis maryx*)**. Both of these species inhabit drier conifer woodlands and barrens in Pennsylvania.

Threats and Stresses:
Habitat degradation and habitat loss are major threats to these species of moths. Since these moths rely on dry, conifer-dominated, barrens habitat, a type which is dependent on periodic disturbance through fire, decades of fire suppression has led to an overall reduction in available habitat. As with all moths and butterflies, gypsy moth control in this area would have a negative effect on the populations of these species of concern. Additionally, the maroonwing is noted to be vulnerable to light pollution.

Conservation Recommendations:
The most immediate threat to the populations of these moths is the loss of habitat, and measures to maintain the habitat should be enacted. This may require the implementation of small prescribed burns to improve the barrens habitat. Gypsy moth spraying should maintain a no-spray buffer around the pitch pine barrens to avoid affecting the populations of these two moths. Some forestry practices that favor pitch pine and maintain more open habitat patches characteristic of barrens could benefit these species. Since the maroonwing is easily affected by light pollution, artificial lighting at the nearby camp should be kept to a minimum.

Ridgeline between Lick Island Run and Gravelly Run

About a mile to the northeast of Grove Hill is a manmade opening, likely created for elk habitat. While most of the opening is planted with forbs, patches of this opening have exposed soils, providing habitat for a population of the **common claybank tiger beetle (*Cicindela limbalis*)**. This species inhabits sparsely vegetated areas with loose stony or sandy soils. In addition to this occurrence, two relatively small **ephemeral/fluctuating natural pools**, more commonly known as vernal pools, are situated within the forest surrounding the food plot. These pools are important for a number of species of amphibians, specialized to breed in these fish-free habitats. Vernal pools are also important habitats for a number of invertebrate species, as well as some plants which can thrive in these seasonally flooded wetlands. Vernal pools are not only important for these breeding amphibians, but the pools are also used by many mammals, birds, and reptiles.

Threats and Stresses:
Changes in hydrology, loss of forest buffer, or direct disturbance to the pools could impact the species that depend upon this specialized habitat. Currently, there are no apparent activities that would result in such changes.

Conservation Recommendations:
Applying forestry practices that take into account both the common claybank tiger beetle, as well as the vernal pool natural community, will provide the most help in maintaining habitat and supporting these species of concern on this site. The forest surrounding the pools should be left to regenerate and a 300 meter upland buffer established around the wetlands themselves to provide the terrestrial habitat needed by the amphibians which use the pool to breed.

Ridgeline west of Hunting Shanty Branch

In the sparse woodlands between McNuff Branch and Hunting Shanty Branch, a population of the **common claybank tiger beetle (*Cicindela limbalis*)** was recently discovered. Usually active in the spring, and again in late summer, the common claybank tiger beetle is a voracious predator on the forest floor. Hunting and eating invertebrates several times it size, this species favors open, sandy or shaley ground. The larvae inhabit the same areas as the adults, hunting at the entrances of their burrows waiting to ambush unsuspecting prey. Once metamorphosing into adults, the common claybank tiger beetle hunts by patrolling their feeding territories for spiders and insects, or taking to the wing to hunt down insects and other arthropods.

Threats and Stresses:
While some tiger beetles may benefit from disturbances to the landscape, as habitat specialists, care must be taken not to impact known populations of this species. Direct disturbance to habitat without consideration of the beetle could be detrimental. Although some tiger beetles benefit from open habitat, roads and rights-of-way or other fragmenting features may not necessarily benefit this species.

Conservation Recommendations:
Forestry and other management practices oriented to maintaining tiger beetle habitat would be most helpful in supporting the needs of this species. Limited clearing and/or fire could help to maintain suitable habitat for this species but such management should follow a plan developed specifically for the purpose of tiger beetle conservation.

Sterling Run Tributaries

A **sensitive species of concern**, which is not named at the request of the jurisdictional agency overseeing its protection, was documented along Sterling Run and its tributaries. This species utilizes both the aquatic habitat of the streams as well as the riparian zone adjacent to the streams.

Threats and Stresses:
The species of concern documented at this location is particularly sensitive to changes in water quality and disruptions to the riparian zone. During the most recent surveys of the site, no threats were noted. However, degradation of the water quality or quantity within the watershed or disruption of the riparian forested canopy, floodplain, or wetlands could detrimentally impact the continued success of this species population. Habitat changes such as forest fragmentation, decreases in air and water quality, hydrologic alterations, increased forest road traffic, and elevated light and noise levels could also impact populations of species of concern.

Conservation Recommendations:
Maintaining good watershed condition and high water quality as well as intact riparian zones will be the most helpful in maintaining the multiple habitats that this species depends upon.

Whitehead Run

PNHP surveys along Whitehead Run have uncovered a population of the **northern water shrew (*Sorex palustris albibarbis*)**. An indicator of exceptional water quality, the northern water shrew feeds on aquatic invertebrates which are susceptible to pollution events. The northern water shrew is well

adapted for diving, with a water proof fur, semi-webbed feet, and hind feet fringed with hairs which aid in swimming. Those who have been lucky enough to observe this animal in the wild have likened its appearance to a bubble moving through the water.

Threats and Stresses:
During the most recent surveys of the site, no threats were noted. Habitat management or disturbance that increases forest fragmentation, decreases air and water quality, alters hydrology, increases forest road traffic,or elevates light and noise levels can impact populations of species of concern. As an aquatic invertebrate specialist, the northern water shrew is particularly sensitive to changes in water quality.

Conservation Recommendations:
Maintaining good water quality and intact riparian habitat is very important in supporting the population of water shrew at this site and within Whitehead Run. Disturbances or management that could potentially increase water temperature, change the flow patterns of the stream, or alter microhabitats should be carefully evaluated.

Portage Township

NATURAL HERITAGE AREAS:	PNHP rank[1]		State Legal Status[1] (proposed)	Last Seen	Quality Rank[1]
	Global	State			
Ridgeline west of Hunting Shanty Branch			*Notable significance*		
Common Claybank Tiger Beetle (*Cicindela limbalis*) - beetle	G5	S3	--	2009Aug26	E

PUBLICLY MANAGED LANDS: Elk State Forest, Bucktail State Park Natural Area, Sizerville State Park

OTHER CONSERVATION AREAS: Northern Allegheny Plateau IMA

EXCEPTIONAL VALUE/HIGH QUALITY STREAMS: EV: Cowley Run, East Branch Cowley Run, Sinnemahoning Portage Creek, West Branch Cowley Run; HQ: Hunting Shanty Branch, McKinnon Branch, McNuff Branch, Shanty Branch

[1] Please refer to Appendix II for an explanation of PNHP ranks, legal status and quality ranks

Portage Township, at 11,533 acres (4,667 ha, 18.0 square miles), is Cameron County's smallest township. Portage Township's topography varies from a high of 2,200 feet, down to 980 feet where the Driftwood Branch of the Sinnemahoning Creek flows into Lumber Township. The bedrock of the township is dominated by sandstone and associated conglomerate with thinner beds of shale, claystone, siltstone, limestone, and coal.

Less than 1% of Portage Township is developed, and around 3% is in agriculture, with the remaining acreage of the township is forest. Much of the township is owned by DCNR and is within Elk State Forest. Sizerville State Park is another publically owned tract that straddles the county border with Potter County.

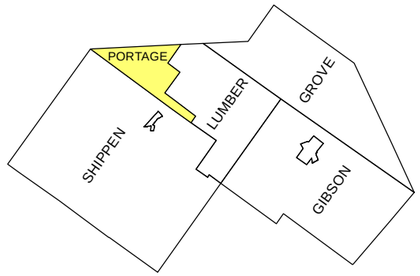
Charlie Eichelberger (PNHP)

About the size of a pencil, the mountain earthsnake (*Virginia pulchra*) is infrequently encountered given its fossorial life history. It spends most of its life under cover, feeding on earthworms and salamanders. This harmless species is considered "globally vulnerable" to extinction, and is known from Portage Township.

Cameron County
Natural Heritage Inventory
Portage Township

Natural Heritage Areas
Ridgeline west of Hunting Shanty Branch

State Public Land
Bucktail State Park Natural Area
Elk State Forest
Sizerville State park



Legend

Natural Heritage Areas
- Core Habitat
- Supporting Landscape

Streams
National Wetland Inventory
100-year Floodplain
Recommended Riparian Buffer

Forest Blocks by Acre
- < 250
- 250 - 1000
- 1000 - 5000
- > 5000

Municipal Boundary
PA DCNR
PA Game Commission
200 Ft. Contour Line

0 0.5 1 2 Kilometers
0 0.5 1 2 Miles

Ridgeline west of Hunting Shanty Branch

In the sparse woodlands between McNuff Branch and Hunting Shanty Branch, a population of the **common claybank tiger beetle (*Cicindela limbalis*)** was recently discovered. Usually active in the spring, and again in late summer, the common claybank tiger beetle is a voracious predator on the forest floor. Hunting and eating invertebrates several times it size, this species favors open, sandy or shaley ground. The larvae inhabit the same areas as the adults, hunting at the entrances of their burrows waiting to ambush unsuspecting prey. Once metamorphosing into adults, the common claybank tiger beetle hunts by patrolling their feeding territories for spiders and insects, or taking to the wing to hunt down insects and other arthropods.

Threats and Stresses:

While some tiger beetles may benefit from disturbances to the landscape, as habitat specialists, care must be taken not to impact known populations of this species. Habitat changes such as forest fragmentation, decreases in air and water quality, hydrologic alterations, increased forest road traffic, and elevated light and noise levels can impact populations of species of concern.

Conservation Recommendations:

Forestry and other management practices oriented to maintaining tiger beetle habitat would be most helpful in supporting the needs of this species. Limited clearing and/or fire could help to maintain suitable habitat for this species but such management should follow a plan developed specifically for the purpose of tiger beetle conservation.

Rocky Gleason (PNHP)

Common claybank tiger beetle (*Cicindela limbalis*)

Shippen Township and Emporium Borough

NATURAL HERITAGE AREAS:	PNHP rank[1]		State Legal Status[1] (proposed)	Last Seen	Quality Rank[1]
	Global	State			
Bobby Run			*High significance*		
Northern water shrew (*Sorex palustris albibarbis*) - mammal	G5T5	S3	(CR)	2009Sep24	E
Turtle head Borer Moth (*Papaipema nepheleptena*) - lepidoptera	G4	SNR	--	2009Sep22	E
Canoe Run Headwaters			*Notable significance*		
Common Claybank Tiger Beetle (*Cicindela limbalis*) - beetle	G5	S3	--	2009Aug27	E
Driftwood Branch Sinnemahoning Creek at Indian Camp Run			*Notable significance*		
Green-patched Looper (*Diachrysia balluca*) - lepidoptera	GNR	SNR	--	2009Aug4	E
East Branch Hicks Run at Bell Run			*Notable significance*		
Common Claybank Tiger Beetle (*Cicindela limbalis*) - beetle	G5	S3	--	2009Sep2	E
Downy lettuce (*Lactuca hirsuta*) - plant	G5?	S3	N (TU)	2009Sep1	E
Finley Run			*High significance*		
Northern water shrew (*Sorex palustris albibarbis*) - mammal	G5T5	S3	(CR)	2009Sep16	E
Fourmile Run at Hickok Hollow			*High significance*		
Northern water shrew (*Sorex palustris albibarbis*) - mammal	G5T5	S3	(CR)	2009Oct1	E
Frenchman's Branch Hicks Run			*Notable significance*		
Common Claybank Tiger Beetle (*Cicindela limbalis*) - beetle	G5	S3	--	2009Aug12	E
Opening between East and West Branch Hicks Run			*High significance*		
Northern Barrens Tiger Beetle (*Cicindela patruela*) - beetle	G3	S2S3	--	2009May21	E
Ridgeline between East Branch Hicks Run and Whippoorwill Hollow			*Notable significance*		
Common Claybank Tiger Beetle (*Cicindela limbalis*) - beetle	G5	S3	--	2009Sep2	E
Sterling Run Tributaries			*Notable significance*		
Sensitive species of concern[2]	--	--	--	2010May28	E
West Branch Hicks Run at Middle Branch			*Notable significance*		
Ski-tailed Emerald (*Somatochlora elongata*) - odonate	G5	S2	--	2009Aug11	E

PUBLICLY MANAGED LANDS: Elk State Forest, Bucktail State Park, State Game Lands #14

OTHER CONSERVATION AREAS: Northern Allegheny Plateau IMA

EXCEPTIONAL VALUE/HIGH QUALITY STREAMS: EV: Clear Creek, Cooks Run, Left Branch Cooks Run, Mud Lick Run, Sinnemahoning Portage Creek, West Branch Hicks Run; HQ: Bear Run, Bell Run, Hunting Shanty Run, Jenks Run, North Creek, Pepper Run, Robinson Run, Rocky Run

[1] Please refer to Appendix II for an explanation of PNHP ranks, legal status and quality ranks
[2] This species is not named at the request of the agency overseeing its protection

Cameron County
Natural Heritage Inventory

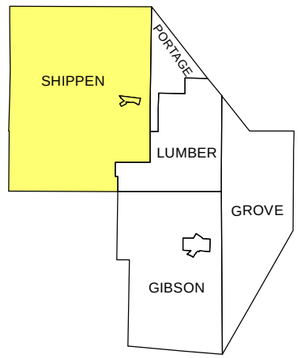
Shippen Township & Emporium Borough

Natural Heritage Areas

- Bobby Run
- Canoe Run Headwaters
- Driftwood Branch Sinnamahoning Creek at Indian Camp Run
- East Branch Hicks Run at Bell Run
- Finley Run
- Fourmile Run at Hickok Hollow
- Frenchman's Branch Hicks Run
- Opening between East and West Branch Hicks Run
- Ridgeline between East Branch Hicks Run and Whippoorwill Hollow
- Sterling Run Tributaries
- West Branch Hicks Run at Middle Branch

State Public Land

- Bucktail State Park Natural Area
- Elk State Forest
- State Game Lands #14



Legend

Natural Heritage Areas
- Core Habitat
- Supporting Landscape

Streams
National Wetland Inventory
100-year Floodplain
Recommended Riparian Buffer

Forest Blocks by Acre
- < 250
- 250 - 1000
- 1000 - 5000
- > 5000

Municipal Boundary
PA DCNR
PA Game Commission
200 Ft. Contour Line

Elk State Forest
Fourmile Run at Hickok Hollow
Driftwood Branch Sinnamahoning Creek at Indian Camp Run
Bobby Run
Canoe Run Headwaters
Bucktail State Park Natural Area
Finley Run
Elk State Forest
Sterling Run Tributaries
Frenchman's Branch Hicks Run
State Game Lands #14
West Branch Hicks Run at Middle Branch
Opening between East and West Branch Hicks Run
Ridgeline between East Branch Hicks Run and Whippoorwill Hollow
East Branch Hicks Run at Bell Run
Elk State Forest

MCKEAN COUNTY
ELK COUNTY
POTTER COUNTY
PORTAGE TOWNSHIP
LUMBER TOWNSHIP
GIBSON TOWNSHIP
ELK COUNTY

Gardeau
Straight Creek
Sizerville
Lawn View
Rich Valley
Lockwood
Prospect Park
Emporium
Weber City
West Creek
Beechwood
Rathbun
Truman
Howard Siding
Swissmont
Cameron
Sterling Run

Elk Fork
Left Branch Cooks Run
Cooks Run
Driftwood Branch Sinnemahoning Creek
Robinson Run
Popper Run
North Creek
Sinnemahoning Portage Creek
Clear Creek
West Creek
Tannery Hollow Run
West Branch Hicks Run
Pole Branch Hicks Run

0 1.25 2.5 5 Kilometers
0 1.25 2.5 5 Miles

N

Shippen Township completely surrounds the borough of Emporium, and for mapping simplicity, Emporium Borough has been grouped with Shippen Township in this report. Together, Shippen Township and Emporium Borough cover 100,700 acres (40,752 ha, 157.3 square miles), with Shippen Township being the largest municipality in Cameron County. The township's bedrock is composed primarily of sandstone and associated conglomerate with thin beds of shale, siltstone, clay, claystone, limestone, and coal. The highest point in Shippen Township is 2,360 and the lowest point is 1,000 feet where the Driftwood Branch of the Sinnemahoning Creek flows into Portage Township to the east.

Less than 1% of Shippen Township is developed, with just over 4% of the township in agriculture. The remainder of the township is forested. Most of Shippen Township is privately owned, primarily by some larger timber companies. Several large tracts throughout the township are owned by DCNR Elk State Forest, and the southwestern corner of the township contains the only Pennsylvania Game Commission land in Cameron County, State Game Land #14.

May Hollow Run and its headwaters, and Finley Run and its headwaters are classified as "impaired" by DEP primarily because of abandoned mine drainage.

Rocky Gleason (PNHP)

Buckthorn can be found on State Game Land #14 in Shippen Township. This aggressive exotic species should be a target for eradication from the county.

Bobby Run

Recent surveys by PNHP staff along Bobby Run uncovered a population of **northern water shrews (*Sorex palustris albibarbis*)**. The northern water shrew feeds on aquatic invertebrates, diving for its dinner found at the bottom of cool, clean moderately flowing streams flanked with rocky retreats. The northern water shrew is uniquely adapted for its semi-aquatic life history. It has a water resistant coat, long tail, and hind feet with stiff bristly hairs which act as flippers. Also found at this location is the **turtle head borer moth (*Papaipema nepheleptena*)**, and as the common name implies, the larvae feed on turtle head (*Chelone glabra*), a common wetland plant.

Threats and Stresses:

This site is on privately managed forest land. Forestry practices, energy and other development, and other management activities do not necessarily follow those of public lands in the county. Habitat management or disturbance that increases forest fragmentation, decreases air and water quality, alters hydrology, increases forest road traffic, and elevates light and noise levels can impact populations of species of concern. As an aquatic invertebrate specialist, the northern water shrew is particularly sensitive to changes in water quality.

Conservation Recommendations:

Maintaining good water quality and intact riparian habitat is very important in supporting the population water shrew at this site and within Bobby Run. Disturbances or management that could potentially increase water temperature, change the flow patterns of the stream, or alter microhabitats should be carefully evaluated. A forest management plan that takes into account the habitat values of this site and the needs of the northern water shrew would help to support the conservation of this mammal.

Canoe Run Headwaters

Surveys along the tract at the headwaters of Canoe Run uncovered a population of the **common claybank tiger beetle (*Cicindela limbalis*),** a species of concern in the Commonwealth. This upland species relies on open canopied habitats, usually with exposed soils of sand, shale, or clay. The site is owned by DCNR.

Threats and Stresses:

While some tiger beetles may benefit from disturbances to the landscape, as habitat specialists, care must be taken not to impact known populations of this species. Direct disturbance to habitat without consideration of the beetle could be detrimental. Although some tiger beetles benefit from open habitat, roads and rights-of-way or other fragmenting features may not necessarily benefit this species.

Conservation Recommendations:

Forestry and other management practices oriented to maintaining tiger beetle habitat would be most helpful in supporting the needs of this species. Limited clearing and/or fire could help to maintain suitable habitat for this species but such management should follow a plan developed specifically for the purpose of tiger beetle conservation.

Driftwood Branch Sinnemahoning Creek at Indian Camp Run

An exceptionally vibrantly colored moth, the **green-patched looper (*Diachrysia balluca*)** was recently found along the Driftwood Branch. Also referred to as the "hologram moth", the green-patched looper is cloaked in an iridescent greenish-gold. A more northern species, the green-patched looper moth is known from only a few other locations in Pennsylvania.

Threats and Stresses:

This site is situated on private forest land, and leased by a hunting club. While little is known about the life history needs of this species, the land use at this site does not appear to be in conflict with the

presumed needs of the green-patched looper moth. However, spraying for gypsy moth control poses a threat to all forest and woodland moth and butterfly species.

Conservation Recommendations:
If gypsy moth control is planned for this portion of the county, a generous buffer around the site should be respected to avoid impacts to the population of green-patched looper moths. Other management or development activities should take into account the life cycle of this moth and obvious conflicts with the use of pesticides and herbicides.

East Branch Hicks Run at Bell Run

Surveys along the East Branch of Hicks Run by PNHP staff uncovered a population of the common **claybank tiger beetle (*Cicindela limbalis*)**, considered a species of concern in Pennsylvania. This species lives in areas where the ground vegetation is sparse, allowing for the foraging beetles to move about their territory in search of other invertebrates to prey upon.

Threats and Stresses:
The habitat for the common claybank tiger beetle is frequently located in areas where the soil has been disturbed. At this site, the population was found using the open areas along the side of Hicks Run Road. Road improvements to Hicks Run Road could impact the common claybank tiger beetle populations, as well as a host of other species known to inhabit the open areas along roadsides.

Conservation Recommendations:
Roadside maintenance techniques should be conducted with the habitat preferences of this species of concern, and others known to live along roadsides in this area, in mind.

Finley Run

Recent surveys along Finley Run documented a population of the seldom seen **northern water shrew (*Sorex palustris albibarbis*)**, a species of concern in the Commonwealth. When foraging for aquatic invertebrates on the bottom of clean, cool streams, the northern water shrew, with its water-repelling fur, appears as an underwater bubble moving on the stream bottom. While foraging, the northern water shrew rapidly exhales and reinhales air bubbles, using its sense of smell to track down prey.

Threats and Stresses:
The portion of Finley Run surveyed is on private forest land, and the surrounding forest has been cut in the past. Some of the forest treatments have apparently occurred within the last 10 years. It appears that an adequate forested buffer was retained along the stream corridor, as the character of the stream superficially does not appear to be impacted by the forestry practices. Downstream of this portion of Finley Run, abandoned mine drainage (AMD), has severely degraded the water quality. Despite this, several of the higher order streams in the watershed, including Finley Run, have not been affected by this pollution, have good water quality, and are in overall good condition. During the survey effort, preparations were being made to develop a Marcellus Shale gas well at the headwaters of Finley Run. Any development that negatively affects water quality in Finley Run could impact the northern water shrew given that it is dependent on a healthy aquatic prey base.

Conservation Recommendations:
Maintaining overall water quality and even improving water quality in sections of Finley Run will help to support the population of water shrew using this watershed. Substantial, forested riparian buffers will help to maintain water quality and stabilize microhabitats important to the water shrew. Careful planning and adherence to Best Management Practices (BMPs) of any development in the watershed will be important.

Four Mile Run at Hickok Hollow

Recent surveys along Four-Mile Run have uncovered a population of the **northern water shrew (*Sorex palustris albibarbis*)**, a mammal species of concern. The northern water shrew inhabits clean, cool, forested waterways with moderate flow and ample streamside crevices. This species actually dives for food, foraging on the bottom of streams for aquatic insect larva. Because the food sources for northern water shrews are so susceptible to water pollution events, northern water shrews serve as indicators of good stream health.

Threats and Stresses:

During the most recent surveys of the site, no threats were noted. Habitat management or disturbance that increases forest fragmentation, decreases air and water quality, alters hydrology, increases forest road traffic, or elevates light and noise levels can impact populations of species of concern. As an aquatic invertebrate specialist, the northern water shrew is particularly sensitive to changes in water quality.

Conservation Recommendations:

Maintaining good water quality and intact riparian habitat is very important in supporting the population water shrew at this site and within Four Mile Run. Disturbances or management that could potentially increase water temperature, change the flow patterns of the stream, or alter microhabitats should be carefully evaluated.

Frenchman's Branch Hicks Run

Surveys by PNHP staff along the Frenchman's Branch of Hicks Run on State Game Lands #14 uncovered a population of the **common claybank tiger beetle (*Cicindela limbalis*)**, a species of concern in the Commonwealth. This species inhabits open areas with little ground vegetation, allowing it to swiftly move about on the ground while hunting for other invertebrate prey.

Threats and Stresses:

This species historically relied on natural disturbances such as periodic wild fires to maintain the open habitats. At times, the common claybank tiger beetle is found to utilize patches of habitat that have been artificially created by man. At this site, the tiger beetles were found using the sparsely vegetated roadsides. However, direct disturbance to habitat without consideration of the beetle could be detrimental.

Conservation Recommendations:

Forestry and other management practices oriented to maintaining tiger beetle habitat would be most helpful in supporting the needs of this species. Improvements to the road must especially be done with care to minimize impact to the species of concern as well as common species inhabiting this area.

Opening between East and West Branch Hicks Run

Considered "globally vulnerable" to extinction, the **northern barrens tiger beetle (*Cicindela patruela*)** was recently documented at an opening on the ridge between the East and West Branches of Hicks Run. This species has a two-year life cycle, with the adults being most active early in the spring, and then again in the fall. The habitat is noted to be barrens-like, with only short vegetation such as mosses and lichens occurring among patches of eroding sandstone soils. This species historically depended on fire to create patches of open habitat.

Threats and Stresses:

The most apparent threat to this species is habitat degradation and destruction. As we have suppressed periodic wild fires over the past century, the habitat for this species has shrunk to transitional areas within the larger forests of Pennsylvania. Loss of these habitats due to succession and/or direct disturbance would be detrimental to the beetle populations.

Conservation Recommendations: Forestry and other management practices oriented to maintaining tiger beetle habitat would be most helpful in supporting the needs of this species. Improvements to the road must especially be done with care to minimize impact to the species of concern as well as common species inhabiting this area.

Charlie Eichelberger (PNHP)

The northern barrens tiger beetle (*Cicindela patruela*), a species considered to be globally vulnerable, was found in Cameron County in 2009.

Ridgeline between East Branch Hicks Run and Whippoorwill Hollow

Recent surveys by PNHP staff have uncovered a population of the **common claybank tiger beetle (*Cicindela limbalis*)** at this site. The site consists of a bend in a forestry road where rock material had been excavated, potentially for improvement to the road. The areas where the soil is exposed are patrolled by the common claybank tiger beetle, as it hunts in search of other invertebrate food.

Threats and Stresses:
The habitat for this species relies on disturbance. Historically, periodic wildfires served as natural disturbances, clearing patches of land of vegetation and providing habitat for a number of species which rely on these sparsely vegetated, dry, sun exposed areas. Wild fires have been suppressed; however, some man-made disturbances now serve as habitat. While the habitat itself may be created by human disturbances, care must be taken to not directly destroy sites already occupied by this species.

Conservation Recommendations:
Forestry and other management practices oriented to maintaining tiger beetle habitat would be most helpful in supporting the needs of this species. Improvements to the road must especially be done with care to minimize impact to the species of concern as well as common species inhabiting this area.

Sterling Run Tributaries

A **sensitive species of concern**, which is not named at the request of the jurisdictional agency overseeing its protection, was documented along Sterling Run and its tributaries. This species utilizes both the aquatic habitat of the streams as well as the riparian zone adjacent to the streams.

Threats and Stresses:
The species of concern documented at this location is particularly sensitive to changes in water quality and disruptions to the riparian zone. During the most recent surveys of the site, no threats were noted. However, degradation of the water quality or quantity within the watershed or disruption of the riparian forested canopy, floodplain, or wetlands could detrimentally impact the continued success of this species population. Habitat changes such as forest fragmentation, decreases in air and water quality, hydrologic alterations, increased forest road traffic, and elevated light and noise levels could also impact populations of species of concern.

Conservation Recommendations:
Maintaining good watershed condition and high water quality as well as intact riparian zones will be the most helpful in maintaining the multiple habitats that this species depends upon.

West Branch Hicks Run at Middle Branch

Surveys along the West Branch of Hicks Run uncovered a population **ski-tailed emerald (*Somatochlora elongata*)**, a dragonfly species of concern in Pennsylvania. The habitat for this species includes moderately slow flowing waters, including marshes and beaver ponds. The ski-tailed emerald gets its common name from the unique, scoop shaped ovipositor (egg laying organ) on the female. The species is known to forage higher in the tree canopy than other dragonflies, often in the shade, where they pause their patrols every few meters in search of food or mates. The ski-tailed emerald, like all dragonflies and damselflies, requires high water quality for the aquatic young to develop.

Threats and Stresses:
Threats to this species include declines in water quality, as well as wetland degradation and destruction. Riparian habitat is very important for this species and activities that would impact this area are of particular concern. Use of pesticides, vegetation control, or road construction within the riparian area would be particularly of concern.

Conservation Recommendations:
Good watershed practices that help to maintain water quality and quantity, limitation of development activities, and compatible forestry practices will all help to maintain good habitat for the ski-tailed emerald at this site.

Rocky Gleason (PNHP)

Ski-tailed Emerald (*Somatochlora elongata*)

CONCLUSIONS AND GENERAL RECOMMENDATIONS

Through the work required to complete the Natural Heritage Inventory, ecologists, botanists, and zoologists, have explored many of the natural areas of Cameron County. Although many field hours over several field seasons were spent surveying to produce this biological resource inventory, this report should not be viewed as the final work on Cameron County's biodiversity. Therefore, additional explorations of the county will very likely yield additional populations of the species listed in this report, as well as species previously unknown to the county.

This work represents an organized effort to inventory the biodiversity present throughout the county. Some of the earliest survey work in this area was completed by botanists and other naturalists during the middle part of the 19th century. These early explorers documented many species in the region, including some early records that have been updated in this report. Much of the modern work has concentrated on ecologically significant area and other sites that harbor rare species. In the surveys conducted through the NHI, we have not only identified rare, threatened and endangered plants and animals, but also many common species, for which no formal records previously existed in museum and agency records.

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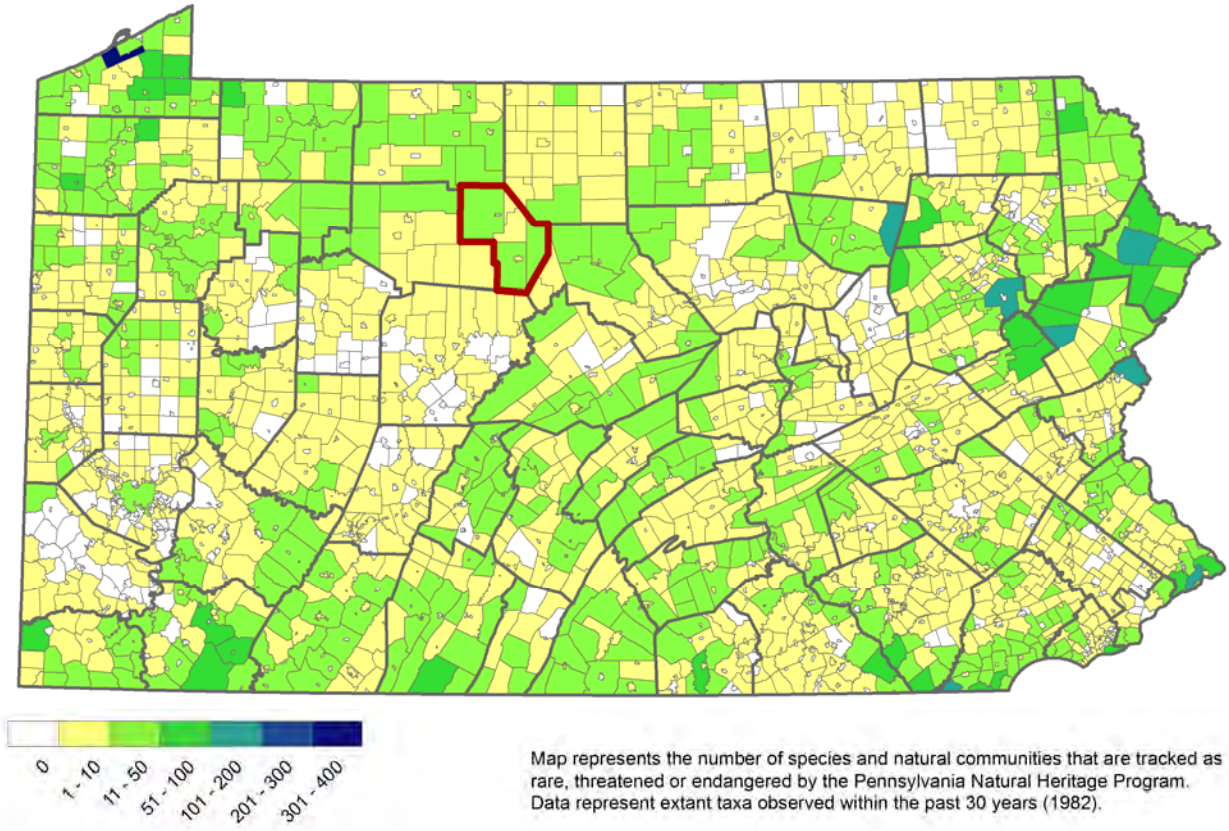
How does Cameron County contribute to the known biodiversity in Pennsylvania?

Cameron County harbors 61 extant occurrences of species and communities of concern, ranking 60th out of the Commonwealth's 67 counties. Municipal breakdowns of these data are presented below.



In this analysis, Cameron County does not stand out as one of the top counties in terms of biodiversity in the state. However, it contains a number of species which are found in few other places in the state. A breakdown of the rare, threatened, and endangered species found in Cameron County by their official state legal status is presented in Appendix II.

The data presented in this report represents a snapshot of the species and ecological conditions present in Cameron County. Natural systems are constantly changing due to variations in climate as well as impacts from human disturbance. Lack of access to some sites of interest prevented surveys that may have yielded additional information about the county. Therefore, this report focuses on the current conditions of the county. We hope that this report can be used as a working document and a guide for conservation of known rare, threatened, and endangered species and habitats of importance, while also working to identify important natural resources previously undocumented in the county.

A Final Note on Rare, Threatened, and Endangered Species

The rare and endangered species highlighted in this report are some of the several hundred species in Pennsylvania that are threatened with extirpation or extinction. If a species becomes extinct, or is lost from a portion of its native range as happens with extirpation, the ecosystem in which it lived will lose an important element. Often the repercussions of extinctions are not known until the species is gone, and more often than not the species is not replaceable in the system. This may be because the habitat has been altered to the point that the species and the ecosystem cycles upon which its survival depends are no longer intact. Rare species are often indicative of fragile ecosystems that may have become degraded - protection of rare species may help monitor the quality of local ecosystems. A great example of a rare species acting as an indicator of environmental quality is the osprey - a bird species which indicated the deleterious effects of the pesticide DDT in our environment.

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

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

General Recommendations

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

1. **Incorporate CNHI information and recommendations into planning efforts.**
   Cameron County is a member of the North Central Pennsylvania Regional Planning and Development Commission, in partnership with Clearfield, Elk, Jefferson, McKean and Potter Counties in an effort to pool resources and responsibilities for this sparsely populated part of the state. Through internal planning, decision making related to land use development, and participation in regional planning initiatives, counties, and municipalities could profoundly shape the land and landscapes of Pennsylvania. Sites delineated in the Cameron County Natural Heritage Inventory can be readily included in comprehensive plans, greenway and open space plans, parks and recreation plans, and regional planning initiatives. DCNR funded greenway and open space plans, Heritage Region plans, and River Conservation plans are good examples of planning efforts that reach beyond county boundaries.

   Planning and zoning initiatives can help achieve a balance of growth and open space preservation within the municipalities. The following are specific recommendations that will serve to

incorporate the information in this report into planning and land conservation activities in Cameron County.

Adopt the Cameron County Natural Heritage Inventory (CNHI) by resolution. The CNHI report should be used as one of the primary sources of information on the location of sensitive natural features within the county.

Cameron County's Comprehensive Plan was adopted in 1969, which was augmented by County Zoning Ordinances that were last updated in 1987. Implementation of several of the goals in the Cameron County Comprehensive Plan can help lead to conservation of sensitive natural features within the county.

- Within Section I of the County Comprehensive Plan, under "Important development factors related to the long-range comprehensive plan" is expressed the prime goal of preserving the wilderness aspect for certain parts of the county:

  "*The County is one of the seven "Wilderness counties" not yet spoiled by human activities in northern Pennsylvania. However, rapid development from 1970 through 1985 could reverse or destroy this natural resource. The retention of a "Wilderness" status for certain parts of the County is considered to be a prime goal in the future development planning.*"
  The comprehensive plan indicates that over 50% of the area of the County is in public ownership and most of the remainder is in very large private landholdings which has had the unintended consequence of focusing development into roadside and stream-side locations (Section I #4 & #5).

- The Land Use Policy Goals outlined in the Comprehensive Plan suggest regulating land use along streams and highways to preserve the scenic and natural characteristics of the county.

  "*Cameron County shall make every attempt to regulate the use of land along the principal highways and stream-beds, thus preserving the natural and scenic characteristics of the county….The obvious tool required is a properly prepared and adopted Zoning Ordinance with supplementary Subdivision and Land Development Regulations." (Section J #1)*
  Within Cameron County, only Emporium Borough, out of its five townships and two boroughs currently has zoning ordinances in place to help guide land use decisions. As expressed in the comprehensive plan, lack of planning and control over the siting of development within the municipalities can result in "…blighting effects…and shoddy development" (Section I #9). Continued lack of planning regulations will likely result in haphazard growth patterns with costly infrastructure demands and discontinuous open space. Future municipal plans and zoning initiatives should be developed for all municipalities and incorporate the CNHI information of this report into future land use decisions.

- The Comprehensive Plan makes clear its commitment to preserve water quality within the County and suggests zoning regulations and enforcement as tools for its protection within two goals of Section J:

  "*The County shall make every attempt to reduce or eliminate stream pollution by enforcing the flood plain zoning concept and by requiring adequate sewage facilities (public or private) in all major watersheds and for population concentrations….Good zoning with supporting regulatory measures are recommended devices in attempting to control future stream pollution. The regulatory controls contained in the flood plain district preclude encroachment of stream beds by …any development proposals which would contribute significantly to the overall pollution of any important waterway within the County." (Section J #2)*

  "*The County shall actively support all conservation measures and legislation geared to the prohibition of stripping of land when such operations will scar the county scenery and possibly contribute to future surface water pollution." (Section J #4)*

- In addition to the general recommendations within the Comprehensive Plan to protect streams, floodplains and water quality and to concentrate development activities within defined growth areas, these specific recommended amendments to the Comprehensive Plan can help assure the continued viability of sensitive natural features within the county:

    - The Cameron County Comprehensive Plan currently does not have a section to specifically encourage the conservation of environmentally sensitive areas within the County. The Comprehensive Plan should be amended to encourage the establishment of "Resource Protection Areas" which would identify land areas worthy of significant local protection in local zoning and land use regulations such as wetlands, floodplains, areas of steep slopes, scenic vistas, prime agricultural lands, and areas identified as "Core Habitat" in the Cameron County Natural Heritage Inventory.

    - Section I, Goal 1 in the Cameron County Comprehensive Plan encourages the County to *"…make every attempt to regulate the use of land along the principal highways and stream-beds, thus preserving the natural and scenic characteristics of the county."* An amendment to include specific language regarding the potential establishment of riparian buffer zones would be consistent with the recommendations in the Cameron CNHI report. Many of the Natural Heritage Areas presented in this report include floodplain and riparian areas and can serve as a basis for the most important areas to prioritize in floodplain ordinances. Action should be taken to amend the Comprehensive Plan to promote the establishment of a minimum 100-meter riparian floodplain setback/buffer to Section I, Goal 1.

    - Section J, Goal 4 in the Cameron County Comprehensive Plan encourages the County to "*actively support all conservation measures and legislation geared to the prohibition of stripping of land when such operations will scar the county scenery and possibly contribute to future surface water pollution."* This goal should be amended to include disturbances that would negatively impact the areas identified as "Core Habitat" in the Cameron County Natural Heritage Inventory.

    - Amend the Comprehensive Plan to add the Cameron CNHI overview map to the series of maps associated with the Comprehensive Plan.

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

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

    Land acquisition by a conservation organization can be at fair market value or as a set bargain sale in which a sale is negotiated for a purchase price below fair market value with tax benefits that reduce or eliminate the disparity. Identify areas that may be excellent locations for new county or township parks. Sites that can serve more than one purpose such as wildlife habitat, flood and

sediment control, water supply, recreation, and environmental education would be particularly ideal. Private lands adjacent to public lands should be examined for acquisition when a County Natural Heritage Inventory site is present on either property and there is a need for additional land to complete protection of the associated natural features.

Fee simple acquisition is when a buyer purchases land outright and has maximum control over the use and management of the property and its resources. This conservation initiative is appropriate when the property's resources are highly sensitive and protection cannot be guaranteed using other conservation approaches.

Unrestricted donations of land are welcomed by land trusts. The donation of land entitles the donor to a charitable deduction for the full market value, as well as a release from the responsibility of managing the land. If the land is donated because of its conservation value, the land will be permanently protected. A donation of land that is not of high biological significance may be sold, with or without restrictions, to a conservation buyer and the funds used to further the land trust's conservation mission.

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

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

Many of the already-protected areas identified in the Cameron County Natural Heritage Inventory are in need of additional management planning to ensure the continued existence of the associated natural elements. This can be accomplished by incorporation of site-specific recommendations into existing management plans or preparation of new plans. Recommendations may include: removal of exotic plant species; leaving the areas alone to mature and recover from previous disturbance; creating natural areas within existing parks; limiting land-use practices such as mineral extraction, residential or industrial development, agriculture, and implementing sustainable forestry practices. For example, some species simply require continued availability of a natural community while others may need specific management practices such as canopy thinning, mowing, or burning to maintain their habitat requirements.

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

4. Protect bodies of water.

Protection of creeks, rivers, wetlands, and reservoirs is vital for ensuring the health of human communities and natural ecosystems, especially those that protect biodiversity, supply drinking water, and are attractive recreation resources. Many rare species, unique natural communities, or locally significant habitats occur in wetlands and water bodies and are directly dependent on natural hydrological patterns and water quality for their continued existence. Ecosystem processes also provide clean water supplies for human communities and do so at significant cost savings in comparison to water treatment facilities. Hence, protection of high quality watersheds is the only way to ensure the viability of natural habitats and water quality. Scrutinize development proposals for their impact on entire watersheds, not just the immediate project area. Cooperative efforts in land use planning among municipal, county, state, and federal agencies, developers, and residents can lessen the impact of development on watersheds.

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

   Watersheds or subwatersheds where natural communities and species of concern occur (outlined on the township maps in this report) should be viewed as areas of sensitivity. As an example, conserving natural areas around municipal water supply watersheds provides an additional protective buffer around the water supply, habitat for wildlife, and may also provide low-impact recreational opportunities.

6. **Increase natural connectivity of the landscape surrounding the areas delineated in the Cameron County Natural Heritage Inventory.**
   Encourage development in sites that have already seen past disturbances. The reclamation of previously disturbed areas, or brownfield development, for commercial and industrial projects presents one way to encourage economic growth while allowing ecologically sensitive areas to remain undisturbed. Cluster development can be used to allow the same amount of development on much less land and leave much of the remaining land intact for wildlife and native plants. By compressing development into already disturbed areas with existing infrastructure (villages, roads, existing right-of-way's), large pieces of the landscape can be maintained intact. If possible, networks or corridors of woodlands or green-space should be preserved linking sensitive natural areas to each other.

   Care should be taken to ensure that protected natural areas do not become biological islands, patches of unconnected habitats surrounded by development. In these situations, the site is effectively isolated and its value to wildlife is severely reduced. Careful planning can maintain natural environments and plants and animals associated with them. A balance between growth and the conservation of natural resources can be achieved by guiding development away from the most environmentally sensitive areas.

7. **Encourage the formation of grassroots organizations.**
   County and municipal governments can do much of the work necessary to plan for the protection and management of natural areas identified in this report. However, grassroots organizations are needed to assist with obtaining funding, identifying landowners who wish to protect their land, and providing information about easements, land acquisitions, and management and stewardship of protected sites. Increasingly, local watershed organizations and land trusts are taking proactive steps to accomplish conservation at the local level. When activities threaten to impact ecological features, the responsible agency should be contacted. If no agency exists, private groups such as conservancies, land trusts and watershed associations should be sought for ecological consultation and specific protection recommendations.

8. **Manage for invasive species.**
   Invasive species threaten native diversity by dominating habitat used by native species and disrupting the integrity of the ecosystems they occupy. Management for invasives depends upon the extent of establishment of the species. Small infestations may be easily controlled or eliminated, but more well established populations might present difficult management challenges. Below is a list of sources for invasive species information.

- The Mid-Atlantic Exotic Plant Pest Council (MA-EPPC) is a non-profit (501c3) organization dedicated to addressing the problem of invasive exotic plants and their threat to the Mid-Atlantic region's economy, environment, and human health by: providing leadership; representing the Mid-Atlantic region at national meetings and conferences; monitoring and disseminating research on impacts and control methods; facilitating information development and exchange; and coordinating on-the-ground removal and training. A membership brochure is available as a PDF file at http://www.ma-eppc.org.
- Several excellent websites exist to provide information about invasive exotic species. The following sources provide individual species profiles for the most troublesome invaders, with information such as the species' country of origin, ecological impact, geographic distribution, as well as an evaluation of possible control techniques.
  - The Virginia Natural Heritage Program's invasive plant page at http://www.dcr.virginia.gov/natural_heritage/invspinfo.shtml
  - The Missouri Department of Conservation's Missouri Vegetation Management Manual at http://mdc.mo.gov/sites/default/files/resources/2010/05/5398_3326.pdf
  - The following site is a national invasive species information clearinghouse listing numerous other resources on a variety of related topics: http://www.invasivespecies.gov/

Evaluating proposed activity within Natural Heritage Areas

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

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

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

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

- *U.S. Fish and Wildlife Service* for federally listed plants and animals.
- *Pennsylvania Game Commission* for mammals and birds.
- *Pennsylvania Fish and Boat Commission* for aquatic animals, reptiles and amphibians.
- *Pennsylvania Department of Conservation and Natural Resources (DCNR)* for plants, natural communities, terrestrial invertebrates, and other species not falling under the above jurisdictions.

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

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

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

GLOSSARY

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

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

Anthropogenic: human caused.

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

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

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

Extant: in existence; not destroyed or lost.

Extirpated: species that have become locally extinct from an area

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

Fragmentation: The process where a continuous habitat, such as forest, shrubland, or grassland, is subdivided into a number of separate components. It is a dynamic process, resulting in a changing pattern of habitats in the landscape through time.

Graminoid: Grass or grass-like plant, including grasses (*Poaceae*), sedges (*Cyperaceae*), rushes (*Juncaceae*), arrow-grasses (*Juncaginaceae*), and quillworts (*Isoetes*).

Natural Heritage Area : an area containing and important in the support of plants or animals of concern at state or federal levels, exemplary natural communities, or exceptional native diversity.

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

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

Vernal: occurring in the spring.

REFERENCES AND LITERATURE CITED

Abrams, M.D. 1998. The red maple paradox. BioScience 48(5): 355-364.

Askins, R.A., J.F. Lynch, and R. Greenberg. 1991. Population declines in migratory birds in eastern North America. Current Ornithology 7: 1-57.

Audubon Society of Pennsylvania. 2002. Important Bird Areas Project. Retrieved from http://pa.audubon.org/iba/IBAs.html on May 5, 2004.

Blaustein, A. R., D. B. Wake, and W. P. Sousa. 1994. Amphibian declines: judging stability, persistence, and susceptibility of populations to local and global extinctions. Conservation Biology 8:60-71.

Braun, E.L. 1950. Deciduous forests of eastern North America. The Free Press, MacMillan Publ. Co., New York. 596 p.

Brauning, D.W. (ed.). 1992. Atlas of Breeding Birds in Pennsylvania Univ. of Pittsburgh Press, Pittsburgh, PA. 484 pp.

Brennan, L.A. and W.P. Kuvlesky. 2005. North American grassland birds: an unfolding conservation Crisis? Journal of Wildlife Management 69(1): 1-13.

Brim Box, J. and J. Mossa. 1999. Sediment, land use, and freshwater mussels: prospects and problems. Journal of the North American Benthological Society 18(1): 99-117.

Brody, A. J., and M. R. Pelton. 1989. Effects of roads on black bear movements in western North Carolina. Wildlife Society Bulletin 17: 5-10.

Brown, L.J. and R.E. Jung. 2005. An introduction of mid-Atlantic seasonal pools. U.S. Environmental Protection Agency. Fort Meade, MD. 91 pp.

Canadian Soil Information System. 2003. Glossary. Retrieved from http://res.agr.ca/cansis/glossary/index.html on 22 April 2003.

Castleberry, S.B., W.M. Ford, P.B. Wood, N.L. Castleberry and M.T. Mengak. 2001. Movements of Allegheny Woodrats in relation to timber harvesting. The Journal of Wildlife Management 65(1): 148-156.

Ciszek, D. 2002. *Lynx rufus*. Animal Diversity Web. Retrieved from http://animaldiversity.ummz.umich.edu/site/accounts/information/Lynx_rufus.html on 19 March 2005.

Compton, B.W., K. McGarigal, S.A. Cushman and L.R. Gamble. 2007. Resistant-kernel model of connectivity for amphibians that breed in vernal pools. Conservation Biology 21: 788-799.

Covell, C.V. 1984 A field guide to moths of eastern North America. Houghton Mifflin Co., Massachusetts. 496 pp.

Cuff, D.J., W.J. Young, E.K. Muller, W. Zelinsk, R.F. Abler, (eds.) 1989. The Atlas of Pennsylvania. Temple Univ. Press, Philadelphia, PA. 288 pp.

Dahl, T.E. 1990. Wetlands losses in the United States 1780's to 1980's. U.S. Department of the Interior, Fish and Wildlife Service. Washington, D.C.Jamestown, ND: Northern Prairie Research Center Online. http://www.npwrc.usgs.gov/resource/wetlands/wetloss/ (Version 16JUL97).

Davis, A.F., T.L. Smith, A.M. Wilkinson, E.B. Drayton, and G.J. Edinger. 1990. A natural areas inventory of Lancaster County, Pennsylvania. Pennsylvania Science Office of the Nature Conservancy, Middletown, Pennsylvania. 165 p.

Deeds, J. Meyer, 2009. PNHP Project Profile: The Yellow Lampmussel: A rare mussel finds a good home in Pennsylvania. Keystone Wild Notes. Winter 2009.

Doutt, J.K., C.A. Heppenstall, and J.E. Guilday. 1977. Mammals of Pennsylvania. Fourth edition. Pennsylvania Game Commission, Harrisburg, USA.

Dunkle, S.W. 2000. Dragonflies through binoculars. Oxford University Press, Oxford. 266 pp.

Ellis, M.M. 1931. Some factors affecting the replacement of the commercial fresh-water mussels. U.S. Bureau of Fisheries Circular 7: 1-10.

Ernst, C.H., and E.M. Ernst. 2003. Snakes of the United States and Canada. Smithsonian Books: Washington, D.C.

Ernst, C.H., and J.E. Lovich. 2009. Turtles of the United States and Canada (Second edition). Johns Hopkins University Press: Baltimore.

Evans, J.G. 1972. Land Snails in Archaeology. Academic Press, London. 436 pp.

Fergus, C. 2000. Wildlife of Pennsylvania and the northeast. Stackpole Books, Mechanicsburg, PA. 438 p.

Fike, J. 1999. Terrestrial & Palustrine Plant Communities of Pennsylvania. Pennsylvania Natural Diversity Inventory. 86 p.

Forman, R. T., and D. R. Deblinger. 2000. The Ecological Road-Effect Zone of a Massachusetts (U.S.A.) Suburban Highway. Conservation Biology 14:36-46.

Forman, R. T., and L. E. Alexander. 1998. Roads and their major ecological effects. Annual Review of Ecology and Systematics 29:207-231.

Geyer, A.R., and W.H. Bolles. 1979. Outstanding Scenic Geologic Features of Pennsylvania. Environmental Geology Report 7, PA Department of Environmental Resources, Bureau of Topographic and Geologic Survey. 508 p.

Geyer, A.R., and W.H. Bolles. 1987. Outstanding Scenic Geologic Features of Pennsylvania, Vol. 2. Environmental Geology Report 7, PA Department of Environmental Resources, Bureau of Topographic and Geologic Survey. 270 p.

Gibbs, J. P., A. R. Breisch, P. K. Ducey, G. Johnson, J. L. Behler, R. C. Bothner. 2007. The Amphibians and Reptiles of New York State: Identification, Natural History, and Conservation. Oxford University Press: New York, NY.

Gleason, Henry A., and Arthur Cronquist. 1991. Manual of Vascular Plants of Northeastern United States and Adjacent Canada. Second Ed. New York: The New York Botanical Garden: 36.

Goodrich, L. J., M. Brittingham, J.A. Bishop, and P. Barber. 2003. Wildlife habitat in Pennsylvania: past, present, and future. Pennsylvania Department of Conservation and Natural Resources. Harrisburg, PA. http://www.dcnr.state.pa.us/wlhabitat/.

Governor's Center for Local Government Services. 2007. e-library. http://www.elibrary.state.pa.us/elibpub.asp

Graveland, J., van der Wal, R., van Balen, J.H. & van Noordwijk, A.J. 1994. Poor reproduction in forest passerines from decline of snail abundance on acidified soils. Nature, 368: 446-448.

Greenberg C.H., S.H. Crownover, D.R. Gordon. 1997. Roadside soils: A corridor for invasion of xeric scrub by nonindigenous plants. Natural Areas Journal. 17:99–109.

Gregory, S. V., F. J. Swanson, W. A. McKee, and K. W. Cummins. 1991. An ecosystem perspective of riparian zones: focus on links between land and water. Bioscience 41: 540-551.

Gross, D.A. 2002. The Current PA List of breeding birds of special concern and species under consideration. PSO Newsletter, 13(3): 8.

Haag, W.R., D.J. Berg, D.W. Garton, J.L. Farris. 1993. Reduced survival and fitness in native bivalves in response to fouling by the introduced zebra mussel (*Dreissena polymorpha*) in western Lake Erie. Canadian Journal of Fisheries and Aquatic Sciences 50: 13-19.

Hakenkamp, C.C, S.G. Riblett and M.A. Palmer. 2001 The impact of an introduced bivalve (*Corbicula fluminea*) on the benthos of a sandy stream. Freshwater Biology 46: 491-501.

Harding, J.S., E.F. Befield, P.V. Bolstad, G.S. Helfman and E.B.D. Jones. 1998. Stream biodiversity: The ghost of land use past. Ecology 95(25): 14843-14847.

Harrison, H. H. 1957. Pennsylvania reptiles and amphibians. Pennsylvania Fish Comm., Harrisburg, third edition, 25 pp.

Hartle, M. A. 2006. Aquatic Biological Investigation in Response to the June 30, 2006 Norfolk Southern Train Derailment and Sodium Hydroxide Release. Unpublised report by the Pennsylvania Fish and Boat Commission's Division of Environmental Services.

Haskell, D. G. 2000. Effects of forest roads on macroinvertebrate soil fauna of the southern Appalachian Mountains. Conservation Biology 14:57-63.

Hassinger, J., C. Butchkoski, D. Diefenbach. 1996. Fragmentation effects on the occupancy of forested Allegheny woodrat (*Neotoma magister*) colony areas. Paper presented to Allegheny Woodrat Recovery Group Meeting. Ferrum College, Ferrum, Virginia.

Hassinger, J., R.J. Hill, G.L. Storm, R.H. Yahner. 1998. Inventory and Monitoring of Biotic Resources in Pennsylvania. Pennsylvania Biological Survey, pp. 221

Heilman, G.E., Strittholt, J.R., Slosser, N.C., Dellasala, D.A. 2002. Forest fragmentation can be measured and monitored in a powerful new way by combining remote sensing, geographic information systems, and analytical software. BioScience 52(5): 411-422.

Higgins, J., Lammert, M., Bryer, M., DePhilip, M., and D.Grossman. 1998 Freshwater conservation in the Great Lakes Basin: Development and application of an aquatic community classification framework. The Nature Conservancy. Arlington, Virginia. 273 pp.

Hitchcock, H. B. 1949. Hibernation of bats in southeastern Ontario and adjacent Quebec. Canadian Field-Naturalist 63: 47-59.

Homer, C. C. Huang, L. Yang, B. Wylie and M. Coan. 2004. Development of a 2001 National Landcover Database for the United States. Photogrammetric Engineering and Remote Sensing, Vol. 70, No. 7, July 2004, pp. 829-840.

Hulse, A.C., C.J. McCoy, and E. Censky. 2001. Amphibians and Reptiles of Pennsylvania and the Northeast. Comstock Publishing Associates: Ithaca.

Indiana Department of Natural Resources. 1985. A preliminary inventory of natural areas of the Hoosier National Forest. Indiana Department of Natural Resources, Indianapolis, Indiana. Unpublished report. 197 pp.

Jones, A. L., and P. D. Vickery. 1997. Conserving grassland birds: managing small grasslands including conservation lands, corporation headquarters, recreation fields, and small landfills for grassland birds. Massachusetts Audubon Society, Lincoln, Massachusetts. 16 p.

Jones, C., J. McCann and S. McConville. 2000. A Guide to the Conservation of Forest Dwelling Interior Birds In the Chesapeake Bay Critical Area. Critical Area Commission for the Chesapeake and Atlantic Coastal Bays, Maryland Department of Natural Resources, Annapolis, MD.

Kazacos, K. R. 1983. Raccoon roundworms (*Baylisascaris procyonis*) - a cause of animal and human disease. Purdue Research Foundation, West Lafayette, Indiana. 25 p.

Kenney, L.P., and M.R. Burne. 2000. A field guide to vernal pools. Massachusetts Division of Fisheries and Wildlife, Natural Heritage & Endangered Species Program, Westborough, Massachusetts. 73 p.

Kopas, F. (1993). *Soil survey of Cameron and Elk counties, Pennsylvania*. Washington D.C.: U.S. Government Printing Office.

Kushlan, J.A., M.J. Steinkamp, K.C. Parsons, J. Capp, M.A. Cruz, M. Coulter, Davidson, L. Dickson, N. Edelson, R. Elliot, R.M. Erwin, S. Hatch, S. Kress, R. Milko, S. Miller, K. Mills, R. Paul, R. Phillips, J.E. Saliva, B. Sydeman, J. Trapp, J. Wheeler, and K. Wohl. 2002. Waterbird Conservation for the Americas: The North American Waterbird Conservation Plan, Version 1. Waterbird Conservation for the Americas, Washington, D.C., U.S.A

Lannoo, M.J. (Ed). 2005. Amphibian Declines: The Conservation Status of United States Species. University of California Press: Berkley.

Latham, R.E., J. Beyea, M. Benner, C.A. Dunn, M. A. Fajvan, R.R. Freed, M. Grund, S.B. Horsley, A.F. Rhoads and B.P. Shissler. 2005. Managing white-tailed deer in forest habitat from an ecosystem perspective: Pennsylvania case study. Report by the deer management forum for Audubon Pennsylvania and Pennsylvania Habitat Alliance, Harrisburg. 340 pp.

Lawrence, J. F., and E. B. Britton 1994. Coleoptera (beetles). In Naumann, I. D. (ed.), Systematic and Applied Entomology: an Introduction, pp. 345-359. Carlton: Melbourne University Press.

Lydeard, C., Cowie, R.H., Ponder, W.F., Bogan, A.E., Bouchet, P., Clark, S.A., Cummings, K.S., Frest, T.J., Gargominy, O., Herbert, D.G., Hershler, R., Perez, K.E., Roth, B., Seddon, M., Strong, E.E. & Thompson, F.G. 2004. The global decline of nonmarine mollusks. BioScience, 54(4): 321-330.

Lynch, J. F., and D. F. Whigham. 1984. Effects of forest fragmentation on breeding bird communities in Maryland, USA. Biological Conservation 28:287-324.

Maryland Department of Natural Resources. 1999. Riparian forest buffers. Forest Service. Available at: http://www.dnr.state.md.us/forests/publications/buffers.html (accessed on 20 February 2008).

Massachusetts Executive Office of Environmental Affairs. 2001. BioMap: Guiding Land Conservation for Biodiversity in Massachusetts. Boston, MA. 59 p.

Matlack, G. R. 1993. Microenvironment variation within and among forest edge sites in the eastern United States. Biological Conservation 66:185-194.

Mazur, K. M., and P. C. James. 2000. Barred Owl (*Strix varia*). *In* The Birds of North America, No. 508 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.

McClure, M.S. 2001. Biological Control of Hemlock Woolly Adelgid in the Eastern United States. USDA Forest Service Forest Health Technology Enterprise Team. FHTET – 2000-08. 10pp.

McWilliams, G.M., and D.W. Brauning. 2000. The Birds of Pennsylvania. Cornell University Press: Ithaca, NY.

Merritt, J. F. 1987. Guide to the mammals of Pennsylvania. University of Pittsburgh Press. Pittsburgh, PA. 408 pp.

Murcia, C. 1995. Edge effects in fragmented forests: implications for conservation. Trends in Ecology & Evolution 10:58-62.

Myers, W., J. Bishop, R. Brooks, T. O'Connell, D. Argent, G. Storm, J. Stauffer, and R. Carline. 2000. Pennsylvania Gap Analysis Project Final Report. The Pennsylvania State University and U.S. Geological Survey, University Park, PA. 142 pp.

Naeem, S. (Chair), F.S. Chapin III., R. Costanza, P.R. Ehrlich, F.B. Golley, D.U. Hooper, J.H. Lawton, R.V. O'Neill, H.A. Mooney, O.E. Sala, A.J. Symstad, and D. Tilman. 1999. Biodiversity and ecosystem functioning: maintaining natural life support processes. Issues in Ecology #4. 11 p.

NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: February 20, 2008).

Nedeau, E., A.K. Smith, and J. Stone. Freshwater Mussels of the Pacific Northwest. US Fish and Wildlife Service, Vancouver, WA. 44 pp. Available at http://www.fws.gov/columbiariver/mwg/pdfdocs/Pacific_Northwest_Mussel_Guide.pdf

Needham, J.G., M.J. Westfall, and M.L. May. 2000. Dragonflies of North America. Scientific Publishers, Florida. 939 pp.

Ortmann, A.E. 1909. The destruction of freshwater fauna in western Pennsylvania. Proceedings of the American Philosophical Society 48: 90-110.

Ostrander, S.J. 2000. Great Natural Areas in Western Pennsylvania. Stackpole Books: Mechanicsburg, PA.

Ostroumov, S.A. 2002. New Definitions of the Concepts and Terms Ecosystem and Biogeocenosis.

Oxley, D. J., M. B. Fenton, and G. R. Carmody. 1974. The effects of roads of populations of small mammals. Journal of Applied Ecology 11:51-59.

Palone, R.S., and A.H. Todd (eds.) 1997. Chesapeake Bay riparian handbook: a guide for establishing and maintaining riparian forest buffers. USDA Forest Service. NA-TP-02-97. Radnor, PA.

Pashley, D. 1996. Watch List. National Audubon Society Field notes. 50(2): 129-134.

Pearson, D. L., Knisley, C. B., Kazilek, C. 2006. A Field Guide to the Tiger Beetles of the United States and Canada: Identification, Natural History, and Distribution of the Cicindelidae. Oxford University Press. 292 pp.

Pennsylvania Department of Conservation and Natural Resources (DCNR). 2005 State Forest Management Plan – Water. retrieved from http://www.dcnr.state.pa.us/forestry/sfrmp/water.htm#protecting on 12 July 2007.

Pennsylvania Department of Conservation and Natural Resources (DCNR). 2006. Wetland Quality. [Web application]. http://www.dcnr.state.pa.us/wlhabitat/aquatic/wlqual.aspx . Accessed on 22 November 2006.

Pennsylvania Department of Conservation and Natural Resources (DCNR). 2007. Geologic Map of Pennsylvania. Harrisburg, Pennsylvania. Available from http://www.dcnr.state.pa.us/topogeo/maps/map7.pdf (accessed September 2007).

Pennsylvania Department of Environmental Protection (DEP). 2004. Pennsylvania Integrated Water Quality Monitoring and Assessment Report. PA DEP, Bureau of Watershed Conservation. Harrisburg, PA.

Pennsylvania Department of Natural Resources. Forest Quality and Current Threats. [Web application] http://www.dcnr.state.pa.us/wlhabitat/forest/forest_quality.aspx . Accessed on 26 June 2006.

Pennsylvania's Conservation Reserve Enhancement Program. http://www.portal.state.pa.us/portal/server.pt?open=514&objID=622399&mode=2 on 24 July 2006.

Pennsylvania Game Commission and Pennsylvania Fish and Boat Commission. 2005 Pennsylvania Comprehensive Wildlife Strategy. Available at http://www.fish.state.pa.us/promo/grants/swg/nongame_plan/pa_wap_complete.pdf (accessed 20 February 2008).

Pennsylvania Natural Heritage Program (PNHP). 2008. Natural Resources Inventory and Management Recommendations for Sinnemahoning State Park. Pennsylvania Natural Heritage Program/Western Pennsylvania Conservancy. Pittsburgh, PA.

Peterjohn, B.G., and J.R. Saur. 1999. Population status of North American grassland birds from the North American breeding bird survey (1966-1996). Studies in Avian Biology 19 (1): 27-44.

Petranka, J. W. 1998. Salamanders of the United States and Canada. Smithsonian Institution Press: Washington, D.C.

Pulcinella, N. 1997. Eighth report of the Pennsylvania Ornithological Records Committee, June 1997. Pennsylvania Birds 11:126-133.

Reese, G.A., D.A. Albert, S.R. Crispin, L.A. Wilsmann, and S.J. Ouwinga. 1988. A natural heritage inventory of Oakland County, Michigan. Volume I: Technical Report: Michigan Natural Features Inventory, Lansing, Michigan. 242 pp.

Reschke, C. 1990. Techniques used for the inventory of rare ecological communities in New York State. pp. 102 –105. In R.S. Mitchell, C.J. Sheviak and D.J. Leopold (eds.), Ecosystem management: rare species and significant habitats. New York State Museum Bulletin 471. 314 p.

Rhoads, A. F. and T. A. Block. 2005. Trees of Pennsylvania. A Complete Reference Guide. University of Pennsylvania Press, Philadelphia, PA. 416 p.

Rhoads, A.F., and T.A. Block. 2007. The plants of Pennsylvania: an illustrated manual, Second Edition. University of Pennsylvania Press, Philadelphia. 1042 pp.

Rhoads, A.F., and W.M. Klein, Jr. 1993. The vascular flora of Pennsylvania: annotated checklist and atlas. American Philosophical Society, Philadelphia, PA. 636 pp.

Richter, B.D., D.P. Braun, M.A. Mendelson. L.L. Master. 1997. Threats to imperiled freshwater fauna. Conservation Biology 11: 1081-1093.

Robbins, C.S. 1980. Effects of forest fragmentation on breeding bird populations in the piedmont of the Mid-Atlantic Region. Atlantic Naturalist 33: 31-36.

Robbins, C.R., D.K. Dawson and B.A. Dowell. 1989. Habitat area requirements of breeding forest birds of the middle Atlantic states. Wildlife Monographs 103: 1-34.

Robertson, R.J., and R.F. Norman. 1976. Behavioral defenses to brood parasitism by potential hosts of the brown-headed cowbird. Condor 78(2): 166-173.

Robinson, S. K. 1994. Nesting success of forest songbirds in northwestern Illinois. Final Report, Project W-115-R-3. Illinois Natural History Survey. Center of Wildlife. Ecology, Urbana.

Robinson, S.K., F.R. Thompson III, T.M. Donovan, D.R. Whitehead, and J. Faaborg. 1995. Regional forest fragmentation and the nesting success of migratory birds. Science 267:1987-1990.

Rodewald, A. D. 2001. Ohio State University Extension fact sheet. Managing for forest songbirds. http://ohioline.osu.edu/w-fact/0006.html.

Rollo, C.D. 1983a. Consequences of competition on the reproduction and mortality of three species of terrestrial slugs. Researches in Population Ecology, 25: 20-43.

Rollo, C.D. 1983b. Consequences of competition on the time budgets, growth, and distributions of three species of terrestrial slugs. Researches in Population Ecology, 25: 44-68

Rosenberg, K.V., and B. Robertson. 2003. Northern Ridge and Valley (Area 17) PIF Landbird Conservation Plan. American Bird Conservancy, The Plains, VA.

Rosenberg, K.V., R.W. Rohrbaugh, Jr., S.E. Barker, J.D. Lowe, R.S. Hames, and A.A. Dhondt. 1999. A Land Manager's Guide to Improving Habitat for Scarlet Tanagers and other Forest-Interior Birds. Cornell Lab of Ornithology.

Roslund, H.R., 1951. Mammal Survey of northcentral Pennsylvania. Final Rpt., Pittman-Robertson Proj. 37-R, Pennsylvania Game Commission: Harrisburg, PA

Sauer, J. R., J. E. Hines, G. Gough, I. Thomas, B. G. Peterjohn. 2000. The North American Breeding Bird Survey results and analysis. Version 98.1. Patuxent Wildl. Res. Center, Laurel, MD.

Schmidt, W. 1989. Plant dispersal by motor cars. Vegetatio 80: 147-152.

Scott, J.M., E.A. Norse, H. Arita, A. Dobson, J.A. Estes, M. Foster, B. Gilbert, D.B. Jensen, R.L. Knight, D. Mattson, and M.E. Soule. 1999. The issue of scale in selecting and designing biological reserves. pp. 19-37. In M.E. Soule and J. Terborgh (eds.), Continental conservation: scientific foundations of regional reserve networks. Island Press, Washington, DC. 227 p.

Seiler, A. 2001. Ecological effects of roads: a review. Introductory Research Essay No. 9, Swedish University of Agricultural Sciences, Upsala, Sweden.

Semlitsch, R. 1998. Biological Delineation of Terrestrial Buffer Zones for Pond-breeding Salamanders. Conservation Biology Vol. 12 No. 5: 1113-1119.

Semlitsch, Raymond D., and J. Russell Bodie. 2003. Biological criteria for buffer zones around wetlands and riparian habitats for amphibians and reptiles. Conservation Biology 17 (5): 1219-1228.

Sevon, W.D., and D.D. Braun. 1997. Glacial Deposits of Pennsylvania [map]. 1:1,200,000. Pennsylvania Geological Survey Map 59. Harrisburg: Pennsylvania Geological Survey.

Shaffer, L.L. 1999. Pennsylvania Amphibians and Reptiles. Pennsylvania Fish and Boat Commission. Harrisburg, Pennsylvania. 161 pp.

Shultz, C.H. editor. 1999. The Geology of Pennsylvania. Geological Survey of Pennsylvania. Pittsburgh Geological Society. Pennsylvania. 888 pp.

Smith, T.L. 1991. Classification of Natural Communities in Pennsylvania. Pennsylvania Natural Diversity Inventory, The Nature Conservancy, Middletown, PA.

Spoo, A. 2008. The Pearly Mussels of Pennsylvania. Coachwhip Publications: Landisville PA.

Squires, J. R., and R. T. Reynolds. 1997. Northern Goshawk (*Accipiter gentilis*). *In* The Birds of North America, No. 298 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.

Stewart, R.E. 2001. Technical Aspects of Wetlands: Wetlands as Bird Habitat. National Summary on Wetland Resources, United States Geological Survey Water Supply Paper 2425. USGS. http://water.usgs.gov/nwsum/WSP2425/birdhabitat.html. Accessed on 10 June 2006.

Strayer, D.L. and K.J. Jirka. 1997. The Pearly Mussels of New York State. The New York State Education Dept., Albany, NY. 113 pp.

Swearingen, J., K. Reshetiloff, B. Slattery, and S. Zwicker. 2002. Plant Invaders of Mid-Atlantic Natural Areas. National Park Service and U.S. Fish & Wildlife Service, Washington, D.C. 82 pp.

Thompson, Sue A., editor. 2002. *Biodiversity in Pennsylvania: Snapshot 2002*.Pennsylvania Biodiversity Partnership, Pittsburgh, Pennsylvania. 60 pp.

Thorne, S. G., K. C. Kim and K. C. Steiner, Eds. 1996. A Heritage for the 21st Century: Conserving Pennsylvania's Native Biological Diversity. A report by the Pennsylvania Biodiversity Technical Committee. Pennsylvania Fish and Boat Commission. Harrisburg, PA.

Tiner, R. W. 1990. Pennsylvania's Wetlands: Current Status and Recent Trends. Pennsylvania Bureau of Water Resources Management. Harrisburg, Pennsylvania. USA.

Tiner, R.W. 1990. Use of high-altitude aerial photography for inventorying forested wetlands in the United States. Forest Ecology and Management 33/34: 593-604.

Trombulak, S. C., and C. A. Frissell. 2000. Review of the ecological effects of roads on terrestrial and aquatic communities. Conservation Biology 14:18-30.

U.S. Census Bureau. 2009. State and County QuickFacts. http://quickfacts.census.gov/qfd/index.html

U.S. Fish and Wildlife Service. A guide to the laws and treaties of the United States for protecting migratory birds. U.S. Department of the Interior. Available at: http://www.fws.gov/migratorybirds/RegulationsPolicies/treatlaw.html accessed August 2007).

U.S. NABCI Committee. 2000. The North American bird conservation initiative in the United States: A vision of American bird conservation. U.S. Fish and Wildlife Service: Arlington, VA.

Vaughn, C.C., and C.C. Hakenkamp. 2001. The functional role of burrowing bivalves in freshwater ecosystems. Freshwater Biology 46: 1431-1446.

Vogelmann, J. E., S. M. Howard, L. Yang, C. R. Larson, B. K. Wylie, and N. Van Driel. 2001. National Land Cover Database 2001 (NLCD 2001). Available online at http://seamless.usgs.gov from the U.S. Geological Survey (USGS), EROS Data Center, MRLC Project, Sioux Falls, South Dakota, USA.

Warren, B. H. 1890. Report on the Birds of Pennsylvania. 2nd. ed., rev. and aug. Harrisburg: State Board of Agriculture.

Watkins, R. Z., J. Chen, J. Pickens, and K. D. Brosofske. 2003. Effects of forest roads on understory plants in a managed hardwood landscape. Conservation Biology 17:411-419.

Wenger, S. 1999. A Review of the Scientific Literature on Riparian Buffer Width, Extent and Vegetation. Office of Public Service & Outreach, Institute of Ecology, University of Georgia, Athens, Georgia.

Wenger, S., L. Fowler. 2000. Protecting Stream and River Corridors – Creating Effective Local Riparian Buffer Ordinances, Carl Vinson Institute of Government, The University of Georgia.

Westfall, M.J. and M.L. May. 1996 Damselflies of North America. Scientific Publishers, Florida. 649 pp.

Welsch, D. 1991. Riparian forest buffers: function for protection and enhancement of water resources. U.S. Department of Agriculture, Forest Service, Northern Area State and Private Forestry.

Whitaker, J. O., Jr., and W. J. Hamilton, Jr. 1998. Mammals of the eastern United States. Cornell University Press. Ithaca, NY. 583 pp.

White, W.B and E.L. White. 1999. Caves. Pp. 805-809 in C.H. Shultz, editor. The Geology of Pennsylvania. Special Publication 1, Pennsylvania Geological Survey, Harrisburg; Pennsylvania Geological Society, Pittsburgh. 888 pp.

Williams, C. E. 1995. Effects of powerline corridors on forest ecosystem integrity. Pages 76-86 *in* S. K. Majumdar, E. W. Miller, and F. J. Brenner, editors. Environmental Contaminants, Ecosystems and Human Health. Pennsylvania Academy of Science, Easton, PA.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18(9): 6-22 pp.

Yahner, R.H. 2000. Eastern Deciduous Forest: Ecology and Wildlife Conservation. University of Minnesota Press: Minneapolis, MN. 220pp.

Zedler, J.B., and S. Kercher. 2004. Causes and consequences of invasive plants in wetlands: opportunities, opportunists, and outcomes. Critical Reviews in Plant Sciences 23: 431-452.

GIS DATA SOURCES

Note: Many diverse data sources were used in the creation of this report. Every attempt was made to ensure the accuracy of the data. The Pennsylvania Natural Heritage Program should not be held liable for any mapping errors resultant from use of these public data sources.

Bishop, Joseph A. 1998. Managed Lands in Pennsylvania. Pennsylvania GAP Analysis Project, Environmental Resources Research Institute.

Bishop, Joseph A. 2003. IBA core polygon boundaries.

Ecological regions of North America, Level III. 1997. North American Commission for Environmental Cooperation. Available online: http://www.epa.gov/wed/pages/ecoregions/na_eco.htm. Accessed: March 2004.

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

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

National Wetlands Inventory ArcInfo Coverages. U.S. Fish and Wildlife Service. Available online: http://www.fws.gov/wetlands/Data/Mapper.html . Accessed: April 2003.

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

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

Bishop, Joseph A. 1998. Managed Lands in Pennsylvania. Pennsylvania GAP Analysis Project, Environmental Resources Research Institute.

Bishop, Joseph A. 2004. Pennsylvania Important Mammal Areas Project.

Ecological regions of North America, Level III. 1997. North American Commission for Environmental Cooperation. Available online: http://www.epa.gov/wed/pages/ecoregions/na_eco.htm Accessed: March 2004.

ESRI Street Map USA. 2005.

Pennsylvania Department of Transportation. 2006. PennDOT - Pennsylvania County Boundaries. Bureau of Planning and Research, Cartographic Information Division. Pennsylvania Spatial Data Access (PASDA). http://www.pasda.psu.edu/

U.S. Fish and Wildlife Service. 2005. National Wetland Inventory (NWI) for Pennsylvania – polygon. Pennsylvania Spatial Data Access (PASDA). www.pasda.psu.edu

USGS 1:24,000 Topographic quadrangles. Pennsylvania Spatial Data Access (PASDA), downloaded 2003. http://www.pasda.psu.edu/

Warner, Eric D. 2000. Pennsylvania Landcover. Penn State University (PSU). http://www.pasda.psu.edu/uci/MetadataDisplay.aspx?entry=PASDA&file=palanduse05utm18nad83.xml&dataset=1100

APPENDIX I: Species and Natural Communities of Conservation Concern in Cameron County

Scientific Name	Common Name	Global Rank[1]	State Rank[1]	State Legal Status[1] (proposed)
Mammals				
Myotis septentrionalis	Northern myotis	G4	S3B,S3N	N(CR)
Sorex palustris albibarbis	Northern water shrew	G5T5	S3	(CR)
Neotoma magister	Allegheny Woodrat	G3G4	S3	PT (PT)
Birds				
Accipiter gentilis	Northern Goshawk	G5	S2S3B,S3N	CR
Ardea herodias	Great blue heron (rookery)	G5	S3S4B,S4N	N
Haliaeetus leucocephalus	Bald eagle	G5	S2B	PT(PT)
Herptiles				
Crotalus horridus	Timber Rattlesnake	G4	S3S4	PC(CA)
Cryptobranchus alleganiensis	Hellbender	G3G4	S3	N
Glyptemys insculpta	Wood turtle	G4	S3S4	N
Liochlorophis vernalis	Smooth green snake	G5	S3S4	N
Plestiodon anthracinus	Northern coal skink	G5	S3	N
Virginia pulchra	Mountain earthsnake	G5T3T4	S3	N
Freshwater Mussels				
Lasmigona subviridis	Green Floater	G3	S2	(CU)
Insects				
Aplectoides condita	A Noctuid Moth	G4	S2S3	N
Cicindela limbalis	Common claybank tiger beetle	G5	S3	N
Chlosyne harrisii	Harris's Checkerspot	G4	S3	N
Enallagma aspersum	Azure Bluet	G5	S3S4	N
Epiglaea apiata	Pointed Sallow	G5	S3S4	N
Papaipema sp. 1	Flypoison Borer Moth	G2G3	S2	N
Sideridis maryx	A moth	G4	S1S3	N
Somatochlora elongata	Ski-tailed Emerald	G5	S2	N
Speyeria atlantis	Atlantis Fritillary	G5	S3	N
Sympetrum obtrusum	White-faced meadowhawk	G5	S3S4	N
Xylotype capax	Barrens Xylotype	G4	S3	N
Plants				
Bartonia paniculata	Screw-stem	G5	S3	P (NR)
Elymus trachycaulus	Slender wheatgrass	G5	S3	N (TU)
Gaultheria hispidula	Creeping snowberry	G5	S3	PR (PR)
Lactuca hirsuta	Downy lettuce	G5?	S3	N (TU)
Taxus canadensis	American yew	G5	S3S4	TU(watch)
Woodwardia areolata	Netted chainfern	G5	S2	N (PT)
Natural Community				
Ephemeral/fluctuating natural pool		GNR	S3	N
Hemlock – mixed hardwood palustrine forest		GNR	S3S4	N
Cotton-grass poor fen		GNR	S3	N

[1] Please refer to Appendix II for an explanation of PNHP ranks, legal status and quality ranks.

APPENDIX II: Federal and State Status; Natural Heritage Ranks

FEDERAL STATUS

U.S. FISH AND WILDLIFE SERVICE CATEGORIES OF ENDANGERED AND THREATENED PLANTS AND ANIMALS

The following definitions are extracted from the September 27, 1985 U.S. Fish and Wildlife Service notice in the Federal Register:

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

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

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

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

C1 - Taxa for which the Service currently has on file substantial information on biological vulnerability and threat(s) to support the appropriateness of proposing to list them as endangered or threatened species.

C2 - Taxa for which information now in possession of the Service indicates that proposing to list them as endangered or threatened species is possibly appropriate, but for which substantial data on biological vulnerability and threats are not currently known or on file to support the immediate preparation of rules.

C3 - Taxa that are no longer being considered for listing as threatened or endangered species. Such taxa are further coded to indicate three categories, depending on the reason(s) for removal from consideration.

3A--Taxa for which the Service has persuasive evidence of extinction.

3B--Names that, on the basis of current taxonomic understanding, usually as represented in published revisions and monographs, do not represent taxa meeting the Act's definition of "species".

3C--Taxa that have proven to be more abundant or widespread than was previously believed and/or those that are not subject to any identifiable threat.

N - Taxa not currently listed by the U.S. Fish and Wildlife Service

STATE STATUS-NATIVE PLANT SPECIES

Legislative Authority: Title 25, Chapter 82, Conservation of Native Wild Plants, amended June 18, 1993, Pennsylvania Department of Environmental Resources.

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

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

PR - Pennsylvania Rare - Plant species which are uncommon within this Commonwealth. All species of native wild plants classified as Disjunct, Endemic, Limit of Range, and Restricted are included within the Pennsylvania Rare classification.

PX - Pennsylvania Extirpated - Plant species believed by the Department to be extinct within this Commonwealth. These plant species may or may not be in existence outside this Commonwealth. If plant species classified as Pennsylvania Extirpated are found to exist, the species automatically will be considered to be classified as Pennsylvania Endangered.

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

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

N - None - Plant species which are believed to be endangered, rare, or threatened, but which are being considered by the required regulatory review processes for future listing

STATE STATUS-ANIMALS

The following state statuses are used by the Pennsylvania Game Commission for (1990, Title 34, Chapter 133 pertaining to wild birds and mammals) and by the Pennsylvania Fish and Boat Commission (1991, Title 30, Chapter 75 pertaining to fish, amphibians, reptiles, and aquatic organisms):

PE - Pennsylvania Endangered - Game Commission - Species in imminent danger of extinction or extirpation throughout their range in Pennsylvania if the deleterious factors affecting them continue to operate. These are: 1) species whose numbers have already been reduced to a critically low level or whose habitat has been so drastically reduced or degraded that immediate action is required to prevent their extirpation from the Commonwealth; or 2) species whose extreme rarity or peripherality places them in potential danger of precipitous declines or sudden extirpation throughout their range in Pennsylvania; or 3) species that have been classified as "Pennsylvania Extirpated", but which are subsequently found to exist in Pennsylvania as long as the above conditions 1 or 2 are met; or 4) species determined to be "Endangered" pursuant to the Endangered Species Act of 1973, Public law 93-205 (87 Stat. 884), as amended.

Fish and Boat Commission - Endangered Species are all species and subspecies: (1) declared by the Secretary of the United States Department of the Interior to be threatened with extinction and appear on the Endangered Species List or the Native Endangered Species list published in the Federal Register; or, (2) declared by the Executive Director (PaFC) to be threatened with extinction and appear on the Pennsylvania Endangered Species List published in the Pennsylvania Bulletin.

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

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

PC - Pennsylvania Concern - Animals that could become endangered or threatened in the future. All of these are uncommon, have restricted distribution, or are at risk because of certain aspects of their biology.

CP - Candidate Proposed - Species comprising taxa for which the Pennsylvania Biological Survey (PBS) currently has substantial information on hand to support the biological appropriateness of proposing to list as Endangered or Threatened.

CA - Candidate at Risk - Species that although relatively abundant now are particularly vulnerable to certain types of exploitation or environmental modification.

CR - Candidate Rare - Species which exist only in one of a few restricted geographic areas or habitats within Pennsylvania, or they occur in low numbers over a relatively broad area of the Commonwealth.

CU - Condition Undetermined - Species for which there is insufficient data available to provide an adequate basis for their assignment to other classes or categories.

N - None - No current legal status, but is under review for future listing.

NATURAL HERITAGE GLOBAL ELEMENT RANKS

G1 - **Critically imperiled** globally because of extreme rarity, or because of some factor(s) making it especially vulnerable to extinction.

G2 - **Imperiled** globally because of rarity, or because of some factor(s) making it very vulnerable to extinction throughout its range.

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

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

G5 - **Secure** globally, though it may be quite rare in parts of its range, especially at the periphery.

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

GNR - Global rank has yet to be assessed. This rank indicates neither commonness nor rarity.

Range ranks (for example, G2G4 or G3G4) indicate a range of uncertainty regarding a species rank.

NATURAL HERITAGE STATE ELEMENT RANKS

S1 - **Critically Imperiled** in state because of extreme rarity, or because of some factor(s) making it especially vulnerable to extirpation from the state.

S2 - **Imperiled** in state because of rarity, or because of some factor(s) making it very vulnerable to extirpation from the state.

S3 - **Vulnerable** - rare in state.

S4 - **Apparently secure** – uncommon but not rare.

S5 - **Secure** – common, widespread, and abundant in the state.

B - Rank Qualifier - Basic rank refers to the breeding population of the element in the state.

N - Rank Qualifier - Basic rank refers to the non-breeding population of the element in the state.

SNR - State status has not yet been assessed. This rank indicates neither commonness nor rarity.

SU - Currently unrankable due to due to a lack of information

SH - Of historical occurrence in the state with the expectation that it may be rediscovered.

SX - Apparently extirpated from the state.

S? – Not ranked to date.

Range ranks (for example, S1S3 or S3S4) indicate a range of uncertainty regarding a species rank.

NATURAL HERITAGE ELEMENT OCCURRENCE QUALITY RANKS

Quality Rank Explanation

A - Excellent occurrence: all A-rank occurrences of an element merit quick, strong protection. An A-rank occurrence is nearly undisturbed by humans or has nearly recovered from early human disturbance; further distinguished by being an extensive, well-buffered occurrence. An A-rank population of a species is large in area and number of individuals, stable, if not growing, shows good reproduction, and exists in natural habitat.

B - Good occurrence: protection of the occurrence is important to the survival of the element in Pennsylvania, especially if very few or no A-rank occurrences exist. A B-rank occurrence is still recovering from early disturbance or recent light disturbance, or is nearly undisturbed but is less than A-rank because of significantly smaller size, poorer buffer, etc. A B-rank population of a species is at least stable, in a minimally disturbed habitat, and of moderate size and number.

C - Fair occurrence: protection of the occurrence helps conserve the diversity of a region's or County's biota and is important to statewide conservation if no higher-ranked occurrences exist. A C-rank occurrence is in an early stage of recovery from disturbance, or its structure and composition have been altered such that the original vegetation of the site will never rejuvenate, yet with management and time partial restoration of the community is possible. A C-rank population of a species is in a clearly disturbed habitat, small in size and/or number, and possibly declining.

D - Small occurrence: protection of the occurrence may be worthwhile for historical reasons or only if no higher ranked occurrences exist. A D-rank occurrence is severely disturbed, its structure and composition been greatly altered, and recovery to original conditions, despite management and time, essentially will not take place. A D-rank population of a species is very small with a high likelihood of dying out or being destroyed, and exists in a highly disturbed and vulnerable habitat.

E - Verified as extant, but has not been given a rank; additional information needed to evaluate quality.

F - While known from the site, the last survey failed to find sufficient evidence to verify the element still occurred at the site or to conclude that the element was no longer present at the site.

H - Recent field information verifying the continued existence of the occurrence is lacking.

Range ranks (for example, AB or CD) indicate a range of uncertainty regarding a quality rank

APPENDIX III: Sustainable Forestry Information Sources

The *Pennsylvania Forest Stewardship Program* is a voluntary program that assists forest landowners in better managing their forestlands by providing information, education, and technical assistance. Participation in the program is open to private landowners who own between 5 and 1,000 acres of forestland. Visit http://paforeststewards.cas.psu.edu/PAprogram.html for more information or contact:

Jim Finley, Assistant Director for Extension
The Pennsylvania State University
School of Forest Resources
7 Ferguson Building
University Park, PA 16802
814- 863-0401; E-mail: fj4@psu.edu

The ***Forest Land Enhancement Program*** complements the Forest Stewardship Program by providing landowners with cost-share dollars to implement their management plans and follow-up technical assistance to encourage the achievement of their long-term forest management goals. For more information, contact:

Jim Stiehler, Forest Stewardship Coordinator
DCNR - Bureau of Forestry
6th Floor, Rachel Carson State Office Building
P.O. Box 8552
Harrisburg, PA 17105-8552
(717)787-4777

The ***Forest Legacy Program*** acts to purchase conservation easements or titles from willing private landowners. In this program, federal funding is administered through the state Bureau of Forestry to foster protection and continued use of forested lands that are threatened with conversion to non-forest uses. Emphasis is given to lands of regional or national significance. For more information, go to http://www.fs.fed.us/spf/coop/programs/loa/flp.shtml or contact:

Gene Odato, Chief, Rural & Community Forestry Station
DCNR – Bureau of Forestry
6th Floor, Rachel Carson State Office Building
P.O. Box 8552
Harrisburg, PA 17105-8552
(717)787-6460; E-mail: godato@state.pa.us

The ***Sustainable Forestry Initiative*** (SFI) program is a voluntary, industry-driven effort developed to ensure that future generations will have the same abundant, healthy, and productive resources we enjoy today. Created in 1995 by the American Forest and Paper Association (the national trade organization representing the United States forest products industry), SFI is a program of comprehensive forestry and conservation practices. Through the SFI of PA program, landowners receive the information they need to enhance their ability to make good forest management decisions, and loggers learn safer, more productive skills and proper environmental practices. For more information, go to http://www.sfiofpa.org/ or contact:

SFI® of PA
315 S. Allen Street, Suite 418
State College, PA 16801
814-867-9299 or 888- 734-9366; E-mail: sfi@penn.com

APPENDIX IV: Aquatic Invasive Species (AIS)

Aquatic invasive species (AIS, also referred to an aquatic nuisance species or ANS) are aquatic animals and plants that have been introduced into waterways in which they do not live naturally. They have harmful effects on the natural resources in these ecosystems and the human uses of these resources. Some of the least-wanted AIS in Pennsylvania are European ruffe, sea lamprey, hydrilla, spiny water flea, purple loosestrife, Eurasian watermilfoil, Asian clam, and red-eared slider (turtle). It's not always foreign invaders that are the problem. White perch and flathead catfish are other examples of species that have turned up where they don't belong. While native to some PA watersheds, they have been introduced to other areas where they are not wanted.

Aquatic species banned in Pennsylvania (sale, barter, possession or transportation)

- Bighead carp (*Hypophtalmichtys nobilis*)
- Black carp (*Mylopharyngodon piceus*)
- European rudd (*Scardinius erythropthalmus*)
- Quagga mussel (*Dreissena bugensis*)
- Snakehead (all species)
- Round goby (*Neogobius melanostomus*)
- Ruffe (*Gymnocephalus cernuus*)
- Rusty crayfish (*Orconectes rusticus*)
- Silver carp (*Hypophtalmichtys molitrix*)
- Tubenose goby (*Proterothinus marmoratus*)
- Zebra mussel (*Dreissena polymorpha*)

Definitions

- Biodiversity -- The variety of species, their genetic makeup, and the natural communities in which they occur.
- Introduced species -- A species living outside of its natural geographic range. Can be deliberately or accidentally introduced or brought into the new ecosystem. Also called exotic, non-native, nuisance or invasive species.
- Invasive -- Spreading or taking over. Invasive species often take over or dominate a habitat.
- Native -- An animal or plant originating in a region or geographic range. For example, brook trout are native to Pennsylvania.

Stop the Spread of AIS

- When retrieving your boat for the day, check the boat, motor and trailer for weeds and other things tagging along.
- Wash your boat's hull with hot water or with a high-pressure spray.
- Drain livewells, bilges and other compartments.
- Drain all standing water from your boat.
- Don't dump leftover bait into the water you're fishing, unless you collected the bait there.

http://www.fish.state.pa.us/ais.htm, accessed January 5th, 2010

APPENDIX V: 'Easy EO' form and instructions

This following form allows the naturalists and the interested public to submit information about sightings and records of rare species, habitats and natural communities to the Pennsylvania Natural Heritage Program.

Current information on which species are tracked by PNHP may be found on our website at http://www.naturalheritage.state.pa.us/

Please submit this form to:

Pennsylvania Natural Heritage Program
c/o Data Management
800 Waterfront Drive
Pittsburgh, PA 15222

Mapping Locations of Species of Special Concern

- Maps made from USGS quadrangle maps are ideal, but a good topographical or gazetteer map will do.
- Draw with a thin red or other bright-colored pen so your lines are easy to see.
- Draw the location of the 'found' species as accurately as you possibly can. We encourage you to draw a precise polygon of the area the species occupies, rather than a vague circle or arrow pointed at the site. If you only find a few plants or one animal, a polygon would be impossible to draw at 1-24:000 map scale (our standard map scale), so a dot would suffice.
- Estimate the size of the area the species is directly observed to be occupying.

Do not include in your polygon the 'suitable' habitat surrounding the location of the species if you did not survey the surrounding area, or if you searched but did not find the species in the surrounding area.

To further complicate things, we do want potential/suitable habitat information if you can provide it. But it must not be confused with the area where you KNOW FOR CERTAIN the species is found.

- To indicate suitable habitat (but not yet known for certain to be occupied), draw a dotted line around the area and label it as 'suitable' or 'potential' habitat.

SPECIES NAME:	**SURVEYOR(S):**(*Please include your address & phone #)*
DATE OF VISIT:	**TIME SPENT AT SITE:**
DIRECTIONS TO SITE:	**GPS Coordinates**: Latitude: _____ Longitude: _____ **Coordinates differentially corrected?** _____ **Topo Quadrangle**: _____

OWNER INFORMATION:

- **Public Land**: give tract name:_____
- **Private Land**: Please fill out landowner info below. **NOTE**: PNHP cannot accept data collected on private land without permission!

Landowner Name:	Address:
Phone Number:	City / State / Zip code:

- Landowner aware of the species of special concern? **YES____ NO____**
- Landowner aware that data are submitted to PA Natural Heritage Program? **YES____ NO____**
- Landowners are welcome to call the PNHP-Pittsburgh office at (412)586-2314 for more information**.**
- If a specimen was collected, please ask for the landowner's signature for permission to save the specimen in a museum: Landowner Signature: _____ Date: _____
- Where is the specimen being held: _____

HABITAT DESCRIPTION: Give a general description of the site. You might include other plant/animal species at site, substrate/soils, topography, land use, weather, etc. If revisiting a site, indicate any obvious changes to the habitat.

DISTURBANCES/THREATS: Include human and/or natural disturbances and threats to the species at this site.

SPECIES DATA: Fill out as much of the following as you can - include anything else you feel is of importance.

♣Give general description of what you saw (*i.e.: found scat, heard song, animal crossing road, found plant in bog*).

♣Count or estimate the number of plants / animals you observed & estimate the size of the area they occupy.

♣Age and condition of individual(s) (*i.e.: fresh adult butterfly; healthy mature plants-50% flowering with immature fruit*)

♣Behavior (*animals*) (*i.e.: nectaring insect, breeding birds, turtle basking*)

♣If revisiting this site, compare the heath and size of the population to previous visits.

♣Confidence level on Identification: ____ID Positive ____ID Somewhat Uncertain ____ID Unknown

♣Voucher specimen or photo taken? (*Please include if possible*)

♣Additional information:

APPENDIX VI: PNHP Aquatic Community Classification (ACC) in Cameron County

Note: the following project description is adapted from Classifying Lotic Systems for Conservation: Project Methods and Results of the Pennsylvania Aquatic Community Classification Project (2007a) and User's manual and data guide to the Pennsylvania Aquatic Community Classification (2007b).

How were aquatic communities defined?

A statewide project of the Pennsylvania Natural Heritage Program, the Pennsylvania Aquatic Community Classification Project, collected aquatic datasets from state and federal agencies, interstate basin commissions, and universities, analyzed information with standard statistical methods, and identified community types and habitat associations. Flowing water habitats, such as rivers and streams, and their community types are described. Aquatic community types of non-flowing waters like lakes, wetlands, and ponds, have not been identified to date. Aquatic communities were identified within watersheds. The most common community type per watershed was chosen to represent typical watershed organisms and habitats. Although other community types may exist in a particular watershed, the major community type is described. The term watershed describes an area of land that drains down slope to the lowest point. Watersheds can be large or small. All of the land in the state is part of a watershed. Every stream, tributary, or river has an associated watershed, and small watersheds join to become larger watersheds. In the PNHP Aquatic Community Classification relatively small watersheds (hydrologic unit code 12 – huc12) are described by their community types. (For more information on huc12: http://water.usgs.gov/GIS/huc.html). Separate communities were identified for fish, macroinvertebrates, and mussels. Aquatic communities for each type of organism can be used to describe the aquatic resources, habitat types, and stream quality. Fact sheets describing the aquatic communities identified in Cameron County are provided at the end of this appendix.

How are communities described?

Commonly occurring animals in the community type are listed. While not every organism described in a community will occur in every community location, organisms listed by community types give a general account of what organisms to expect in a community habitat. Species of concern (considered state or globally rare) that may occur with each community type are listed. Environmental and water quality habitats typically associated with the community type are also described.

1) Community Habitat - The environment of the stream where the community occurs is described by watershed and stream characteristics. Size of the stream and watershed, gradient (slope), and elevation are a few habitat characteristics that may be important to the community type. Local conditions are also mentioned.

2) Stream quality rating- Community locations are ranked as low, medium, or high quality based on known habitat, water quality, and sensitivity of organisms to pollution.

3) Threats and Disturbances - Pollution sources or other threats that may alter the natural state of the community are discussed, where known.

4) Conservation recommendations – Recommendations for the county natural resource managers and land planners to consider in protection and management of the watersheds and communities are described.

What do fish, macroinvertebrates, and mussels tell me about streams and watersheds?

All three groups of organisms described in the ACC hold unique places in Pennsylvania's streams and rivers. Macroinvertebrates include aquatic insects, worms, and crustaceans, occupy the lower levels of food webs in aquatic systems. The presence of certain macroinvertebrates reflects food availability, water quality, and habitats, and provides an overall picture of stream health. Fish prey upon macroinvertebrates and other stream organisms. Food resources and spawning habitats can be specific for fish and they too, are influenced by the stream quality and entire environment of the watershed. Freshwater mussels are filter-feeders, which siphon water to extract particles of food, and also require relatively clean water to thrive. They are particularly sensitive to industrial discharge, abandoned mine drainage, and urban runoff pollution. Mussels require habitats where they can burrow into the stream bottom and typically occur in larger streams and in rivers that contain sufficient food particles.

Many factors influence the occurrence of aquatic communities, including natural variations in stream habitats. Fast-flowing, cold streams originating from ridges provide a different environment than slower and warmer rivers meandering through valleys. Geology also varies across Pennsylvania and flowing water may have a unique chemical composition based on the rock that it contacts.

Over any natural habitat, variations are caused by human alterations to aquatic environments. Many changes within a watershed can be detected within its streams and rivers. Runoff from improperly implemented timber harvest, agriculture, urban development, and roads cause changes in water quality and stream habitats and are deemed "non-point" source pollution. Pollutants entering aquatic systems from "point" sources include discharges from specific sewage treatment plants, mines, and industrial sources.

***What is the relationship between Aquatic Community Classification and DEP stream designations*?**

Pennsylvania protects aquatic life as a "designated use" of waters in the commonwealth under the federal Clean Water Act. Enforced by PA DEP (Department of Environmental Protection) is the regulation that four types of aquatic life should be propagated and maintained based on their designation in Pennsylvania (PA Code 93.3; http://www.pacode.com/secure/data/025/chapter93/chap93toc.html, accessed 10/14/2009):

> **Cold Water Fisheries (CWF):** Fishes and associated aquatic flora and fauna preferring colder waters (included in the cold water fishes are trout species).
>
> **Warm Water Fisheries (WWF):** Fishes and associated aquatic flora and fauna preferring warmer waters.
>
> **Trout Stocked Fisheries (TSF):** Stocked trout species (maintained from Feb 15 to July 31) and warm-water flora and fauna.
>
> **Migratory Fisheries (MF):** Fishes (those having anadromous, catadromous, or similar life histories) which must migrate through flowing waters to their breeding habitats.

Additionally, some water bodies receive additional special protections as "Exceptional Value" or "High Quality" waters because they are especially valued for aquatic life, water quality, and/or recreation. Meeting relatively high water quality and other standards qualify the water bodies for additional protections from degradation beyond the aquatic life uses (PA Code 93.4b, http://www.pacode.com/secure/data/025/chapter93/chap93toc.html, accessed 10/14/2009).

The purpose and meanings of the DEP stream designations differ from the Aquatic Community Classification. In both cases these categories are meant to relatively define the organisms and aquatic habitats along a gradient of water temperatures (and associated stream size). The DEP stream designations more broadly describe habitats and may be occupied by several ACC fish assemblages. The DEP stream designations and are used in water quality regulation.

PA DEP stream designations and their relationship to the fish communities described in the ACC: (EV = Exceptional Value Waters, HQ = High Quality waters, CWF= Cold Water fishes, WWF= Warm Water Fishes, TSF= Trout Stocked Fishes, MF= Migratory Fishes).

Increasing watershed area ↓	Fish Communities	EV	HQ	CWF	WWF	TSF	MF
	Coldwater	X	X	X			
	Coolwater		X	X	X	X	X
	Warmwater			X	X	X	X
	Large River				X		X

Conservation Watershed Priorities

Watersheds with aquatic communities deemed important for conservation, those having waterways called "Least Disturbed Streams" (which have the fewest sources of potential degradation - e.g. determined by a high proportion of natural land cover and having few dams, point sources, or roads), and those where a macroinvertebrate index suggested good water quality were selected as "Conservation Watersheds". Tier 1 Conservation Watersheds include those having the best potential for high quality streams of conservation value. Tier 2 Conservation Watersheds are also high quality watersheds that are important for conservation, but have lower rankings for macroinvertebrate metrics or aquatic communities. (See http://www.naturalheritage.state.pa.us/aquaticsConservPrior.aspx for more details).

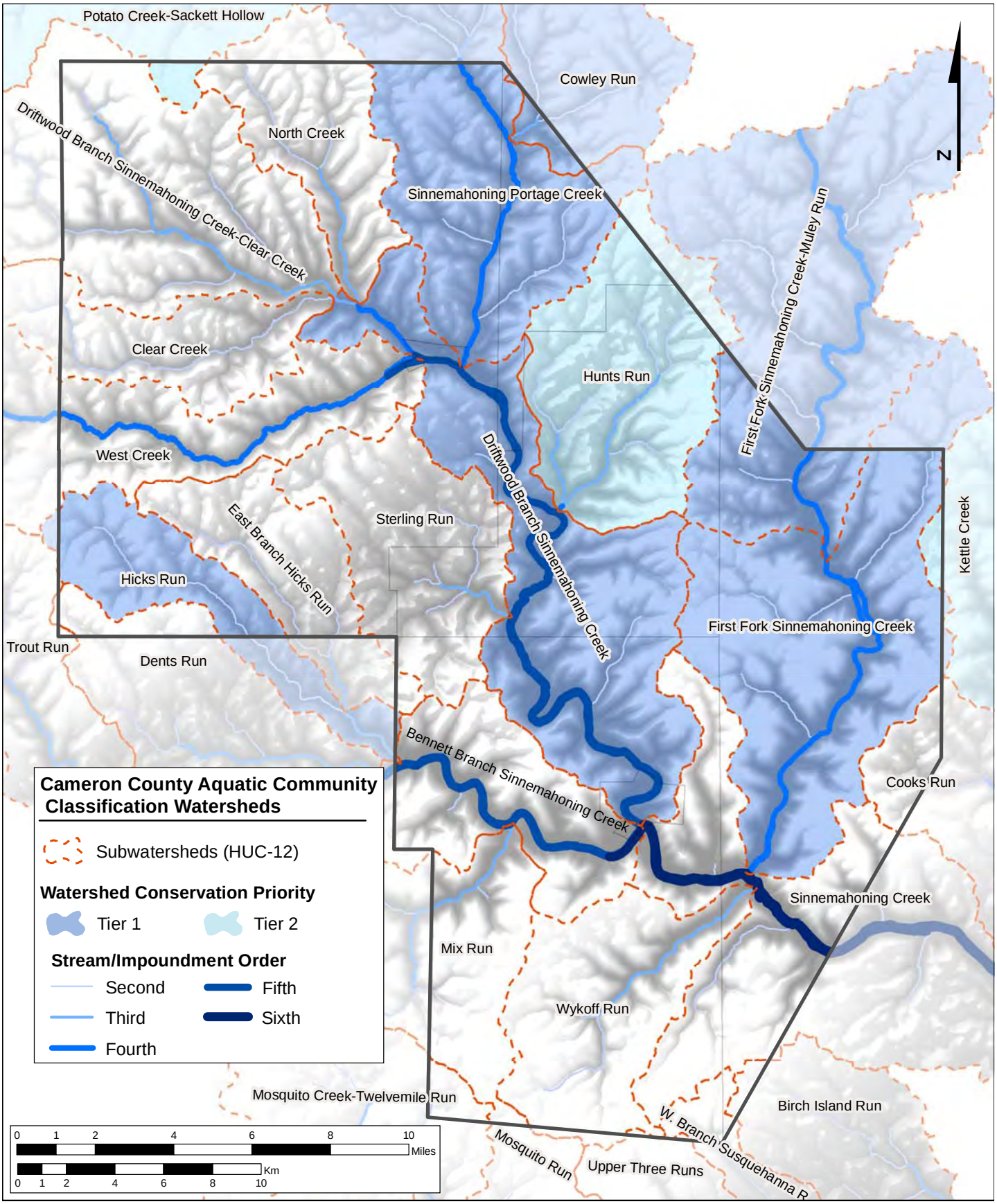


Figure 13: Priority Watersheds for Cameron County

Table 10. Fish and macroinvertebrate communities identified by the most commonly occurring community in each watershed (Also called 12-digit hydrologic unit) for each animal type in Cameron County.

12-Digit Hydrologic Unit Code	Hydrologic Unit Name	Fish Community Name	Macroinvertebrate Community Name
020502020312	Bennett Branch Sinnemahoning Creek	Coldwater Community	High Quality Mid-Sized Stream Community
020502010712	Birch Island Run	Coldwater Community	not assessed
020502020202	Clear Creek	Coldwater Community	High Quality Small Stream Community
020502030201	Cooks Run	Coldwater Community	High Quality Small Stream Community
020502020101	Cowley Run	Warmwater Community	High Quality Mid-Sized Stream Community
020502020308	Dents Run	Coldwater Community	Common Headwater Stream Community
020502020207	Driftwood Branch Sinnemahoning Creek	River and Impoundment Community	High Quality Mid-Sized Stream Community
020502020201	Driftwood Branch Sinnemahoning Creek-Clear Creek	Coldwater Community	not assessed
020502020309	East Branch Hicks Run	Coldwater Community	not assessed
020502020407	First Fork Sinnemahoning Creek	Coldwater Community	not assessed
020502020406	First Fork Sinnemahoning Creek-Muley Run	Warmwater Community	High Quality Mid-Sized Stream Community
020502020310	Hicks Run	Coldwater Community	High Quality Large Stream Community
020502020205	Hunts Run	Coldwater Community	High Quality Large Stream Community
020502020311	Mix Run	Coldwater Community	not assessed
020502010601	Mosquito Creek-Twelvemile Run	River and Impoundment Community	Common Headwater Stream Community
020502010602	Mosquito Run	Coldwater Community	Common Headwater Stream Community
020502020203	North Creek	Coldwater Community	High Quality Mid-Sized Stream Community

50100010101	Potato Creek-Sackett Hollow	Coolwater Community	not assessed
020502020502	Sinnemahoning Creek	Coldwater Community	not assessed
020502020102	Sinnemahoning Portage Creek	Warmwater Community	High Quality Small Stream Community
020502020206	Sterling Run	Coldwater Community	Common Headwater Stream Community
020502020307	Trout Run	Coldwater Community	not assessed
020502010709	Upper Three Runs	Coldwater Community	not assessed
020502010711	W. Branch Susquehanna River	Coldwater Community	not assessed
020502020204	West Creek	Warmwater Community	Common Headwater Stream Community
020502020501	Wykoff Run	Coldwater Community	not assessed

References

- Walsh, M., J. Deeds, and B. Nightingale. 2007a. Classifying lotic systems for conservation: project methods and results of the Pennsylvania Aquatic Community Classification Project. Pennsylvania Natural Heritage Program.
- Walsh, M. C., J. Deeds, and B. Nightingale. 2007b. User's manual and data guide to the Pennsylvania Aquatic Community Classification. Pennsylvania Natural Heritage Program, Western Pennsylvania Conservancy.

Coldwater Fish Community

typified by: Brook trout (*Salvelinus fontinalis*), *brown trout (*Salmo trutta*), *rainbow trout (*Oncorhynchus mykiss*)

Community Description and Habitat: This headwater stream community occurs in small, swift streams running off ridges. Streams are generally at high elevation with high gradient. Water temperatures are the coldest among the fish communities. The Coldwater Fish Community represents headwater streams with brook trout and slightly larger streams with both brook trout and brown trout or brown trout only. At times, rainbow trout are also found in this community.

The small streams that support the Coldwater Fish Community tend to have fewer disturbances than larger waters flowing through valleys. These systems often flow from sandstone or shale ridges and have with few dissolved cations and low buffering capacity. The natural vegetation in the coldwater community watersheds maintains the water temperature is small forested streams.

Photo: http://www.cnr.vt.edu/efish

Brook Trout

This community occurs in headwater streams in Cameron County. Clear Creek, Cooks Run, Hunts Run, and Wykoff Run are examples of this community habitat in Cameron County.

Other streams in the County may be designated as Cold Water Fisheries (CWF) and Trout Stocked Fisheries (TSF) by PA DEP. A community dominated by wild cold water species characterizes the assemblage, as determined by the PA Aquatic Community Classification. The TSF and CWF designations, occurring with other PA Aquatic Community fish classes, may include streams with wild-reproducing trout, streams stocked with trout or those that may have marginal cold water habitats that also support other assemblages.

Stream Quality Rating: high

Threats and Disturbances: The streams supporting the Coldwater Fish Community have fewer disturbances than other stream habitats. Forested, headwater streams have relatively little human influence in the watershed. However, streams may be acidified by atmospheric deposition in some locations. Acidic precipitation that falls on these watersheds can leach away the watershed's natural acid buffering capacity, resulting in low stream pH.

Trout streams in Pennsylvania are highly valued by fisherman, but have been greatly altered by the transplantation of European brown trout and rainbow trout. This has restricted habitats for native brook trout through competition with other trout species.

Conservation Recommendations: Protecting headwater streams flowing from forested ridges is necessary to ensure habitat for this community. Minimizing impacts from roads, gas well development and timber harvest near headwater streams will maintain healthy waters.

Coldwater Fish Community streams in these watersheds may have wild-reproducing populations of brook trout, a key fishery resource. Because cold, headwater streams often occur in terrain unsuitable for most types of human developments, they are subject to different types of water pollution issues than valley streams.

Photo: Andrew Strassman (PNHP

Small, high gradient streams with forested watersheds are typical of the Atlantic Coldwater Fish Community habitat.

References

- PA Department of Environmental Protection. 2006. Pennsylvania Integrated Water Quality Monitoring and Assessment Report.
- Walsh, M., J. Deeds and B. Nightingale. 2007a. Classifying lotic systems for conservation: project methods and results of the Pennsylvania Aquatic Community Classification Project. Pennsylvania Natural Heritage Program.
- Walsh, M. C., J. Deeds and B. Nightingale. 2007b. User's manual and data guide to the Pennsylvania Aquatic Community Classification. Pennsylvania Natural Heritage Program, Western Pennsylvania Conservancy, Middletown, PA, and Pittsburgh, PA.

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Coolwater Fish Community

typified by: Slimy sculpin (*Cottus cognatus*), brown trout (*Salmo trutta*), fathead minnow (*Pimephales promelas*), pearl dace (*Margariscus margarita*)

Community Description and Habitat:
This community generally occurs in high gradient streams, slightly downstream of the watershed headwaters. The community typically is found in relatively small streams high in the watershed, but may also be found in valley streams. In contrast to the Coldwater Fish Community, the Coolwater Fish Community stream habitats are influenced by some non-natural conditions. Watersheds surrounding the Coolwater Fish Community may be influenced by agricultural practices and by human settlements.

Photo: http://www.cnr.vt.edu/efish

Fathead Minnow

The fish that indicate this community type prefer cool, rocky streams that may occur in transitional areas between cold-water streams and warm-water streams. The Coolwater Fish Community may represent streams with put-and-take trout fisheries or cool streams with seasonally warm temperatures. Brown trout may also occur in this community. Fish inhabiting this Community type may tolerate some acidic conditions, low dissolved oxygen, suspended sediments, or other water quality impairments. Potato Creek–Sackett Hollow is the only example of the Coolwater Fish Community habitat in Cameron County.

Stream quality rating: Low

Threats and Disturbances:
Acid mine drainage in portions of the watershed causes poor water quality including heavy metal contamination and low pH. These otherwise forested watersheds are pock-marked by mines which contribute to the polluted water. Where stocking of non-native fish is occurring within the Coolwater Fish Community, native fish are displaced.

Conservation Recommendations:
Restoration of water quality and habitat in streams affected by acid mine drainage will greatly improve conditions for aquatic life.

Photo: PNHP

Medium size streams are typical of Coolwater Fish Community.

The natural gas industry should strive to maintain water quality, quantity, and habitat during the development of natural gas wells and related infrastructure (e.g. roads and pipe lines). When developing gas wells, locations should be placed at the maximum possible distance from aquatic environments. Special consideration should be given to safe storage and transport of toxic materials and wastewater to prevent accidental releases into aquatic environments. Restoration of well pads to native vegetation will benefit both upland and aquatic systems.

The habitat for the Coolwater Fish Community represents an important transition between cold headwater streams and warm, larger streams; the habitat is distinct among other habitat types and should be protected and restored, where it is degraded.

References

- PA Department of Environmental Protection. 2006. Pennsylvania Integrated Water Quality Monitoring and Assessment Report.
- Walsh, M., J. Deeds and B. Nightingale. 2007a. Classifying lotic systems for conservation: project methods and results of the Pennsylvania Aquatic Community Classification Project. Pennsylvania Natural Heritage Program.
- Walsh, M. C., J. Deeds and B. Nightingale. 2007b. User's manual and data guide to the Pennsylvania Aquatic Community Classification. Pennsylvania Natural Heritage Program, Western Pennsylvania Conservancy, Middletown, PA, and Pittsburgh, PA.

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Warmwater Fish Community

typified by: Sunfish (*Lepomis spp.*), rock bass (*Ambloplites rupestris*), smallmouth bass (*Micropterus dolomieu*), largemouth bass (*Micropterus salmoides*), common shiner (*Luxilus cornutus*), satinfin shiner (*Cyprinella analostana*), spotfin shiner (*Cyprinella spiloptera*), spottail shiner (*Notropis hudsonius*), swallowtail shiner (*Notropis procne*), shield darter (*Percina peltata*), tessellated darter (*Etheostoma olmstedi*), American eel (*Anguilla rostrata*), bluntnose minnow (*Pimephales notatus*), common carp (*Cyprinus carpio*)

Photo: http://www.ohiodnr.com/dnap

Redbreast Sunfish

Community Description and Habitat:
The Warmwater Fish Community is found in many larger waterways. The typical habitat is made up of low-gradient, medium-to-large sized streams at low elevations.

The fish inhabiting this community prefer pools in warm streams. Some indicator fish are tolerant of low dissolved oxygen and turbid waters. Many fish of this community are habitat generalists including game fish, such as smallmouth bass and bluegill, which were likely stocked in many locations and have since become naturalized.

In Cameron County, the larger creeks classified as the Warmwater Fish Community include Cowley Run, West Creek and parts of First Fork Sinnemahoning Creek. In some locations the community may also contain stocked trout.

Photo: Andrew Strassman (PNHP)

Warmwater Fish Community occurs in large streams and rivers, with warmwaters, because of variety of habitats supports a diverse fish community.

Stream Quality Rating:
medium

Threats and Disturbances:
There is a fish consumption advisory because of excess mercury levels in First Fork Sinnemahoning Creek. Acid mine drainage affects streams in the Driftwood Branch of Sinnemahoning Creek

Many fish in the community were not originally present in the Susquehanna River watershed that covers the eastern and central regions of Pennsylvania. For instance, rock bass and smallmouth bass were introduced into the Susquehanna River basin and are widely stocked.

Conservation Recommendations:
This community has typically been altered to some degree from its natural condition. Protection of the variety of habitats in Cameron County's creeks is critical to maintaining a diverse fish community. Control of combined sewer overflows, residential and road runoff, and stream habitat improvements in populated areas would improve community quality.

References

- PA Department of Environmental Protection. 2006. Pennsylvania Integrated Water Quality Monitoring and Assessment Report.
- Walsh, M., J. Deeds and B. Nightingale. 2007a. Classifying lotic systems for conservation: project methods and results of the Pennsylvania Aquatic Community Classification Project. Pennsylvania Natural Heritage Program.
- Walsh, M. C., J. Deeds and B. Nightingale. 2007b. User's manual and data guide to the Pennsylvania Aquatic Community Classification. Pennsylvania Natural Heritage Program, Western Pennsylvania Conservancy, Middletown, PA, and Pittsburgh, PA.

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River and Impoundment Fish Community

typified by: Walleye (*Sander vitreus*), yellow perch (*Perca flavescens*), black crappie (*Pomoxis nigromaculatus*), goldfish (*Carassius auratus*)

Community Description and Habitat:
The River and Impoundment Fish Community habitat includes low gradient large streams and rivers at low elevations. This community type can also be found behind dam impoundments in rivers and creeks which have resulted in deep pools with soft-sediment stream bottoms.

Examples of community habitat are parts of Driftwood Branch Sinnemahoning Creek and parts of Mosquito Creek-Twelvemile Run. The presence of game fish in large streams, rivers and impoundments is indicative of this community type.

Photo: PNHP

Impoundments (e.g., George B. Stevenson Reservoir on the First Fork Sinnemahoning Creek) are habitat of the River and Impoundment Fish Community type.

Stream Quality Rating:
Intermediate

Threats and Disturbances:
Large streams and rivers, downstream of human settlements, are subject to many types of pollution. The Driftwood Branch Sinnemahoning Creek and First Fork Sinnemahoning Creek may receive effluents from unpaved roads and septic systems. Fish consumption is restricted on the First Fork Sinnemahoning Creek because of mercury contamination.

Non-native fish and artificial environments characterize this community. Black crappie and many other game fish are not native to the Susquehanna River watersheds. The large impoundment on the First Fork Sinnemahoning Creek has created an unnatural lake environment, limits connectivity in the creek and prevents movement of aquatic organisms.

Photo: http://www.cnr.vt.edu/ef

Yellow Perch

Conservation Recommendations:
Large stream and river habitats in good quality condition are rare. Although the potential sources of pollution to the River and Impoundment Fish Community are many, solutions to pollution problems are possible by minimizing point source pollution and managing water quality in the smaller tributaries. Reducing pollution inputs from unpaved roads and septic systems would help improve the water quality of this aquatic community. The mercury pollution in Cameron County has been carried long distances by air currents from industrial sources. Improved regulation of air pollution would reduce the amount of mercury that drifts to Cameron County from industrial sources and is deposited in waterways.

References

- PA Department of Environmental Protection. 2006. Pennsylvania Integrated Water Quality Monitoring and Assessment Report.
- Walsh, M., J. Deeds and B. Nightingale. 2007a. Classifying lotic systems for conservation: project methods and results of the Pennsylvania Aquatic Community Classification Project. Pennsylvania Natural Heritage Program.
- Walsh, M. C., J. Deeds and B. Nightingale. 2007b. User's manual and data guide to the Pennsylvania Aquatic Community Classification. Pennsylvania Natural Heritage Program, Western Pennsylvania Conservancy, Middletown, PA, and Pittsburgh, PA.

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Common Headwater Stream Macroinvertebrate Community

Typified By: Little plain brown sedge (Lepidostomatidae), slender winter stonefly (Capniidae), spiketail dragonflies (Cordulegastridae)

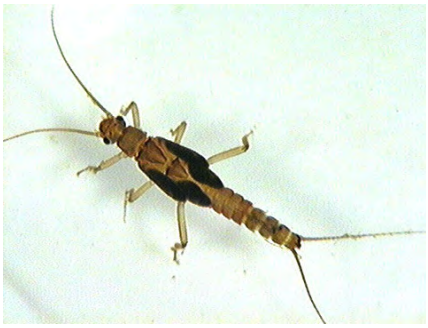

Photo: www.nwnature.net/

Slender winter stonefly

Habitat: The Common Headwater Stream Community is generally found in small, fast-flowing streams with a diversity of in-stream habitats. There is usually no stream channelization or riparian disturbance.

This community type is associated with streams in shale or sandstone geology and generally have low amounts of dissolved ions. The organisms inhabiting this community type prefer cold, well-oxygenated streams that may be slightly acidic. Some examples of the community habitat include Dents Run, Mosquito Run, Sterling Run, and West Creek..

Stream Quality Rating: Moderate

Threats:

Because small, headwater streams are the most numerous of Pennsylvania's waterways and contribute the most stream miles of all flowing water types, the quality of small streams has a great influence on the overall status of the Commonwealth's waters. Small, forested streams at the headwaters of watersheds have relatively few threats. However, in Cameron County mining discharges degrade even small, otherwise undisturbed streams. Runoff from road surfaces may lead to altered hydrology and poor water quality.

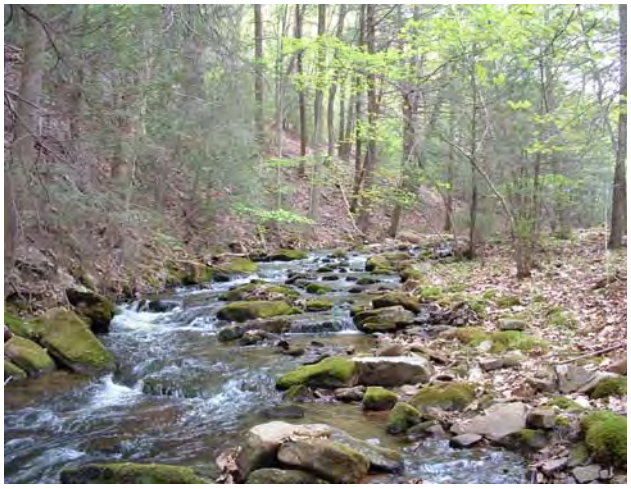

Photo: PNHP

Small, high-gradient streams are typical of this community type

Conservation Recommendations:

Protecting the Common Headwater Stream Community habitats and other small streams will help protect overall watershed water quality.

In instances where mining discharges are present in small streams, remediation of mining is recommended. Restoration of water quality in streams influenced by mining typically may include partially diverting stream flow to a mitigation wetland, where stream acidity is normalized and metal compounds are removed from the water. Although remediation measures are costly and must be maintained over time, streams without treatment will remain highly polluted.

References

- PA Department of Environmental Protection. 2006. Pennsylvania Integrated Water Quality Monitoring and Assessment Report.
- Walsh, M., J. Deeds and B. Nightingale. 2007a. Classifying lotic systems for conservation: project methods and results of the Pennsylvania Aquatic Community Classification Project. Pennsylvania Natural Heritage Program.
- Walsh, M. C., J. Deeds and B. Nightingale. 2007b. User's manual and data guide to the Pennsylvania Aquatic Community Classification. Pennsylvania Natural Heritage Program, Western Pennsylvania Conservancy, Middletown, PA, and Pittsburgh, PA.

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High Quality Mid-Sized Stream Macroinvertebrate Community

Typified by: Green stonefly (Chloroperlidae), giant black stonefly (Pteronarcyidae), spiny crawler (Ephemerellidae), flat-headed mayfly (Heptageniidae), free-living caddisfly (Rhyacophilidae), light brown stonefly (Perlodidae), prong gill mayfly (Leptophlebiidae), common stoneflies (Perlidae), crane fly (Tipulidae), roachlike stoneflies (Peltoperlidae), clubtail dragonfly (Gomphidae), northern case maker (Limnephilidae), Uenoid caddisfly (Uenoidae), Odonocerid caddisflies (Odontoceridae)

Photo: www.dec.state.ny.us

Giant black stonefly (Pteronarcyidae)

Community Description and Habitat: The High Quality Mid-Sized Stream Macroinvertebrate Community in most locations is found in small to medium-sized streams including Cowley Run, North Creek, Bennett Branch Sinnemahoning Creek, and Driftwood Branch Sinnemahoning Creek. Streams are generally high gradient systems with diverse habitats. The community habitats typically are undisturbed by humans and are often in mainly forested basins. The stoneflies, mayflies, caddisflies, and other organisms that maleup this community are sensitive to pollution.

Stream Quality Rating: High

Threats and Disturbances: Streams with the High Quality Mid-Sized Stream Community generally have few threats, compared to other communities. Relatively natural watershed landcover in the watersheds help protect the water quality and stream habitat.

Photo: PNHP

Mid-sized, high gradient streams with high quality habitats and water quality are the typical habitat of this community

Conservation Recommendations: Watershed managers should work to conserve high quality small- to medium-sized streams in good condition. Managing practices that contribute sediment and nutrient runoff will help maintain relatively high quality streams in rural watersheds. Addressing mine drainage is a challenge to watershed managers. Although remediation measures are costly and must be maintained, streams without treatment will remain highly polluted.

References

- PA Department of Environmental Protection. 2006. Pennsylvania Integrated Water Quality Monitoring and Assessment Report.
- Walsh, M., J. Deeds and B. Nightingale. 2007a. Classifying lotic systems for conservation: project methods and results of the Pennsylvania Aquatic Community Classification Project. Pennsylvania Natural Heritage Program.
- Walsh, M. C., J. Deeds and B. Nightingale. 2007b. User's manual and data guide to the Pennsylvania Aquatic Community Classification. Pennsylvania Natural Heritage Program, Western Pennsylvania Conservancy, Middletown, PA, and Pittsburgh, PA.

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High Quality Small Stream Macroinvertebrate Community

Typified by: Brushlegged mayfly (Isonychiidae), fingernet caddisfly (Philopotamidae), dobsonfly (Corydalidae), saddlecase maker (Glossosomatidae), watersnipe fly (Athericidae), common burrower (Ephemeridae), snail-case maker caddisfly (Helicopsychidae)

Community Description and Habitat: This community is found in small size streams that are high gradient and fast flowing. Clear Creek, Cooks Creek, and Sinnemahoning Portage Creek are some examples of this community habitat.

The High Quality Small Stream Macroinvertebrate Community is typically found in streams with sandy substrates mixed with larger cobble and boulders. This community type is indicative of high quality streams, and the organisms associated with this community are generally intolerant of pollution.

Photo: www.dec.state.ny.us

Brushlegged Mayfly

Stream quality rating: High

Threats and Disturbances: Organisms in this community type are sensitive to organic pollution and habitat degradation.

Conservation Recommendations: While some non-point source pollution may occur in watersheds supporting the High Quality Small Stream Macroinvertebrate Community, water pollution is less common here than in other stream types. Protecting high quality small streams should be a priority for watershed managers. Measures should include pollution and habitat degradation prevention.

Practices that reduce soil erosion and nutrient runoff are recommended. Riparian buffers should be installed and maintained to capture silt and excess nutrients. Buffer vegetation that shades streams and stabilize water temperatures and stream banks will improve in-stream habitats for macroinvertebrate communities.

Photo: PNHP

Typical community habitats are small to medium-sized streams with diverse stream-bottom habitats and high water quality.

References

- Walsh, M., J. Deeds and B. Nightingale. 2007a. Classifying lotic systems for conservation: project methods and results of the Pennsylvania Aquatic Community Classification Project. Pennsylvania Natural Heritage Program.
- Walsh, M. C., J. Deeds and B. Nightingale. 2007b. User's manual and data guide to the Pennsylvania Aquatic Community Classification. Pennsylvania Natural Heritage Program, Western Pennsylvania Conservancy, Middletown, PA, and Pittsburgh, PA.

Pennsylvania Natural Heritage Program

APPENDIX VII: Selected Fact Sheets

Northern Water Shrew (*Sorex palustris albibarbis*)

Pennsylvania Candidate Rare Mammal Speceis
State Rank: S3 (vulnerable), Global Rank: G4T5 (apparently secure)

Identification

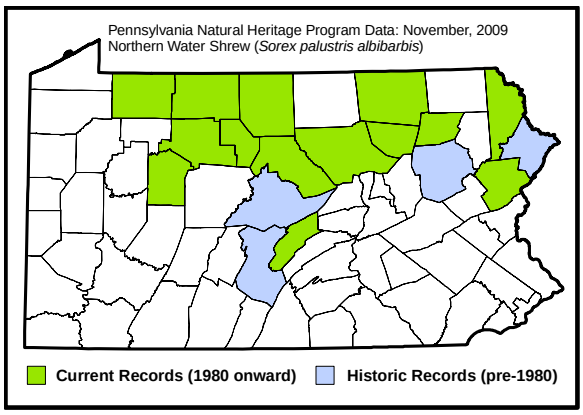
The northern water shrew (*Sorex palustris albibarbis*) is a relatively large member of the *Sorex* genus, reaching lengths of 130-170mm and weighting 10-16 grams. Water shrews are black to gray in color with a silvery-gray belly and a bicolored tail. The chin and throat of this species are whitish, noticeably more so than the belly. The large, partially webbed hind feet have hairs on the toes and sides and there are some hairs present on the fore feet. The northern water shrew (*Sorex palustris albibarbis*) can be distinguished from other water shrews by very specific physical characteristics such as dental and skull features.

Photo source: Charlie Eichelberger (PNHP)

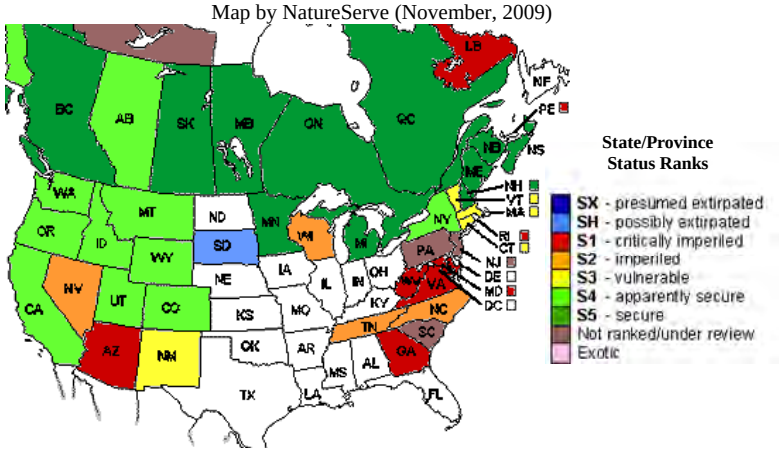
Northern water shrew (*Sorex palustris albibarbis*)

Habitat/Behavior

Water shrews are solitary, short-lived species with an average life span of 18 months. They breed from December to September and have 2-3 litters per year. They are active both day and night and spend their lives in and around water. Water shrews can be found along streams and lake edges, in boulders and sphagnum moss. They dive and swim into water when foraging for food and to avoid predators. Air trapped in the fur allows them to immediately come to the surface when they stop swimming. The fringe of hairs on the hind foot trap air and allow the shrews to walk on water. Easy access to food is essential to the survival of this species. Water shrews can only survive without food for up to three hours. In captivity, they have been found to feed almost every 10 minutes.



North American State/Province Conservation Status
Note: This map should show Pennsylvania as Yellow (S3)
Map by NatureServe (November, 2009)



Status

Sorex palustris is found throughout most of Canada, the western U.S., the upper northeastern U.S. and the Appalachian mountains. The *albibarbis* subspecies is found in southeastern Canada and the upper northwestern U.S. including north central and northeastern Pennsylvania. Globally, this species is considered secure. However, in Pennsylvania, the northern water shrew is vulnerable and a candidate for listing as rare. It is only found in a few sites around the state and is affected by many factors, which could lead to declines in their populations.

Conservation

Decreased water quality may have a significant effect on this species. A decrease in numbers of aquatic insects may be very detrimental to this species since food is such a limiting factor. Timber harvesting along streams and lake edges may also be detrimental to this species. Many times, they will live in vegetation or crevices along the waters edge. The loss of the overstory could dramatically change the microhabitat conditions on the forest floor. Maintaining natural stream corridors and lake buffers is essential to the protection of this species.

References

ENature.com Field Guide. Water Shrew (*Sorex palustris*). http://www.enature.com/fieldguide/

Genoway, H.H. and F.J. Brenner. 1985. Species of Special Concern in Pennsylvania. Carnegie Museum of Natural History. Pittsburgh, PA. 430pp.

The University of Michigan Museum of Zoology Animal Diversity Web. Species Account: *Sorex palustris* (water shrew). http://animaldiversity.ummz.umich.edu/site/accounts/information/Sorex_palustris.html

Pennsylvania Natural Heritage Program

Northern Myotis (*Myotis septentrionalis*)

Pennsylvania Mammal Species of Concern

State Rank: S3B (vulnerable, breeding), S3N (vulnerable, non-breeding), Global Rank: G4 (apparently secure)

Identification

The Northern Myotis (*Myotis septentrionalis*), also known as the Northern Longed-eared Myotis, is characterized by its long-rounded ears that when folded forward, extend beyond the tip of the nose. Also, the shape of the tragus, the flap of skin inside the ear area, is long and dagger shaped compared to the little brown bats curved and blunted tragus. This species has a longer tail and larger wing area than other similar sized bats in this genus. The fur is dull yellow/brown above and a pale gray on the belly. Another characteristic of this species is that the calcar, a spur extending from the foot, lacks a keel. These bats weigh only 6 to 8 grams and have a wingspan of 9 to 10 inches.

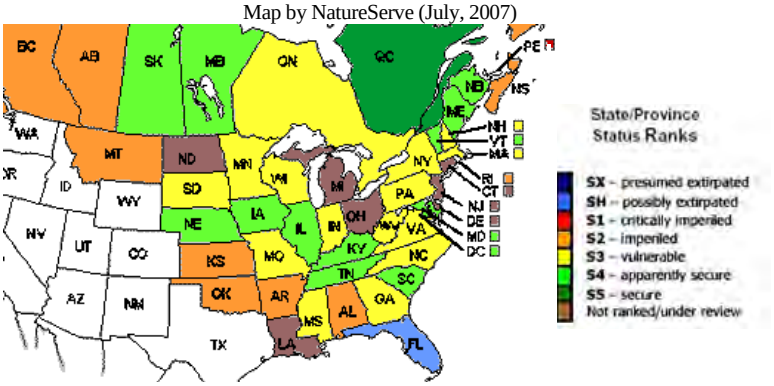
photo source: Aura Stauffer

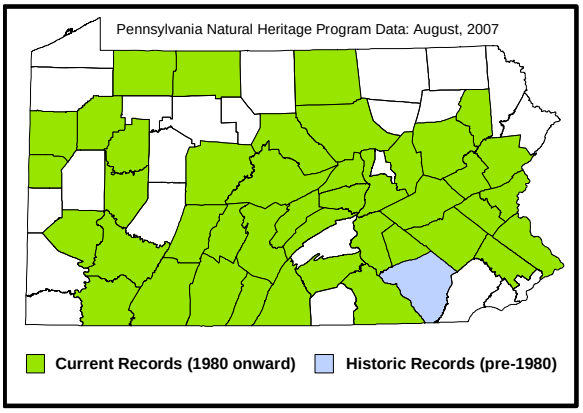
Habitat/Behavior

In the more northern parts of their range the northern long-eared bat is associated with boreal forests. In Pennsylvania, this bay is found in forests around the state. Northern Myotis hunt at night over small ponds, in forest clearings, at tree top level and along forest edges. They eat a variety of night-flying insects including caddisflies, moths, beetles, flies, and leafhoppers. This species uses caves and underground mines for hibernation and individuals may travel up to 35 miles from their summer habitat for hibernation. Maternity roosts are located in tree cavities, under exfoliating tree bark and in buildings.

North American State/Province Conservation Status

Map by NatureServe (July, 2007)





Status

The status of the Northern Myotis in Pennsylvania is uncertain. The state status of this species currently is candidate rare (CR). More information is needed before adequate management decisions can be made. It occurs throughout Pennsylvania, but has been found in relatively low numbers.

Traditionally, bats have been unpopular with the public because of a misunderstanding of their ecology and due to their presence as pests in homes and barns. However, bats play a very important role in the environment by eating large amounts of insects. For example, a single little brown bat (*Myotis lucifugus*) can eat up to 1,200 mosquito-sized insects in just one hour!

More than 50% of American bat species are rapidly declining or already listed as endangered. The loss of bat species in Pennsylvania could greatly affect our ability to protect our plants from pests and enjoy the outdoors. For more information on bats and bat houses visit the Bat Conservation International website at http://www.batcon.org/.

References

- Bat Conservation International, Inc. 2002. "Bat Species: U.S. Bats: Myotis septentrionalis" Website: www.batcon.org/discover/species/mystep.html .
- Ollendorff, J. 2002. "Myotis septentrionalis" (On-line), Animal Diversity Web. Accessed February 25, 2004 at Http://animaldiversity.ummz.umich.edu/site/accounts/information/Myotis_septentrionalis.htm .

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Allegheny Woodrat

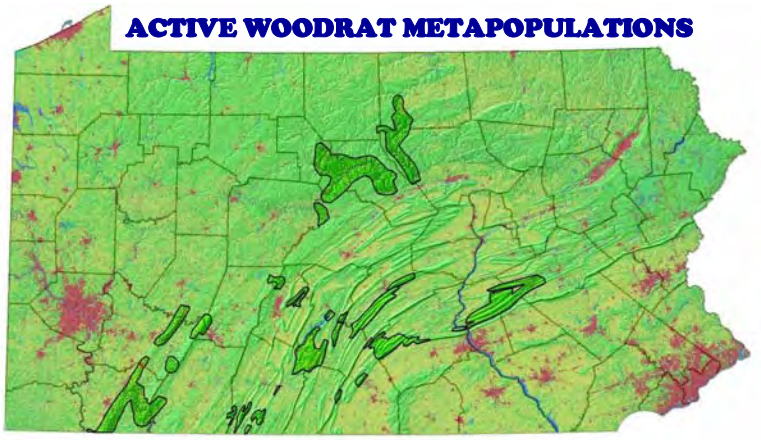
Neotoma magister

CURRENT STATUS: In Pennsylvania, the Allegheny woodrat is listed as threatened and protected under the Game and Wildlife Code. It is a Priority Species in the state Wildlife Action Plan. Considered vulnerable nationally, this species warrants federal prelisting consideration.

POPULATION STATUS: The Allegheny woodrat (*Neotoma magister*) was once considered a common resident of Pennsylvania's mountains. The species, first described from a specimen taken in a cave near Carlisle in 1858, has disappeared from the southeastern portion of the state and has declined in much of the rest of the state. The reason for the decline is not well-understood and likely results of a combination of factors. At present, sustainable populations remain in Pennsylvania's southwestern, south-central and north-central counties, with a few remnant populations in eastern counties. Our state has an important position in the biology of this species, holding both the diminishing northeastern range margin and a core of still-healthy populations. At one time, its range extended from southwestern Connecticut west to Indiana and south to northern Alabama. The Allegheny woodrat is now extirpated from Connecticut and New York, studies in remaining northern states document decline, and its status in southern states is unknown because of a shortage of recent surveys.

IDENTIFYING CHARACTERISTICS: The Allegheny woodrat is a relative of the better-known packrats of the West. Although this animal is referred to as a "rat" it is more mouse-like in appearance and has a bicolor, furred tail – unlike the naked tail of the Norway rat. It also is distinguished by noticeably larger ears and eyes, a larger, heavier head, and much longer whiskers. It is gray above with white underparts and paws. The average adult weighs less than a pound and is about 17 inches in total length, including an eight-inch tail.

BIOLOGY-NATURAL HISTORY: Allegheny woodrats are largely solitary, tolerating each other's presence briefly during the breeding season. Individual woodrats build a nest of plant material within a rock outcrop and may surround the nest with dry leaves and twigs, possibly as an alarm system. They emerge at dusk to forage for food, which includes a variety of leaves, fruit, nuts, seeds, fungi and twigs. Radio-telemetry studies indicate that woodrats may change den locations during summer, but after mid-autumn they retain one den for winter. Woodrats do not hibernate. Beginning in mid-summer, they store food for winter by stuffing leaves and other materials into rock crevices and protected ledges. They also collect non-food items such as wasp nests, bones, molted snakeskins, candy wrappers, and shotgun shells. Another distinctive behavior is their tendency to establish latrines for defecation, usually a flat rock surface protected by an overhang, separate from their living quarters. Reproductive success is difficult to measure because the Allegheny woodrat places its nests deep within rock outcrops. The most common litter size is probably two or three young. Some females may have two litters per year. This supposition is supported by captures of juvenile woodrats during each month from May to October in West Virginia. Variability in the length of the reproductive season may be influenced by variability in mast crops, severity of winter, and availability of secure cover. Predators of the Allegheny woodrat include the great horned owl, raccoon, coyote, weasel, fisher and black rat snake.

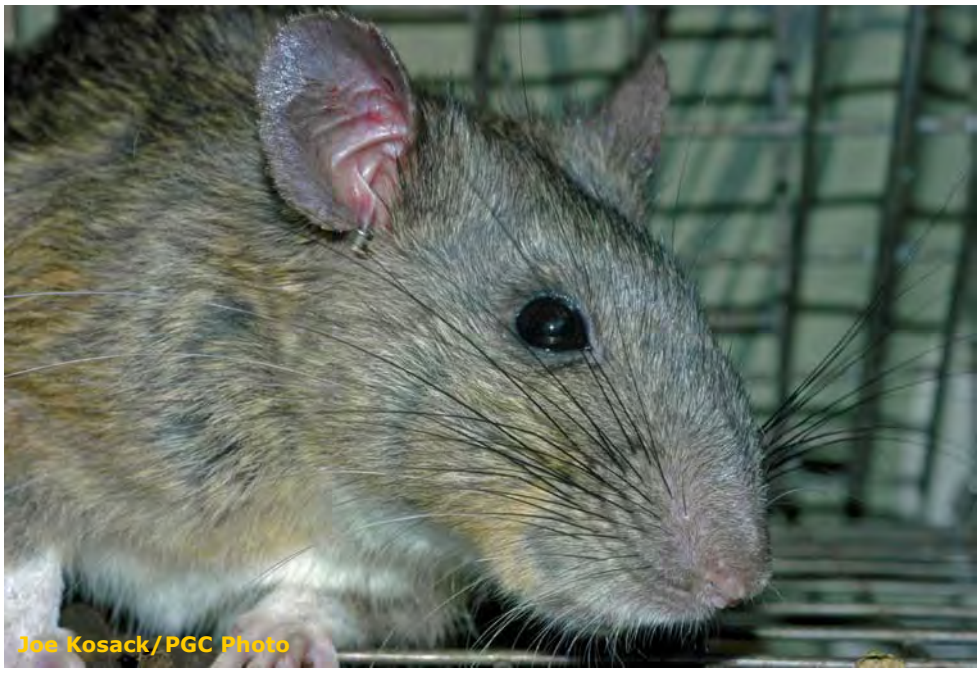


Cal Butchkoski/PGC Map

PREFERRED HABITAT: Ideal habitat for woodrats appears to be extensive expanses of abundant, closely-spaced surface rock surrounded by un-fragmented forest. Outcrops, cliffs, ledges, boulder fields, and caves are essential, providing protection and locations for nests and food caches. Vegetation may be deciduous, coniferous or mixed forest. Mast-producing trees are important; in some areas woodrats accumulate large nut caches. One study found that woodrats increased the size of their home range in years of poor mast production, which may increase their vulnerability to predators. In Pennsylvania, appropriate sandstone and limestone are typically distributed in patches interspersed with forest, where woodrats are usually found in population groups of fewer than 20 individuals, each centered on one rock patch.

REASONS FOR BEING THREATENED: No single factor has been identified to explain the decline of Allegheny woodrat populations. Instead, it's likely a wide variety of factors interact. While woodrats are general herbivores, they are not indiscriminate consumers. Reports from the early 1900s indicate that the American chestnut may have been an important food source - until chestnut blight removed all the mature trees of that species. Later, gypsy moth infestations that damaged oaks affected acorn production. The raccoon roundworm parasite affects a wide range of wildlife species; infected woodrats may die in a matter of weeks or succumb to predators as they become disabled. A study during the mid-1990s proposed that as the interface between forest and agricultural fields spread in Pennsylvania, the number of great horned owls increased, and this may have put woodrat populations under greater pressure. Porcupines, which also den in rock crevices and caves, are becoming more abundant and may preempt favorable den sites. Timbering, road building, utility lines, ridge-top telecommunications towers and wind farms, and conversion of land to agricultural or residential use have all affected forests surrounding rock habitat and created barriers that reduce the woodrat's ability to travel between rock patches, increasing isolation and reducing recolonization. Another mid-1990s study found that woodrat populations within one kilometer (0.62 mile) of forest edge were 15 times as likely to disappear as those more than two kilometers (1.24 miles) from forest edge.

MANAGEMENT PRACTICES: The conservation objective for Allegheny woodrats is to maintain viable breeding populations in three Pennsylvania regions: Appalachian Plateau, Ridge and Valley Province, and upper Susquehanna River drainage. To help achieve that goal, a series of three federal State Wildlife Grants Program projects produced an adaptive conservation-management plan; developed a model for predicting population viability, determined age-specific demographics, characterized habitat, and tested supplemental feeding; and funded training workshops for 92 biologists, foresters and land managers statewide. Implementation of management practices for the Allegheny woodrat will be tracked and evaluated. The Pennsylvania Game Commission's Wildlife Diversity Section is assisting a Purdue University



Joe Kosack/PGC Photo

study of genetic diversity of woodrat populations and captive breeding program. Research and survey priorities include continuing surveys for the presence of woodrats, assessment of the level of raccoon roundworm infestation, radio telemetry to gather additional data on population dynamics and specific habitat requirements, and studies to determine impacts of human encroachment and forest fragmentation.


Cal Butchkoski/PGC Photo

Sources:

Balcom B. J., Yahner R. H. 1996. Microhabitat and landscape characteristics associated with the threatened Allegheny woodrat. Conservation Biology 10 (2):515-525.

Butchkoski C. 2003. Eastern woodrat research/ management. Project 6718 Annual Report, Pennsylvania Game Commission Bureau of Wildlife Management, Harrisburg, Pennsylvania, 11 pp.

Castleberry S. B., Ford W. M., Wood P. B., Castleberry N. L. 2001. Movements of Allegheny woodrats in relation to timber harvesting. Journal of Wildlife Management 65:148-156.

Kiefer C. S., Magel C., Peles J. D., Pell L. A., Wright J. 2003. Spatial and seasonal den use in Allegheny woodrats (*Neotoma magister*) in south-central Pennsylvania. Journal of the Pennsylvania Academy of Science 76:121 (abstract).

LoGiudice K. 2003. Trophically transmitted parasites and the conservation of small populations: Raccoon roundworm and the imperiled Allegheny woodrat. Conservation Biology 17:258-266.

Peles J. D., Wright J., editors. 2008. The Allegheny Woodrat; Ecology, Conservation, and Management of a Declining Species. Springer Science+Business Media, LLC. New York, NY. 231 pp.

Wright J., Kirkland G. 2000. A possible role for chestnut blight in the decline of the Allegheny woodrat. Journal of the American Chestnut Foundation 8(2): 30-35.

Suggested further reading:

Hall J. S. 1988. Survey of the woodrat in Pennsylvania. Final Report, Contracts 878903 and 878919, Pennsylvania Game Commission, Harrisburg, Pennsylvania.

Hassinger J. C., Butchkoski C., Diefenbach D. 1996. Fragmentation effects on the occupancy of forested Allegheny woodrat (*Neotoma magister*) colony areas. Paper presented to Allegheny Woodrat Recovery Group Meeting, Ferrum College, Ferrum Virginia.

Hoover G. 2001. Gypsy moth (*Lymantria dispar*). Entomological Notes, Department of Entomology, Pennsylvania State University, University Park, Pennsylvania.

Peles J. D., Wright J., editors. 2008. The Allegheny Woodrat; Ecology, Conservation, and Management of a Declining Species. Springer Science+Business Media, LLC. New York, NY. 231 pp.

By Eileen Butchkoski
Pennsylvania Game Commission
Connecting you with wildlife!

1/13/10

Northern Goshawk (*Accipiter gentilis*)

Pennsylvania Candidate Rare Species

State Rank S2S3B, S3N (imperiled/vulnerable breeding, vulnerable nonbreeding), Global Rank: G5 (secure)

Identification:

The Northern Goshawk is a large forest raptor, occupying boreal and temperate forests throughout the entire Northern Hemisphere. It is the largest member of the genus *Accipiter* that occurs in North America. Males generally weigh between 1.4 and 2.4 pounds, average 22 inches in length, and have a wingspan ranging from 38.5 to 41 inches. Females are slightly larger, weighing, on average, between 1.9 and 3 pounds, and having a wingspan of 41 to 45 inches and an average length of 24 inches.

Tim Kimmel

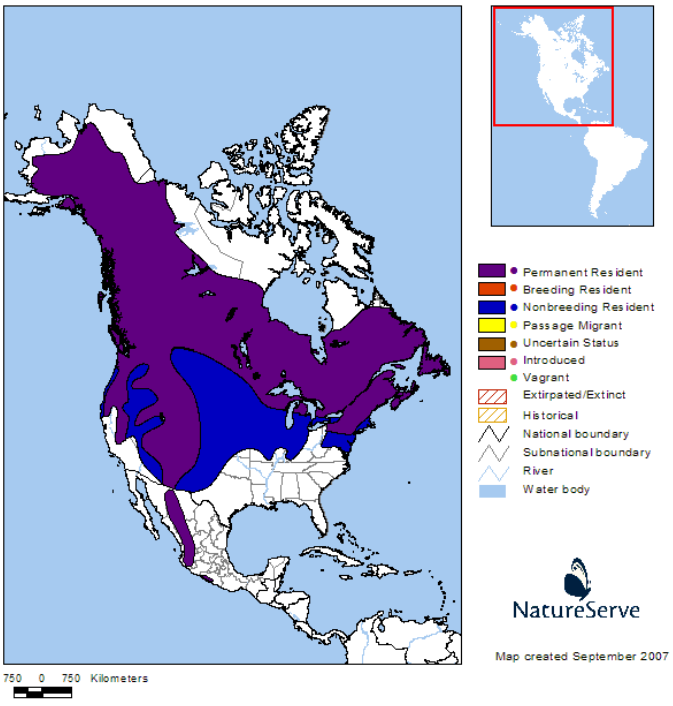
Northern Goshawk (*Accipiter gentilis*)

All accipiters, including Northern Goshawks, have a distinctive white grouping of feathers that form a band above the eye. In goshawks this band is thick and more pronounced than in the other members of the genus. The eye color of adult goshawks is red to reddish-brown, in juveniles eye color is bright yellow.

The colorings of adult male and female Northern Goshawks range from slate blue-gray to black. Their backs, the feathers at the leading edge of the wings, and heads are usually dark, and their undersides are white with fine, gray, horizontal barring. Their tails are light gray with three or four dark bands. The coloring of a juvenile goshawk is quite different than that of an adult. Their backs, the feathers at the leading edge of the wings, and heads are brown, and their undersides are white with vertical brown streaking.

Habitat/Behavior:

Range of the Northern Goshawkin North America



In the eastern U.S., the Northern Goshawk nests in hardwood-hemlock (*Tsuga canadensis*) forests, where black birch (*Betula lenta*) and American beech (*Fagus grandifolia*) are preferred nest trees. They prefer mature forests consisting of a combination of old, tall trees with intermediate canopy coverage and small open areas within the forest for foraging. Each pair of goshawks build and maintain between three and nine nests within their home range, but use and defend only one (or less) per year. Northern Goshawks are highly territorial and a mating pair will advertise their nesting territory by performing an elaborate aerial display before and during nest construction and/or repair. If their nesting area is encroached upon, they will defend it fiercely. Goshawks breed once yearly, usually between early April and mid-June. The female lays between 2 to 4 eggs that hatch in 28 to 38 days. The young may begin to fly when they are 35 to 46 days old. Juvenile fledglings may continue to be fed by their parents until they are about 70 days old.

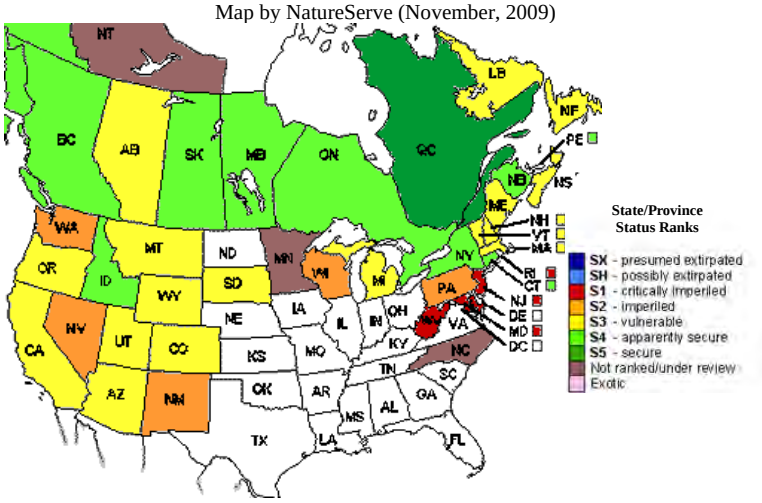
The goshawk is a top predator and opportunistic hunter that preys on ground and tree squirrels, rabbits and hares, large passerines, woodpeckers, game birds, corvids, and occasionally reptiles and insects. Prey may be taken on the ground, in vegetation, or in the air.

Status:

In Pennsylvania, the Northern Goshawk is near the southern extent of its range in eastern North America. Population trends are difficult to determine due to the paucity of historic quantitative data and because of biases inherent in the various survey methods used to track bird populations. Nesting range in the eastern U.S. is currently expanding as second-growth forests mature.

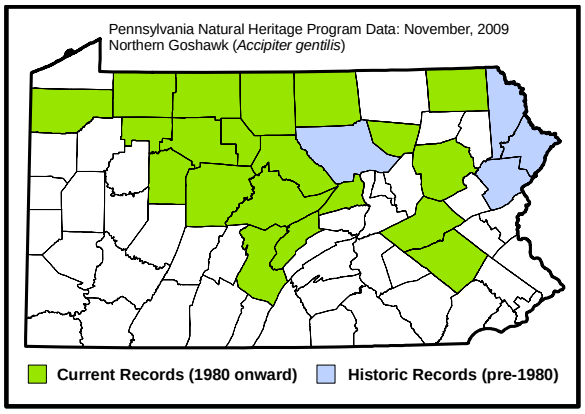
North American State/Province Conservation Status

Map by NatureServe (November, 2009)



Conservation Considerations:

Timber harvesting is the principal threat to breeding populations of northern goshawk. In addition to the relatively long-term impacts of removing nest trees and degrading habitat by reducing stand density and canopy cover, logging activities conducted near nests during the incubation and nestling periods can result in nest failure due to abandonment. Following canopy reduction by logging, goshawks are often replaced by other raptors including the Red-tailed Hawk (*Buteo jamaicensis*).



Because the goshawk is a top predator and an ecological engineer, its decline contributes to the unraveling of forest ecosystems, stressing other forest dependent species. Northern goshawks play an important role in the forest food web as voracious predators of squirrels, jays, flickers, rabbits, snowshoe hares, and songbirds. As builders of numerous, large nests, goshawks provide essential nesting opportunities for many species which can not build their own nests. Empty goshawk nests may be utilized by the Great Gray Owl (*Strix nebulosa*), Cooper's Hawk (*Accipiter cooperii*), Red-tailed Hawk, Great Horned Owl (*Bubo virginianus*), Short-eared Owl (*Asio flammeus*), squirrels, and many other species. Within a decade of goshawks being driven from a forest, their nests collapse from lack of maintenance and a precious wildlife habitat is lost.

References

Center for Biological Diversity. 2006. "Northern Goshawk". Available online:
http://www.biologicaldiversity.org/swcbd/species/goshawk/goshawk.html.

Clark, W., and B. Wheeler. 1987. Peterson Field Guides, Hawks. Boston: Houghton Mifflin Company.

Johnsgard, P. 1990. Hawks, Eagles, & Falcons of North America. Washington: Smithsonian Institution Press.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available
http://www.natureserve.org/explorer (Accessed: November 6, 2009).

Pajerski, L. 2005. "Accipiter gentilis", Animal Diversity Web. Available online at:
http://animaldiversity.ummz.umich.edu/site/accounts/information/Accipiter_gentilis.html.

Squires, J. R., and R. T. Reynolds. 1997. Northern Goshawk (Accipiter gentilis). In The Birds of North America, No. 298 (A. Poole and F. Gill, eds.) The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.

PNHP
Pennsylvania Natural Heritage Program

Great Blue Heron (*Ardea herodias*) Rookery

Pennsylvania Bird Species of Concern

State Rank: S3S4 (vulnerable/apparently secure), Global Rank: G4 (apparently secure)

Identification

A rookery is a colony of nesting birds. Great blue herons build their nests as high as 30 meters off the ground, in wooded areas isolated from human disturbance. Although they are wading birds, living on fish caught at the edges of rivers, in ponds, and in wetlands, Great blue heron rookeries may be located well away from water features; one colony found in Pennsylvania was as much as 17 miles from good fishing grounds. They may also nest in mixed-species rookeries with other heron species, other waterbirds, or even raptors such as owls and hawks.

Great Blue Heron (*Ardea herodias*) Rookery.

Habitat/Behavior

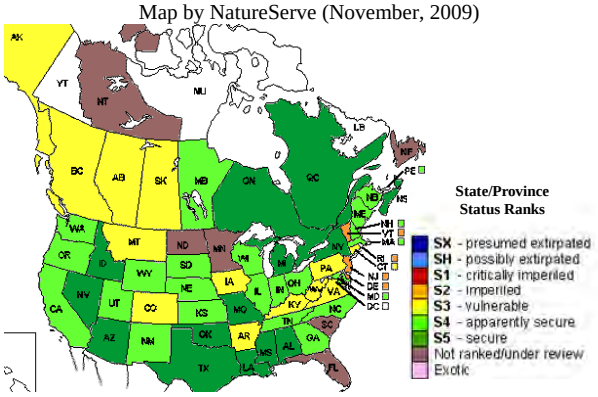
Great blue herons usually return to the same rookery site every year, starting in the spring when males arrive to scout the area and claim their nests, from which they court the later-arriving females. Nests are re-used and expanded year-to-year – they start as simple platforms of sticks but can eventually become saucers up to a meter deep. Each mated pair builds up the nest together, the male bringing new twigs and other materials to the female, who adds them to the structure.

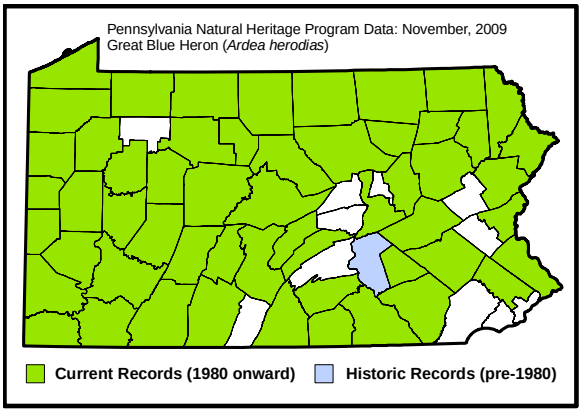
In Pennsylvania, the eggs are laid from mid-March to early June, after the female has had access to sufficient food for a period of about a week. Chicks hatch about a month later, usually a little less than two days apart, in the order in which their eggs were laid with brood contain two or three chicks. The parents share the tasks of incubating feeding, catching more than 20 percent of their own body weight in fish every day.

Great blue heron chicks are covered with a light gray down. Chicks require the most food between 26 and 41 days after hatching, when they may eat 0.6 pounds of fish each day. The chicks are ready to leave the nest by the end of the summer.

North American State/Province Conservation Status

Map by NatureServe (November, 2009)





Conservation

Protection of breeding grounds is one of the keys to conserving bird species. Great Blue Herons tolerate fewer disturbances to their breeding colonies than most waterbirds. It is recommended that human activity be excluded from a buffer zone of 300 meters (roughly 1000 feet) around heron rookeries to prevent people from scaring the herons off their nests. Severe or prolonged disturbance may cause the birds to abandon the nesting site, though they may re-colonize nearby if they find suitable habitat. Rookeries are also vulnerable to destruction of forest habitat and, when they are located in wetlands, changes to the flood regime that may kill trees.

References

Bennett, Darin C., Philip E. Whitehead, and Leslie E. Hart. 1995. "Growth and energy requirements of hand-reared Great Blue Heron (*Ardea herodias*) chicks." *The Auk*, 112(1): 201-9.

Brauning, Daniel W., ed. 1992. Atlas of Breeding Birds in Pennsylvania. Pittsburgh: University of Pittsburgh Press. 50-1.

Butler, Robert. W. 1992. "Great Blue Heron." *In* The Birds of North America, No. 25 (A. Poole, P. Stettenheim, and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, DC: The American Ornithologists' Union.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer . (Accessed: November 6, 2009).

Rodgers, James A. and Henry T. Smith. 1995. "Set-back distances to protect nesting bird colonies from human disturbance in Florida." *Conservation Biology*, 9(1): 89-99.

PNHP
Pennsylvania Natural Heritage Program

CURRENT STATUS: In Pennsylvania, the bald eagle is threatened and protected under the Game and Wildlife Code. Although not listed as endangered or threatened at the federal level, the bald eagle is protected by the Bald and Golden Eagle Protection Act and the Migratory Bird Protection Treaty Act.

POPULATION TREND: The recovery of the bald eagle (*Haliaeetus leucocephalus*) has been one of the great wildlife conservation stories in the history of both the state and the nation. Pennsylvania's nesting bald eagle population has increased steadily and dramatically in recent years, roughly 15 percent annually. As recently as 1980, the state's known nesting population numbered only three pairs. For milestones, there were eight active nests in 1990; 48 nests in 2000. Pennsylvania's nesting bald eagle population in 2006 cleared 100 for the first time since DDT decimated it in 1950s and '60s; there were 116 known active nests. The increases continued into 2008 when the state's nesting eagles numbering more than 150 pairs. More than 70 percent of the nests produced eaglets. The exponential increase in Pennsylvania's bald eagle nesting population is part of a regional increase. There has been a similar increase in populations in the Chesapeake Bay area and New York. Many bald eagles that nest or have been seen in migration in Pennsylvania have come from other states. Populations of these states are overlapping and the successes of the state programs have been feeding into each other.

The bald eagle recovery was fueled by the Game Commission's eagle reintroduction program from 1983-89. Conditions were right for such a reintroduction because the factors limiting bald eagles in the state had been removed. These limitations included the harmful effects of pesticides on eagle reproduction, poor stream water quality, the lack of trees along many streams, and in some cases, direct persecution. The success of bald eagles in Pennsylvania is directly related to improvements in environmental quality; eagles so dependent on good water and riparian forest quality and subsequent fish availability. Its recovery is a victory for the Endangered Species Act and much more.

The bald eagle was removed from the federal Endangered Species Act in 2006, but remains a "threatened species" in Pennsylvania. Each year, eagle nest success hovers around 70 percent, which signals that environmental conditions and protections have been successful. Although the population has increased greatly, it does not occupy all available habitats in the state. We expect further increases and continued expansion in the bald eagle nesting population and expansion. But it would not be surprising if this expansion begins to slow down as the best available habitat is occupied. The bald eagle's future in the commonwealth is brighter than ever.

IDENTIFYING CHARACTERISTICS: Bald eagles are among the largest birds of prey. They may weigh up to 14 pounds and have seven-foot wingspans. Like most raptors, female bald eagles are larger than males. Bald eagles are most readily identified by their white heads and tails, however, they don't attain this characteristic plumage until five years of age. Until that time, they are dark brown with varying amounts of white mottling. Their large, sharp talons are capable of dispatching large prey items and their

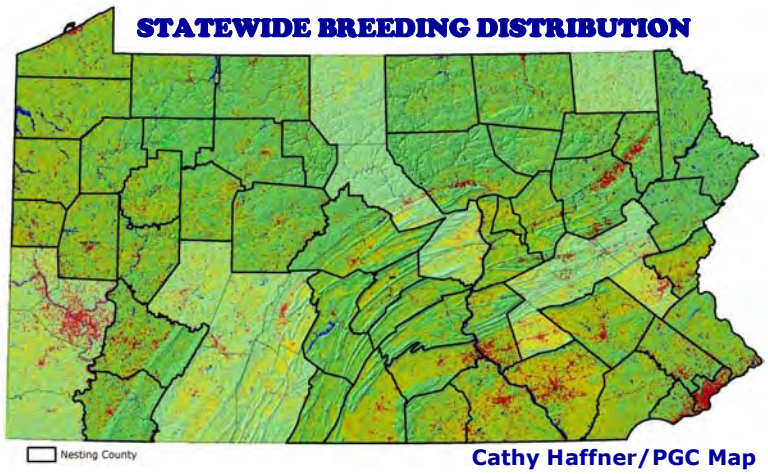
large beaks are capable of tearing apart carcasses of large mammals that they sometimes scavenge upon. They have broad wings appropriate for both powerful thrust in flight and soaring. Unlike the golden eagle, which is a "booted" eagle, the tarsi of the bald eagle are not feathered. The bald eagle is considered a member of the fish eagle or sea eagle group that includes large eagles such as Steller's sea eagle (*Haliaeetus pelagicus*) of northwestern Asia and the white-tailed eagle (*H. albicolla*) of Eurasia.

Bald eagles fly with slow, powerful wing beats and soar with wings at right angles from the body in a flat plane – giving them the "flying plank" nickname at hawk watches. Bald eagles have a different profile than the golden eagle (*Aquila chrysaetos*). In flight, the bald eagle's head and neck protrude half the length of the tail or more; a golden eagle's head protrudes less than half the length of the tail. The golden eagle's tail protrudes behind the bird about 3 times as much as the head protrudes in front. The bald eagle's massive bill also is a good field mark, yellow in adults. The bald eagle's flight profile is very flat, while the golden has a profile similar to buteo hawks like the red-tailed (*Buteo jamaicensis*) or red-shouldered hawks (*Buteo lineatus*). Bald eagles lack the diagnostic golden hackles that mark a golden eagle of any age or plumage. These eagle species also forage differently. The bald eagle is generally a "sit and wait" predator often perching patiently in a tree and watching for fish to surface, while a golden eagle usually hunts actively from the wing.

NATURAL HISTORY AND BEHAVIOR: Bald eagles are found throughout and only in North America, most often around water where they catch and scavenge fish. During nesting season, fish are a major part of their diet. They supplement their diet with waterfowl, small mammals, turtles and carrion. Bald eagles are notorious for their ability to pirate fish from other piscivorous (fish-eating) birds like ospreys (*Pandion haliaetus*) and common mergansers (*Mergus merganser*), chasing the other bird until it drops the fish. Bald eagles are very efficient foragers that are conservative in their energy expenditure. Although bald eagles will hunt in flight and by wading in water for prey, they generally perch on a tree or snag and wait for their prey to appear. They are opportunistic foragers and take whatever is available, but generally consume fish. Bald eagles also will scavenge dead fish, waterfowl and mammal carcasses, including large herbivores such as deer and livestock. Mammals, birds, and carcasses become a more important part of their diet in winter when fish can be more difficult to find and reach because of water levels or ice-cover.

Eagles don't reach adulthood and begin nesting until age four or five and can live a long life for a bird, up to about 30 years. At least two bald eagles in Pennsylvania, a nesting pair, are at least 25 years old. Bald eagles are known for their spectacular courtship, including acrobatic flight displays. The "cartwheel display" is perhaps the best known. In this courtship act, the pair flies to great altitude, lock their talons in flight, and tumble in cartwheels back toward the earth, breaking off their hold at last moment before colliding with the ground. These flight displays often occur in winter, giving support to the idea that many pairs remain bonded through the year. In Pennsylvania, some pairs seem to occupy the same ar-

eas all year long, while others leave their nesting area when ice forms on the water and decreases their ability to find fish.



Cathy Haffner/PGC Map

Bald eagles build among the largest nests of all birds, a massive and often conspicuous structure that is reused and refurbished each year. Nests are almost always near water, including islands, riparian woods, hillsides and swamps. The only nests on cliffs in Pennsylvania are actually supported by trees that grow on the side of the cliff. Eagle nests, called an eyrie, are a huge pile of interconnecting sticks, rubbish, and cornstalks that support a cup of softer materials such as small twigs, grasses, mosses, weeds, sod and feathers. Sprigs of greenery, especially conifer branches, are often found in nests and can be delivered to the nest during the incubation or nestling periods. Typically, these stick nests are 5 to 6 feet (1.5 – 1.8 meters) in diameter, 2.5 to 4 feet (0.7 – 1.2 meters) deep and conform to the shape of the tree where they are built, the shape ranging from cylindrical to conical to flat. Some nests famously have reached huge dimensions including one in Ohio that was 9 feet in diameter and 12 feet high, weighting about two metric tons, that was used for 34 years. Adults will continue using and seasonally adding material to the same nest for years. With damage by storms and rambunctious eaglets, nests often need extensive repairs each year. Eagles will lay eggs in February through April, sometimes sitting on eggs when there is ice and snow on the ground. This is one of the reasons why it is not good to approach nests too closely. If you flush an adult off of a nest in the incubation period you can expose the eggs to cold air, causing nest failure.

Bald eagles normally produce one to three young per year. One pair in Northampton County produced a record four young in 2009, an extremely rare event. A good way to determine that eagles are incubating is to notice when an eagle sits quietly on the nest for long periods, sometimes hours, at a time. Hatching can be inferred when the sitting adult seems to sit higher on the nest contents.

Pairs bonds tend to last more than one year, but although bald eagles are generally believed to generally bond for life, this is poorly studied because of the difficulties in capturing and marking each bird. (Pennsylvania's population is largely unmarked.) The persistence of pairs at sites from year to year, sometimes for decades, suggests long-term pair bonds. However, it is possible that pair bonds can break up after nesting failures. When one of the pair dies, the remaining eagle often seems to find a mate and retains the same territory.

Nest-building generally begins one to three months before egg-laying. In some cases, it seems that pairs build or start to build a nest a year previous to egg-laying. Both sexes contribute to nest-building, but the female may place the sticks in place. Sticks are collected from the ground near the nest tree or broken off from nearby trees. Eagles sometimes use a previously built raptor nest as a base for building their own nest. Pairs sometimes build an alternative nest in their territory that they use some years. The alternative nest may be in a location quite different from the original nest (on a hillside rather than an island, for instance).


Hal Korber/PGC Photo

Bald eagles generally rebuild or refit their old nest each year. The normal time for this activity in this area is December

through February, but they may begin nest repair earlier in the fall or when the nest is in use. In Pennsylvania, most egg sets are laid between mid-February and mid-March, with early March as the peak period. Eggs commonly hatch in April and the young fledge by the end of June or in July.

Bald eagles generally have a clutch of one to three eggs with two the most common clutch size. One egg is laid per day, but not always in successive days, with the clutch completed in three to six days. The eggs are large (averaging 130 grams) and dull white in color with no markings. Incubation begins with the first egg, so the young hatch out over a series of days. Both adults have brood patches, but that of the female is better developed than the male presumably because she does more brooding. The incubation period is generally 35 days in length, but there is some variation. Hatching, like egg-laying, occurs over several days, with one to four days between hatchings. This leads to differences in size between the nestlings and consequential advantage in competition for food, a source of mortality of young nestlings if food is not readily available. Flight feathers emerge in two to three weeks and body contour feathers emerge along the upper wing in three to four weeks. Eaglets gain a lot of weight daily with a maximum average gain of 102 grams per day and 130 grams per day by males and females, respectively. They achieve maximum growth in three to four weeks. Competition between nestlings may lead to starvation or violent death of younger, smaller eaglets caused by their larger nest mates. Nest success can be affected by bad weather and water conditions that make it difficult for the adults to find and capture fish.

Some nest departures are unsuccessful, so eaglets are sometimes grounded near the nest for weeks before gaining flight ability, making them vulnerable to predators or accidents. Adults feed them, but not always successfully if the eaglets are caught in vegetation outside the nest. Young leave the nest about 8 to 14 weeks after hatching, depending on many factors. The adults may encourage fledging by circling the nest with food items. Humans may cause pre-mature and unsuccessful fledging by climbing to the nest or advancing to the bottom or the supporting tree. The juveniles continue to grow and develop after fledging and are cared for by the adults for four to 10 weeks after leaving the nest. The fledglings often follow the adults after leaving the nest site, but often stay fairly close to the nest area (less than 1,000 feet) during the post-fledging period.

Although we tend to focus on the nesting population of bald eagles, many eagles migrate through the state or spend the winter here. The migration population can be divided into two parts: eagles that nest in the southern United States that migrate north after nesting season in winter to spend time in the northern part of their range, including Pennsylvania; and northern eagles that migrate from Canada and northern states through Pennsylvania to the south and return north each spring to their nesting grounds. Southern eagles generally account for the eagles observed between August and September, their migration continuing into November. This migration peaks in mid-September in our state. Many Florida subadult bald eagles migrate north through Pennsylvania and other northeastern states each spring and then migrate south in late summer and fall. Northern eagles that migrate South in autumn generally migrate later in the season, accounting for most bald eagles observed in Pennsylvania in November and December. Raptors, including eagles, migrating late in the fall and early winter tend to use terrain-derived uplifts and migrate close to topographic features that generate that lift, such as the ridge-tops and escarpment edges. Raptors that migrate in such conditions are probably more at risk from collisions with wind

turbines and other structures built in these areas. Bald eagles tend to follow deflection currents along ridges and escarpments and our larger rivers where they can hunt for fish. By contrast, the eastern population of golden eagle follows leading lines and diversion lines along ridges and edges of the plateaus in the Appalachian Mountains. Bald eagles are attracted to open water even during migration.


Karen Laubenstein/USFW Photo

HABITAT AND RANGE: Bald eagles are widely distributed in North America, especially where there is expansive aquatic habitat. Bald eagles thrive around bodies of water where adequate food exists and human disturbance is limited. They need a large tree or other supporting structure for their large, heavy stick nests. Bald eagles tend to select quality riparian forest and wetlands for their nesting habitat. As such, it can be considered an indicator species for this habitat and an "umbrella species" for protecting the valuable riverside forests and wetlands of the state, because they get more public recognition and support for conservation than many of the other inhabitants of these habitats. These habitats are important for a variety of wildlife from small cerulean warblers (*Dendroica cerulea*) that nest in tall trees to wood ducks (*Aix sponsa*) that nest in hollow trees along the river bank and American bitterns (*Botaurus lentiginosus*) that nest in large wetlands. Our perception of conditions that bald eagles will tolerate or with which they can be successful continues to change. Indeed, bald eagles are teaching us about eagle habitat as they continue to colonize parts of the state where they have been absent for many decades. More pairs are nesting closer to civilization, so long as their basic nest site and foraging requirements are met and their nest area is not disturbed.

Today, thanks to recovery efforts, bald eagles are nesting across the state and in places where they have not nested in decades, if not centuries. Bald eagles are increasing not only in number, but also in geographical coverage of the state. As of the summer of 2009, bald eagles nested in 46 of the state's 67 counties, and those nests have fledged more than 1,000 eaglets since the mid 1980s. Counties with the most nests were Crawford, Pike, Lancaster and York. Non-breeding adults and sub-adults may be found throughout the state at any time of year. In winter, dozens of eagles are typically found along the Delaware River between Matamoras and Hancock, N.Y., and along the Lackawaxen River in Pike and Wayne counties. Other concentration points include the lower Susquehanna River – south of Harrisburg – and Pymatuning Reservoir in Crawford County. Ice cover often is the limiting factor for bald eagle winter distribution. There are some winter roosting sites in Pennsylvania now that the population has increased to the point where eagles can congregate near good feeding areas. Some of these roosts are in agricultural areas near large bodies of water.

Nesting eagles are particularly sensitive to human intrusions or disturbances, but more eagles are nesting near communities and activity areas than ever before. Eagles may forage a mile or two from a nest, but tend to be very efficient hunters that do not wander far from good foraging opportunities where they nest. When they feel threatened, eagles will leave a nest, exposing young to harsh weather or to predators, causing nest failure. Eaglets sometimes fledge prematurely from human interference and subsequently suffer injury or mortality. These and other human activities can cause eagles to abandon a nest.

REASONS FOR BEING THREATENED: Like other raptors, bald eagles were persecuted by shooting and trapping from to colonization of the state through the early twentieth century, reducing their numbers greatly and their range to the wildest parts of the state. Direct persecution of eagles has been a serious limiting factor for this species in Pennsylvania up until the early 1940s, when they were federally protected. Despite its status as a national symbol, the bald eagle has been one of most persecuted birds in the county. Early publications accused bald eagles of preying upon game and farm animals and they were routinely shot on sight. Even respected ornithologists and naturalists voiced their negative assessments of the character and value of eagles.

Bald eagles forage for fish and other aquatic life, so water pollution made many areas of the state – and continent – unsuitable for eagles. Since eagles depend on good fish populations, the water quality of rivers and lakes is paramount for its existence. In addition, many former nesting sites have been lost to human development and encroachment. It is good to remember that Pennsylvania was developed first along its rivers, which provided transportation, a source of power, relatively easy development and good soil for farming. So, much eagle habitat was compromised early as this state was colonized and its population grew. Timbering also eliminated many good nesting sites because eagles generally nest in large trees. But the primary reason for the eagle's decline over the last century was the effect of the pesticide DDT and its derivatives on eagle reproduction. It accumulated in eagles and caused their eggs to be too thin to withstand the eagle's weight during incubation. As a result, the bald eagle population plummeted. In 1972, the use of this DDT and other harmful pesticides that bio-accumulated in birds was banned in the United States. The drastic decline of bald eagles and other birds eventually bottomed out. Clean water regulations and heightened environmental awareness during this period also contributed to better fish populations and spurred the recovery on.

MANAGEMENT PROGRAMS: The Game Commission annually monitors bald eagle nests – both existing and new – to measure nesting population trends and nesting success. Monitoring helps the agency to continue to follow bald eagle's recovery and let's biologists know immediately problems are occurring, both locally and statewide. Wildlife Conservation Officers protect nests and work with landowners to ensure the safety of bald eagles and their future success. When discovered, new nest sites are protected and production is monitored. The new management plan for bald eagles also calls for more public education about eagles. This expanded and updated bald eagle account is part of the agency's outreach program. An informed public guided by good "eagle etiquette" will be the best advocate for a continued bald eagle recovery and the best chance that any Pennsylvanian can see a bald eagle near his or her home in the future.

Sources:

Bildstein, K. 2008. A brief history of raptor conservation in North America. Pages 5-36, In State of North America's Birds of Prey, Series in Ornithology No. 3 (K. L. Bildstein, J. P. Smith, E. R. Inzunz, and R. R. Veit, editors). Nuttall Ornithological Club, and the American Ornithologists' Union, Printed by Cadmus Communications, Lancaster, PA.

Buehler, D. 2000. Bald Eagle, *Haliaeetus leucocephalus*, *In* The Birds of North America, No. 506 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Goodrich, L. and J. P. Smith. 2008. Raptor migration in North America. Pages 37 – 150 in State of North America's Birds of Prey, Series in Ornithology No. 3 (K. L. Bildstein, J. P. Smith, E. R. Inzunz, and R. R. Veit, editors). Nuttall Ornithological Club, and the American Ornithologists' Union, Printed by Cadmus Communications, Lancaster, PA.

Gross, D. A. 2009. Bald Eagle Nest Surveys and Studies [2008]. Pennsylvania Game Commission, Bureau of Wildlife Management Research Division, Annual Project Report. Project code No: 06711, Job code No: 71101.

Kosack, J. 1995. The Pennsylvania Game Commission, 1895-1995: 100 Years of Wildlife Conservation. Pennsylvania Game Commission, Harrisburg, PA.

Leberman, R. C. 1992. Bald Eagle. Pp 92-93, *In* Atlas of Breeding Birds in Pennsylvania (D. W. Brauning, Ed.). Pittsburgh University of Pittsburgh Press.

McWilliams, G. M. and D. W. Brauning. 2000. The Birds of Pennsylvania. Cornell University Press, Ithaca, New York.

For further reading:

American Eagle Foundation

Gross, D. A. 2010. Bald Eagle Nest Etiquette. Pennsylvania Game Commission, Bureau of Wildlife Management.

Brandes, D. 2005. Wind power development and raptor migration in the Central Appalachians. Hawk Migration Studies: 20-25.

Clark, W. S. and B. K. Wheeler. 2001. A Field Guide to Hawks of North America. 2nd Ed. Houghton Mifflin Co., Boston and New York.

Dunne, P., D. Sibley, and C. Sutton. 1988. Hawks in Flight. Houghton Mifflin Co., Boston.

Eagle Institute, Barryville, NY.

Gerrald, G. M. and G. R. Bortolitti. 1988. The Bald Eagle: haunts and habits of a wilderness monarch. Smithsonian Institute Press, Washington, D.C.

Johnsgard, P. A. 1990. Hawks, Eagles, and Falcons of North America. Smithsonian Institution Press, Washington and London.

McCullough, M. A. 1989. Molting sequence and aging of Bald Eagles. Wilson Bulletin 101:1-10.

Mojica, E. K., J. M. Meyers, B. A. Millsap, and K. L. Haley. 2008. Migration of Florida sub-adult Bald Eagles. Wilson Journal of Ornithology 120: 304-310.

Pennsylvania Audubon. 2005. Important Bird Area Conservation Plans. Pennsylvania Audubon Society, Harrisburg, PA.

U.S. Fish and Wildlife Service Bald and Golden Eagle website pages.

Weidensahl, S. 1996. Raptors: the Birds of Prey. Lyons and Burford, New York, NY.

Wheeler, B. K. and W. S. Clark. 1995. A Photographic Guide to North American Raptors. Academic Press, San Diego, CA.

By Doug Gross and Dan Brauning
Pennsylvania Game Commission
Connecting you with wildlife!
11/12/09

Timber Rattlesnake (*Crotalus horridus*)

Reptile Species of Concern

State Rank: S3S4 (vulnerable/apparently secure), Global Rank: G4 (apparently secure)

Identification

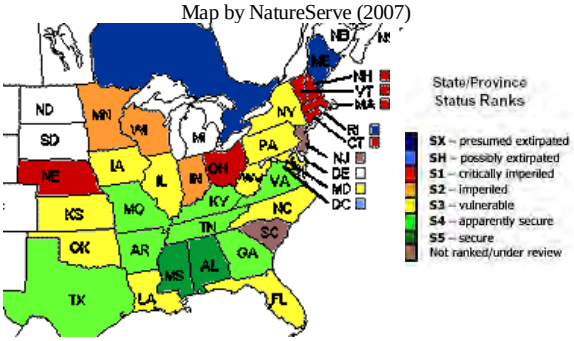
Timber rattlesnakes (*Crotalus horridus*) are easily distinguished from other snakes in Pennsylvania. Timber rattlesnakes are stout-bodied, large snakes reaching lengths of up to 5 feet. Color is extremely variable but usually consists of brown or black bands on bright yellow to black coloration. The head is triangular in shape and a rattle is present at the end of the black tail. This species may be confused with the less common eastern massasauga (*Sistrurus catenatus catenatus*) only present in the western portion of the state. The timber rattlesnake can be distinguished from the massasauga by the lack of white facial lines, the black tail forward of the rattle, and numerous small head-scales.

Habitat

Crotalus horridus is associated with deciduous forests and rocky outcrops. Hibernacula are usually found on south-facing rocky slopes with adequate crevices to provide shelter during the winter months. Males may travel far from the den site in the summer, moving into valleys and low-lying areas. Gravid females are far less mobile and tend to stay within a short distance of the den. Timber rattlesnakes are venomous, however are generally mild-mannered and not likely to strike.

North American State/Province Conservation Status

Map by NatureServe (2007)



Conservation/Status

Timber rattlesnake numbers have decreased significantly from historic records. This species was once widespread across the state. The remaining populations are usually found in remote, isolated areas. Collection and destruction of habitat are likely the main reasons for reductions in population size. Den sites have been targets for collection and should be the focus of conservation efforts for this species. The state status of the timber rattlesnake is candidate at risk (CA). Though this species is still relatively abundant across the state, it remains vulnerable to exploitation. Permits are now required to collect rattlesnakes and only one snake can be taken each year. Snake hunts still occur in the state but after capture, snakes must be marked and release and the site of capture. Biologists are gathering information from collectors and individual studies to determine the current status of this species in the state.

References

Genoway, H.H. and F.J. Brenner. 1985. Species of Special Concern in Pennsylvania. Carnegie Museum of Natural History. Pittsburgh, PA. 430pp.

Hulse, A.C., C.J. McCoy, and E.J. Censky. 2001. Amphibians and Reptiles of Pennsylvania and the Northeast. Cornell University Press, New York. 419pp.

The Center for Reptile and Amphibian Conservation and Management. Species Accounts: Timber Rattlesnake. Website: http://herpcenter.ipfw.edu/outreach/accounts/reptiles/snakes/Timber_Rattlesnake/

NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: September 4, 2007).

PNHP
Pennsylvania Natural Heritage Program

Eastern Hellbender (*Cryptobranchus alleganiensis alleganiensis*)

Pennsylvania Amphibian Species of Concern
State Rank: S3 (vulnerable), Global Rank: G3G4 (vulnerable)

Identification

The eastern hellbender is the largest salamander species in the northeastern United States. Males are around 17 inches in length, while females are a bit larger, averaging 21 inches. With a wide head, white tipped toes and wrinkled body, the hellbender has a bizarre monster-like appearance. Despite its odd looks, the hellbender is completely harmless. The base color is brown, and blotched with darker spots, though some adults may vary from yellowish brown to nearly black. The hellbender is one of two aquatic salamanders in Pennsylvania. The other is the mudpuppy (*Necturus maculosus*) which has distinctive external gills through adulthood and is easily distinguished from the hellbender.

Photo source: Tim Maret

The Eastern Hellbender
(*Cryptobranchus alleganiensis alleganiensis*)

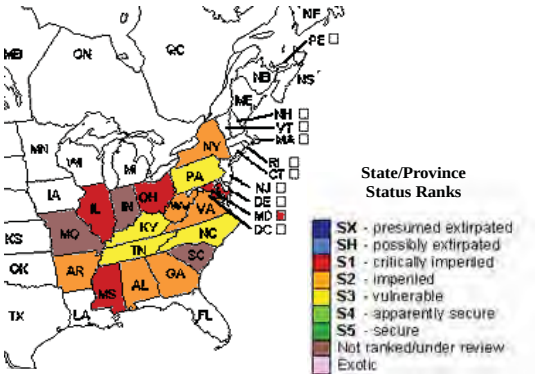
Habitat and Natural History

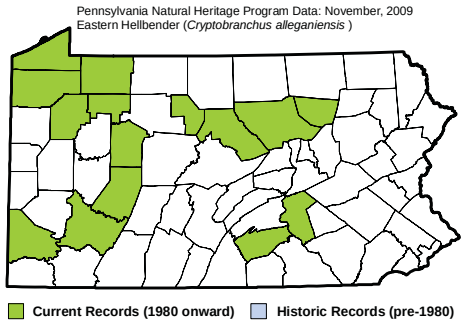
Inhabitants of swift-flowing, clean, clear waters, eastern hellbenders live in crevices under flat rocks on medium sized stream and river bottoms. Hellbenders feed almost exclusively on crayfish and pose no threat to game fish populations; however, they were once thought of as vicious predators of trout and other game fish and were consequently persecuted. Hellbenders are usually active at night, retreating under rocks during the daylight hours. Between late August through the end of September, adult hellbenders are seen more frequently moving about on the river bottoms in search of mates. Males construct nest chambers below rocks and lure females in for breeding. As the female deposits pearl-like strings of eggs, the male fertilizes them and guards the eggs until they hatch.

Conservation/Status

The eastern hellbender has declined in Pennsylvania for a number of reasons, but primarily due to decreases in water quality. Amphibians as a whole are particularly susceptible to chemical contamination given their permeable skin. Increased sedimentation due to soil erosion may choke out hellbender habitat, by filling in the gaps beneath rocks where they live. While some populations of hellbenders appear to be stable; many others seem to have vanished. Introductions of invasive exotic crayfish, such as the rusty crayfish (*Orconectes rusticus*) which are more aggressive than our native species, are thought to be the cause for some of these declines. Recent work has shown that predation by non-native game fish including walleye and brown trout may also lead to hellbender declines.

North American State/Province Conservation Status
Map by NatureServe 2009





References

Gibbs, J.P., A.R. Breisch, P.K. Ducey, G. Johnson, J.L. Behler, R.C. Bothner. 2007. The Amphibians and Reptiles of New York State: Identification, Natural History, and Conservation. Oxford University Press: New York. 422pp.

Hulse, A.C., C.J. McCoy, and E.J. Censky. 2001. Amphibians and Reptiles of Pennsylvania and the Northeast. Cornell University Press, New York. 419pp.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: December 3, 2009)

Pennsylvania Natural Heritage Program

Green Floater (*Lasmigona subviridis*)

Freshwater Mussel Species of Concern

State Rank: S2 (imperiled), Global Rank: G3 (vulnerable)

Identification

The green floater (*Lasmigona subviridis*) is a small mussel, usually less than 55 mm in length. The shell is thin and the mussel has a subovate or trapezoidal shape. The color varies from a dull yellow to green with many dark green rays visible, especially in young individuals. This species may be confused with the creek heelsplitter (*Lasmigona compressa*) (NatureServe 2005; Strayer and Jirka 1997). The creek heelsplitter is larger, thicker shelled, and less ovate. Also, the creek heelsplitter has only been found in the Ohio River Drainage in Pennsylvania while the green floater is also present in the Susquehanna and Delaware River Drainages.

photo source: PNHP

Green floater (*Lasmigona subviridis*)

Habitat

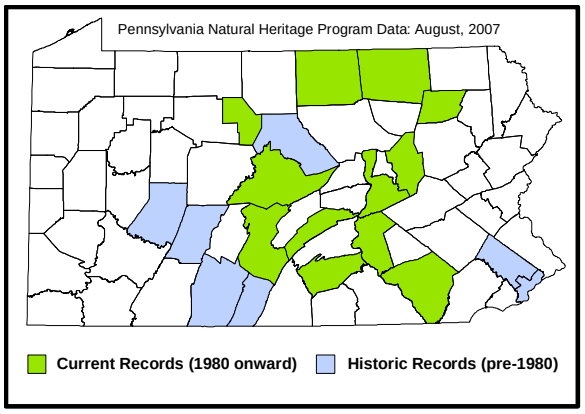
The green floater is often found in small creeks and large rivers and sometimes canals. This species is intolerant of strong currents and occurs in pools and other calm water areas (NatureServe 2005, North Carolina Mussel Atlas, Strayer and Jirka 1997). Preferred substrate is gravel and sand in water depths of one to four feet. This species is more likely to be found in hydrologically stable streams, not those prone to flooding and drying. Good water quality is also important for this mussel species (North Carolina Mussel Atlas).

Host Fish

Glochidial (larval) hosts for the green floater are not known (NatureServe 2005, Strayer and Jirka 1997).

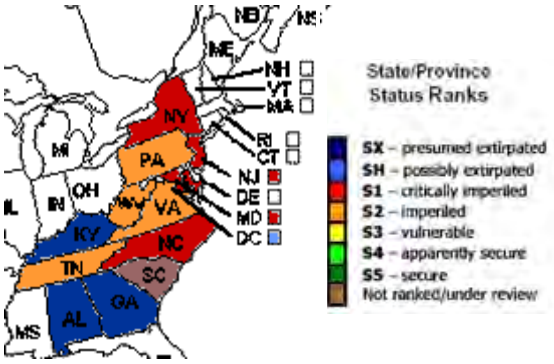
Status

From New York south to Georgia and west to Tennessee the green floater is found. This species is not very common in Pennsylvania, but has been found in the Susquehanna, Delaware, and Ohio River Drainages (NatureServe 2005). The state status of the green floater is imperiled (S2), as it is not frequently encountered within its expected range (www.naturalheritage.state.pa.us/invertebrates.aspx). The small size of this species may make it difficult to locate live animals during surveys. Shells of dead green floaters tend to get buried in the surrounding habitat. More extensive surveys are necessary to determine the current status of this species in Pennsylvania and the United States.



North American State/Province Conservation Status

Map by NatureServe (July, 2007)



The green floater was listed as threatened in an assessment of the conservation status of the freshwater mussels of the United States by the American Fisheries Society (Williams et al. 1993). The green floater has been historically widespread in the Susquehanna River drainage in New York; however, populations have declined since the early 1990s, probably due to pollution (Strayer and Jirka 1997). Decline in the abundance of this species in other places could be due to stream transport of their preferred habitat, as well as increases in pollutants. The introductions of zebra mussels and Asian clams have also negatively impacted abundance of this species in surveys. However, since this mussel species is hermaphroditic, small populations might survive slightly better than other mussel species in less than ideal conditions (NatureServe 2005).

References

- NatureServe Explorer: An online encyclopedia of life [web application]. 2005. Version 4.5. Arlington, VA. Website: www.natureserve.org/explorer .
- North Carolina Mussel Atlas, Species Information and Status. Website: www.ncwildlife.org/pg07_WildlifeSpeciesCon/pg7b1a1_9.htm
- Pennsylvania Natural Heritage Program. Biota of Concern In Pennsylvania (BOCIP) Lists. Website: www.naturalheritage.state.pa.us/invertebrates.aspx
- Strayer, D.L. and K.J. Jirka. 1997. The Pearly Mussels of New York State. The New York State Education Dept., Albany, NY 113pp and plates.
- Williams, J.D., M.L. Warren, K.S. Cummins, J.L. Harris, and R.J. Neves. 1993. Conservation Status of Freshwater Mussels. Fisheries 18(9): 6-22.

SKI-TAILED EMERALD (*Somatochlora elongata*)

Pennsylvania Invertebrate Species of Concern
State Rank: S2 (imperiled) Global Rank: G5 (secure)

- Introduction -

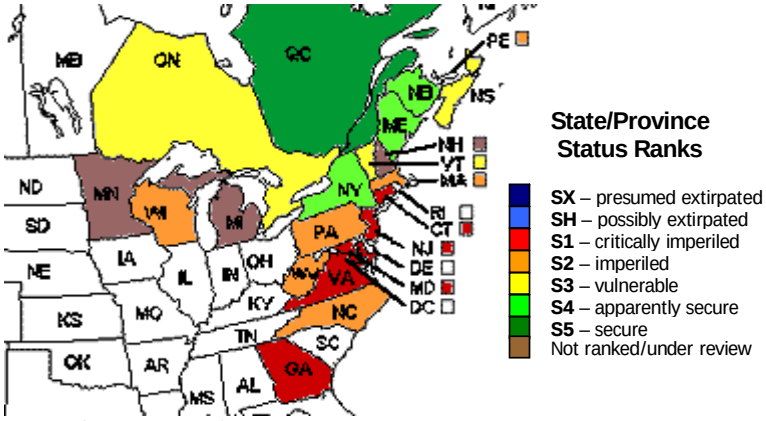
The Ski-tailed Emerald dragonfly is in the family Corduliidae. This family is known as the Emeralds, so-called because many of them have emerald green jewel-like eyes as adults and some have a metallic iridescence on the body. Many of these species look similar and identification can be difficult. The Ski-tailed Emerald is a relatively large Emerald, with bright yellow lateral thoracic markings.

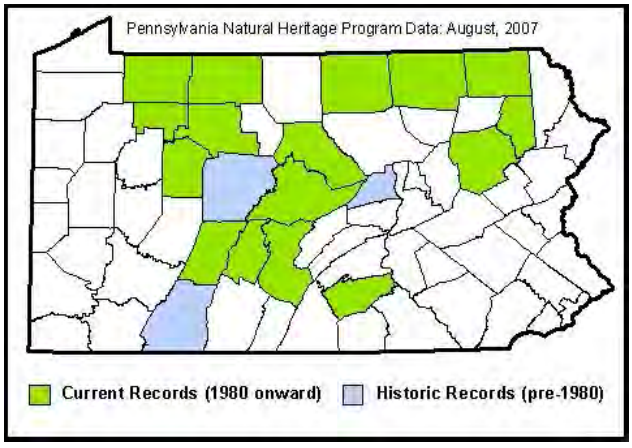

Ski-tailed Emerald
Somatochlora elongata
Dave Czaplak

-Habitat/Behavior -

The Emeralds are active and persistent flyers and even eat their prey while in flight. When they do rest, they tend to perch either vertically or obliquely from vegetation. The Ski-tailed Emerald can be found in patrolling slow, shaded small streams and outlets of beaver ponds.

North American State/Province Conservation Status
Map by NatureServe (2007)





- Current Status -

Emeralds are often difficult to find and generally aren't a very common family of dragonflies. Many of the species inhabit somewhat uncommon wetland habitats. The adults are fairly short-lived and fly for a short period of time, making them difficult to observe. The Ski-tailed Emerald is considered globally secure (G5) and statewide imperiled (S2). The most critical factors to protect this dragonfly species of concern are habitat preservation and water quality protection. Further studies of the dragonflies of Pennsylvania will help biologists to better understand the current status of these species of concern and the most important habitats for protection in the state.

References

- Dunkle, S.W. 2000. Dragonflies through Binoculars: A Field Guide to Dragonflies of North America. Oxford University Press, New York, NY.
- NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.2. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: September 6, 2007).
- Nikula, B., J.L. Loose, M.R. Burne. 2003. A Field Guide to the Dragonflies and Damselflies of Massachusetts. Massachusetts Division of Fisheries & Wildlife, Natural Heritage & Endangered Species Program, Westborough, MA.

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The Barrens Moths

Pennsylvania Animal Species of Concern

State Rank: SH to S3S4 **(historic to vulnerable/apparently secure)** **Global Rank: G2G3 to G5** **(imperiled/vulnerable to secure)**

Introduction

Barrens are scattered throughout the state. Some of these include the Moosic Mountain barrens, the Pocono Mountains barrens, and extensive ridgetop dwarf tree forest throughout the ridge and valley region. These barrens are home to many rare plants, animals, and natural communities, including some rare moths that are globally threatened. There are at least 18 state-listed moths that inhabit areas in the barrens and ridgetop dwarf tree natural communities in Pennsylvania. Some of these species rely solely on barrens areas for every stage of their life cycle. Listings of these moths and their habitat requirements are summarized below.

Jim Vargo ©

Pointed Sallow (*Epiglaea apiata*)

Some of these moths are more widespread and occur in throughout the eastern United States, while the Fly-poison Borer Moth (*Papaipema* sp. 1), is known to occur only in Pennsylvania. There is also little information on the full ranges for some of these species, but some are extremely restricted in habitat, which restricts their distribution as well.

Species and Habitat (bold species are found in Jefferson County)

Barrens dagger (*Acronicta albarufa*) SH, G2G3 – Dry oak habitats, including black oak, bur oak, pitch pine and scrub oak
A sallow moth (*Chaetaglaea cerata*) S2S3, G3G4 – Pitch pine/scrub oak barrens
Barrens chaetaglaea (*Chaetaglaea tremula*) S1, G5 – Xeric sites with abundant scrubby oaks and low ericaceous shrubs
Pine devil (*Citheronia sepulcralis*) S2S4, G4 – Pitch pine barrens, forests, occasional plantations
Pointed sallow (*Epiglaea apiata*) S3S4, G5 – Cranberry patches in bogs and northern pitch pine/scrub oak barrens
Blueberry gray (*Glena cognataria*) S1, G4 – Bogs and blueberry (*Vaccinium* spp.) dominated barrens
Esther moth (*Hypagyrtis esther*) S2S3, G5 – Pitch pine barrens
Barrens itame (*Itame* spp. 1) S1, G3G4 – Pine barrens with sandy soils
Black-waved flannel moth (*Lagoa crispata*) S1, G5 – Restricted to pitch pine/oak woods or pitch pine/scrub oak barrens
Twilight moth (*Lycia rachelae*) S1, G4G5 – Sand plain pine barrens as well as some dry, acidic, scrubby ridges
Footpath sallow (*Metaxaglaea semitaria*) S2, G5 – Bogs, acidic swamps, barrens with extensive blueberry patches
Fly-poison borer moth (*Papaipema sp.1*) S2, G2G3 – Fly-poison (*Amianthium muscaetoxicum*) dominated areas
A noctuid moth (*Platyperigea meralis*) S1, G4 – Dry, sandy sites such as pine barrens
Broad sallow moth (*Xylotype capax*) S3, G4 – Barrens, oak-pine woods, acidic swamps, with abundant pitch pine
Pine barrens zale (*Zale* spp.) S1, G3G4 – Exclusively pine barrens

Conservation

Conservation of these moth species depends on the protection of the habitat to which they depend on for all stages of their life cycles. Fire and microclimate are important factors in helping to maintain these community types. The pitch pine barrens are disturbance dependent ecosystems and the development of a prescribed burn management program would help maintain the quality of this naturally occurring community. Without periodic fires, the scrub habitat would succeed to other hardwood and pine species. Some area of the barrens have seen heavy industrial/residential/commercial development in the past couple of years, so it is critical to protect the remaining best examples of Pitch Pine/Scrub Oak Barrens in the state in order to fully protect the rare moths that depend upon this natural community. Additional inventories and monitoring are needed to determine the extent of the population and occurrences of many different species of moths in many different barrens communities in Pennsylvania.

References

Barton, Barb. Unknown date. Animal Survey Information, Volume 1. The Nature Conservancy, Pennsylvania Science Office.

Cameron, D. S., A. F. Davis, B. Barton, J. R. Belfonti, N. Clupper, J. L. Farber, J. R. Kunsman, A. Leimanis, and R. M. Ring. 1997. A Natural Areas Inventory of Lackawanna County, Pennsylvania.

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: November 6, 2009).

The Nature Conservancy, The Pennsylvania Science Office. 2003. A Natural Areas Inventory of Schuylkill County, Pennsylvania.

PNHP
Pennsylvania Natural Heritage Program

Slender Wheatgrass
Elymus trachycaulus

Description

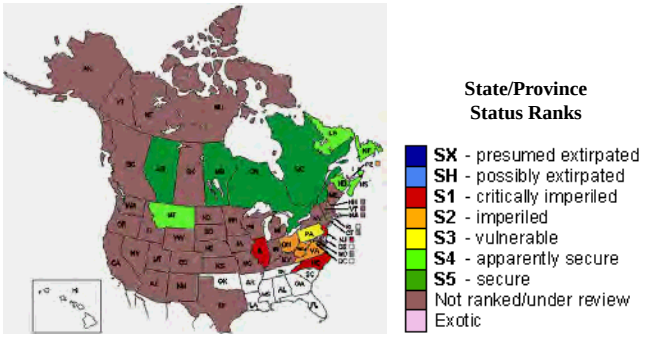
Slender Wheatgrass is a perennial grass that may grow to 3 feet (1 m) in height. The leaves are alternately arranged, consisting of a basal sheath portion that envelopes the stem and a linear shaped, flattened, and untoothed blade that is 2 to 5 inches (5-13 cm) in length, about 3/8 inch (7-12 mm) in width, and pointed at the tip. The minute flowers, appearing in summer, occur in an elongate and very slender unbranched inflorescence. The inflorescence contains many individual flower-bearing spikelets that occur singly in an alternating arrangement. The lower part of each spikelet, more specifically the scales called glumes, tends to remain attached to the inflorescence after the fruits mature and drop from the plant. This species closely resembles the weedy and exotic species known as quackgrass (*Elymus repens*), but the latter produces well-developed rhizomes (often forming colonies), has longer anthers, a hairless spikelet axis, and the complete spikelet (including the glumes) falls as one unit at maturity.

Photo source: John Kunsman (PNHP)

Distribution & Habitat

Slender Wheatgrass has a transcontinental range across North America. In Pennsylvania, it has been documented historically mostly primarily in the northern counties. It grows in mostly well-drained habitats that receive considerable sun, such as woods borders, rocky banks, grasslands, barrens, thickets, and utility rights-of-way.

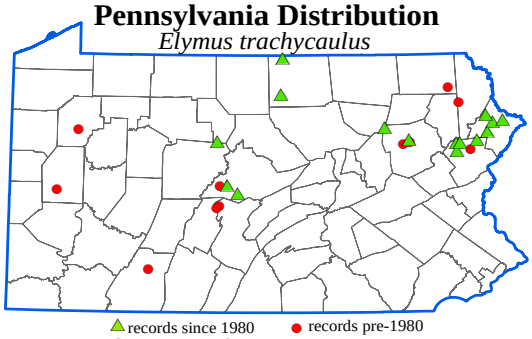
North American State/Province Conservation Status
Map by NatureServe 2010



Current State Status

The PA Biological Survey (PABS) considers Slender Wheatgrass to be a species of special concern, based on the limited number of locations recently confirmed. It does not have a PA legal rarity status, but has been assigned a PABS suggested rarity status of Tentatively Undetermined.

Pennsylvania Distribution
Elymus trachycaulus



Pennsylvania Natural Heritage Program Data 3-2011

Conservation Considerations

The viability of populations of Slender Wheatgrass will require maintaining early successional conditions and controlling invasive species. In some cases, active management, such as periodic mowing or the use of prescribed fire may be needed to create the proper successional stage and ecological conditions for this species to thrive.

NatureServe conservation status ranks

G5 – Globally secure; S3 – Vulnerable in Pennsylvania

Pennsylvania Natural Heritage Program

References

- NatureServe. 2011. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer.
- Pennsylvania Natural Heritage Program. 2011.
- Rhoads, A.F. and W.M. Klein, Jr. 1993. The Vascular Flora of Pennsylvania. American Philosophical Society, Philadelphia, Pennsylvania.
- Rhoads, A.F. and T.A. Block. 2007. The Plants of Pennsylvania: An Illustrated Manual. 2nd edition. University of Pennsylvania Press, Philadelphia, Pennsylvania.

Creeping Snowberry
Gaultheria hispidula

Description

Creeping Snowberry is a low-growing, matlike, evergreen shrub. All parts of the plant have a wintergreen odor when bruised. The plant may be recognized in any season by its growing habit and its leaves. The leaves are alternately arranged, mostly less than 3/8 inch (1 cm) in length, egg-shaped or rounded, very short-stalked, hairless above and with scattered brownish hairs below. The plants produce flowers and fruits, but these can be a challenge to locate. The flowers, which appear in spring, are greenish/white, only a few millimeters in length, and occur singly along the stem. The fruit is white, berry-like but rather dry, contains many seeds, and is the source of the common name.

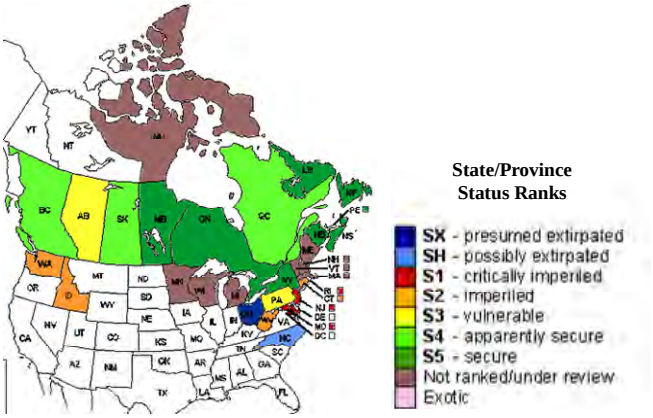
Photo Source: John Kunsman (PNHP)

Distribution & Habitat

Creeping Snowberry has a transcontinental range across the cooler regions of North America. In Pennsylvania, it represents a northerly species and has been documented historically in the northern counties. The species grows on decaying logs, stumps, and moss hummocks in bogs, peaty wetlands, and swamps.

North American State/Province Conservation Status

Map by NatureServe 2010

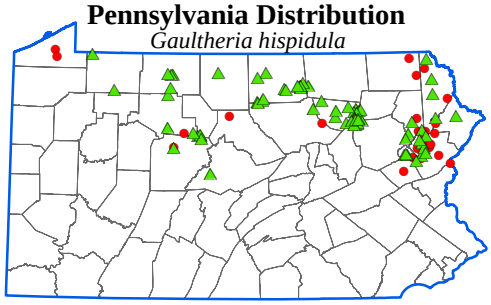


Current State Status

The PA Biological Survey (PABS) considers Creeping Snowberry to be a species of special concern, based on the moderate number of locations recently confirmed and the wetland habitat. It has a PA legal rarity status and a PABS suggested rarity status of Rare.

Pennsylvania Distribution

Gaultheria hispidula



Pennsylvania Natural Heritage Program Data 3-2011

Conservation Considerations

The viability of populations of Creeping Snowberry and its habitat may be enhanced by creating buffers and protecting the natural hydrology around wetlands and controlling invasive species.

NatureServe conservation status ranks

G5 – Globally secure; **S3** – Vulnerable in Pennsylvania

Pennsylvania Natural Heritage Program

References

- NatureServe. 2011. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available at http://www.natureserve.org/explorer.
- Pennsylvania Natural Heritage Program. 2011.
- Rhoads, A.F. and W.M. Klein, Jr. 1993. The Vascular Flora of Pennsylvania. American Philosophical Society, Philadelphia, Pennsylvania.
- Rhoads, A.F. and T.A. Block. 2007. The Plants of Pennsylvania: An Illustrated Manual. 2nd edition. University of Pennsylvania Press, Philadelphia, Pennsylvania.

Downy Lettuce
Lactuca hirsuta

Description
The Downy Lettuce is an annual or biennial herb with milky sap. The slightly to densely hairy stem can reach 8 feet (2.5 m) in height. The leaves are arranged alternately on the stem and variable in shape and length, but tend to have toothed, pinnate lobes. The flowers are individually tiny and are grouped in yellow flower heads that are 5/8 to 7/8 inch (15 to 22 mm) long at maturity. The individual fruits have a slender "beak" at the top, somewhat similar to dandelions. The flower heads and fruits of Downy Lettuce are slightly larger than a very similar and much more common species of wild lettuce, *Lactuca canadensis*.

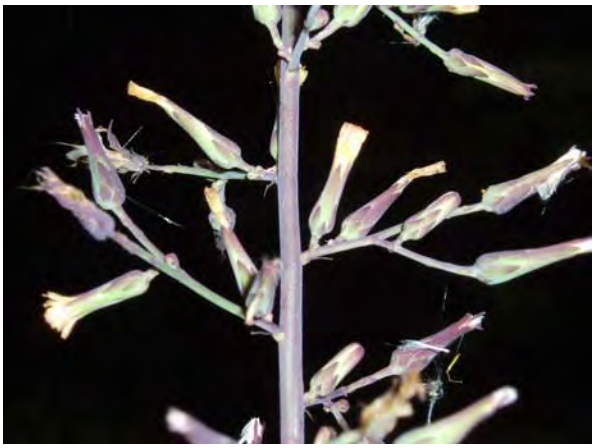
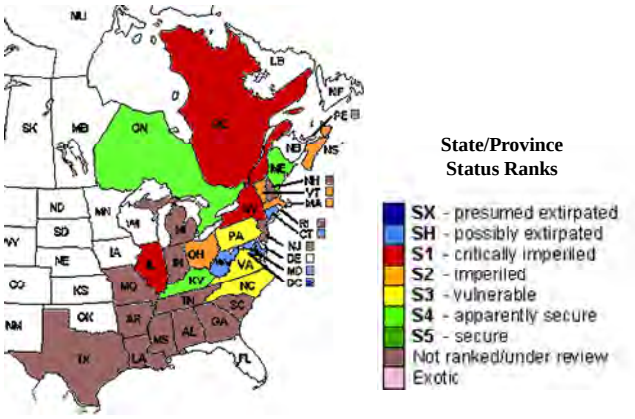


Photo source: John Kunsman (PNHP)

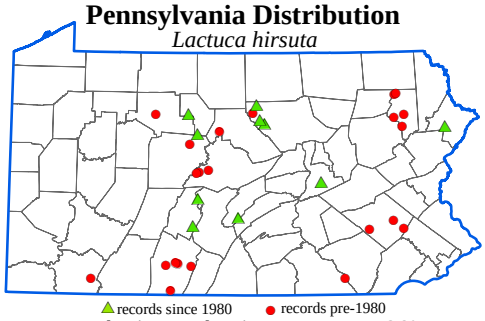
Distribution & Habitat
The Downy Lettuce has a distribution from Canada south and west into Georgia and Texas. In Pennsylvania, it has been found scattered throughout the state. The species grows in open woods, clearings, thickets, powerline and pipeline rights-of-way, and ridgetops.

North American State/Province Conservation Status
Map by NatureServe 2010



Current State Status
The PA Biological Survey (PABS) considers Downy Lettuce to be a species of special concern, based on the relatively few occurrences that have been recently confirmed. It does not have a PA legal rarity status, but has been assigned a suggested rarity status of Undetermined by PABS. meaning that more information is needed before a more definitive rarity status can be designated

Pennsylvania Distribution
Lactuca hirsuta



Pennsylvania Natural Heritage Program Data 3-2011

Conservation Considerations
More field surveys are needed to determine the range, abundance, and ecological requirements of Downy Lettuce before a more definitive conservation status, if any, can be assigned. Based on current data, it appears to be a short-lived, early successional species that may have a very limited viability at a given occurrence, even under optimal conditions.

NatureServe conservation status ranks
G5 – Globally Secure; **S2** – Imperiled in Pennsylvania

Pennsylvania Natural Heritage Program

References

- NatureServe. 2011. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available at http://www.natureserve.org/explorer
- Pennsylvania Natural Heritage Program. 2011.
- Rhoads, A.F. and W.M. Klein, Jr. 1993. The Vascular Flora of Pennsylvania. American Philosophical Society, Philadelphia, Pennsylvania.
- Rhoads, A.F. and T.A. Block. 2007. The Plants of Pennsylvania: An Illustrated Manual. 2nd edition. University of Pennsylvania Press, Philadelphia, Pennsylvania.

Netted Chainfern
Woodwardia areolata

Description

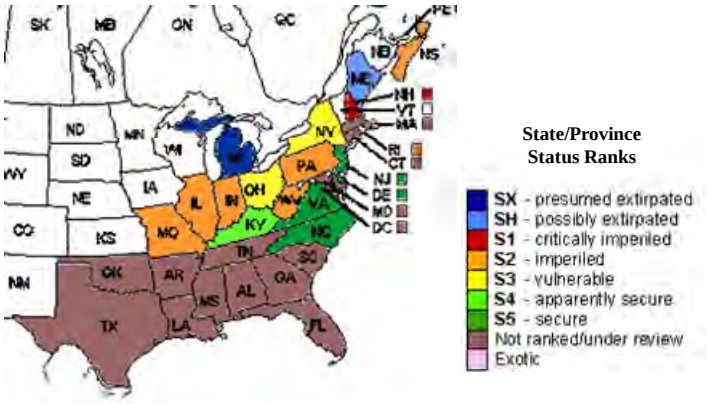
Netted Chainfern grows from 1½ to 2½ feet (5-8 dm) in height, and may form small colonies due to the presence of creeping underground stems. The leaves are easily distinguishable into vegetative and fertile types. The vegetative leaves have a typical fern-like appearance, being green, flattened, and divided into 7 to 12 very deep lobes (or distinct leaflets on the lower part of the leaf) that are not further subdivided into smaller lobes. The leaf veins are conspicuous and have a net-like or chain-like arrangement, as the common name implies. The fertile leaves of Netted Chainfern are dark colored, much narrower, not flattened and leaf-like, and have spore-producing structures on their underside. The vegetative leaf of this species resembles the leaf of the Sensitive Fern (*Onoclea sensibilis*), a common species in Pennsylvania, but the lobes in Netted Chainfern tend to be alternately arranged along the leaf stalk while the lobes of Sensitive Fern tend to be oppositely arranged.

Photo source: Andrew Strassman (PNHP)

Distribution & Habitat

Netted Chainfern has a distribution centered mainly on the Atlantic coastal plain from Nova Scotia south and west into Texas and Florida. In Pennsylvania, the species has been documented historically in scattered counties, particularly in the Delaware River drainage. It grows in swamps, seepages, wet woods, boggy wetlands and along the margins of streamlets.

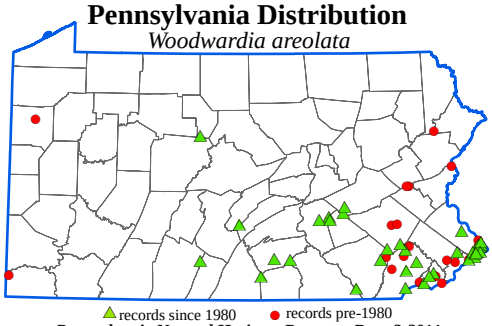
North American State/Province Conservation Status
Map by NatureServe 2010



Current State Status

The PA Biological Survey (PABS) considers Netted Chainfern to be a species of special concern, based on the relatively few occurrences that have been recently confirmed and the wetland habitat. It has no PA legal rarity status, but has been assigned a suggested rarity status of Threatened by PABS. About 30 populations are currently known from the state.

Pennsylvania Distribution
Woodwardia areolata



Pennsylvania Natural Heritage Program Data 3-2011

Conservation Considerations

The viability of populations of netted chainfern and its habitat may be enhanced by establishing buffers around wetlands, controlling invasive species, and protecting the natural hydrology surrounding wetlands.

NatureServe conservation status ranks

G5 – Globally Secure; **S2** – Imperiled in Pennsylvania

Pennsylvania Natural Heritage Program

References

- NatureServe. 2011. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available at http://www.natureserve.org/explorer
- Pennsylvania Natural Heritage Program. 2011.
- Rhoads, A.F. and W.M. Klein, Jr. 1993. The Vascular Flora of Pennsylvania. American Philosophical Society, Philadelphia, Pennsylvania.
- Rhoads, A.F. and T.A. Block. 2007. The Plants of Pennsylvania: An Illustrated Manual. 2nd edition. University of Pennsylvania Press, Philadelphia, Pennsylvania.