



It's About Habitat...

West Virginia Wildlife Conservation Action Plan

West Virginia
Division of Natural Resources

Wildlife Resources Section



ACKNOWLEDGEMENTS

The West Virginia Wildlife Conservation Action Plan could not have been developed without the knowledge, effort and commitment by the individuals, agencies and organizations listed below. It is our hope that through their hard work, expertise and dedication to the resource that this Action Plan will help guide the current and future conservation of SGNC and their habitats. Of equal importance are the stronger bonds that were formed with our partners and cooperators in the process of developing this plan that will ensure that this plan not be relegated to the shelf, but will instead be a useful document that will continue to evolve as more is learned about the resource and the WVWCAP is actually implemented. The following individuals and organizations were directly involved in the development of this plan:

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We would also like to thank the members of the West Virginia Wildlife Diversity Committee, West Virginia Partners in Flight, West Virginia Entomological Society and Northeast Endangered Species and Wildlife Diversity Technical Committee. We are especially grateful to our many partners and cooperators and to all those who provided comments and feedback on the plan via the WVDNR Website. We also deeply appreciate the assistance provided by the International Association of Fish and Wildlife Agencies and by the U.S. Fish & Wildlife Service, Region 5 Office, the latter whose dedicated staff came to West Virginia to offer further guidance and support throughout the WV Wildlife Conservation Action Plan development process.

The development of the WWWCAP was made possible, in part, by funding from the U.S. Fish & Wildlife Service through the State Wildlife Grants Program.

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Section 1. Executive Summary

Plan Overview

The Wildlife Resources Section of the West Virginia Division of Natural Resources (WVDNR) is charged with the conservation and management of all species of fish and wildlife in the state. The goal of the *West Virginia Wildlife Conservation Action Plan* is to conserve the diversity of West Virginia's fish and wildlife resources by emphasizing those species in greatest need of conservation. The plan was prepared by the WVDNR in consultation with other government agencies, academia, conservation organizations and individual citizens.

Recognizing that, in many cases, vital conservation information on the natural history, abundance and distribution of these species in West Virginia is incomplete, this plan charts a course for science-driven, active conservation of fish and wildlife resources over the next decade. Key features of the plan are its emphasis on conservation actions, including a land conservation initiative, and the collaborative approach to plan implementation. The plan is both species- and habitat-based, its core component being the 128 species and species group fact sheets that will function as mini-plans within the broader comprehensive plan. Although the plan covers a ten-year span, it is actually only the first step in a continuous, adaptive management process for collaborative conservation of the state's fish and wildlife resources and the habitats that sustain them.

Although they are not currently fundable activities under the State Wildlife Grants Program, the plan also recognizes the value of *Education* and *Recreation* as valuable elements of conservation action. Several strategies are identified in the plan as potential action items should federal law be changed to provide additional funding in these areas.

Required Elements

To qualify the State of West Virginia for continued receipt of federal funds under the State Wildlife Grants Program, this plan must address eight required elements described by the U.S. Congress and must be approved by the Director of the U.S. Fish and Wildlife Service. What follows is a description of the eight required elements and how each has been addressed by this plan.

1. Information on the distribution and abundance of species of wildlife, including low and declining populations as the State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State's wildlife

Thirty-one recognized experts on fish and wildlife species in West Virginia reviewed species listings in 15 taxonomic groups submitted by 10

international, national, state and private conservation organizations. By expert consensus and the application of ranking criteria, 128 species or species groups were identified as species in greatest need of conservation for the purposes of this plan. Sections 4-E, 5-E, Appendix 2 and Appendix 3 of the plan address this required element.

2. Descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified in (1)

Sections 4-F and 5-F of the plan address this required element. Three habitat classes, terrestrial, subterranean and aquatic, comprising 26 individual habitat types that have been described to date, were identified and discussed as key habitats for species in greatest need of conservation. Habitat condition and trends are specifically discussed in Section 4-F.

3. Descriptions of problems which may adversely affect species identified in (1) or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats

The plan addresses this element by identifying and discussing major issues and challenges for conservation of species in greatest need in West Virginia. Mining, residential and commercial development, atmospheric acid deposition, stream sedimentation, forest management, invasive species, water pollution and loss of instream, wetland, and riparian habitat have been identified as major regional or statewide conservation issues. Section 4-D, 5-E, 5-F and 9 of the plan address this required element.

4. Descriptions of conservation actions proposed to conserve the identified species and habitats and priorities for implementing such actions

In addition to major survey and inventory actions to collect and manage better abundance and distribution data for species in greatest need, seven potential actions to conserve these and other species are identified and discussed in Section 5-A of the plan. Species fact sheets (Section 5-E) identify and prioritize actions for data management, surveys, research and active conservation of individual species or species groups. Several broad strategies to address habitat issues are identified as challenges in Sections 4-D and 5-F. Significant among those strategies is a broad-based land conservation initiative, described in Section 6. Section 6 also describes a process designed to integrate diverse categories of action, regionally prioritize them and facilitate annual workplanning by the WVDNR and plan partners. Finally, Section 9 identifies long-range, strategic priorities for which commitments will be made in order to implement specific actions identified

elsewhere in the plan. Collectively, Sections 4-D, 5-A, 5-E, 5-F, 6 and 9 of the plan address this required element.

5. Proposed plans for monitoring species identified in (1) and their habitats, for monitoring the effectiveness of the conservation actions proposed in (4), and for adapting these conservation actions to respond appropriately to new information or changing conditions

Section 7 of this plan describes a process to establish a *Conservation Decision Support System (CDSS)* to guide conservation action and to monitor species, habitats and the effectiveness of conservation actions. Section 8 discusses how the CDSS will feed the adaptive management process to respond to new information or changing conditions. Specific monitoring actions are also identified in the Species and Habitat Fact Sheets (Sections 5-E and 5-F). Appendix 7 of the plan identifies ongoing monitoring actions that will continue as part of plan implementation. Finally, the CDSS and other monitoring actions are elevated as strategic priorities in Section 9 of the plan.

6. Descriptions of procedures to review the strategy at intervals not to exceed ten years

The entire plan will be reviewed and revised every two years. The biennial plan coordination meeting among plan partners will be an exciting venue to facilitate this review and revision. Section 8 of the plan addresses this required element.

7. Plans for coordinating the development, implementation, review, and revision of the plan with Federal, State, and local agencies and Indian tribes that manage significant land and water areas within the State or administer programs that significantly affect the conservation of identified species and habitats

The identification process for species in greatest need of conservation included species listed by the U.S. Fish and Wildlife Service and the U.S. Forest Service, two of the federal agencies that administer significant land and water areas within the state. The plan was offered to these and other federal, state and local agencies for review. The WVDNR has cooperative management agreements with many of these agencies that will facilitate partnerships for plan implementation. Section 6 of the plan addresses this required element.

8. Congress also affirmed through this legislation that broad public participation is an essential element of developing and implementing these plans, the projects that are carried out while these plans are developed, and the Species in Greatest Need of Conservation that

Congress has indicated such programs and projects are intended to emphasize

This plan was developed with extensive input from 31 species experts, 24 of whom were from outside the WVDNR. Four completed public surveys provided additional input into the plan. Conservation actions were developed in collaboration with numerous plan partners. The reviewer from Trust for Public Land commented that:

“DNR has done a good job of engaging the conservation community throughout this planning process, and this is reflected in the plan. I believe the plan will be utilized by several organizations and agencies in their priority setting of conservation actions, as DNR envisioned.”

The plan was offered to 57 partners and cooperators as well as the general public for review. The WVDNR held a public open house and a plan partners meeting following release of the initial draft. The plan was, and continues to be, available on the WVDNR website and the plan was publicized in several in-state newspapers. Section 4-C and Appendix 5 of the plan address this required element.

2. Why Did We Do the Plan?

The federally administered State Wildlife Grants program provides federal dollars to every state and territory to support cost-effective conservation aimed at preventing wildlife from becoming endangered. The U.S. Congress created the program in 2001. Funds appropriated under the State Wildlife Grants program are allocated to the states according to a formula that takes into account each state's size and population.

To make the best use of the State Wildlife Grants funding, Congress charged each state and territory with developing a comprehensive plan for fish and wildlife conservation, emphasizing those species and habitats in greatest need of conservation (SGNC). These plans will provide an essential foundation for the future of wildlife conservation and will stimulate state and federal agencies and other conservation partners to think strategically about their roles in conserving fish and wildlife resources in each state and territory.

State fish and wildlife agencies have a great record of success in conserving game species, thanks to the contributions of hunter and angler license fees and federal excise taxes. But 90 percent of our nation's wildlife is neither hunted nor fished. Thus, there is a serious gap in wildlife conservation funding, and thousands of species are falling through the cracks. More than 1,000 species are already listed as federally threatened and endangered, with many more under consideration.

State Wildlife Grants support projects that prevent wildlife from declining to the point of being endangered. Projects supported by State Wildlife Grants restore degraded habitat, develop partnerships with private landowners, collect data to find out more about declining species and, if feasible, restore native species. Statewide strategic plans will ensure that funds are spent wisely and effectively on actions to enhance and restore wildlife populations and habitat.

The State Wildlife Grants program will save taxpayer dollars. Taking action to conserve wildlife before it becomes endangered is environmentally sound and fiscally responsible. Once a species drops to the point of potential extinction, recovery efforts become risky and expensive. An ounce of prevention is worth a pound of cure. A non-federal match requirement assures local ownership and leverages state and private funds to support conservation. In an era of tight budgets, the State Wildlife Grants program is a wise use of limited federal funding to get the most results for taxpayers.

The State Wildlife Grant program has broad, bipartisan support. The program is supported by the Teaming With Wildlife Coalition, made up of more than 3000 groups representing sportsmen and environmentalists, fish and wildlife

managers, and tourism and nature businesses. The program has strong bipartisan support in Congress and from the President.

Each state's plan will establish a vision and a plan of action for state wildlife conservation and funding. State fish and wildlife agencies are leading the strategy development process, but the aim is to create a strategic vision for conserving the state's wildlife, not just a plan for the agency. While each state strategy will reflect a different set of issues, management needs and priorities, states are working together to ensure nationwide consistency and a common focus on targeting resources to prevent wildlife from declining to the point of endangerment.

What makes these plans different from other plans that have been drafted in the last decade? Two things: *money* and *scale*. If approved, the objectives and approaches defined by each state strategy will receive millions of dollars of federal funds over time, and matched with support from other sources, each strategy will be implemented. Very few other plans have this clear program of support. In addition, the strategies are being produced by every state and territory to address the entire diversity of wildlife and habitats. Collectively, they will create the first nationwide approach to comprehensive wildlife conservation.

The West Virginia Wildlife Conservation Action Plan is a long-range fish and wildlife conservation plan developed by the West Virginia Division of Natural Resources (WVDNR) with input from other state and federal agencies, academia, conservation organizations and other non-profit groups, and private citizens. The plan's primary emphasis is on species that are in greatest need of conservation. These would include (1) non-game species of fish and wildlife for which conservation funding has been historically unavailable or inadequate and (2) some game species whose habitats, despite past conservation efforts, remain under severe stress.

The goal of this plan, as with those of other states, is to facilitate conservation of fish and wildlife species and their habitats before they become truly endangered. The principal function of the plan is to prioritize species, habitats and locations for conservation action by WVDNR and others. Conservation actions are intended to prevent further declines in species numbers by protecting species, habitats and locations from the stressors that have caused their decline. Conservation actions would range from active protection of habitat or species to efforts to increase public awareness of species needs.

This plan is a first step in what will be a continuous cycle of assessment, action and adjustment. As such, it is not a static document, but rather a description of a dynamic process designed to conserve the diversity of West Virginia's fish and wildlife resources through collaborative conservation of species and their habitats. The WVDNR encourages all interested West Virginians to become partners in this effort, for the state's fish and wildlife resources really belong to each of us. It is our obligation to conserve them.

Section 3: How Did We Do the Plan?

The plan is mandated by Congress to emphasize species in greatest need of conservation (SGNC) and their habitats. As such, the first action was to determine how species in greatest need of conservation were to be defined and then to compile a list of such species. Once the list was compiled, a review of each species was made to determine the status of the species and what conservation and monitoring actions were best suited to each species. This process led to a realization that for many of the species there is insufficient information to do on-the-ground site conservation.

Consequently, information gaps were identified for the majority of the species and survey, data management and research needs outlined. The large array of fact sheets outlines the actions identified. Not surprisingly many of the actions are similar across the species spectrum. Because of the dearth of basic distribution and status data for many species in similar taxonomic groupings, these species were grouped together and incorporated into single fact sheets. Within taxonomic groups for which there was significant information but conservation actions were similar, species were grouped by habitat preference (many bird groups fell into this category).

Concurrent with the identification of species, the habitat requirements of each species or group were assessed. Again much of the specific (or quantifiable) habitat for individual species was lacking. A species and broad habitat system correlation was attempted but, again due to imprecise data, this was only somewhat successful because experts differed widely in their opinions. Species which depend primarily on one habitat system were identified and those habitat systems that were deemed to be in management need are listed. Other conservation efforts will need to focus on a site by site basis for many species.

Conservation issues related to certain regions of the state were identified and will be used in detailed planning for habitat and site conservation actions. Because watersheds are a better ecologic unit than county boundaries (a traditional approach), species occurrence information is generally listed by watershed. Many watershed conservation groups have been formed in the state and it is thought that these will likely be strategic partners in species conservation efforts.

With the advent of Geographic Information Systems, the portrayal and analysis of data can be done on many scales as long as the basic geographic descriptors are present. Consequently the emphasis on watersheds can easily be amended to look at the data from a county, ecoregional or other scale as desired.

Congress listed eight required elements to be addressed in each state's wildlife conservation strategy.

- (1) Information on the distribution and abundance of species of wildlife, including low and declining populations as the State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State's wildlife; and,
- (2) Descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified in (1); and,
- (3) Descriptions of problems which may adversely affect species identified in (1) or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats; and,
- (4) Descriptions of conservation actions proposed to conserve the identified species and habitats and priorities for implementing such actions; and,
- (5) Proposed plans for monitoring species identified in (1) and their habitats, for monitoring the effectiveness of the conservation actions proposed in (4), and for adapting these conservation actions to respond appropriately to new information or changing conditions; and,
- (6) Descriptions of procedures to review the strategy at intervals not to exceed ten years; and
- (7) Plans for coordinating the development, implementation, review, and revision of the plan with Federal, State, and local agencies and Indian tribes that manage significant land and water areas within the State or administer programs that significantly affect the conservation of identified species and habitats.
- (8) Congress also affirmed through this legislation that broad public participation is an essential element of developing and implementing these plans, the projects that are carried out while these plans are developed, and the Species in Greatest Need of Conservation that Congress has indicated such programs and projects are intended to emphasize.

Meeting the intent of the eight required elements of the plan was accomplished through a variety of analyses, presentations, consultations, and reviews of multiple data sources. Actions and information fulfilling the required congressional intent for the Plan (as outlined in the Eight Elements) are described and appear throughout the document with a "roadmap" to the elements given in the Executive Summary.

Generally the plan was built from a species action approach rather than trying to construct a habitat conservation plan, because we lack comprehensive information for that type of approach. Revisions in the plan will eventually lead us to a better defined listing of on-the-ground conservation actions. The increase in conservation actions will coincide with the increase in conservation resources as a broad inclusive land conservation network is strengthened across the state.

Section 4. What Do We Know?

Introduction

Before conservation actions could be developed to address SGNC, considerable assessment of the current situation was required. The following sections of the plan generally describe what is currently known about the physical, biological and sociological landscape of West Virginia. Specifically, these sections provide detail on:

- Physical and demographic landscape of West Virginia
- Watershed descriptions
- Public opinion on conservation issues
- Major conservation issues and challenges
- Identification of species in greatest conservation need
- Fish and wildlife habitat descriptions and species associations

Section 4-A. West Virginia's Physical and Demographic Landscape

Because of the wide variation in elevation, latitude and longitude, West Virginia is considered to be a "transition state." It has attributes of the northern and southern states, and to some extent, eastern and western states. West Virginia is the only state that lies totally within the Appalachian Upland. Most of the state has very rugged terrain, and with a mean elevation of 1,500 feet, it is the most elevated state east of the Mississippi River (See West Virginia Elevation Map). West Virginia is about 240 miles long and 130 miles wide. Its total area covers 15,513,326 acres, making it the 41st largest of the 50 states. Land areas total 15,420,497 acres, and 92,829 acres are covered in water. Major rivers, streams, lakes and impoundments comprise about 87,098 acres of these areas. The remaining 5,731 acres are wetlands. (See Maps of West Virginia Major Rivers and West Virginia Wetlands, 5 Acres or More). The Mountain State has historically had very few areas classified as wetlands. Lacustrine areas (defined as open areas with standing water or pond or river edges) are shown in blue on the map, and palustrine areas (defined as other wetland areas with emergent vegetation) are shown in green. Forests cover 12,108,000 acres, or 78.5 percent of the total land area. The highest point is Spruce Knob at 4,861 feet above sea level, and the lowest point is Harper's Ferry at 240 feet above sea level.

The highest temperature (Fahrenheit) recorded was 112 degrees, and the lowest 37 degrees below zero. The monthly average temperatures range from a high of 85.6 degrees to a low of 23.9 degrees. The average annual precipitation for West Virginia can be seen on the West Virginia Annual Precipitation Map based on data from 1961-1990. Precipitation is well distributed throughout the year, and all parts of the state receive adequate rainfall with no dry season. The prevailing winds are westerly. As the moisture-laden air approaches the mountains in the central part of the state and is forced to ascend, the cooling air drops precipitation, thus the highest amounts of rainfall occur in this portion of the state.

The most populated areas of the state are found around the following cities from North-east to South-west: Martinsburg, Morgantown, Fairmont, Clarksburg, Weirton, Wheeling, Moundsville, Bluefield, Beckley, Charleston, St. Albans, Vienna, Parkersburg and Huntington (See map of Population Density Per Square Mile by County, West Virginia 2000 & 1980).

The 1950 Federal Census listed West Virginia's population at 2,005,552. By 2003, the population was 1,810,354, about a nine percent decrease. However, while the vast majority of counties showed decreases, all seven Eastern Panhandle Counties experienced increases in population (see Map of West Virginia 10 Year Population Change (2004-1994)), with Berkeley and Jefferson counties exhibiting a +150 and +145.5 percent change, respectively. These two counties are the nearest to the Washington-Baltimore complex.

Hence many “bedroom” communities are developing in this area, as well as second homes. The only other county showing a significant increase in population is Putnam County, which borders Kanawha County containing the state capitol, Charleston. Several new industries have moved into this area. Those counties experiencing the greatest declines in population are the southwestern “coal” counties, (McDowell, Logan and Wyoming) where increasing mechanization of the coal industry as well as the advent of mountain top removal/valley fill coal mining methods have reduced the number of available related industry jobs, with few other options available for employment.

Approximately 12 percent of the land in West Virginia is public land, with the remaining 88 percent in private holdings (see West Virginia Public Lands Map). The National Forests (Monongahela, totally within West Virginia’s borders, and George Washington-Jefferson National Forest, of which only a portion is in West Virginia) comprise 1,032, 968 acres. Other federal lands total about 145,000 acres. Federal Land Set-Asides total 276,000 acres, National Parks (89,000 acres), Reserved National Forest (181,000 acres) and National Wildlife Refuges (6,000). There are 73 Wildlife Management Areas and nine State Forests, which together comprise a total of 444,500 acres. There are 34 State Parks, totaling about 68,200 acres. In addition, there are 38, 917 miles of public roads (See Map of West Virginia Major Highways).

Of the total 11,900,000 acres of timberland in West Virginia, the ownership breakout is as follows: Government (2,357,000 acres, 11 percent)—Federal: (1,033,000 acres, 78 percent), State: (253,000 acres, 19 percent) and County & Municipal: (38,000 acres, 2 percent)-- Forest Industry (887,000 acres, 7 percent): and other Private Non-industrial: (9,689,000 acres, 82 percent). (Hardwood Forest Foundation website).

Based on the physiography and distribution of plants, the state may be divided into three physiographic regions: The **Western Allegheny Plateau**, **Allegheny Mountains** and **Eastern Ridge and Valley** (See Map of West Virginia Physiographic Regions and Map of West Virginia Land Cover by Physiographic Regions Overview).

The **Western Allegheny Plateau** is the largest of the three physiographic regions, covering about 5/6 of the state. (See the two Maps of West Virginia Land Cover by Physiographic Regions-Western Allegheny Plateau.) It can be found west of an imaginary line drawn along the east edge of Monongalia County southwest to eastern McDowell County. The surface rocks of this region are mainly shales and sandstones of the Pennsylvanian age. Extensive coal beds underlie much of the central and southern part of the region. The land area is rugged, marked by flat-topped highlands and more rounded hills as opposed to the more sharply defined landscape to the east. However, the terrain is highly dissected and the drainage is of a dendritic pattern. In the northern portion of the region the hills are below 1,476 feet, but in the southern region the hills are higher and elevations reach to 3,281 feet. The principal river in this region is the

Ohio, with two main tributaries, the Monongahela River in the north, and the Kanawha River in the south. The Kanawha has three major tributaries, the Gauley, Greenbrier and New Rivers. There is little flatland except along the Ohio and Kanawha rivers. The vegetation of the Western Allegheny Plateau is described as mainly hardwoods, containing several communities from wet to dry including flood plains, cove hardwoods, oak-hickory and oak-pine.

The vegetation of the southern portion of this region has been somewhat permanently impacted by deep and strip mining activities, as well as mountain top removal/valley fill operations. Many mining sites have been reclaimed by planting cool season grasses and pines. It will be decades or longer before most of these reclaimed lands return to a natural state.

The **Allegheny Mountain Region** lies east of the Western Allegheny Plateau and extends to the Allegheny Front and Back Allegheny Mountain, as far south as eastern Greenbrier County and north to Preston County. (See the Map of West Virginia Land Coverage by Physiographic Regions-Allegheny Mountains.) This area includes the highest elevations found in the state (some ridges and knobs are over 4,000 feet) and is comprised of mountain ranges running northeast to southwest with deep valleys between. Surface rocks are mainly Mississippian and Devonian age, with some from the Pennsylvanian period. Drainage from the mountains follows a combination of trellis and dendritic patterns. Water drains from the Eastern Continental Divide to the Monongahela River system through its two main branches, the Tygart Valley and Cheat rivers, from the headwaters of the Greenbrier River which flows into the Kanawha River system and from the North Branch of the Potomac River and a few other streams that flow into the Potomac River. The vegetation of the Allegheny Mountain Region is mainly classified as northern hardwood consisting of the northern hardwood (maple, beech, birch, hemlock) and northern evergreen (spruce, balsam) types. Higher elevations were originally covered by almost pure stands of red spruce (at one time covering about 467,000 acres); less than 10 percent of that forest remains today. The higher mountain valleys often contain swamps and bogs including many small sphagnum bogs. Although the Pleistocene glaciations did not reach the borders of West Virginia, many Canadian species migrated southward during the last ice age, forming tundra-like communities. As temperatures moderated, and more southern communities advanced northward, the high mountain glades retained relict communities, such as Cranberry Glades in Pocahontas County. The steep and narrow valleys in this region support little agriculture.

The original forests of the Allegheny Mountain Region were almost completely timbered by the turn of the 20th century. Remnant stands of virgin forest were left, such as those found at Gaudineer Knob and Cathedral State Park, that reflect what these magnificent forests may have looked like. Most of the forests regenerated in similar species compositions, except for the white pine and spruce forests and where fires burned a significant portion of the organic humus. Areas that have been continuously grazed have remained grasslands.

The **Eastern Ridge and Valley Region** lies to the east of the Allegheny Mountain Region and extends down through Greenbrier, Monroe and most of Summers and Mercer counties. (See the two Maps of West Virginia Land Cover by Physiographic Regions-Eastern Ridge and Valley). The rock strata are extremely folded and the surface rocks are mainly Devonian, with some outcroppings of Silurian, Ordovician and Cambrian-age rocks. More limestone is found here than elsewhere, but shales and sandstones are also present. Mountain ridges and valleys run parallel in a northeast to southwest direction. A trellis drainage pattern exists in this region. Elevations in the western part of the region reach 4,000 feet. The lowest elevation in the state (240 feet) at Harper's Ferry is in this region where the Potomac River enters Maryland. This region is drained by the Potomac River and its tributaries in the north and by the tributaries of the New River in its southern part.

Forest cover in this region is influenced by its position in the rain shadow of the higher mountains to the west. The vegetation may be classified as mostly oak-hickory-pine, although the American chestnut once dominated the region. According to Stevenson (1993), the trees of this region are mostly chestnut, red, white, scarlet, scrub and black oak, in association with Virginia, pitch and Table Mountain pine. Of particular interest in this region are the shale barrens, which have several rare plant associations. Farmland and grazing are important in this region, as well as extensive orchards.

Land use by Physiographic region is listed below (WVDEP 2005).

Physiographic Regions	Western Allegheny Plateau	Allegheny Mountains Valley	Eastern Ridge & Valley
Square Miles	15,545	3,354	5,342
% Low Density Development	2.1	0.4	0.8
% High Density Development	0.8	0.1	0.2
% Hay & Pasture	7.0	5.6	8.3
% Crops	2.4	5.2	1.9
% Probable Crops	4.0	9.7	11.1
% Mixed	12.1	9.5	13.3

Physiographic Regions	Western Allegheny Plateau	Allegheny Mountains Valley	Eastern Ridge & Valley
% Deciduous	66.8	59	60.0
% Wetlands	3.4	2.1	1.0
# Surface Mining Permits	1,607	522	87
# Underground Mining Permits	2,004	238	22

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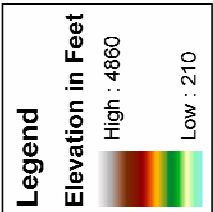
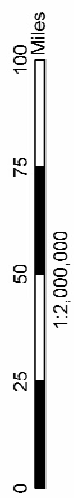
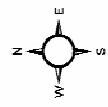
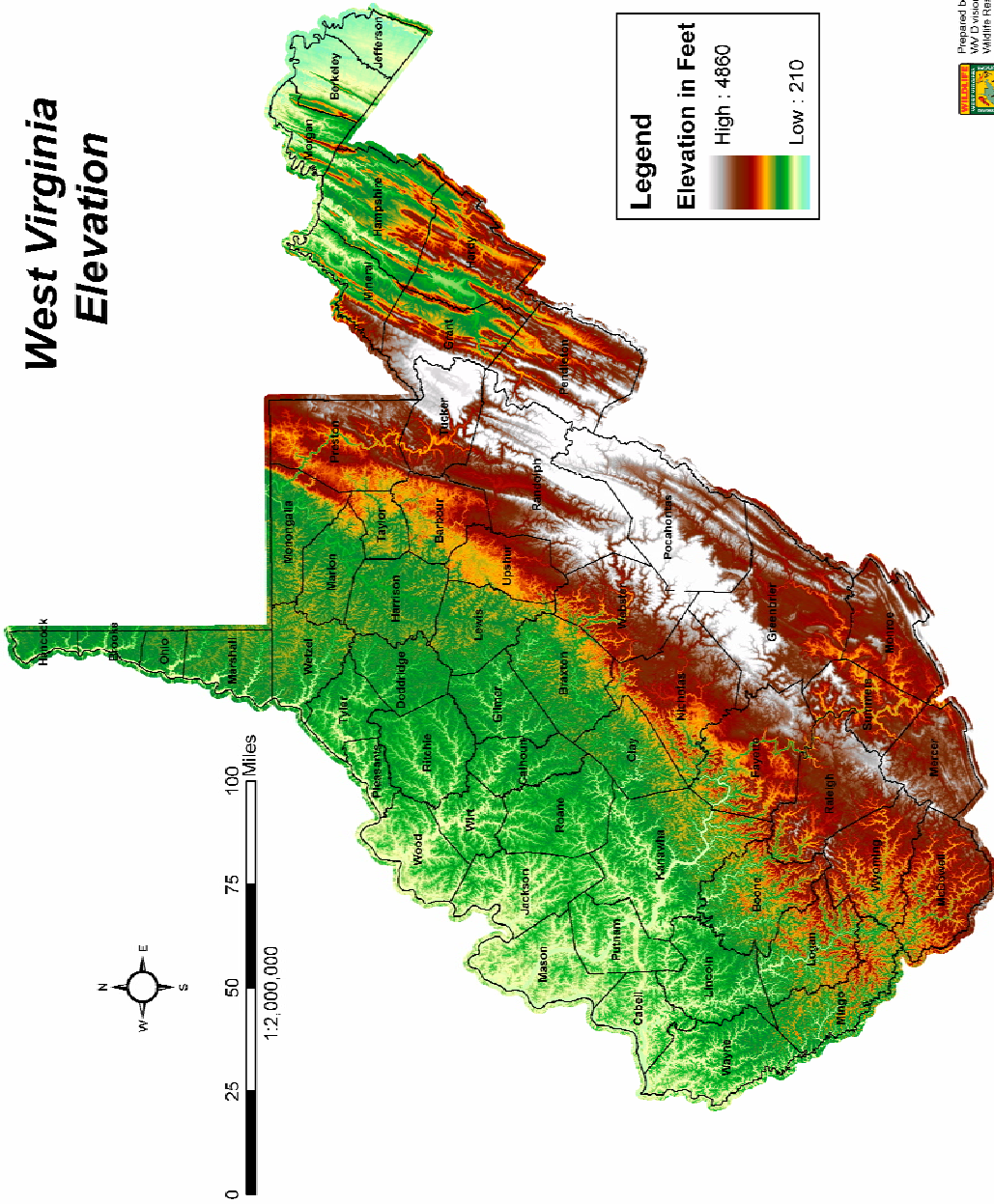
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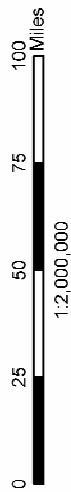
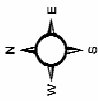
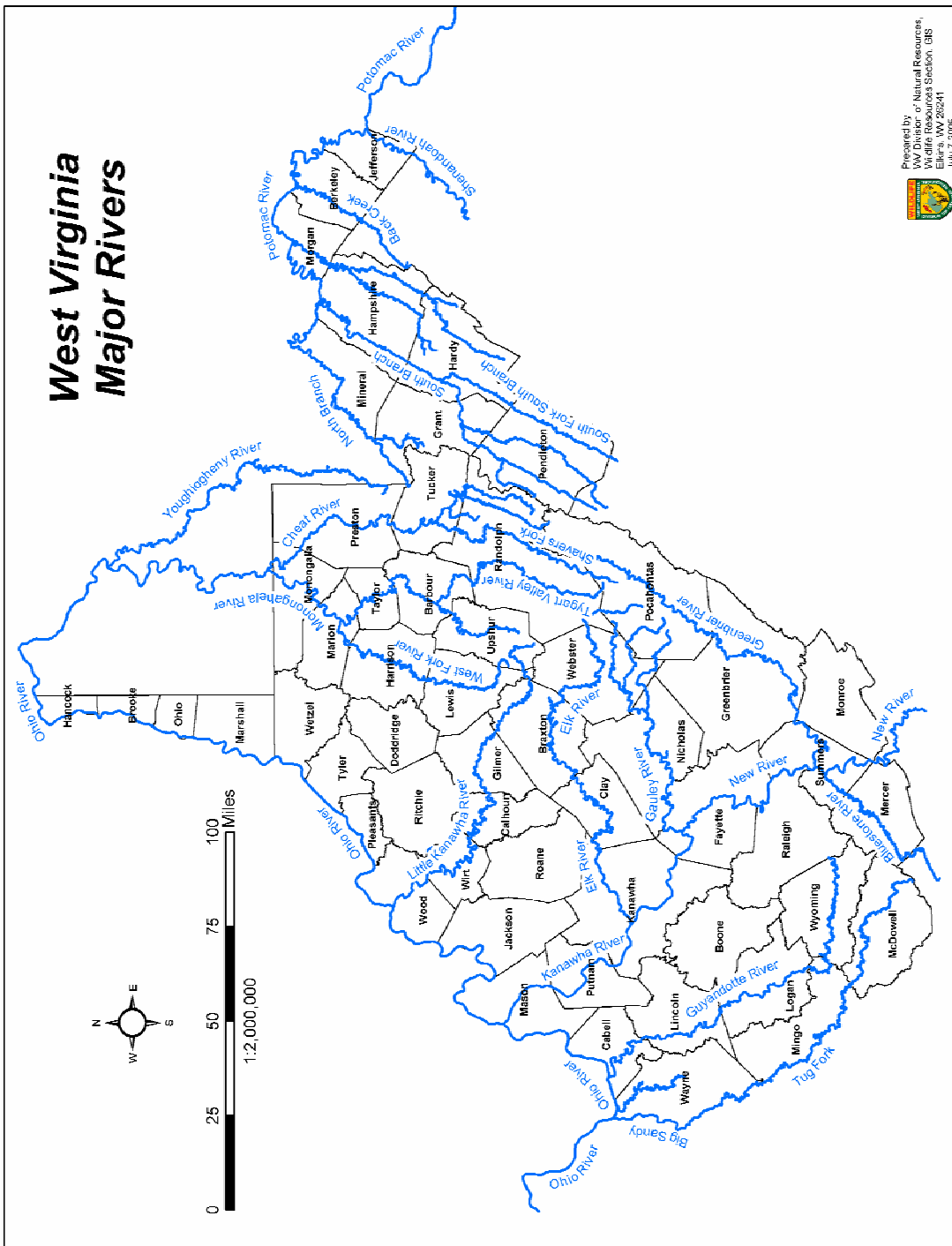
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West Virginia Elevation

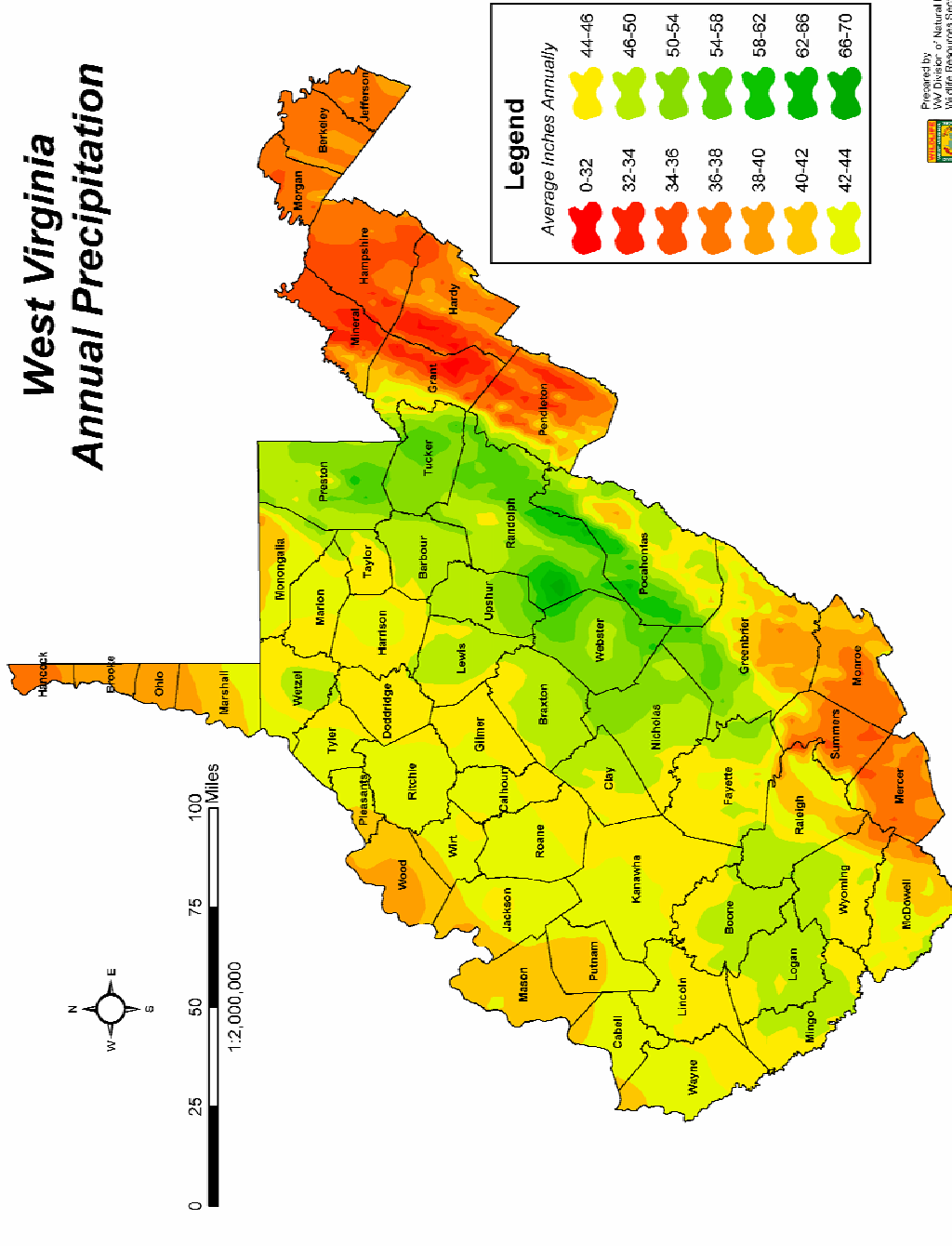


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JUN 7 2005

West Virginia Major Rivers



West Virginia Annual Precipitation

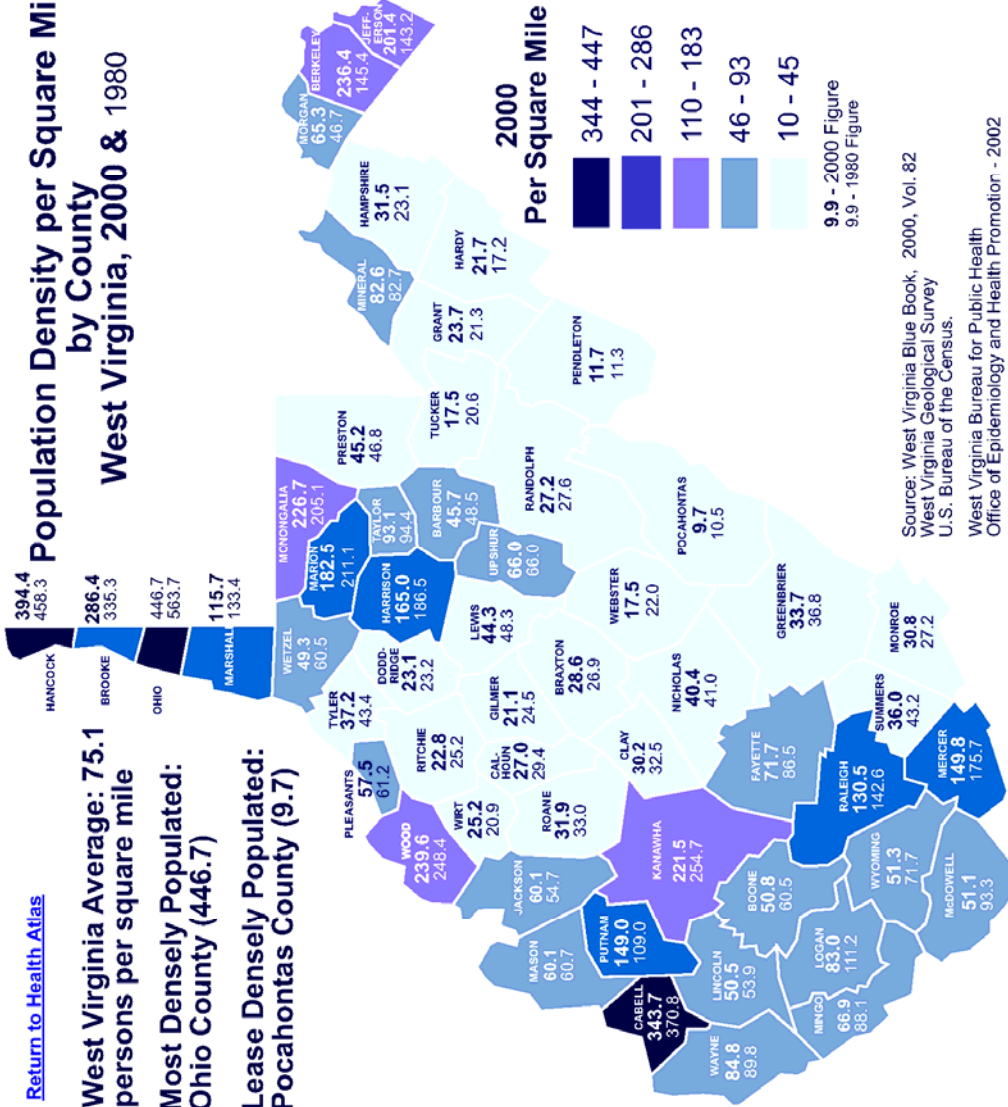


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Elkins, WV 26241
July 7, 2006

Population Density per Square Mile by County West Virginia, 2000 & 1980

[Return to Health Atlas](#)

West Virginia Average: 75.1 persons per square mile
Most Densely Populated: Ohio County (446.7)
Least Densely Populated: Pocahontas County (9.7)

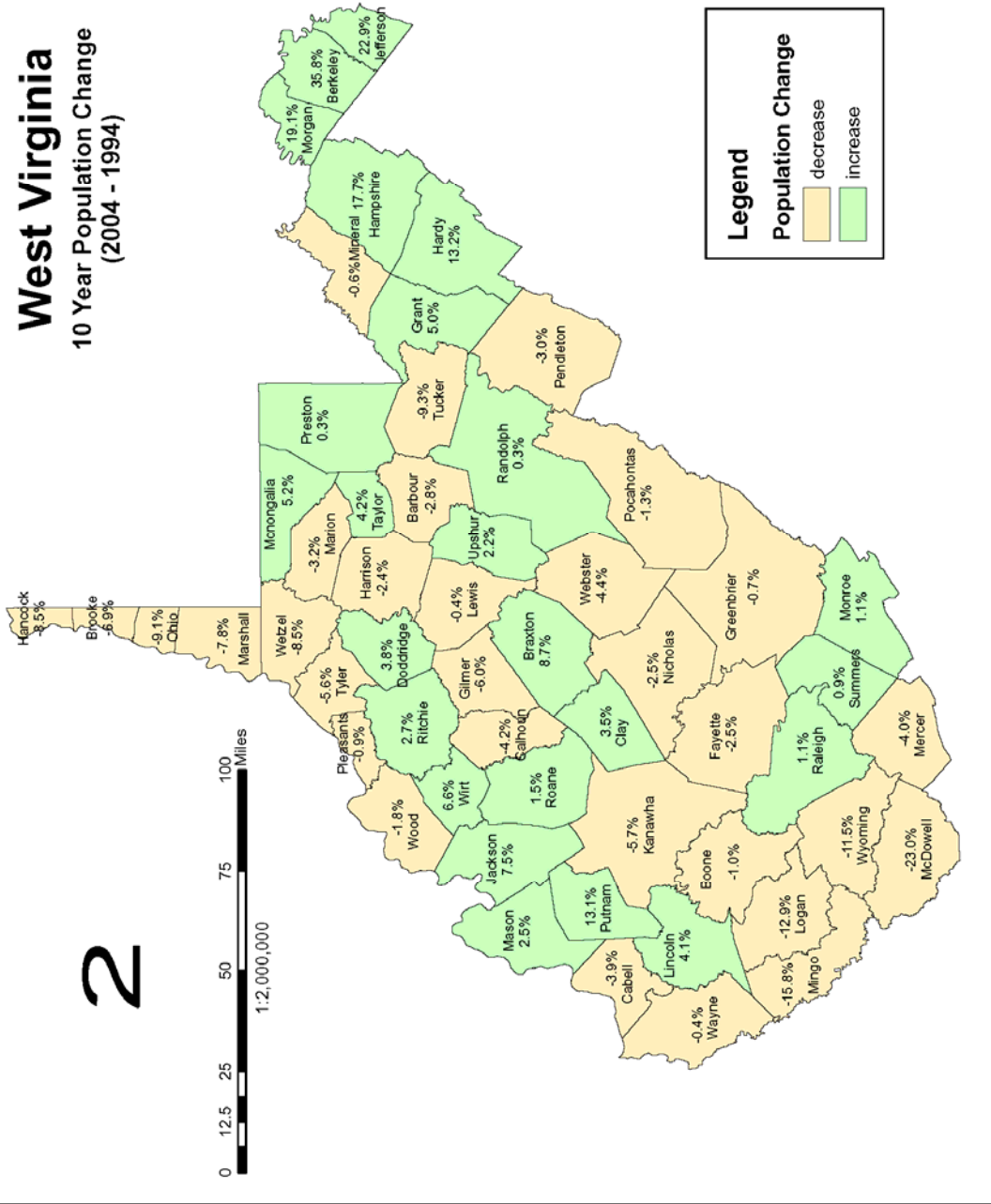


Sources: West Virginia Blue Book, 2000, Vol. 82
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 U.S. Bureau of the Census.
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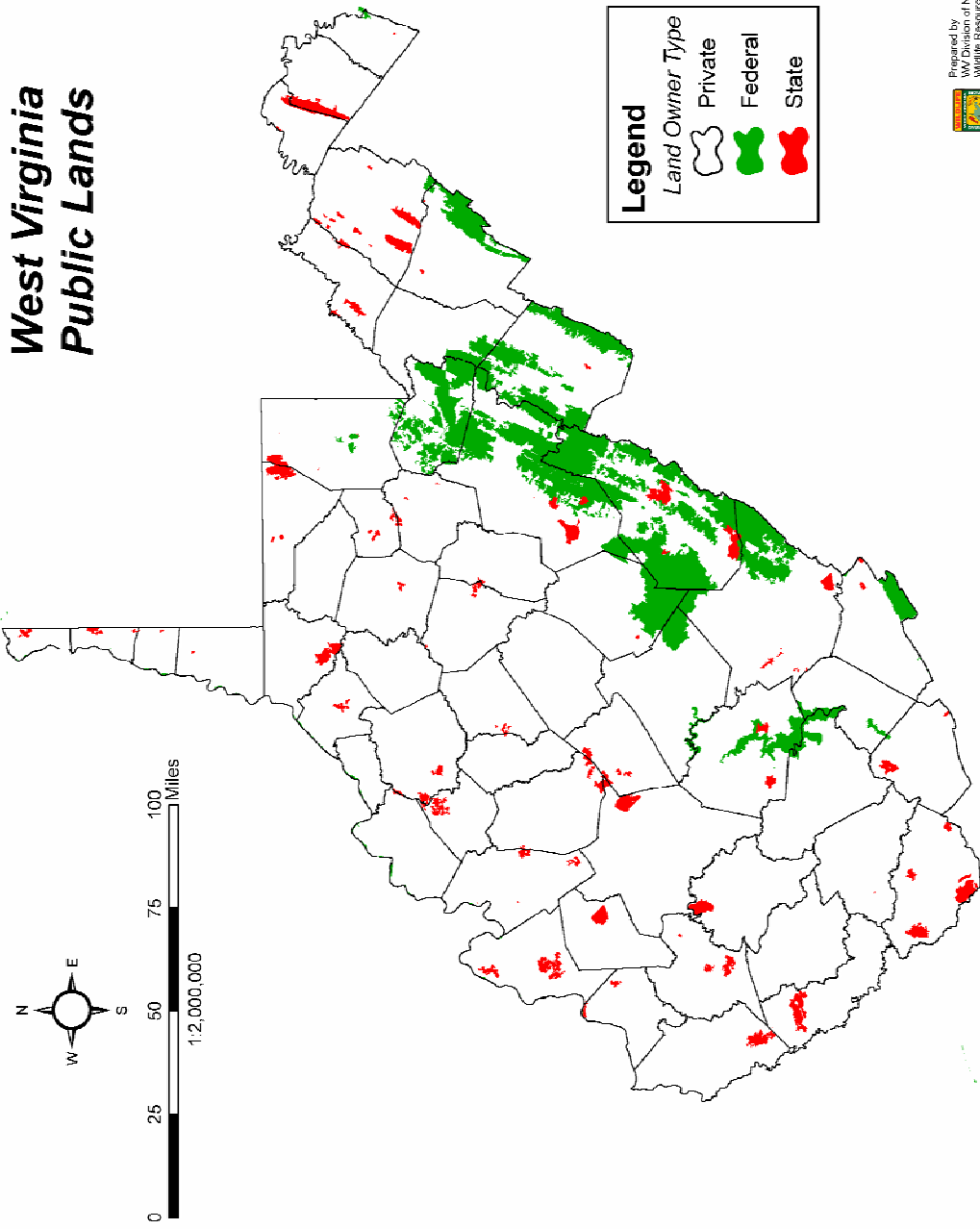
West Virginia

10 Year Population Change (2004 - 1994)

2

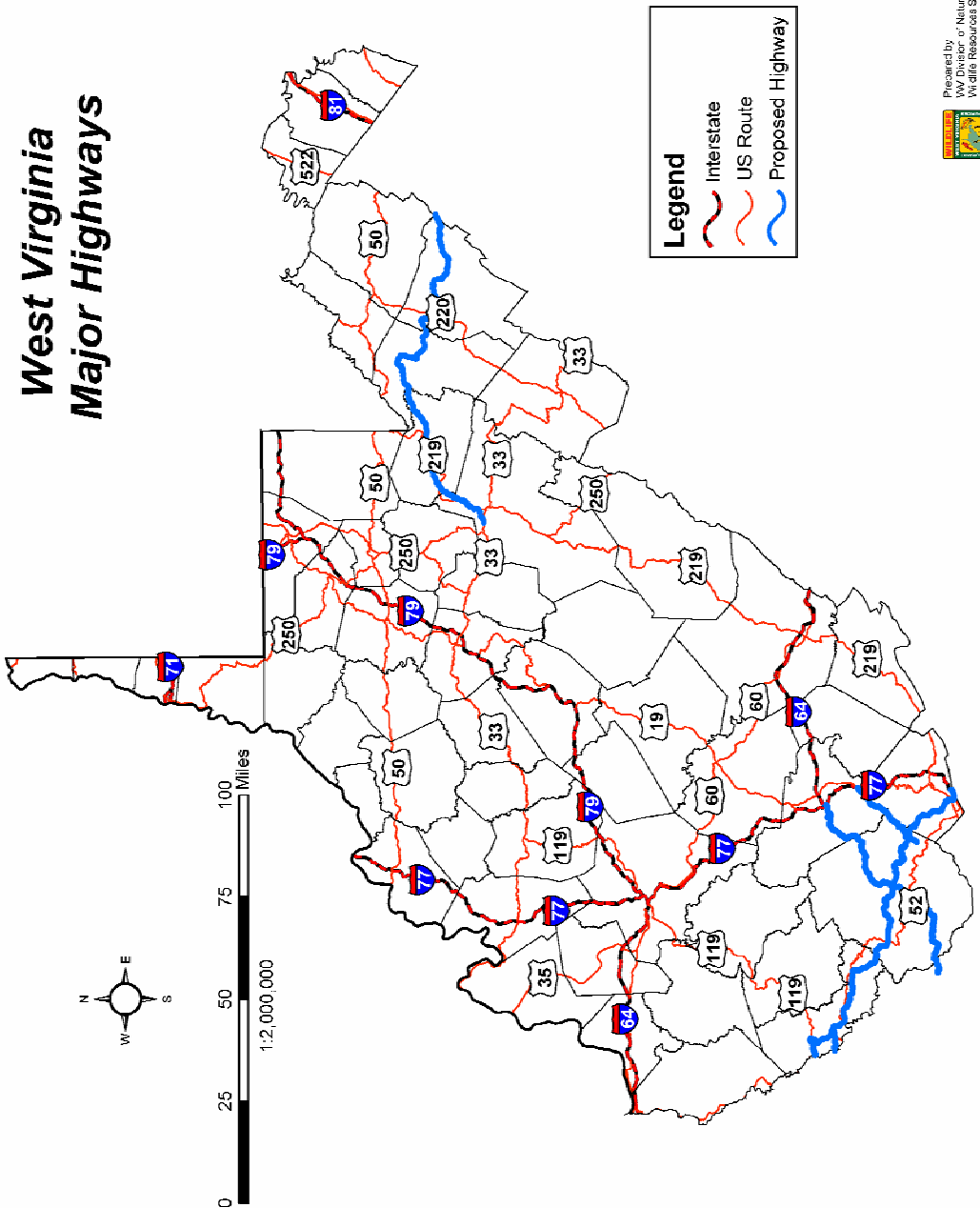


West Virginia Public Lands



Prepared by
WV Division of Natural Resources
Wildlife Resources Section, GIS
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July 9, 2005

West Virginia Major Highways

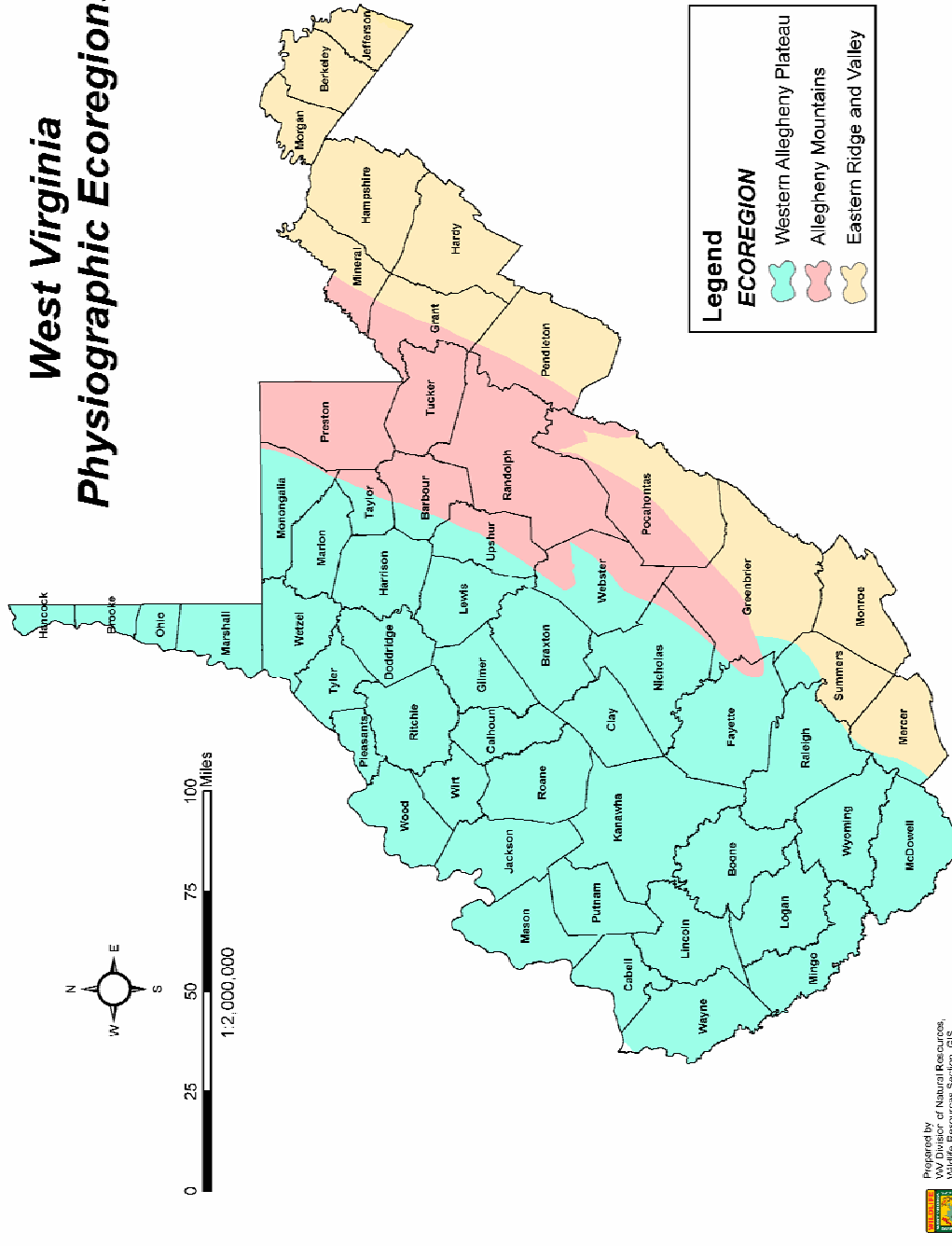


Legend

- Interstate
- US Route
- Proposed Highway

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Unit, 1000 11th Street, N.E.
Martinsburg, WV 26151
July 7, 2005

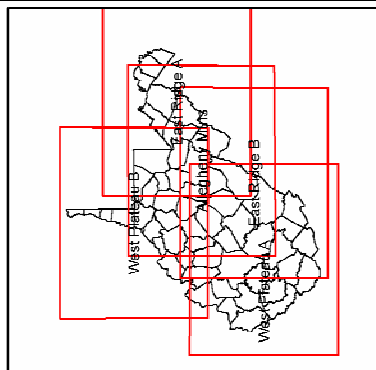
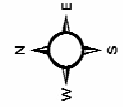
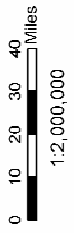
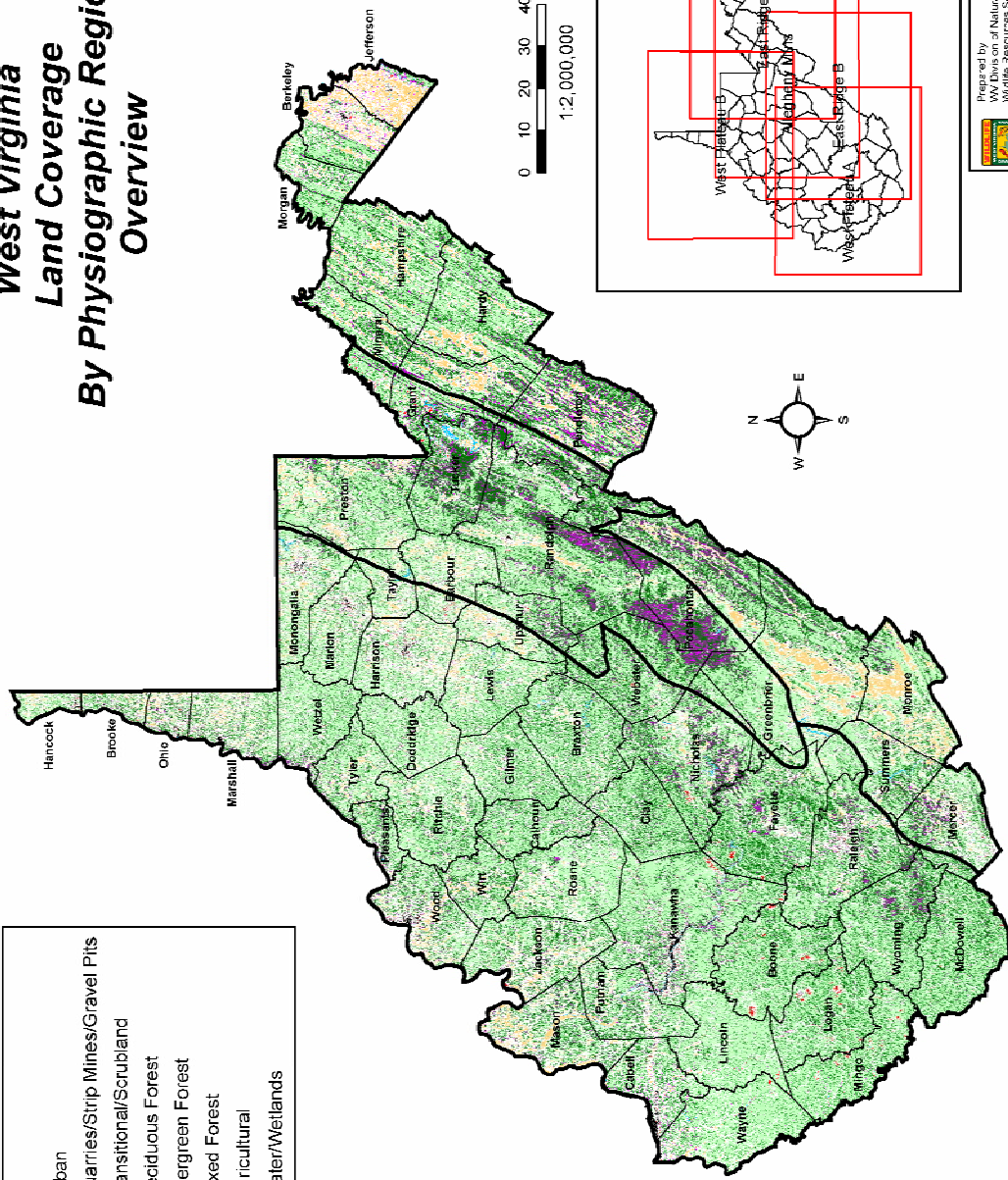
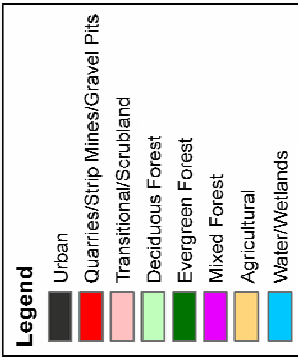
West Virginia Physiographic Ecoregions



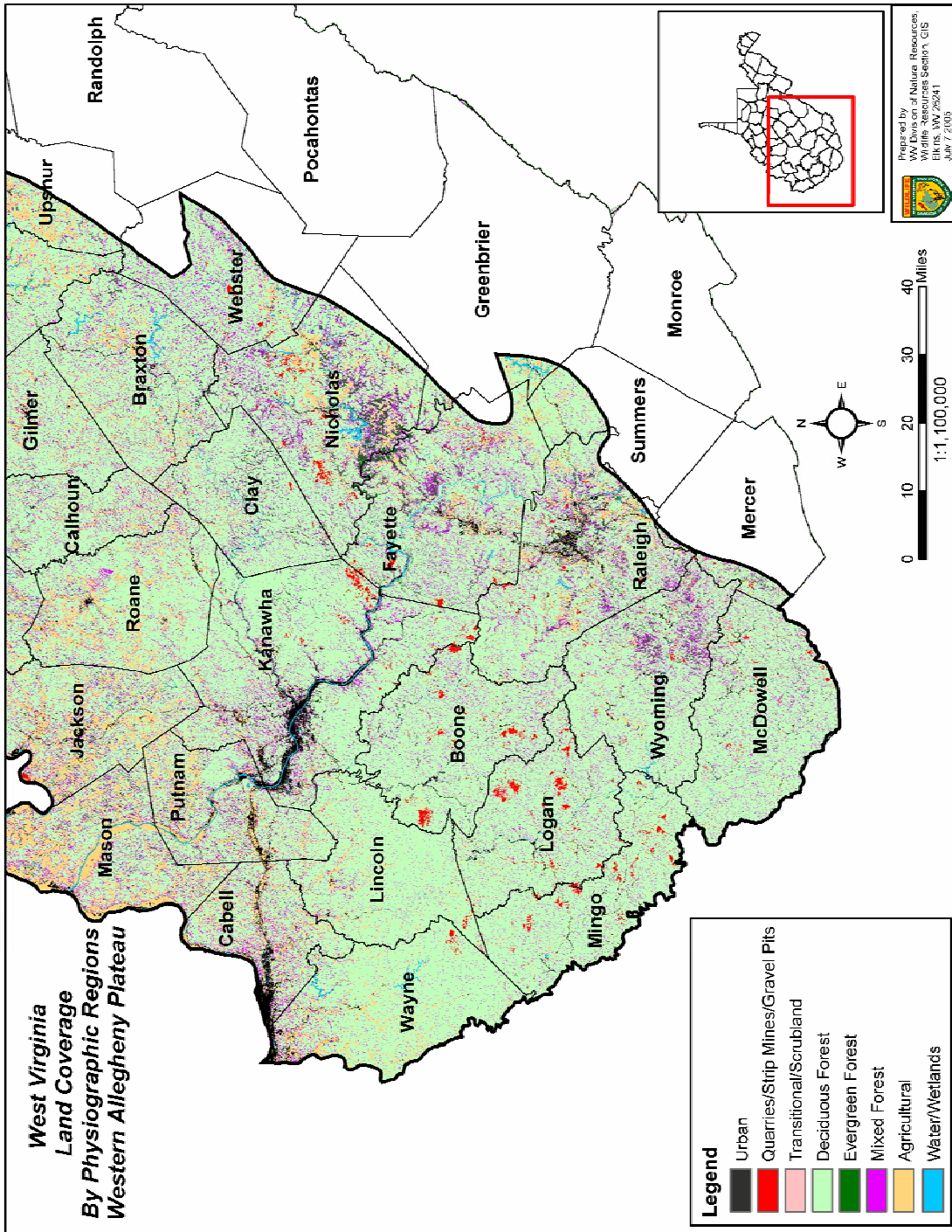
Prepared by Natural Resources,
Wildlife Resources Section, GIS
Elkins WV 26241
Jan. 12, 2005



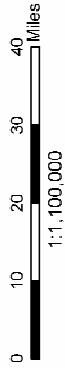
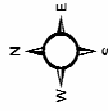
West Virginia Land Coverage By Physiographic Regions Overview




 Prepared by:
 WV Division of Natural Resources
 Wildlife Resources Section, GIS
 Elkins, WV 26241
 July 7, 2009

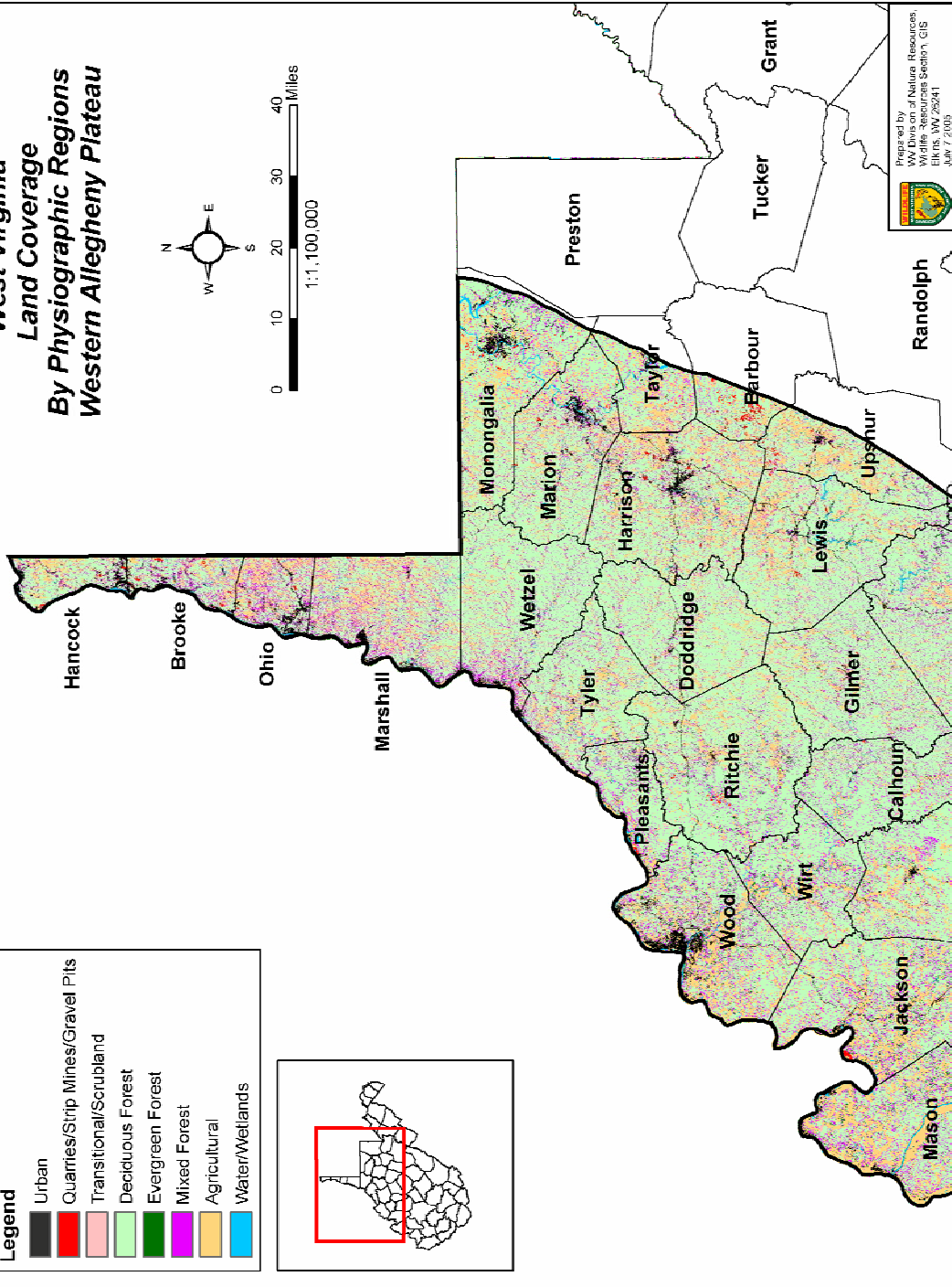
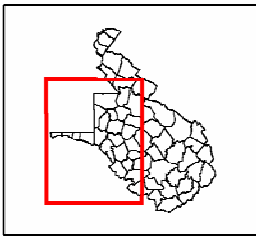


West Virginia Land Coverage By Physiographic Regions Western Allegheny Plateau

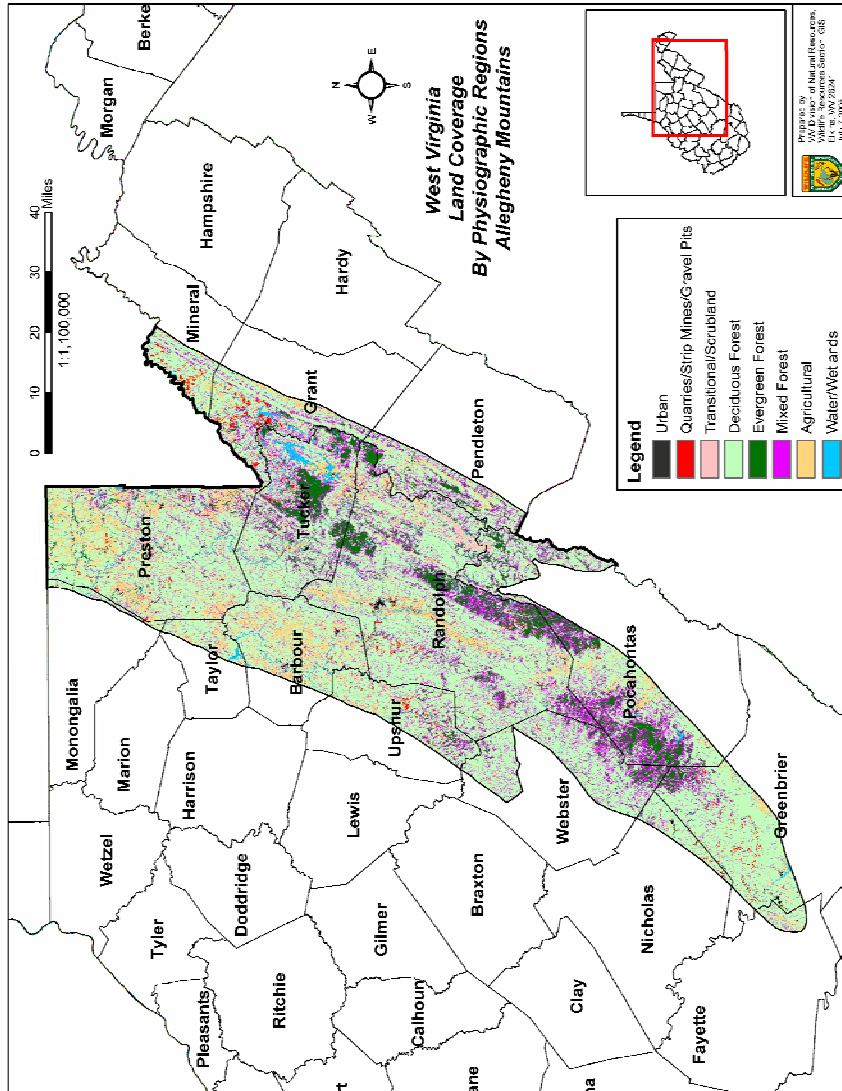


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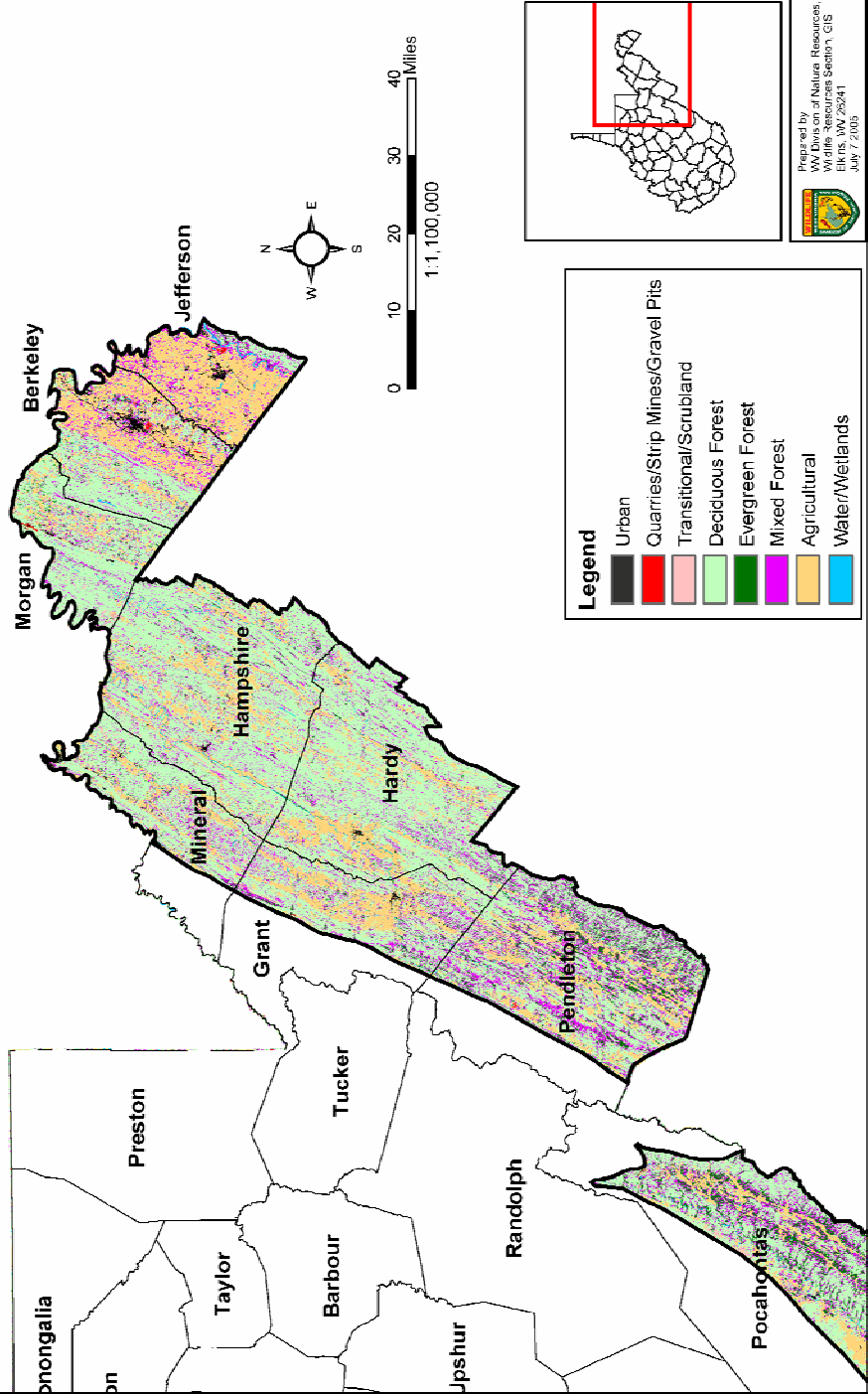
	Urban
	Quarries/Strip Mines/Gravel Pits
	Transitional/Scrubland
	Deciduous Forest
	Evergreen Forest
	Mixed Forest
	Agricultural
	Water/Wetlands

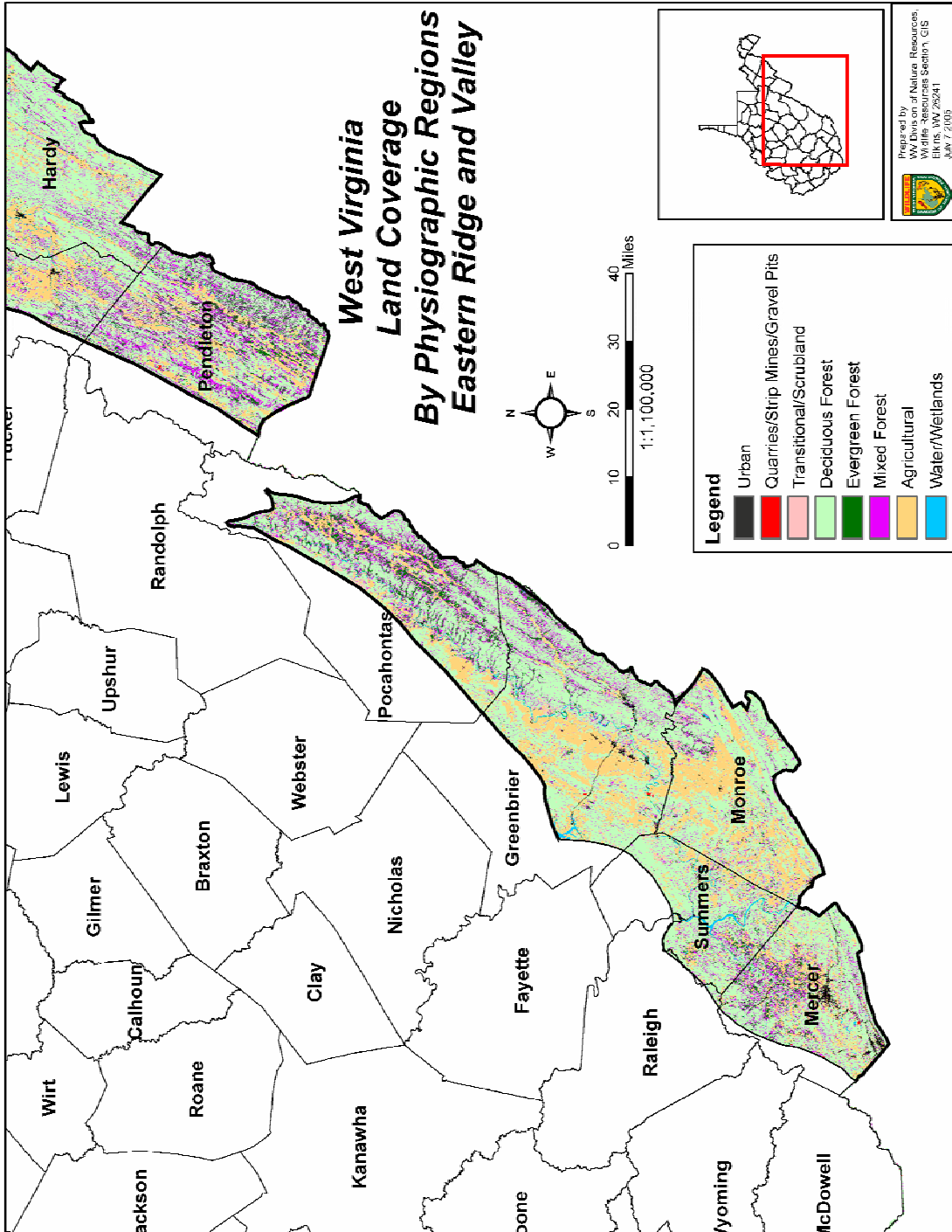


Prepared by:
West Virginia Department of Natural Resources
Wildlife Resources Section, GIS
Elkins, WV 26241
July 7, 2009



West Virginia Land Coverage By Physiographic Regions Eastern Ridge and Valley



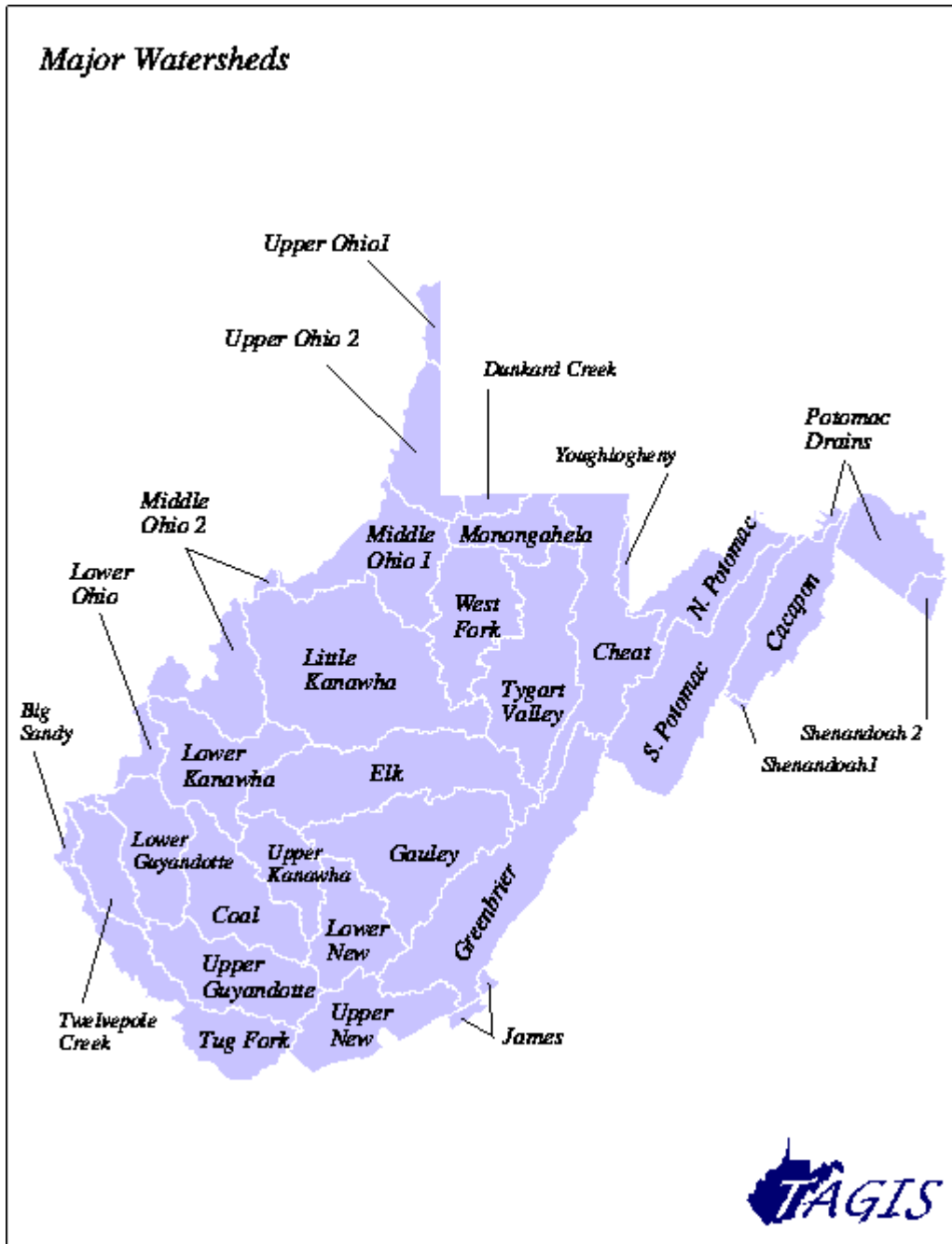


Section 4-B. Watersheds

Because watersheds are a more meaningful ecologic unit than county boundaries (a traditional approach), species occurrence information (see Fact Sheets) is generally listed by watershed. As individual species conservation plans are compiled they can be aggregated by occurrence within each watershed. This will allow conservation actions to be accomplished in such a way as to maximize the use of resources. This compilation of information for each watershed will decrease inadvertent disturbance to one species through conservation actions on another by having all information readily available from the start of planning. In addition, many watershed groups, land trusts and other non-governmental conservation organizations have been formed in the state. It is thought that these organizations will likely be strategic partners in species' conservation efforts; thus working within watersheds may be a meaningful approach.

Watersheds are initially described here at a fairly broad scale. They are delimited using the Federal eight digit Hydrologic Unit Codes, otherwise known as HUCs. This general scale depiction helps orient the reader to the geographic distribution of the species, as well as survey and monitoring needs. Most on-the-ground conservation project planning will be accomplished within sub-watersheds of the watershed units depicted here. (See Watershed Map.)

Map of 32 Watersheds in the State



References

West Virginia Division of Environmental Protection. 2005. Watershed Atlas Project.

<http://www.dep.state.wv.us/watershed/>

Accessed 5/26/05

Section 4-C. Public Input

Introduction

The development and implementation of the *West Virginia Wildlife Conservation Action Plan* is a continuous process of public input and participation. Beginning with external input on species selection and surveys to identify issues of public concern, followed by input from conservation partners and public review of the plan, then regularly refreshed by public symposia on species, habitats, and conservation strategies, this is one of WVDNR's most robust public participatory processes.

Maintaining an aggressive process of public participation for this plan is a substantial challenge in West Virginia. We are a small, lightly populated, rural state. Many West Virginia residents have a long and strong attachment to game animals and sport fish species. While a large number of residents indicate some concern about other species of fish and wildlife, moving from simple concern to knowledge about and a commitment to conservation action for species in need will require substantial effort beyond solicitation of public input. It will require a serious, and continuous, outreach effort that will extend far beyond completion of the initial planning document.

The following sections provide detail on the individual components of the public input process for the *West Virginia Wildlife Conservation Action Plan*.

External Input by Species Experts

There was substantial input from external experts into the selection of species in greatest need of conservation (SGNC). Ten lists of species of concern were analyzed against a set of preselected SGNC qualifications and a subset was selected to form a single list of SGNC. One of those lists came from the WVDNR; the other nine came from international, national, state and nonprofit conservation organizations. Thirty-one experts on fish and wildlife species in West Virginia reviewed the list of candidate species. Seven of those experts are current or past WVDNR employees; the remaining 24 are external to the agency.

The species fact sheets for SGNC are the core of the *West Virginia Wildlife Conservation Action Plan*. They were prepared in consultation with the same group of experts who participated in the species selection process.

Public Input on Conservation Issues

Surveys

The WVDNR believes that scientifically conducted public surveys are the most reliable method of identifying issues of public concern and gauging public support for conservation initiatives. Since 1998, four completed surveys of West Virginians have yielded over 1,800 completed interviews that provide a wealth of input to this plan. A fifth

survey, designed to yield an additional 2,500 interviews is ongoing and will provide additional input for the continuous process of revising the plan. Highlights of each completed survey are presented below.

1998 Survey: Public Lands, Issues and Funding

This random, telephone survey was conducted for the WVDNR by Responsive Management, of Harrisonburg, Virginia. Completed surveys were obtained from 505 resident, adult West Virginians. The statistical margin of error for a survey with this sample size is plus or minus 4.5 per cent. Relevant survey highlights include the following:

Public Lands Issues

- Public recreation lands were rated as *very important* to 75 per cent of respondents.
- More than two-thirds of respondents had visited public lands for recreation in the previous twelve months.
- Eighty-one per cent of respondents supported state purchase of additional public recreation lands.
- Sixty-seven per cent supported state purchase of additional lands for habitat conservation.

Program Emphasis

- Seventy-five per cent of respondents felt that *much more* effort should be spent on restoring streams damaged by acid rain or acid mine drainage.
- Seventy-three per cent wanted *much more* effort focused on educating youth about fish and wildlife conservation.
- Half of respondents felt that *much more* effort should be spent on public information regarding fish and wildlife resources and on biological research efforts to better understand and conserve those resources.
- Fifty-seven per cent of respondents said that *much more or slightly more* effort should be spent on management and protection of the state's non-hunted wildlife resources. This opinion was more frequently expressed by younger (18-34) respondents than by older ones.

Funding Sources

- Sixty-one per cent of West Virginians felt that people who don't hunt or fish should help fund the state conservation of fish and wildlife resources.
- Fifty-nine per cent felt that the percentage of state conservation funding that should come from those who do not hunt or fish should be less than 20 per cent.

2000 Survey: Attitudes Toward Land Conservation

A random, telephone survey conducted in 2000 by Peter D. Hart Research Associates for The Nature Conservancy explored West Virginians' attitudes toward land conservation issues in the state. Completed survey interviews were obtained from 507 voters in the state. The statistical margin of error for a survey with this sample size is plus or minus 4.5 per cent. Some survey highlights are provided here by permission. They include the following.

- Thirty-eight per cent of respondents ranked *scenic beauty* as the quality they like most about living in West Virginia. *Rural or small-town way of life* was the second most highly ranked quality.
- More than half of respondents said *preserving forests, mountains and natural areas* was an *extremely important* issue to them.
- Respondents ranked *water quality* (59%) as the top environmental issue in the state.
- About two-thirds of respondents were not aware that most of the state's timberland is privately owned.
- Seventy-nine per cent of respondents favored spending public funds to *preserve forests, mountains and natural areas* in the state.
- *Heritage/legacy, protecting West Virginia's outdoor lifestyle, tourism/economy, urgency, and protecting wildlife/air/water* were seen by a majority of respondents as good reasons to spend public funds for land conservation in West Virginia.
- A majority of respondents supported the use of public funds for land conservation through *voluntary purchase of land from willing sellers* and through *voluntary purchase of development rights from willing sellers*.

2004 Survey: Fish and Wildlife Management Issues

A random, telephone survey was conducted in 2004 by Responsive Management for the Northeast Conservation Information and Education Association, of which the WVDNR is an active member. The survey subsampled populations in each northeastern state, yielding 400 completed interviews of West Virginians. The survey provided an opportunity for the WVDNR to tailor specific questions designed to provide input for this plan. The survey reported results at the state level where, for West Virginia, the statistical margin of error is less than 4.9 per cent. Relevant West Virginia highlights from the survey include the following.

Participation in Outdoor Activities

- The most frequently identified outdoor activities were *wildlife viewing within 1 mile of home* (74% of respondents), *taking a trip to view wildlife* (55%), and *taking a trip to a State or National Park* (51%).
- Sixty-nine per cent of respondents indicated that they *had gone out to observe wildlife* in the past twelve months.

- Thirty-eight per cent of respondents said that they had *attended an educational program that dealt with fish and wildlife*.

Conservation Issues and Values

- *Polluted water/water quality* was the top-ranked fish and wildlife issue facing West Virginia today. Other issues frequently noted included *Deer overpopulation* and *Habitat loss*.
- When asked which fish and wildlife values they would rate as *very important*, the following values were cited by more than 84 per cent of all respondents:
 - *Wildlife exists in West Virginia*
 - *West Virginia's water resources are safe and well protected*
 - *Natural areas exist in West Virginia for enjoying and experiencing nature*
 - *People have the opportunity to fish, hunt and view wildlife in West Virginia*
 - *Ecologically important habitat and lands in West Virginia are being protected and preserved*
 - *Fish and wildlife populations are being properly managed and conserved in West Virginia*
- A majority of respondents *strongly agreed* that fish and wildlife considerations should affect the use and development of land in West Virginia.
- Per centages of respondents who felt that the following WVDNR programs were *very important* were as follows:
 - *Protecting and preserving fish and wildlife habitat* (90%)
 - *Enforcing fish and wildlife laws* (90%)
 - *Managing wildlife populations* (87%)
 - *Protecting endangered species* (86%)
 - *Providing wildlife education programs* (84%)

Wildlife Recreation and Education

- Additional wildlife-related recreation and education facilities desired by respondents included:
 - *Nature centers* (33%)
 - *Public lands for wildlife recreation* (29%)
 - *Nature trails with signs* (29%)
- Additional types of wildlife-related information desired by respondents included:
 - *Information to improve for hunting, fishing, wildlife watching, photography skills* (33%)
 - *Species and habitat information* (28%)

2005: Fish and Wildlife Management Issues

A random, telephone survey was conducted in 2005 by Responsive Management for the Southeastern Association of Fish and Wildlife Agencies, of which the WVDNR is an active member. The survey subsampled populations in each southeastern state, yielding 402 completed interviews of West Virginians. The survey provided an opportunity for the WVDNR to tailor specific questions designed to provide input for this plan. The survey reported results at the state level where, for West Virginia, the statistical margin of error is less than 4.9 per cent. Relevant West Virginia highlights from the survey include the following.

Importance of WVDNR Programs and Assessment of Performance

- Respondents ranked the following WVDNR programs on a 10-point scale of *importance* (10=most important):
 - *Providing educational programs on the state's fish and wildlife resources* (8.87)
 - *Enforcing fish and wildlife laws* (8.84)
 - *Conserving fish and wildlife habitat* (8.82)
 - *Protecting threatened and endangered species* (8.78)
 - *Managing wildlife populations* (8.55)
 - *Restoring native fish and wildlife species* (8.43)
- When respondents were asked to rate the WVDNR's *performance* in these same program areas, the gap between *importance* and *performance* was greatest (indicating the need for greater performance) for the following programs:
 - *Conserving fish and wildlife habitat*
 - *Protecting threatened and endangered species*
 - *Restoring native fish and wildlife species*
 - *Providing educational programs on the state's fish and wildlife resources*

Participation in Outdoor Activities

- The most frequently identified outdoor activities were *feeding bird/other wildlife on a regular basis* (69% of respondents), *visiting a State or National Park* (56%) and *observing wildlife within 1 mile of home* (45%).
- Forty-six per cent of respondents indicated that they had *taken a trip of greater than 1 mile to observe wildlife* in the past twelve months.
- Thirty-two per cent of respondents said that they had *attended an educational program that dealt with fish and wildlife*.

Conservation Issues and Values

- *Polluted water/water quality* was again the top-ranked fish and wildlife issue facing West Virginia today. Other issues frequently noted included *Pollution in general, Air pollution/air quality, Habitat loss* and *Deer overpopulation*.
- When asked to put their concern for the state's *water quality* on a 10-point scale, with 10 being *extremely concerned*, two-thirds of respondents indicated that their level of concern was 8 or higher.
- Seventy-five per cent of respondents indicated that their concern for water quality was a concern both for human health and for fish and wildlife.
- Respondents identified the following as major factors contributing to water quality issues in West Virginia:
 - *Industrial waste* (44%)
 - *Litter/trash* (20%)
 - *Sewage* (19%)
 - *Agricultural runoff* (12%)
- When asked to put their concern for *endangered species* on a 10-point scale, with 10 being *extremely concerned*, fifty-two per cent of respondents indicated that their level of concern was 7 or higher.
- The most frequently cited factor in species becoming threatened or endangered was *Habitat loss/fragmentation*.
- Three-quarters of respondents *strongly or moderately agreed* that fish and wildlife considerations should affect the use and development of land in West Virginia.
- As with the Northeast survey, when asked which fish and wildlife values they would rate as *very important*, the following values were cited by more than 82 per cent of all respondents:
 - *West Virginia's water resources are safe and well protected*
 - *Wildlife exists in West Virginia*
 - *People have the opportunity to fish, hunt and view wildlife in West Virginia*
 - *Natural areas exist in West Virginia for enjoying and experiencing nature*
 - *Fish and wildlife populations are being properly managed and conserved in West Virginia*
 - *Ecologically important habitat and lands in West Virginia are being protected and preserved*

Integration of Survey Results and Conclusions

Integration of these survey results yields some solid conclusions regarding conservation issues in the state and provides a good gauge of the potential public support for actions to address those issues. Action categories that should be addressed by the plan include:

- Mitigating the factors that negatively affect water quality and aquatic habitats
- Land and water conservation efforts, especially efforts focused on conserving fish and wildlife habitats in the state
- Native species conservation and restoration
- Efforts to better manage threatened and endangered species, specifically emphasizing efforts to avoid species population declines prior to federal listing
- Improving information and education programs
- Developing additional wildlife-related recreational facilities

Input from Land Trust Partners

It is clear that there is broad public support for an increase in land conservation efforts in the state. It is also clear that voluntary land conservation can be a very important conservation strategy for SGNC on private lands. The WVDNR has thus increased its involvement with potential land conservation partners, especially Land Trusts. Eighteen months ago, WVDNR personnel began attending, then informally hosting, quarterly meetings of the Coalition of West Virginia Land Trusts. Our goals were to seek input from the Coalition about the status of land conservation efforts in the state and to gain a better understanding of specific land conservation strategies. Land conservation specialists from The Trust for Public Land, The Nature Conservancy and the Cacapon and Lost Rivers Land Trust were invited and have visited the WVDNR administrative offices to present educational programs for agency personnel on land conservation strategies. Agency staff have also attended planning sessions with individual land trusts.

The WVDNR is also cognizant of the fact there are many other potential partners for land conservation in the state. State and federal agencies and other conservation organizations either engage directly in land conservation efforts or would like to do so. In March of 2005, to facilitate the development of better land conservation partnerships through information exchange, the WVDNR established the West Virginia Land Conservation Working Group and hosted the first meeting thereof. The meeting was attended by more than 40 individuals representing federal, state and private organizations. There is great interest in the working group, which will meet twice annually hereafter.

These efforts have advanced the agency's collective understanding of land conservation at both the strategic and tactical levels. That increased understanding is incorporated in subsequent portions of this plan.

Input from Other Conservation Partners

Input has been provided by other conservation partners as well. As the plan was being developed, WVDNR staff discussed the plan at formal and informal meetings with a number of organizations including:

- WV Partners in Flight
- WV Wildlife Diversity Advisory Council

- WV Master Naturalist Program Steering Committee
- WV Council Trout Unlimited
- WV Cooperative Fish and Wildlife Research Unit
- West Virginia University Extension Service
- WV Entomological Society
- Oglebay Institute
- Oglebay Zoo

The draft plan was also offered for review to 57 individuals and organizations who could be partners and cooperators for plan implementation. The list of potential partners and cooperators is provided in Appendix 4. On September 7, 2005, a plan partners meeting was held at the WVDNR Operations Center in Elkins where attendees were shown a PowerPoint presentation on the plan and provided with an opportunity for face-to-face input. That presentation is included in Appendix 6. On September 9, 2005, the same PowerPoint presentation was given to the WV Wildlife Diversity Advisory Council whose members provided comments on the plan.

Public Review

In addition to review by partners and cooperators, the plan was released to the general public for review and comment. A news release to that effect was released by WVDNR on September 1, 2005. At that time, the WVDNR made the plan available on its official website, where it will remain for some time. On September 8, 2005 a public open house on the plan was held at the WVDNR Operations Center in Elkins. The meeting was announced in the September 1 statewide news release on the plan. On September 18, 2005, a story on the plan was published in the Sunday edition of the Charleston Gazette. Additional information on the plan was published in the West Virginia Wildlife Notes, the monthly publication of the West Virginia Wildlife Federation. Copies of these materials are included in Appendix 6. Finally, a booth to present the plan was staffed by WVDNR personnel during the National Hunting and Fishing Days celebration held at Stonewall Jackson State Park on September 24 and 25, 2005. During this event more than 300 visitors visited the booth, received information on the plan via the PowerPoint presentation and in conversation with WVDNR staff. To date, this has been our most productive venue for plan communication with the general public.

General Public Reaction to Date

Public and partner reaction to the draft plan was light, but generally positive. Comments were received from:

- WV Wildlife Diversity Advisory Council
- Oglebay Institute
- Oglebay Zoo
- The Nature Conservancy
- Trust for Public Land
- Defenders of Wildlife
- U.S. Forest Service

- Members of the general public

Highlights from the comments included this from The Nature Conservancy reviewer:

“The Conservancy applauds the efforts made by the Division of Natural resources to further conservation work within the state through the implementation of cooperative private landowner focused programs such as the Landowner Incentive Program and the development of a State Conservation Network. The West Virginia Draft Wildlife Conservation Plan is a further step that strengthens this commitment to conservation and gives direction for successful conservation action and implementation.”

The reviewer from Trust for Public Land commented that:

“DNR has done a good job of engaging the conservation community throughout this planning process, and this is reflected in the plan. I believe the plan will be utilized by several organizations and agencies in their priority setting of conservation actions, as DNR envisioned. The creation of a land conservation program within DNR will help to foster relationships for implementation. I see many ways that TPL and other NGOs will be able to partner with the DNR to implement the priority actions identified in the plan, including developing a more refined land conservation prioritization map and developing additional funding sources for implementation.”

Some reviewers, including those from Defenders of Wildlife, indicated a desire for greater specificity in the plan, which was duly noted by the planning team, but, in most cases, that specificity must await the collection of better data on species/habitat distribution and status in the state. A significant step in that direction, however, is the inclusion of *Section 9: Summary of Strategic Priorities* in this revised plan. The planning team believes the inclusion of this summary addresses many of the comments received to date and, perhaps more significantly, provides additional strategic direction for the WVDNR and plan partners.

Public Input after October, 2005

As previously stated, the planning process for conservation of SGNC in West Virginia is a continuous one, as is the process of public participation in plan implementation and revision. The WVDNR has indicated to the public that comments and suggested improvements to the plan are welcome at any time in the future and will be incorporated as they are received. Sections 6 and 8 of this plan detail a regular process

of plan coordination and revision that will involve both the general public and plan partners.

Finally, the WVDNR has committed to a vigorous public outreach effort to communicate the features of the plan to various publics across the state. The agency believes that communication of a simple theme for the plan, *It's About Habitat...*, will be an effective mechanism to unify diverse constituencies behind the plan's conservation action components.

Section 4-D. Conservation Issues

Introduction

One of the eight required elements of this plan is a description of problems that may adversely affect SGNC or their habitats. Its purpose is to help identify factors that may assist in restoration and/or conservation of SGNC. For the purposes of this plan, these problems are referred to as *Conservation Issues*. Some of the issues discussed below are regional ones; others are statewide in scope. All of these issues are of major importance to the conservation of SGNC.

Regional Issues

Three regional conservation issues have been identified as major issues for the purposes of this plan. They are:

- Mining
- Commercial and Residential Development
- Atmospheric Acid Deposition

These issues are classified as regional ones because their potential effects on SGNC vary significantly by region. The regions where their effects appear to be of greatest significance are delineated on the *Regional Conservation Issues* map associated with this section of the plan. Each issue is discussed individually below.

Mining

West Virginia has a long and storied history of coal mining. It is a major activity that is still of great importance to the state's economy and the nation's energy security. Current mining activity in the state is divided along geographic lines. In the southern coalfields, the principal extraction method is mountaintop removal mining with associated valley fills. To the north, deep mining and traditional surface mining are the principal methods used. In the center of the state, these methods mix.

Coal extraction has not occurred in West Virginia without a cost to the state's fish and wildlife species and their habitats, both aquatic and terrestrial. In an area noted for its rich floral and faunal diversity, mountaintop removal mining activities have resulted in over 86,000 acres of mature deciduous forest converted to grassland, over 300 miles of streams buried in valley fills or otherwise directly impacted. Traditional mining practices in the northern coalfields have resulted in over 3,000 miles of streams and rivers degraded by acid mine drainage. The impacts on the diversity of plant, invertebrate, fish, amphibian, reptile, bird and mammal species have undoubtedly been profound, but have gone largely unmeasured.

Mining activity is projected to continue at or above current levels for the foreseeable future in both the southern and, increasingly, in the northern coalfields. The challenge to conservation of SGNC is to ensure that the effects of mining on SGNC and their habitats are mitigated by better reclamation practices and the stringent protection of water quality. By thus preserving property values, these actions will benefit not only SGNC but also the corporate and other private landowners who will retain ownership after mining is completed. These landowners are potential partners for implementation of strategies identified in this plan.

Commercial and Residential Development

Of all land uses, development is one of the most lasting forms of habitat loss, because once land is developed for housing or commercial establishments, it is hindered from ever returning to a natural state. Various estimates place the loss of farmland, forestland and wildlife habitat to development in the United States at between one and three million acres annually. On the low end, that is about the total acreage of the Monongahela National Forest in West Virginia; on the high end, it is about the size of the entire state of Connecticut.

Once developed, these lands no longer provide high-quality habitat for many species of fish and wildlife. In fact, various studies have concluded that residential and commercial development is one of the most immediate threats to rare and declining species. Beyond the quantitative loss of habitat, development can fragment or otherwise reduce the quality of remaining habitat to the point that species mobility, genetic exchange and viability are threatened.

In West Virginia, we have been spared the widespread loss of habitat from rapid residential and commercial development. Statewide population growth and development has occurred at a fairly deliberate pace and is projected to do so into the foreseeable future. Despite the statewide pace of development, West Virginians contacted for a 2005 public opinion survey saw habitat loss from development as the most important issue confronting rare, threatened and endangered species. Perhaps they are attuned to the fact that there are major regional exceptions to the statewide pattern. Regions experiencing above average development in the last decade are illustrated on the *Regional Conservation Issues* map. Some of this development occurred as a proportional consequence of regional population growth, e.g., in Jefferson County. Some of it, however, occurred as a result of vacation home or resort development, e.g., in Pocahontas County. In either case, the important conservation issue is the footprint of that development in areas of potentially important fish and wildlife habitat. The challenge for fish and wildlife managers, sportsmen, family farmers, land trusts and other open space advocates is to conserve high-priority undeveloped habitats in the face of the advancing tide of residential and commercial development.

Atmospheric Acid Deposition

Atmospheric acid deposition occurs as a result of sulfur and nitrogen emissions from power plants and automobile exhaust. When these airborne pollutants fall in the form of rain or snow, the acidity of that precipitation often exceeds the soil's buffering capacity. In poorly buffered soils receiving high rates of deposition, the results are a permanent reduction in soil buffering capacity, loss of valuable soil calcium and other base cations, increased soil acidities and acidified streams.

West Virginia's higher elevations receive some of the highest rates of atmospheric acid deposition in the eastern United States. In the headwaters of many of the state's watersheds this extremely acidic rain and snow falls on soils that are very poorly buffered. The most vulnerable region of the state is delineated on the *Regional Conservation Issues* map. The most obvious effect of acid deposition is the loss of fish and other aquatic life in acidified streams in these watersheds. Addressing this loss was one of the highest ranked issues for state residents polled in a 1997 public opinion survey. Assessments conducted by the WVDNR have estimated that 25 percent of the state's high-elevation brook trout streams have been severely degraded or are at-risk from acid deposition. This is probably a conservative estimate. Beyond the impact to streams, there are the less obvious, but equally important, effects of acid deposition on sensitive terrestrial wildlife species, e.g., amphibians, and their forest habitats.

The WVDNR has an active program to mitigate some of the impacts of acid deposition on aquatic life by annually applying limestone to selected high-elevation streams. Where it can be implemented, this program has achieved local success in restoring brook trout fisheries and other aquatic life and will be expanded in the future. However, because of limited access and funding constraints, the program will never be extended to all streams impacted by acid deposition nor does it in any way address the more extensive degradation of terrestrial wildlife habitats in acidified watersheds. The principal challenge for fish and wildlife conservation will be to research and develop more extensive solutions to the problem of acid deposition, focusing especially on further reductions of both sulfur and nitrogen emissions and watershed-level mitigation of atmospheric acid deposition.

Statewide Conservation Issues

Statewide issues are those that, to some degree, are present in most of the state's watersheds. Five have been identified as major conservation issues for SGNC. They are:

- Stream sedimentation
- Forest health

- Invasive species
- Water pollution
- Instream, wetland and riparian habitat loss

Stream Sedimentation

Soil and sediment washing into streams can degrade instream habitat for fish and other aquatic species. Sedimentation reduces the quantity and quality of habitat where aquatic organisms live, feed and lay their eggs. Research has shown that about one-quarter of the streams in the mid-Atlantic region that includes West Virginia have poor instream habitats as a result of excessive sedimentation. In fact, that same research lists stream sedimentation as one the greatest environmental stressors for the mid-Atlantic region. State water quality assessments underscore the importance of the issue, listing 2,912 stream miles in the state as biologically impaired. A likely cause of much of the impairment may be stream sedimentation.

There are many sources of excess stream sedimentation. They include, but are not limited to:

- Road maintenance
- Unpaved secondary roads
- Construction activities
- Poor agricultural practices
- Poor logging practices
- Mining activities
- Failing streambanks
- Other activities that expose unvegetated soils

These are all considered to be non-point sources of water pollution, meaning that the pollution does not reach the stream from a pipe or other single, identifiable point. The distributed nature of the sources is what makes sedimentation such a difficult problem to solve. The continuing conservation challenge associated with this issue is to develop, incentivize and implement better practices for all activities that disturb the land. This will require continuous collaboration with state and federal agencies, industry groups, landowners and other private individuals.

Forest Health

West Virginia is the third most heavily forested state in the nation. Seventy-eight percent of the state is forestland. Private landowners control 90 percent of that forestland. Three percent of these landowners own 50 percent of the state's private forestland acreage. Most of the state's private timberland owners practice some form of timber management, including harvest, on their

lands. The harvest of West Virginia's predominantly hardwood forests supports a wood products industry that is very important to the state's economy.

These principally private forestlands support a rich diversity of plant and animal species, both aquatic and terrestrial. Well-managed forestland also preserves both water and air quality in the state. Because much of West Virginia's forestland is again reaching harvestable age, timber harvest is increasing and will likely continue to do so over the next decade covered by this plan. This will result in an increase in early-successional forest stages on the landscape. In the process, habitat will be temporarily created for some species of wildlife and temporarily lost for others. If increased timber harvest is implemented as part of sustainable forest management plans, following the recommendations of professional foresters, then the result will be a mosaic of forest successional stages across the landscape, thus avoiding total loss for any single wildlife species or species group. The conservation challenges posed by this issue for SGNC include collaboration among state and federal agencies, industry groups, and forestland owners to minimize excessive fragmentation of forest habitats and ensure that best management practices are employed to protect water quality.

Invasive Species

Exotic species are species of plants and animals that did not occur naturally in the US prior to colonization by Europeans in the 1600s. Since that time, thousands of species have been brought to this country for a variety of purposes including food, pets and nursery stock and some have been introduced without an invitation. Most of these species of plants and animals do not create any problems for our native species. Unfortunately some of these species have the ability to live outside of cultivation or captivity and affect our native species. The species that can invade our natural areas and significantly affect native species are called *invasive species*. These species are a major conservation issue in virtually every region of the state.

Invasive species range from pathogens (West Nile virus) to plants (purple loosestrife) to insects (gypsy moth) to birds (starlings). Insects in particular can have landscape-level impacts. An example is the hemlock woolly adelgid, a serious pest that could eliminate eastern hemlock in our forests. The absence of hemlocks from the state's streamside forests will undoubtedly increase stream temperatures and seriously degrade habitat for coldwater stream species. Invasive plants can also have widespread effects on the quality of fish and wildlife habitat. Purple loosestrife, for example, can so dominate wetlands and streamside areas that they become totally unavailable to wetland wildlife species. One of the most destructive species of animal invasives is the zebra mussel, which has only recently appeared in state waters and could seriously impact native mussels and sport and nongame fishes.

The principal conservation challenges posed by the invasive species issue are education and collaboration. Invasive species problems are best addressed by early detection and intervention, suggesting both the need to better educate publics about this issue and the need for increased collaboration among state and federal agencies to implement early intervention programs.

Water Pollution

West Virginians polled in a 2005 opinion survey indicated that water pollution was the most important issue facing the state's fish and wildlife resources. Three major sources of water pollution, acid mine drainage, atmospheric acid deposition and sedimentation, have been previously discussed as separate issues in this plan and thus will not be addressed again here. Chemical pollution and human waste pollution have not been previously addressed and will be discussed.

In some rural areas of West Virginia, collection and treatment of human sewage from domestic sources is limited or nonexistent. The disposal of this sewage through straight pipes or failing septic systems results in bacterial problems in many of the state's streams and rivers. Forty-five percent of the state's households are not connected to a centralized wastewater treatment system. Some communities that do operate wastewater treatment systems periodically discharge untreated sewage into the state's waters under overflow conditions.

Chemical pollution occurs principally in two forms. The first is the existence of persistent bioaccumulative toxins, such as mercury, PCBs and dioxin, in the state's waters or in sediments thereof. One indicator of the occurrence of these toxins in state waters is the issuance of fish consumption advisories. Currently, a general consumption advisory has been issued for most predator species, e.g., black bass, from all state waters. Water-specific advisories have been issued for 17 rivers and lakes in the state. Further information on fish consumption advisories can be found by visiting <http://www.wvdhhr.org/fish/current.asp>. The second significant form of chemical pollution typically occurs as a result of spill events, e.g., oil spills. Such events can seriously impact fish, mussels and other aquatic life.

The conservation challenges posed by this issue are as diverse as the diverse array of pollutants. Clearly the biggest challenge posed by domestic sewage is that of securing additional funding and developing innovative methodologies for wastewater treatment systems. For chemical pollution, interagency coordination to monitor toxins and the implementation of restoration programs for resources impacted by spill events are the most significant challenges.

Instream, Wetland and Riparian Habitat Loss

Many species depend on both riparian and instream habitats for their survival. Riparian, or streamside, habitat includes the trees, shrubs and grasses growing along the stream. Riparian vegetation shades and cools streams, provides organic material to sustain aquatic invertebrates and stabilizes streambanks to reduce sedimentation of instream habitats. Healthy instream habitats are usually complex, e.g., woody debris, a mixture of boulders, cobblestones and gravel and a good mix of riffles and pools. Wetlands help stabilize stream flows and provide high-quality habitat for both aquatic and terrestrial species of wildlife. All three are very important habitats for many SGNC; all three habitats are significantly at risk.

West Virginia ranks second from the bottom in state wetland acreage. As a result of draining and filling of wetlands, the state has experienced an estimated 24 percent loss of these scarce habitats since colonial times. Riparian habitats have probably fared even worse. In the mid-Atlantic highlands, including all of West Virginia, removal of woody streamside vegetation for development, agriculture and other purposes has left over half of the remaining riparian habitats in poor to fair condition. Inadequate riparian habitat quality is now probably the second greatest environmental stressor in the mid-Atlantic highlands. Finally, the combined impacts of sedimentation, channel modifications and other human activities have resulted in less than optimum instream habitats for fish and other aquatic organisms. Across the mid-Atlantic highlands, 67 percent of the stream miles are estimated to be in fair to poor condition for fish and 75 percent in fair to poor condition for aquatic insects.

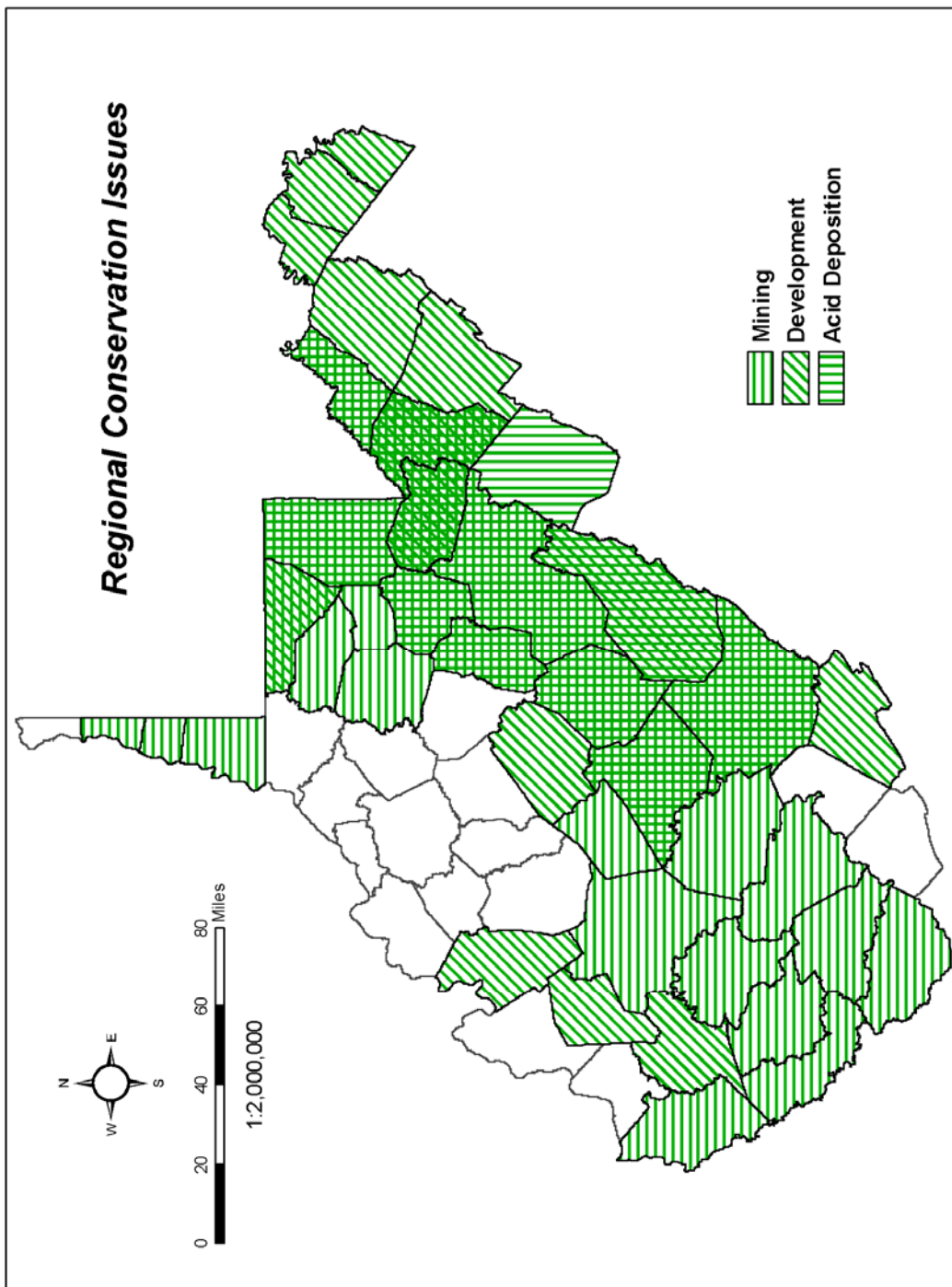
The challenges posed by this issue for conservation of SGNC include the need for increased public awareness of the value and condition of these habitats, the need to conserve them and the implementation of state-of-the-art habitat restoration methodologies, e.g., natural stream channel design.

Other Issues

Other issues were identified in the planning process but were not yet elevated to the status of major issues. Some are subsequently addressed in individual fact sheets for SGNC; others, e.g., the development and operation of wind power generation facilities, are emerging issues that require further study before they might be elevated to major issue status. These other issues include:

- Wind power generation facilities
- Road construction
- Utility line construction and maintenance
- Oil and gas drilling

- Water use – surface and groundwater
- Unregulated harvest of SGNC
- Off-road vehicle use
- Recreational use of sensitive habitats
- Waste or residual materials
- Thermal pollution
- Introduced genetic material
- Climate change



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Section 4-E. Selection of Species in Greatest Need of Conservation

The driving guidance behind this comprehensive plan is to conserve what has been termed Species in Greatest Need of Conservation. Since this is in effect the starting point and backbone of the plan, a method had to be established to compile such a listing of species. The following outline shows the flow of analysis used to derive the initial list of SGNC.

Step 1. Compiling of Lists.

Many organizations have their own species of concern list. Each list that included a West Virginia species was considered. Organizations/groups included:

- West Virginia DNR, Natural Heritage Program
- U.S. Fish and Wildlife Service
- The World Conservation Union (IUCN list)
- Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES list)
- American Fisheries Society
- Northeast State Fish and Wildlife Technical Committee
- West Virginia Partners in Flight
- National Audubon Society
- Monongahela National Forest
- Jefferson and George Washington National Forests

Each list was compiled and organized by taxonomic group. Groups included:

- Mammals
- Birds
- Reptiles
- Amphibians
- Fish
- Butterflies
- Moths
- Dragonflies and Damselflies
- Stoneflies
- Tiger beetles
- Cave invertebrates
- Spiders
- Landsnails
- Mussels

- Crayfish

If each animal on these lists were included on the SGNC list for the state, there would be 574 species (see Appendix 2 for a complete listing of the species compiled from all group lists). Since this number is impractical from a plan implementation perspective, a methodology was established to narrow down the number to those that were deemed to be sufficiently in need of conservation to be included in the first planning period.

Step 2. Narrowing Down the INVERTEBRATE Species to be Included on the List.

After meeting with the experts, it was apparent that for some invertebrate groups, data was lacking. It was decided that all invertebrate species were to be left on the list because of the high need for survey and distribution data for most of these groups. Presenting each species' conservation needs would be a daunting task so their needs are presented in the plan under their respective taxonomic groups instead of individual species. Certain groups are better known and there are individual sheets for high NatureServe globally (G3G4 or below) ranked dragonflies, butterflies, tiger beetles, crayfish and mussels.

Also, with expert consultation and re-evaluation of all species, it was decided that some species were not in need of conservation for the purposes of this plan. Those species were taken off of the list.

Species	Global Rank	State Rank
Flat Floater	G5	S1
Eastern Elliptio	G5	S2
Spike	G5	S3
Plain Pocketbook	G5	S3
Round Hickorynut	G4	S3
Pink Papershell	G5	S1

Step 3. Narrowing Down the VERTEBRATE Species to be Included on the List.

Meetings were held with statewide experts for each vertebrate animal group and the status of each species on the list was evaluated. Any species that was considered extirpated, accidental, or a non-West Virginia breeder was automatically taken off of the list. Some animals were included on the initial list because they were of concern in the Northeast Region of the United States. Some of these species are highly documented in West Virginia and are not currently considered to be of conservation concern in the state. These animals (15 birds, 2 reptiles, and 2 amphibians) were taken off of the list.

Species	Global Rank	State Rank
Yellow-breasted Chat	G5	S4B
Cliff Swallow	G5	S3B
Eastern Meadowlark	G5	S4N, S5B
Black-throated Blue Warbler	G5	S4B
Eastern Wood Peewee	G5	S5B
Brown Thrasher	G5	S3N, S5B
Canada Warbler	G5	S4B
Northern Parula	G5	S5B
Yellow-throated Vireo	G5	S5B
Hooded Warbler	G5	S5B
Belted Kingfisher	G5	S4N, S4B
Yellow-throated Warbler	G5	S4B
Indigo Bunting	G5	S5B
Scarlet Tanager	G5	S5B
Red-eyed Vireo	G5	S5B
Eastern Box Turtle	G5	S5
Queen Snake	G5	S4
Longtail Salamander	G5	S5
Mountain Chorus Frog	G5	S4

Also, with expert consultation and re-evaluation of all species, it was decided that some species were not in need of conservation for the purposes of this plan. Those species were also taken off of the list.

Species	Global Rank	State Rank
Bigmouth Chub	G4Q	S4
Mountain Redbelly Dace	G5	S4

Step 4. Species Additions to the List.

An indicator fish species and two fur-bearer species were felt to be indicators of certain ecosystem health or are in need of conservation and therefore were added to the SGNC list.

Species	Global Rank	State Rank
Brook Trout	G5	S4
Northern River Otter	G5	S2
Fisher	G5	S3

Step 5. Prioritizing the List.

It was decided that each species on the SGNC list would be placed in a priority group.

Priority Groups

Priority 1: Vertebrate Criteria

- All species with a NatureServe Global rank of G1-G3G4 and a state rank of SH, S1, S1S2
- Experts were consulted and some species not meeting these criteria were added to Priority list 1. Most birds added to the list were identified by Partner's in Flight as foci for research due to population declines as well as the large proportions of their total breeding populations occurring in West Virginia. These and other species added included:

Species	Global Rank	State Rank
Eastern Hellbender	G4	S2
Upland Chorus Frog	G5T5	S2
Wood Turtle	G4	S2
Timber Rattlesnake	G4	S3
Eastern Spotted Skunk	G5	S2S3
Cerulean Warbler	G4	S4B
Bald Eagle	G4	S2B, S3N
Golden-winged Warbler	G4	S2B
Saw-whet Owl	G5	S2B, S3N
American Woodcock	G5	S4B, S4N
Blue-winged Warbler		
Worm-eating Warbler		
Louisiana Waterthrush		
Wood Thrush		
Prairie Warbler		
Acadian Flycatcher		
Kentucky Warbler		
Eastern Wood Peewee		

Whip-Poor-Will		
Field Sparrow		

Priority 1: Invertebrate Criteria

- All species with a NatureServe Global rank of G1-G3G4

Many invertebrate species are lacking data and even though they have a high Global rank, they can not be placed in a Priority 1 category. Species *excluded* from Priority group 1 are:

Common Name	Global Rank	State Rank
Stoneflies:		
Monongahela Snowfly	G2	S2
Aracoma Sallfly	G3	S1
Dusky Sallfly	G3	S1
Little Kanawha Perlodid Stonefly	G3	S1
Hanson's Appalachian Stonefly	G3	S2
Splendid Stonefly	G2	S1
Shenandoah Stonefly	G2	S1
Notched Forestfly	G4	S1
Bent Forestfly	G3	S1
Spiny Salmonfly	G3	S2
Pocahontas Sallfly	G2	S2
Gaspe Sallfly	G3	S1
Emerton's Grass Spider	G?	S1
Reddish Arctosa	G?	S1
West Virginia Calymmaria	G1	S1
Diverse Ant Mimic	G?	S1
Jenning's Comb-foot	G1	S1
Fierce Wolf Spider	G?	S1
Carolina Wolf Spider	G?	S1
Vegetable Leaf Wolf Spider	G?	S1
Barred Neriene	G?	S1
Shy Toad Spider	G?	S1
Adorned Leopard-Wolf Spider	G?	S1
Island Pirate Spider	G?	S1
Sedentary Pirate	G?	S1
Seminole Swamp Pirate	G?	S1
Eager Swamp Pirate	G?	S1
Backward Schizocosa	G?	S1
Garden Rug Merchant	G?	S1

Hentz's Zelotes	G?	S1
Moths:		
<i>Catocala dulciola</i>	G3	SU
<i>Catocala herodias gerhardi</i>	G3T3	SU
<i>Chaetagnaea cerata</i>	G3G4	S1
<i>Euchlaena milnei</i>	G2G4	S2
<i>Hadena ectypa</i>	G3G4	S1
<i>Merolonche dollii</i>	G3G4	SH
Landsnails:		
Maryland Glyph Snail	G2	S2
Tallus Coil	G2	SH
Seep Mudalia	G2?	SU
Round Supercoil	G3	S1
Barred Supercoil	G3	SH
Shale Pebblesnail	G3	SU

Priority 2: Vertebrate Criteria:

- All species with a NatureServe State rank of S2, S2S3, S3S4 (all of the rest of the SGNC not included in Group 1)
- Experts were consulted and one species fitting the Group 1 criteria was demoted to Group 2:

Species	Global Rank	State Rank
Evening Bat	G5	S1

Priority 2: Invertebrate Criteria:

- All species with a NatureServe Global rank of G4 and G5 (and all of the invertebrates *excluded* from Group 1 listed above).

State Experts: Individuals / Groups Consulted for SGNC List

- Dr. Thomas K. Pauley – Reptiles and Amphibians, Marshall University
- Jayme Waldron - Reptiles and Amphibians, Clemson University
- Jeff Humphries - Amphibians, Clemson University
- Dr. Mike Osborne - Amphibians, Marshall University
- Nancy Johnson – Amphibians, Compliance Monitoring Labs, Inc.
- Keith Johnson – Amphibians, Compliance Monitoring Labs, Inc.
- Zach Felix – Amphibians, University of Alabama
- Dr. William Flint – Amphibians, James Madison University

- Craig Stihler – Snails, Mammals, Cave invertebrates, WVDNR
- Dr. Ralph Taylor – Snails, Marshall University
- Dr. Mary Etta Hight – Mammals, Marshall University
- Dr. Edwin D. Michael – Mammals, retired, West Virginia University
- Dr. Paul Keenlance – Mammals, Alderson Broaddus College
- Dr. Mark Ford – Mammals, USDA Forest Service
- Tom Allen – Butterflies, retired, WVDNR
- Rob Tallman – Birds, WVDNR
- Donna Mitchell - Birds, WVDNR
- Dr. Tom Jones - Crayfish, Marshall University
- Jennifer Wykle – Crayfish, Odonates, WVDNR
- Dr. John Enz – Odonates, Alderson Broaddus College
- Dr. Don Tarter – Stoneflies, Odonates, retired, Marshall University
- Janet Clayton – Mussels, WVDNR
- Dr. Linda Butler – Moths, West Virginia University
- Dr. John Strazanak – Moths, West Virginia University
- Bob Acciavatti – Tiger beetles, UDSA Forest Service
- Dr. Stuart Welsh – Fish, West Virginia University
- Dan Cincotta – Fish, WVDNR
- Jim Arnold – Spiders, Marshall University
- Ken Hotopp—Landsnails, James Madison University
- West Virginia Partners in Flight - Birds
- West Virginia Entomological Society – Insects

Section 4-F. Habitats

In order to conserve species one must conserve the habitat on which they depend. The question is how to do this with the limited resources available. First, no one entity can do the job alone, only a collaborative approach will accomplish the task. Second, the approach to conserving habitat must be as efficient as possible to maximize returns on the small amount of human and monetary capital available.

How do we define habitat? Webster defines it as “the place or type of site where a plant or animal naturally or normally lives and grows.” This definition immediately addresses a key question in the approach to conservation. Do we place our efforts on conserving known places (sites) where the species in question is found or do we put our efforts into the type of site (habitat) where the species is found?

The answer to this dilemma is that both approaches are necessary to do an adequate job of conservation. An eagle cannot be conserved solely by protecting the tree in which it nests and a Rock Vole cannot be conserved by setting aside a block of Northern Hardwood Forest that does not have the necessary rocky substrate needed by the vole. The eagle needs a large area of appropriate feeding habitat and the vole needs its rocky patch in the forest.

So how do we accomplish both tasks simultaneously? The logical sequence of action is to identify specific sites for area-limited SGNC and try to conserve larger blocks of habitat that incorporate these sites, effectively killing two birds with one stone (poor analogy given the subject matter!). Groups such as The Nature Conservancy have used this approach to leverage the effect of their conservation dollars and management recommendations.

Individual sites where SGNC are found have been documented in West Virginia since 1975, when the Natural Heritage Program began to keep such records. Currently there are about 3,100 site records for animal species tracked by the WVDNR. In addition to these records there are other databases with site specific information that need to be included in the analyses. This information represents efforts of many people and institutions over the last one hundred years. Many records need to be updated since older data is of marginal use for modern conservation planning. There is a body of information available on the sites of SGNC occurrence although the status of the species at any given site is largely lacking except for a few well studied species.

The critical question is “What is the description of the habitat in which each SGNC lives?” Unfortunately this is largely an unknown at this point. While we may have a mental picture of the habitat for a given species, we often do not have a system that quantifies the habitat. A general description is not adequate because it is somewhat subjective and the same area may be described

differently by different individuals. A uniform descriptive approach is needed to quantify habitat. This type of approach will evolve as we move forward trying different techniques that ultimately will be the building blocks of a way to adequately describe whole ecological systems required to maintain viable populations of SGNC. There are three broad habitat classes that harbor SGNC that form the building units of the International Classification of Ecological Communities (ICEC). These are Terrestrial (includes non-channel wetlands), Subterranean (caves and abandoned mine openings), and Aquatic (streams, ponds, and lakes).

Terrestrial Habitats

One of the most promising current approaches to classifying terrestrial habitats is the National Vegetation Classification, which addresses the terrestrial portion of the ICEC. Many states and agencies are employing this quantitative system to define their ecological communities. West Virginia is also using this approach to better understand our range of communities and how they relate to the global distribution of similar communities. Twenty-four of the currently identified ecological systems are used here to define the larger habitat units or “places” that SGNC call home in West Virginia. This level of the classification system is the best defined but still somewhat broad in scope. Ultimately there will be one to two hundred actual vegetative associations identified and classified in the state based on quantitative vegetation plot sampling. In the mean time, the ecological system level is what we will use for planning purposes. There has been essentially no incorporation of animals into this concept of ecological communities. Associating animals with these habitats, or the more refined association descriptions, will become an important consideration once the vegetative classification system is better developed. Experts were asked to assign SGNC to these various habitat systems. The results were not encouraging because of the discrepancies among the reviewers with regard to species/habitats assignments. The exercise points out the need to have a formal quantitative habitat/species matrix that can be of greater utility in assessing habitat conservation needs. The outcome of the species/habitat correlation is incorporated into a chart of species for each of the 24 annotated habitat descriptions that follow. Many species occur in more than one terrestrial habitat system and not all species were assigned to habitats due to a lack of knowledge about the relationships. Additional information about each species or species group may be found in the Species Fact Sheets in Section 5-F of this plan.

Red Spruce Forest

Red Spruce Forests are upland evergreen and mixed forests dominated by Red Spruce, and are found at higher elevations (above 2,500 feet) in the Allegheny Mountains. Red Spruce is known from Preston, Tucker, Grant, Randolph, Pocahontas, Webster, Greenbrier and Nicholas counties. This type was more abundant prior to logging (circa 1900) and much of the previously

occupied area now supports Northern Hardwoods Forests. Original estimates put the coverage of this forest type at 469,000 acres; current estimates indicate that fewer than 30,000 acres remain. Several associated dominant understory plants, in areas with a primarily Red Spruce canopy, include Giant Rhododendron, Southern Mountain Cranberry, and/or Bryophytes.

SPECIES IN GREATEST NEED OF CONSERVATION RED SPRUCE FOREST	
Scientific Name	Common Name
<i>Glaucomys sabrinus fuscus</i>	West Virginia Northern Flying Squirrel
<i>Microtus chrotorrhinus carolinensis</i>	Southern Rock Vole
<i>Neotoma magister</i>	Allegheny Woodrat
<i>Sorex palustris punctulatus</i>	Southern Water Shrew
<i>Accipiter gentilis</i>	Northern Goshawk
<i>Aegolius acadicus</i>	Northern Saw-Whet Owl
<i>Carduelis pinus</i>	Pine Siskin
<i>Catharus ustulatus</i>	Swainson's Thrush
<i>Contopus cooperi</i>	Olive-Sided Flycatcher
<i>Sphyrapicus varius</i>	Yellow-Bellied Sapsucker
<i>Plethodon nettingi</i>	Cheat Mountain Salamander
<i>Virginia valeriae pulchra</i>	Mountain Earthsnake
<i>Sorex dispar</i>	Long-Tailed Shrew
<i>Sorex hoyi winnemana</i>	Southern Pygmy Shrew
<i>Sylvilagus obscurus</i>	Appalachian Cottontail
<i>Certhia americana</i>	Brown Creeper
<i>Seiurus noveboracensis</i>	Northern Waterthrush
<i>Dendroica coronata</i>	Yellow-Rumped Warbler
<i>Dendroica fusca</i>	Blackburnian Warbler
<i>Cambarus monongalensis</i>	A Crayfish

Northern Hardwoods Forest

These upland deciduous forests are most abundant in the Allegheny Mountains, but also are found at the higher elevations of the Ridge and Valley physiographic province and in cool topographic positions (e.g. deep valleys) elsewhere in the state. These forests are usually dominated by a mixture of deciduous tree species including Sugar Maple, Red Maple, Yellow Birch, Black Cherry, Tulip Poplar, Basswood, Beech, Red Oak, Cucumber Magnolia and White Ash. Evergreen conifers (Red Spruce, Hemlock, White Pine) may occur but are not dominant.

SPECIES IN GREATEST NEED OF CONSERVATION NORTHERN HARDWOOD FORESTS	
Scientific Name	Common Name
<i>Glaucomys sabrinus fuscus</i>	West Virginia Northern Flying Sq
<i>Microtus chrotorrhinus carolinensis</i>	Southern Rock Vole
<i>Neotoma magister</i>	Allegheny Woodrat
<i>Sorex palustris punctulatus</i>	Southern Water Shrew
<i>Accipiter gentilis</i>	Northern Goshawk
<i>Aegolius acadicus</i>	Northern Saw-Whet Owl
<i>Contopus virens</i>	Eastern Wood Peewee
<i>Seiurus motacilla</i>	Louisiana Waterthrush
<i>Sphyrapicus varius</i>	Yellow-Bellied Sapsucker
<i>Aneides aeneus</i>	Green Salamander
<i>Plethodon nettingi</i>	Cheat Mountain Salamander
<i>Plethodon punctatus</i>	Cow Knob Salamander
<i>Plethodon virginia</i>	Shenandoah Mountain Salamander
<i>Virginia valeriae pulchra</i>	Mountain Earthsnake
<i>Polygonia faunus smythi</i>	Green Comma
<i>Sorex dispar</i>	Long-Tailed Shrew
<i>Sorex hoyi winnemana</i>	Southern Pygmy Shrew
<i>Sylvilagus obscurus</i>	Appalachian Cottontail
<i>Accipiter cooperii</i>	Cooper's Hawk
<i>Accipiter striatus</i>	Sharp-Shinned Hawk
<i>Certhia americana</i>	Brown Creeper
<i>Coccyzus erythrophthalmus</i>	Black-Billed Cuckoo
<i>Ambystoma jeffersonianum</i>	Jefferson Salamander
<i>Erora laeta</i>	Early Hairstreak
<i>Polygonia progne</i>	Gray Comma
<i>Cambarus monongalensis</i>	A Crayfish

This matrix forest type was impacted by logging around the turn of the twentieth century and no original stands are known. However, its current extent is probably expanded compared to its historical extent, although in a degraded condition. Northern hardwoods occupy much of the area which was the original spruce forest. It is now probably decreasing in overall area as spruce forests expand and also due to development. At the same time it is likely expanding in abandoned agricultural and mined areas at high elevations as successional forests mature.

Hemlock Forests

Hemlock Forests are upland evergreen forests found on cool aspects such as ravines and north slopes throughout much of the state, and as an extensive type on the plateaus near the Gauley River. These forests are dominated by Hemlock, but are often mixed with the deciduous trees of the Northern Hardwoods Forest type. Giant Rhododendron is a common tall shrub species in many stands. Herb layers are typically sparse.

Hemlock Forests are under immediate and severe threat from the Hemlock Woolly Adelgid, a sap sucking insect that can kill their host. Many trees

have already been killed in the state and the infestation is moving south and west from the Eastern Panhandle. Prospects for the continued existence of significant Hemlock stands are not good. This is a very threatened system with no current Adelgid control available for large areas of trees.

SPECIES IN GREATEST NEED OF CONSERVATION HEMLOCK FOREST	
Scientific Name	Common Name
<i>Glaucomys sabrinus fuscus</i>	West Virginia Northern Flying Sq
<i>Myotis sodalist</i>	Indiana Bat
<i>Microtus chrotorrhinus carolinensis</i>	Southern Rock Vole
<i>Neotoma magister</i>	Allegheny Woodrat
<i>Sorex palustris punctulatus</i>	Southern Water Shrew
<i>Empidonax virescens</i>	Acadian Flycatcher
<i>Hylocichla mustelina</i>	Wood Thrush
<i>Seiurus motacilla</i>	Louisiana Waterthrush
<i>Aneides aeneus</i>	Green Salamander
<i>Plethodon punctatus</i>	Cow Knob Salamander
<i>Plethodon virginia</i>	Shenandoah Mountain Salamander
<i>Plethodon nettingi</i>	Cheat Mountain Salamander
<i>Triodopsis platysayoides</i>	Flat-Spined Three-Toothed Landsn
<i>Sorex dispar</i>	Long-Tailed Shrew
<i>Sorex hoyi winnemana</i>	Southern Pygmy Shrew
<i>Accipiter cooperii</i>	Cooper's Hawk
<i>Accipiter striatus</i>	Sharp-Shinned Hawk
<i>Ambystoma jeffersonianum</i>	Jefferson Salamander
<i>Cambarus monongalensis</i>	A Crayfish

Mixed Mesophytic Forest

Mixed Mesophytic Forests are upland deciduous forests and are dominated by a mixture of trees adapted to moist, fertile soils, usually found at lower elevations than Northern Hardwoods Forests. Co-dominant trees include Sugar Maple, Basswood, Buckeye, White Ash, Tulip Poplar, Umbrella Magnolia, Slippery Elm, Beech, Red Oak, Shagbark Hickory and Black Birch. There is often a lush and diverse herbaceous layer including many spring ephemerals.

SPECIES IN GREATEST NEED OF CONSERVATION MIXED MESOPHYTIC FOREST	
Scientific Name	Common Name
<i>Microtus chrotorrhinus carolinensis</i>	Southern Rock Vole
<i>Myotis sodalist</i>	Indiana Bat
<i>Neotoma magister</i>	Allegheny Woodrat
<i>Sorex palustris punctulatus</i>	Southern Water Shrew
<i>Asio otus</i>	Long-Eared Owl
<i>Caprimulgus vociferus</i>	Whip-Poor-Will
<i>Contopus virens</i>	Eastern Wood Peewee
<i>Dendroica cerulea</i>	Cerulean Warbler
<i>Empidonax virescens</i>	Acadian Flycatcher
<i>Haliaeetus leucocephalus</i>	Bald Eagle
<i>Hylocichla mustelina</i>	Wood Thrush
<i>Oporornis formosus</i>	Kentucky Warbler
<i>Seiurus motacilla</i>	Louisiana Waterthrush
<i>Aneides aeneus</i>	Green Salamander
<i>Plethodon punctatus</i>	Cow Knob Salamander
<i>Plethodon virginia</i>	Shenandoah Mountain Salamander
<i>Triodopsis platysayoides</i>	Flat-Spired Three-Toothed Landsnail
<i>Calephelis borealis</i>	Northern Metalmark
<i>Speyeria diana</i>	Diana
<i>Lasiurus borealis</i>	Eastern Red Bat
<i>Lasiurus cinereus</i>	Hoary Bat
<i>Sorex dispar</i>	Long-Tailed Shrew
<i>Sorex hoyi winnemana</i>	Southern Pygmy Shrew
<i>Sylvilagus obscurus</i>	Appalachian Cottontail
<i>Accipiter cooperii</i>	Cooper's Hawk
<i>Accipiter striatus</i>	Sharp-Shinned Hawk
<i>Coccyzus erythrophthalmus</i>	Black-Billed Cuckoo
<i>Ambystoma jeffersonianum</i>	Jefferson Salamander
<i>Pseudotriton ruber</i>	Northern Red Salamander
<i>Autochthon cellus</i>	Golden-Banded Skipper
<i>Cyllopsis gemma</i>	Gemmed Satyr
<i>Parrhasius m-album</i>	White-M Hairstreak
<i>Polygonia progne</i>	Gray Comma
<i>Staphylus hayhurstii</i>	Hayhurst's Scallopwing
<i>Cambarus monongalensis</i>	A Crayfish

This matrix forest type was heavily impacted by logging around the turn of the century and no original stands are known. The type occurs in areas with high site index for timber production and most areas have been logged multiple times likely leading to reduced biodiversity and ecological function. Areal coverage of the type has also been and continues to be decreased by coal mining, notably by valley fill operations. In protected areas, this type is increasing as successional forest types mature and as drier oak forests become more mesophytic and give way to shade tolerant tree species.

Calcareous Forests and Woodlands

Calcareous Forests and Woodlands are upland deciduous forests occurring on soils derived from limestone and dolomite, and are most abundant in the Ridge and Valley physiographic province, but are also found elsewhere. These forests, never extensive, have been greatly reduced by conversion to pasture, cropland and quarries. Dominant trees include Chinquapin Oak, White Ash, Sugar Maple, Black Maple, Black Walnut, Hackberry and Bitternut Hickory.

SPECIES IN GREATEST NEED OF CONSERVATION CALCAREOUS FOREST AND WOODLAND	
Scientific Name	Common Name
<i>Corynorhinus townsendii virginianus</i>	Virginia Big-Eared Bat
<i>Neotoma magister</i>	Allegheny Woodrat
<i>Caprimulgus carolinensis</i>	Chuck-Will's-Widow
<i>Contopus virens</i>	Eastern Wood Peewee
<i>Dendroica cerulea</i>	Cerulean Warbler
<i>Empidonax virescens</i>	Acadian Flycatcher
<i>Haliaeetus leucocephalus</i>	Bald Eagle
<i>Helmitheros vermivorus</i>	Worm-Eating Warbler
<i>Hylocichla mustelina</i>	Wood Thrush
<i>Oporornis formosus</i>	Kentucky Warbler
<i>Plethodon virginia</i>	Shenandoah Mountain Salamander
<i>Crotalus horridus</i>	Timber Rattlesnake
<i>Accipiter cooperii</i>	Cooper's Hawk
<i>Accipiter striatus</i>	Sharp-Shinned Hawk
<i>Coccyzus erythrophthalmus</i>	Black-Billed Cuckoo
<i>Ambystoma jeffersonianum</i>	Jefferson Salamander
<i>Carphophis amoenus</i>	Wormsnake
<i>Eumeces laticeps</i>	Broad-Headed Skink
<i>Heterodon platirhinus</i>	Eastern Hog-Nosed Snake
<i>Erynnis lucilius</i>	Columbine Duskywing
<i>Cambarus monongalensis</i>	A Crayfish

The distribution of forests and woodlands over calcareous substrate is poorly understood in the state. Existing geological maps do not adequately delineate limestone and calcareous substrate thereby making even a basic assessment of acreage difficult. Much of the original forest on limestone has been converted to agricultural use making this the pre-eminent threat for the last couple of centuries. We will need to learn much more about the distribution and current status of this habitat before an integrated plan can be formulated to conserve or restore adequate quantities to conserve species that are dependent on the unique edaphic and floristic characters of the habitat. There is not yet a comprehensive listing of species that are highly dependant on these forests and woodlands. Because it is known that much of this habitat has been lost to uses other than naturally functioning forest land, viable examples should be conserved as the means to do so become available. In other words, although our understanding of this habitat is incomplete, we are confident that immediate

conservation/restoration of this habitat is critical to the ecological communities dependent upon it because of the wholesale conversion that has occurred over the last two hundred years.

Oak/Hickory and Dry/Mesic Oak Forest

Oak/Hickory and Dry/Mesic Oak Forests occur at middle to lower elevations throughout the state. Soils are usually somewhat less acidic and more fertile compared to the oak/heath forests, but are drier than the mixed mesophytic forest type. Dominant trees include Red Oak, Black Oak, Chestnut Oak, Pignut Hickory, Mockernut Hickory, Shagbark Hickory, White Ash, Black Gum and Red Maple. Heath shrubs may be present but are not as abundant as in the Oak/Heath Forest type. The herb layer ranges from sparse to moderate but is often quite diverse.

SPECIES IN GREATEST NEED OF CONSERVATION OAK/HICKORY AND DRY/MESIC OAK FOREST	
Scientific Name	Common Name
<i>Corynorhinus townsendii virginianus</i>	Virginia Big-Eared Bat
<i>Myotis leibii</i>	Eastern Small-Footed Bat
<i>Myotis sodalist</i>	Indiana Bat
<i>Neotoma magister</i>	Allegheny Woodrat
<i>Asio otus</i>	Long-Eared Owl
<i>Contopus virens</i>	Eastern Wood Peewee
<i>Dendroica cerulea</i>	Cerulean Warbler
<i>Empidonax virens</i>	Acadian Flycatcher
<i>Haliaeetus leucocephalus</i>	Bald Eagle
<i>Helmitheros vermivorus</i>	Worm-Eating Warbler
<i>Hylocichla mustelina</i>	Wood Thrush
<i>Aneides aeneus</i>	Green Salamander
<i>Crotalus horridus</i>	Timber Rattlesnake
<i>Triodopsis platysayoides</i>	Flat-Spined Three-Toothed Landsnail
<i>Callophrys irus</i>	Frosted Elfin
<i>Lasiurus borealis</i>	Eastern Red Bat
<i>Lasiurus cinereus</i>	Hoary Bat
<i>Accipiter cooperii</i>	Cooper's Hawk
<i>Accipiter striatus</i>	Sharp-Shinned Hawk
<i>Coccyzus erythrophthalmus</i>	Black-Billed Cuckoo
<i>Ambystoma jeffersonianum</i>	Jefferson Salamander
<i>Carphophis amoenus</i>	Wormsnake
<i>Eumeces laticeps</i>	Broad-Headed Skink
<i>Heterodon platirhinus</i>	Eastern Hog-Nosed Snake
<i>Euchloe olympia</i>	Olympia Marble
<i>Parrhasius m-album</i>	White-M Hairstreak
<i>Polygonia progne</i>	Gray Comma
<i>Satyrrium edwardsii</i>	Edward's Hairstreak
<i>Cicindela unipunctata</i>	A Tiger Beetle

These matrix forest types were highly impacted by logging around the turn of the century and no old growth stands are known. An unknown area, probably

large, was converted permanently to agriculture and other development on more gentle topography. Oaks and hickories sprout from rootstocks following fire and other disturbance (e. g. logging), thus, in the absence of land conversion to agriculture or other development, their dominance was likely reestablished following the logging boom. The types' prevalence at relatively low elevations, much of it on private lands, and value for timber has resulted in repeated logging cycles. Their resistance to fire and competitiveness following stand-replacing events may have led to an increase in total area in the 1900s. Today, oak's intolerance of shade and it's palatability by deer may result in a future decline in areal cover as forests succeed towards more mesophytic types such as mixed mesophytic and hemlock forests. However, current prescribed burning programs and intensive management of these types for timber and game production may postpone this succession in some areas. Where this habitat occurs on upper slopes in southwestern WV, it is being reduced by mountain top removal coal mining.

Oak/Heath and Oak/White Pine Forests

Oak/Heath and Oak/White Pine Forests occur on warm, dry topographic positions and soils throughout the state, but are most extensive in the Ridge and Valley physiographic province. Soils are typically highly acidic, with low to moderate fertility. Dominant trees include Chestnut Oak, Scarlet Oak, Black, Oak, White Oak and White Pine. Other pine species may be present but are not dominant. The Oak/White Pine Forests are most abundant in the southeastern counties (e.g. Pocahontas, Monroe).

SPECIES IN GREATEST NEED OF CONSERVATION Oak /Heath and Oak/White Pine Forests	
Scientific Name	Common Name
<i>Neotoma magister</i>	Allegheny Woodrat
<i>Caprimulgus carolinensis</i>	Chuck-Will's-Widow
<i>Contopus virens</i>	Eastern Wood Peewee
<i>Dendroica cerulea</i>	Cerulean Warbler
<i>Empidonax virescens</i>	Acadian Flycatcher
<i>Haliaeetus leucocephalus</i>	Bald Eagle
<i>Helmitheros vermivorus</i>	Worm-Eating Warbler
<i>Hylocichla mustelina</i>	Wood Thrush
<i>Calephelis borealis</i>	Northern Metalmark
<i>Erynnis martialis</i>	Mottled Duskywing
<i>Pygrus wyandot</i>	Grizzled Skipper
<i>Lasiurus borealis</i>	Eastern Red Bat

<i>Accipiter cooperii</i>	Cooper's Hawk
<i>Accipiter striatus</i>	Sharp-Shinned Hawk
<i>Coccyzus erythrophthalmus</i>	Black-Billed Cuckoo
<i>Atrytonopsis hianna</i>	Dusted Skipper
<i>Euchloe olympia</i>	Olympia Marble
<i>Fixsenia favonius ontario</i>	Northern Hairstreak
<i>Parrhasius m-album</i>	White-M Hairstreak
<i>Polygonia progne</i>	Gray Comma
<i>Cicindela unipunctata</i>	A Tiger Beetle

These matrix and large patch forest types were impacted by logging around the turn of the century but a few small old growth stands are known. Additional old growth is likely to be found on more extreme sites. The white pine component was drastically reduced due to widespread fires following the logging boom, but is now increasing due, in part, to fire suppression. Oaks sprout from rootstocks following fire and other disturbance (e. g. logging), thus, in the absence of land conversion to agriculture or other development, their dominance was likely reestablished following the logging boom. Their resistance to fire and competitiveness following stand replacing events may have led to an increase in total area in the 1900s. Today, oak's intolerance of shade and its palatability by deer may result in a future decline in areal cover as forests succeed towards more mesophytic types such as oak-hickory, mixed mesophytic and hemlock forests. However, current prescribed burning programs and intensive management of these types for timber and game production may preclude this succession. Where it occurs on upper slopes in some areas of southwestern WV it is being reduced by mountain top removal coal mining.

Dry Rocky Pine/Oak Forests and Woodlands

Dry Rocky Pine/Oak Forests and Woodlands occur in warm, dry topographic positions throughout the state, but are most common in the Ridge and Valley physiographic province. Stands are often small patches on rocky summits, outcrops and cliffs. Dominant pines which comprise distinct subtypes include Pitch Pine, Table Mountain Pine, Virginia Pine and Red Pine. Oaks are commonly co-dominant. The understories are usually dominated by heath shrubs including Blueberries, Huckleberry and Mountain Laurel. The herb layer is typically sparse and has low diversity.

SPECIES IN GREATEST NEED OF CONSERVATION Dry Rocky Pine/Oak Forests & Woodlands	
Scientific Name	Common Name
<i>Corynorhinus townsendii virginianus</i>	Virginia Big-Eared Bat
<i>Spilogale putorius</i>	Eastern Spotted Skunk
<i>Asio otus</i>	Long-Eared Owl
<i>Contopus virens</i>	Eastern Wood Peewee
<i>Helmitheros vermivorus</i>	Worm-Eating Warbler
<i>Hylocichla mustelina</i>	Wood Thrush
<i>Elaphe guttata guttata</i>	Cornsnake
<i>Colias interior pop 1</i>	Pink-Edged Sulphur (High Elevation)
<i>Erynnis martialis</i>	Mottled Duskywing
<i>Pygrus Wyandot</i>	Grizzled Skipper
<i>Lasiurus cinereus</i>	Hoary Bat
<i>Accipiter cooperii</i>	Cooper's Hawk
<i>Accipiter striatus</i>	Sharp-Shinned Hawk
<i>Coccyzus erythrophthalmus</i>	Black-Billed Cuckoo
<i>Erynnis lucilius</i>	Columbine Duskywing
<i>Fixsenia favonius Ontario</i>	Northern Hairstreak
<i>Hesperia metea</i>	Cobweb Skipper
<i>Parrhasius m-album</i>	White-M Hairstreak
<i>Phyciodes cocyta</i>	Northern Crescent
<i>Polugonia progne</i>	Gray Comma
<i>Cicindela unipunctata</i>	A Tiger Beetle

These small to large patch types were impacted somewhat by the logging boom, but were not generally converted to agriculture due to rocky soils and inaccessible locales. One old growth stand (240 year old table mountain pine on Short Mountain) is known and others are likely to exist on remote, rocky summits. The type may have increased in response to widespread fires and soil erosion associated with the logging boom. The current trend for this type is probably a reduction in areal cover due to fire suppression, succession towards more mesophytic forest types, and removal of mountain tops by coal mining operations.

Hill Country Deciduous Forests

Hill Country Deciduous Forests occur in the highly dissected but relatively low relief hills of the Western Allegheny Plateau physiographic province. In this region there is a rapid gradation of forest composition in response to slope position and aspect, such that large forest blocks are difficult to classify. These forests are typically composed of small, intergrading patches of Oak/Hickory, Oak/Heath and Mixed Mesophytic Forest types.

SPECIES IN GREATEST NEED OF CONSERVATION HILL COUNTRY DECIDUOUS FORESTS	
Scientific Name	Common Name
<i>Neotoma magister</i>	Allegheny Woodrat
<i>Spilogale putorius</i>	Eastern Spotted Skunk
<i>Asio otus</i>	Long-Eared Owl
<i>Caprimulgus vociferus</i>	Whip-Poor-Will
<i>Contopus virens</i>	Eastern Wood Peewee
<i>Dendroica cerulea</i>	Cerulean Warbler
<i>Empidonax virescens</i>	Acadian Flycatcher
<i>Haliaeetus leucocephalus</i>	Bald Eagle
<i>Helmitheros vermivorus</i>	Worm-Eating Warbler
<i>Hylocichla mustelina</i>	Wood Thrush
<i>Oporornis formosus</i>	Kentucky Warbler
<i>Seiurus motacilla</i>	Louisiana Waterthrush
<i>Acris crepitans blanchardi</i>	Blanchard's Cricket Frog
<i>Aneides aeneus</i>	Green Salamander
<i>Crotalus horridus</i>	Timber Rattlesnake
<i>Erynnis martialis</i>	Mottled Duskywing
<i>Speyeria Diana</i>	Diana
<i>Parrhasius m-album</i>	White-M Hairstreak
<i>Phyciodes cocyta</i>	Northern Crescent
<i>Polygonia progne</i>	Gray Comma
<i>Satyrium edwardsii</i>	Edward's Hairstreak
<i>Staphylus hayhurstii</i>	Hayhurst's Scallopwing
<i>Accipiter cooperii</i>	Cooper's Hawk
<i>Accipiter striatus</i>	Sharp-Shinned Hawk
<i>Coccyzus erythrophthalmus</i>	Black-Billed Cuckoo
<i>Limnothlypis swainsonii</i>	Swainson's Warbler
<i>Protonotaria citrea</i>	Prothonotary Warbler
<i>Acris crepitans crepitans</i>	Eastern Cricket Frog
<i>Ambystoma jeffersonianum</i>	Jefferson Salamander
<i>Carphophis amoenus</i>	Wormsnake
<i>Autochton cellus</i>	Golden-Banded Skipper
<i>Cyllopsis gemma</i>	Gemmed Satyr

These matrix forests were almost entirely logged prior to the early 1900s and no original stands are known although a few small patches are expected to be found. Much of their area was converted to and remains in agriculture and other development. The type is probably now increasing in area due to abandonment of pastures, but quality of these stands is degraded due to the lapse in forest cover. The type occurs mostly on private lands and most areas which have remained as forest have been logged multiple times and are highly fragmented.

Shale Barrens

Shale Barrens are small patch woodlands and openings occurring on hot, dry aspects on Devonian shale in the Ridge and Valley physiographic province. The open stand structure is probably maintained by drought stress to trees. The most common trees are Virginia Pine and Chestnut Oak. The herb layer is often diverse and includes a distinct assemblage of herbs called “shale barren endemics,” which occur nowhere else in the world.

SPECIES IN GREATEST NEED OF CONSERVATION SHALE BARRENS	
Scientific Name	Common Name
<i>Calephelis borealis</i>	Northern Metalmark
<i>Pygrus Wyandot</i>	Grizzled Skipper
<i>Euchloe Olympia</i>	Olympia Marble
<i>Fixsenia favonius Ontario</i>	Northern Hairstreak
<i>Hesperia metea</i>	Cobweb Skipper
<i>Phyciodes cocyta</i>	Northern Crescent
<i>Cicindela purpurea</i>	A Tiger Beetle

Shale Barrens form on steep south (or southeastern or southwestern) slopes that are often undercut by streams. While other conditions for formation are known, this is the most characteristic ontogeny. Because the rate of formation is more analogous to geologic time versus a human lifetime, no new shale barrens can be realistically created or easily restored. A number of barrens have been lost to road building, borrow “pits” for surfacing dirt roads, dam building, development, and to a lesser degree agriculture. Some shale barrens may be decreasing in size due to woody encroachment. Invasions of exotic weeds and chemical drift are some other threats to biodiversity of these habitats.

The WVDNR is not aware of any quantitative studies of the loss of shale barren habitat but have documented loss of individual barrens and loss of natural processes on others. There is no question that the habitat has decreased in the last 100 years.

Limestone Barrens and Glades

Limestone Barrens and Glades are small patch woodlands and openings occurring on hot, dry aspects on limestone in the Ridge and Valley and possibly in the Western Allegheny Plateau physiographic provinces. The open stand structure is probably maintained by drought stress to trees. Dominant trees include Red Cedar, Eastern White Cedar, and Chinquapin Oak. The herb layer is usually diverse and often includes several rare plant species.

SPECIES IN GREATEST NEED OF CONSERVATION LIMESTONE BARRENS AND GLADES	
Scientific Name	Common Name
<i>Corynorhinus townsendii virginianus</i>	Virginia Big-Eared Bat
<i>Calephelis borealis</i>	Northern Metalmark
<i>Hesperia metea</i>	Cobweb Skipper
<i>Cicindela purpurea</i>	A Tiger Beetle

This rare small patch type is confined to xeric exposures on calcareous geologic strata that have always comprised only a small proportion of WV. At least one outstanding occurrence in the Ridge and Valley was destroyed by development of a limestone quarry. Most of the limestone and dolomite exposures in Jefferson and Greenbrier Counties have been converted to agriculture, quarries, or residential development. Although there is no way to determine how many limestone barrens and glades occurred in these counties prior to settlement, the recent discovery of a small remnant dolomite barren in Jefferson County surrounded by mines and corn fields suggests that at least some additional occurrences have been destroyed. The greatest concentration of these habitats is located on private and USFS lands in the Cave Mountain/Smoke Hole area which has recently seen conservation action to preserve and restore these habitats. The type is highly susceptible to invasions of exotic plants adapted to its high pH soils. It is likely to continue to decrease in area and quality.

Sandstone Glades

Sandstone Glades are small patch woodlands and openings occurring on hot, dry aspects on sandstone bedrock in the Ridge and Valley physiographic province. The open stand structure is probably maintained by drought stress to trees. Dominant trees include Red Cedar, Virginia Pine, Post Oak, Chestnut Oak and Pignut Hickory. The herb layer is usually dominated by sedges and warm season grasses.

SPECIES IN GREATEST NEED OF CONSERVATION SANDSTONE GLADES	
Scientific Name	Common Name
<i>Corynorhinus townsendii virginianus</i>	Virginia Big-Eared Bat
<i>Cicindela patruela</i>	A Tiger Beetle
<i>Hesperia metea</i>	Cobweb Skipper
<i>Cicindela purpurea</i>	A Tiger Beetle

This rare small patch habitat type is known from just a few occurrences. At least one of these is threatened by a planned road expansion which will decrease

the size and quality of the barren. Most known occurrences are near roads and other development and have seen a decrease in quality due to invasions of exotic weeds.

Heath/Grass Barrens and Balds

Heath/Grass Barrens and Balds are open dwarf shrub and grassland communities occurring at high elevations in the Allegheny Mountains and possibly in the Ridge and Valley physiographic province (e.g. Pike Knob). These may have been naturally maintained by wildfire and severe growing conditions, but their extent probably increased following settlement. Dominant shrubs include Blueberries, Huckleberries, Chokeberries and other Heath species. The dominant grasses are Allegheny Flyback and Hairgrass. Dwarfed forms of Red Spruce and a few deciduous trees may be scattered in this type.

SPECIES IN GREATEST NEED OF CONSERVATION HEATH/GRASS BARRENS AND BALDS	
Scientific Name	Common Name
<i>Bartramia longicauda</i>	Upland Sandpiper
<i>Circus cyaneus</i>	Northern Harrier
<i>Vermivora chrysoptera</i>	Golden-Winged Warbler
<i>Sylvilagus obscurus</i>	Appalachian Cottontail
<i>Ammodramus savannarum</i>	Grasshopper Sparrow
<i>Dolichonyx oryzivorus</i>	Bobolink
<i>Eremophila alpestris</i>	Horned Lark
<i>Poocetes gramineus</i>	Vesper Sparrow
<i>Colias interior pop 1</i>	Pink-Edged Sulphur (High Elevation)

Although the natural status of these barrens and balds has been debated, its occurrence prior to European settlement has been documented by early travel writings and illustrations (Porte Crayon). The type certainly expanded dramatically following the logging, burning, and grazing of the high elevation spruce forest. It now occurs in small to large patches. Many occurrences seem to be resistant to succession towards forest physiognomy, perhaps due to competition and dense shade from shrubs and/or cold microclimate, but the current trend is probably a slow decrease in this type's areal extent. Loss of some natural areas of this type along the Allegheny Front may be accelerated by fire suppression.

Rock Outcrops/Cliffs/Talus

Rock Outcrops/Cliffs/Talus are small patches of sparsely vegetated rock exposures that occur throughout the state. Many examples have all three components with a horizontal rock outcrop (or "pavement") above a cliff, above talus. These communities occur in all vegetation zones and are more

characterized by their topographical structure than by vegetation. Subtypes may be broken out based on rock type and aspect.

SPECIES IN GREATEST NEED OF CONSERVATION ROCK OUTCROPS/CLIFFS/TALUS	
Scientific Name	Common Name
<i>Corynorhinus townsendii virginianus</i>	Virginia Big-Eared Bat
<i>Microtus chrotorrhinus carolinensis</i>	Southern Rock Vole
<i>Myotis leibii</i>	Eastern Small-Footed Bat
<i>Neotoma magister</i>	Allegheny Woodrat
<i>Spilogale putorius</i>	Eastern Spotted Skunk
<i>Falco peregrinus</i>	Peregrine Falcon
<i>Aneides aeneus</i>	Green Salamander
<i>Cnemidophorus sexlineatus</i>	Eastern Six-Lined Racerunner
<i>Crotalus horridus</i>	Timber Rattlesnake
<i>Elaphe guttata guttata</i>	Cornsnake
<i>Virginia valeriae pulchra</i>	Mountain Earthsnake
<i>Triodopsis platysayoides</i>	Flat-Spired Three-Toothed Landsnail
<i>Sorex dispar</i>	Long-Tailed Shrew
<i>Coragyps atratus</i>	Black Vulture
<i>Petrochelidon pyrrhonota</i>	Cliff Swallow
<i>Eurycea lucifuga</i>	Cave Salamander
<i>Carphophis amoenus</i>	Wormsnake
<i>Eumeces anthracinus anthracinus</i>	Northern Coal Skink
<i>Eumeces laticeps</i>	Broad-Headed Skink
<i>Scincella lateralis</i>	Little Brown Skink
<i>Virginia valeriae valeriae</i>	Eastern Earthsnake
<i>Erynnis lucilius</i>	Columbine Duskywing

Areal extent of this rare type is likely not much changed since pre-settlement although a few occurrences have been flooded behind reservoirs. Some artificial examples may have been created by strip mining but their ecological value has not been documented. Although these features are fairly stable in extent, most are declining in quality due to trampling, disturbance by recreational visitation and close proximity of home development. High visitation also disturbs the vertebrate fauna which is an important component of the type's biodiversity.

Wetland Habitat Types

There are a number of wetland types in the state and all have experienced losses in both numbers and area. Four generalized types (High Allegheny Swamps, High Allegheny Bogs and Fens, Marshes and Wet Meadows and Forest Seeps and Vernal Pools) are discussed in greater detail following this summary.

Wetlands covered and estimated 134,000 acres in West Virginia in the late 1700s. Today there are between 57,000 and 102,000 acres based on two separate estimates. These figures represent a 24-53 percent loss from historical levels. The state has fewer wetlands than many states primarily because of its rugged topography; wetlands cover less than one percent of the land surface.

The majority of wetland loss comes from the filling of wetlands for development and secondarily from draining for agriculture. Regardless of the cause, these are extremely important habitats for both wildlife and plants and the conservation of all wetland types remains a high priority.

High Allegheny Swamp

High Allegheny Swamps are wetlands occurring at high elevations in the Allegheny Mountains, and are dominated by woody vegetation. Distinct subtypes include evergreen forests dominated by Red Spruce and Hemlock; deciduous and mixed forests and woodlands dominated by Yellow Birch, Black Ash, Balsam Fir, or Larch; and shrub swamps dominated by Speckled Alder, Deciduous Holly, Chokeberry, Glade St. John's Wort, or Pipestem.

SPECIES IN GREATEST NEED OF CONSERVATION HIGH ALLEGHENY SWAMP	
Scientific Name	Common Name
<i>Sorex palustris punctulatus</i>	Southern Water Shrew
<i>Aegolius acadicus</i>	Northern Saw-Whet Owl
<i>Asio flammeus</i>	Short-Eared Owl
<i>Asio otus</i>	Long-Eared Owl
<i>Contopus cooperi</i>	Olive-Sided Flycatcher
<i>Empidonax flaviventris</i>	Yellow-Bellied Flycatcher
<i>Vermivora chrysoptera</i>	Golden-Winged Warbler
<i>Vermivora ruficapilla</i>	Nashville Warbler
<i>Synaptomys cooperi</i>	Southern Bog Lemming
<i>Empidonax alnorum</i>	Alder Flycatcher
<i>Seiurus noveboracensis</i>	Northern Waterthrush

High Allegheny swamp forests were largely removed by logging at the turn of the twentieth century, and the fires and grazing which followed slowed or prevented their re-establishment. No large patches of swamp forest remain, but a few very small patches of old growth persist today. The original area of forested swamp has been largely converted to open wetlands, or drained for development or agricultural purposes. In some protected areas, the slow process of succession back to shrub swamp and eventually forested swamp is taking place. As vegetative structure (especially the development of drier hummock habitats above the wetter hollows) increases, the area of High Allegheny swamp within protected areas is increasing very slowly. However, development pressure and timbering in unprotected areas is probably resulting in an overall decline of the few remaining fragments this type. Shrub swamps may

have increased following the logging boom and the demise of the swamp forests. Some types of shrub swamp (e.g. pipestem and St. John's wort thickets) may have decreased with extirpation of the beaver and increased again after their reintroduction.

High Allegheny Bogs and Fens

High Allegheny Bogs and Fens are wetlands found at high elevations in the Allegheny Mountains and are dominated by herbs and bryophytes. Sedges often dominate the herb layer and individual species characterize several distinct subtypes. Sphagnum mosses may be dominant on acidic substrates. Soils are characterized by deep peat accumulations.

SPECIES IN GREATEST NEED OF CONSERVATION HIGH ALLEGHENY BOGS AND FENS	
Scientific Name	Common Name
<i>Aegolius acadicus</i>	Northern Saw-Whet Owl
<i>Asio flammeus</i>	Short-Eared Owl
<i>Botaurus lentiginosus</i>	American Bittern
<i>Circus cyaneus</i>	Northern Harrier
<i>Cistothorus platensis</i>	Sedge Wren
<i>Contopus cooperi</i>	Olive-Sided Flycatcher
<i>Empidonax flaviventris</i>	Yellow-Bellied Flycatcher
<i>Gallinago delicata</i>	Wilson's Snipe
<i>Vermivora ruficapilla</i>	Nashville Warbler
<i>Colias interior</i>	Pink-Edged Sulphur
<i>Empidonax alnorum</i>	Alder Flycatcher
<i>Seiurus noveboracensis</i>	Northern Waterthrush
<i>Ambystoma jeffersonianum</i>	Jefferson Salamander
<i>Pseudotriton ruber</i>	Northern Red Salamander
<i>Chlosyne harrisii</i>	Harris's Checkerspot
<i>Euphyes bimacula</i>	Two-Spotted Skipper
<i>Euphyes conspicua</i>	Black Dash
<i>Lycaena epixanthe</i>	Bog Copper
<i>Speyeria atlantis</i>	Atlantis Fritillary

This small patch type was heavily impacted by sedimentation and increased runoff from logging at the turn of the twentieth century. Beavers, which help to maintain the ponded conditions necessary for this habitat type, were essentially lost from West Virginia in the early 1900's along with the logging boom. During this period, down-cutting and drainage of some important bogs and fens, such as Cranberry Glades, was observed. Re-introduced in the 1930's, beavers are again widespread, and may maintain open wetland habitats in more areas than they originally did, since the area of open wetland has increased at the expense of forested swamp. High Allegheny bog and fens are well-represented in protected areas. Their areal coverage is declining slightly, mostly as a result of losses to coal mines.

Marshes and Wet Meadows

Marshes and Wet Meadow are herbaceous wetlands occurring on mineral soils in all parts of the state. Marshes generally maintain standing water throughout the year while Wet Meadows may have standing water in the spring and become fairly dry later in the year. Examples of Marshes include those along the Ohio River (particularly associated with embayments), marl Marshes in Jefferson County, alluvial Marshes, and early successional herbaceous communities in old beaver ponds. Wet Meadows are found statewide usually on cleared floodplains and occasionally over other poorly drained soils and are often kept open by grazing. Characteristic plants of Marshes include species of Burreeds, Cattails, Bulrushes, Rice Cutgrass and Bluejoint Reedgrass. Wet meadows often have Sedges, Rushes, Shrubby St. John's Wort and a host of other herbaceous species.

SPECIES IN GREATEST NEED OF CONSERVATION MARSHES AND WET MEADOWS	
Scientific Name	Common Name
<i>Reithrodontomys humulis</i>	Eastern Harvest Mouse
<i>Botaurus lentiginosus</i>	American Bittern
<i>Cistothorus palustris</i>	Marsh Wren
<i>Cistothorus platensis</i>	Sedge Wren
<i>Fulica americana</i>	American Coot
<i>Gallinago delicata</i>	Wilson's Snipe
<i>Ixobrychus exilis</i>	Least Bittern
<i>Nycticorax nycticorax</i>	Black-Crowned Night-Heron
<i>Porzana carolina</i>	Sora
<i>Rallus elegans</i>	King Rail
<i>Rallus limicola</i>	Virginia Rail
<i>Acris crepitans blanchardi</i>	Blanchard's Cricket Frog
<i>Ambystoma barbouri</i>	Streamside Salamander
<i>Pseudacris triseriata feriarum</i>	Upland Chorus Frog
<i>Pseudotriton montanus diastictus</i>	Midland Mud Salamander
<i>Scaphiopus holbrookii</i>	Eastern Spadefoot
<i>Clemmys guttata</i>	Spotted Turtle
<i>Boloria selene myrina</i>	Myrina Fritillary
<i>Chlosyne harrisii</i>	Harris's Checkerspot
<i>Euphyes bimacula</i>	Two-Spotted Skipper
<i>Lycaena hyllus</i>	Bronze Copper
<i>Speyeria atlantis</i>	Atlantis Fritillary
<i>Microtus ochrogaster</i>	Prairie Vole

This small patch type was heavily impacted by sedimentation and increased runoff from logging at the turn of the twentieth century. Its area has also decreased dramatically as a result of the channelization of rivers and streams, reducing the areal extent of active floodplains, oxbows, backchannels, overflow channels, and sloughs. Beavers, which help to maintain this habitat type, were largely removed from West Virginia in the early 1900's. Re-introduced in the 1930's, beavers are again widespread, but the streamside areas mentioned above may no longer be available to them. Marshes and wet

meadows thrive in protected areas, especially roadless areas, but continue to decrease in overall extent and quality due to development pressures and drainage infrastructure along streams.

Forest Seeps and Vernal Pools

Forest Seeps and Vernal Pools are comprised of small patch wetlands embedded in upland systems, usually forests, and occur in all sections of the state. Seeps are generally wet throughout much of the year and are mostly shaded by a tree canopy. Vernal Pools dry out later in the season; they often occur in old roadways and ditches.

SPECIES IN GREATEST NEED OF CONSERVATION FOREST SEEPS AND VERNAL POOLS	
Scientific Name	Common Name
<i>Corynorhinus townsendii virginianus</i>	Virginia Big-Eared Bat
<i>Myotis leibii</i>	Eastern Small-Footed Bat
<i>Ambystoma barbouri</i>	Streamside Salamander
<i>Ambystoma texanum</i>	Smallmouth Salamander
<i>Scaphiopus holbrookii</i>	Eastern Spadefoot
<i>Aeshna mutata</i>	Spatterdock Darner
<i>Lasiurus borealis</i>	Eastern Red Bat
<i>Ambystoma jeffersonianum</i>	Jefferson Salamander
<i>Rana pipiens</i>	Northern Leopard Frog

This very small patch type was heavily impacted by logging and fires at the turn of the twentieth century. A very few high quality remnant examples remain in old growth forests. This type is dependent on seepage traveling through the substrate of the forest (as contrasted with overland flow), and therefore very sensitive to the amount of humus and organic debris on the forest floor. Heavily degraded forest seeps are quite common, occupying drainages and areas of shallow slope throughout most forest types. Naturally occurring vernal pools are extremely rare in the state. This type is generally declining in area due to development pressures and continued timbering and removal of organic debris from the forest.

Floodplain Forests and Swamps

Floodplain Forests and Swamps are forests and shrublands occurring on depositional floodplains of rivers and large tributaries in all parts of the state, including wetlands and uplands. Wetlands include Pin Oak Swamps and Buttonbush Swamps. Floodplain Forests are more often not wetlands; characteristic trees in these types include Silver Maple, Sycamore, Green Ash and American Elm. These floodplain systems are dynamic but are more stable

than riverscour communities which may occur in adjacent positions closer to the stream channel.

SPECIES IN GREATEST NEED OF CONSERVATION FLOODPLAIN FORESTS AND SWAMPS	
Scientific Name	Common Name
<i>Corynorhinus townsendii virginianus</i>	Virginia Big-Eared Bat
<i>Myotis leibii</i>	Eastern Small-Footed Bat
<i>Reithrodontomys humulis</i>	Eastern Harvest Mouse
<i>Sorex palustris punctulatus</i>	Southern Water Shrew
<i>Botaurus lentiginosus</i>	American Bittern
<i>Cistothorus palustris</i>	Marsh Wren
<i>Gallinula chloropus</i>	Common Moorhen
<i>Haliaeetus leucocephalus</i>	Bald Eagle
<i>Ixobrychus exilis</i>	Least Bittern
<i>Nycticorax nycticorax</i>	Black-Crowned Night-Heron
<i>Porzana carolina</i>	Sora
<i>Rallus elegans</i>	King Rail
<i>Rallus limicola</i>	Virginia Rail
<i>Seiurus motacilla</i>	Louisiana Waterthrush
<i>Ambystoma barbouri</i>	Streamside Salamander
<i>Ambystoma texanum</i>	Smallmouth Salamander
<i>Scaphiopus holbrookii</i>	Eastern Spadefoot
<i>Clemmys insculpta</i>	Wood Turtle
<i>Aeshna mutata</i>	Spatterdock Darner

This small to large patch type was heavily impacted by logging at the turn of the twentieth century and most occurrences were converted to and remain in agriculture or other development. Floodplain habitat area has also decreased significantly as a result of stream channelization (reducing the extent of active floodplains) and restriction of naturally fluctuating flows along rivers by flood control projects. Most floodplains are privately owned and development pressure at these sites has been and continues to be intense. No original stands are known. Only a tiny fraction of second-growth floodplain forest and swamp habitat persists today, and this continues to decrease.

Riverscour Communities

Riverscour Communities contain vegetated and unvegetated habitat and are found along high energy rivers and streams in all parts of the state. These communities include herbaceous and shrub dominated vegetation, open woodlands, and bare cobble and sand. The open stand structure is maintained by frequent high energy floods. Distinct subtypes include prairies dominated by warm season grasses, woodlands dominated by battered River Birch and Sycamore, twisted Sedge beds along tributaries and high elevation ice scour herbaceous communities.

SPECIES IN GREATEST NEED OF CONSERVATION RIVERSCOUR COMMUNITIES	
Scientific Name	Common Name
<i>Cicindela ancocisconensis</i>	A Tiger Beetle
<i>Cicindela marginipennis</i>	Cobblestone Tiger Beetle
<i>Synaptomys cooperi</i>	Southern Bog Lemming
<i>Zapus hudsonius</i>	Meadow Jumping Mouse
<i>Actitis macularia</i>	Spotted Sandpiper
<i>Cicindela cuprascens</i>	A Tiger Beetle
<i>Cicindela formosa generosa</i>	A Tiger Beetle
<i>Cicindela hirticollis</i>	Beach-Dune Tiger Beetle
<i>Cicindela scutellaris</i>	A Tiger Beetle
<i>Megacephala virginica</i>	Virginia Big-Headed Tiger Beetle

This linear habitat is confined to riverside areas impacted by frequent high energy floods. The type has decreased in area behind dams, which have also altered the flooding regimes downstream. Miles of habitat have also been degraded by riverside roads and railroads. Since the type is defined by its disturbance regime, its occurrences have likely moved in response to changing flooding regimes. Individual patches are likely to be relatively ephemeral. The impact of altered flooding regimes on habitat composition and quality are not known. One exemplary occurrence was degraded by a prescribed burn which was intended to mimic flooding disturbance. Some occurrences are threatened by invasions of exotic weeds, particularly Japanese knotweed.

Successional Conifer Forests and Woodlands

Successional Conifer Forests and Woodlands are upland evergreen forests and woodlands occurring throughout the state, which develop after clearing or other catastrophic disturbances (e.g. fire). These forests are relatively short lived and, barring repeated disturbance, will succeed to other forest types. They are often monocultures, the dominant species depending, in part, on rock type and soil moisture. Distinct subtypes include White Pine in more mesic habitats, Virginia Pine on sandstone and shale, Pitch Pine on sandstone, and Red Cedar on limestone. Understories are typically sparse due to heavy shading.

SPECIES IN GREATEST NEED OF CONSERVATION Successional Conifer Forests and Woodlands	
Scientific Name	Common Name
<i>Vermivora pinus</i>	Blue-Winged Warbler
<i>Vermivora chrysoptera</i>	Golden-Winged Warbler
<i>Dendroica discolor</i>	Prairie Warbler
<i>Calephelis borealis</i>	Northern Metalmark
<i>Erynnis martialis</i>	Mottled Duskywing
<i>Cryptotis parva</i>	Least Shrew

These types increase and decrease in response to forest management and abandonment of agricultural and mining lands.

Successional Deciduous Forest

Successional Deciduous Forests are upland deciduous forests occurring throughout the state, which develop after clearing or other catastrophic disturbances (e.g. fire). These are often monocultures, the dominant species depending on elevation and moisture regime. Distinct subtypes include Quaking Aspen at high elevations, and Tulip Poplar and Black Locust at lower and middle elevations.

SPECIES IN GREATEST NEED OF CONSERVATION Successional Deciduous Forests	
Scientific Name	Common Name
<i>Myotis sodalist</i>	Indiana Bat
<i>Neotoma magister</i>	Allegheny Woodrat
<i>Caprimulgus vociferus</i>	Whip-Poor-Will
<i>Dendroica discolor</i>	Prairie Warbler
<i>Hylocichla mustelina</i>	Wood Thrush
<i>Spizella pusilla</i>	Field Sparrow
<i>Thryomanes bewickii altus</i>	Appalachian Bewick's Wren
<i>Vermivora chrysoptera</i>	Golden-Winged Warbler
<i>Vermivora pinus</i>	Blue-Winged Warbler
<i>Aneides aeneus</i>	Green Salamander
<i>Elaphe guttata guttata</i>	Cornsnake
<i>Calephelis borealis</i>	Northern Metalmark
<i>Erynnis martialis</i>	Mottled Duskywing
<i>Ochrotomys nuttallii</i>	Golden Mouse
<i>Sylvilagus obscurus</i>	Appalachian Cottontail
<i>Ambystoma jeffersonianum</i>	Jefferson Salamander
<i>Carphophis amoenus</i>	Wormsnake
<i>Eumeces anthracinus anthracinus</i>	Northern Coal Skink
<i>Opheodrys aestivus</i>	Rough Greensnake
<i>Scincella lateralis</i>	Little Brown Skink
<i>Cylopsis gemma</i>	Gemmed Satyr
<i>Parrhasius m-album</i>	White-M Hairstreak
<i>Phyciodes cocyta</i>	Northern Crescent
<i>Polygonia progne</i>	Gray Comma

These types increase and decrease in response to forest management and abandonment of agricultural and mining lands.

Old Fields

Old Fields contain early successional vegetation dominated by herbs and shrubs, which develop on abandoned farmlands, mines and other cleared lands.

There is often a large component of exotic species, especially forage grasses and legumes. Native tall Goldenrods and Asters are often conspicuous later in the growing season.

SPECIES IN GREATEST NEED OF CONSERVATION Old Fields	
Scientific Name	Common Name
<i>Corynorhinus townsendii virginianus</i>	Virginia Big-Eared Bat
<i>Reithrodontomys humulis</i>	Eastern Harvest Mouse
<i>Spilogale putorius</i>	Eastern Spotted Skunk
<i>Aimophila aestivalis</i>	Bachman's Sparrow
<i>Ammodramus henslowii</i>	Henslow's Sparrow
<i>Bartramia longicauda</i>	Upland Sandpiper
<i>Caprimulgus vociferus</i>	Whip-Poor-Will
<i>Chondestes grammacus</i>	Lark Sparrow
<i>Dendroica discolor</i>	Prairie Warbler
<i>Lanius ludovicianus migrans</i>	Migrant Loggerhead Shrike
<i>Spizella pusilla</i>	Field Sparrow
<i>Vermivora chrysoptera</i>	Golden-Winged Warbler
<i>Vermivora pinus</i>	Blue-Winged Warbler
<i>Elaphe guttata guttata</i>	Cornsnake
<i>Virginia valeriae pulchra</i>	Mountain Earthsnake
<i>Callophrys polios</i>	Frosted Elfin
<i>Pygrus Wyandot</i>	Grizzled Skipper
<i>Speyeria idalia</i>	Regal Fritillary
<i>Cryptotis parva</i>	Least Shrew
<i>Microtus ochrogaster</i>	Prairie Vole
<i>Ochrotomys nuttallii</i>	Golden Mouse
<i>Zapus hudsonius</i>	Meadow Jumping Mouse
<i>Ammodramus savannarum</i>	Grasshopper Sparrow
<i>Colinus virginianus</i>	Northern Bobwhite
<i>Dolichonyx oryzivorus</i>	Bobolink
<i>Eremophila alpestris</i>	Horned Lark
<i>Melanerpes erythrocephalus</i>	Red-Headed Woodpecker
<i>Petrochelidon pyrrhonota</i>	Cliff Swallow
<i>Pooecetes gramineus</i>	Vesper Sparrow
<i>Spiza americana</i>	Dickcissel
<i>Eumeces anthracinus anthracinus</i>	Northern Coal Skink
<i>Eumeces laticeps</i>	Broad-Headed Skink
<i>Heterodon platirhinos</i>	Eastern Hog-Nosed Snake
<i>Opheodrys aestivus</i>	Rough Greensnake
<i>Scincella lateralis</i>	Little Brown Skink
<i>Virginia valeriae valeriae</i>	Eastern Earthsnake
<i>Atrytonopsis hianna</i>	Dusted Skipper
<i>Hesperia metea</i>	Cobweb Skipper
<i>Speyeria atlantis</i>	Atlantis Fritillary
<i>Cicindela cirsitans</i>	A Tiger Beetle

Old Fields are by definition a successional small patch type falling between anthropogenic grasslands/croplands and eventual reversion to a variety of natural forest types. Old fields are increasing in some cases where former

farmland has been abandoned, but in general this type is decreasing as it is converted to residential use or as natural succession moves toward forest re-establishment.

Anthropogenic Grassland

Anthropogenic grasslands are maintained by human activities, usually by annual or semi-annual haying, mowing, grazing, or burning. This habitat includes grasslands dominated by cool season grasses (mostly introduced species), and grasslands dominated by warm season grasses (mostly native species).

SPECIES IN GREATEST NEED OF CONSERVATION Anthropogenic Grassland	
Scientific Name	Common Name
<i>Corynorhinus townsendii virginianus</i>	Virginia Big-Eared Bat
<i>Reithrodontomys humulis</i>	Eastern Harvest Mouse
<i>Ammodramus henslowii</i>	Henslow's Sparrow
<i>Asio flammeus</i>	Short-Eared Owl
<i>Bartramia longicauda</i>	Upland Sandpiper
<i>Chondestes grammacus</i>	Lark Sparrow
<i>Spizella pusilla</i>	Field Sparrow
<i>Tyto alba</i>	Barn Owl
<i>Cicindela patruela</i>	A Tiger Beetle
<i>Callophrys irus</i>	Frosted Elfin
<i>Speyeria idalia</i>	Regal Fritillary
<i>Staphylus hayhurstii</i>	Hayhurst's Scallopwing
<i>Microtus ochrogaster</i>	Prairie Vole
<i>Ochrotomys nuttallii</i>	Golden Mouse
<i>Ammodramus savannarum</i>	Grasshopper Sparrow
<i>Chordeiles minor</i>	Common Nighthawk
<i>Colinus virginianus</i>	Northern Bobwhite
<i>Dolichonyx oryzivorus</i>	Bobolink
<i>Eremophila alpestris</i>	Horned Lark
<i>Melanerpes erythrocephalus</i>	Red-Headed Woodpecker
<i>Petrochelidon pyrrhonota</i>	Cliff Swallow
<i>Poocetes gramineus</i>	Vesper Sparrow
<i>Spiza americana</i>	Dickcissel
<i>Atrytonopsis hianna</i>	Dusted Skipper
<i>Erora laeta</i>	Early Hairstreak
<i>Hesperia metea</i>	Cobweb Skipper
<i>Parrhasius m-album</i>	White-M Hairstreak
<i>Speyeria atlantis</i>	Atlantis Fritillary
<i>Cicindela cursitans</i>	A Tiger Beetle
<i>Cicindela purpurea</i>	A Tiger Beetle
<i>Cicindela splendida</i>	A Tiger Beetle

This small patch non-natural type expanded greatly during the turn of the twentieth century logging and subsequent increase in fires, cattle grazing, and human settlement. It probably reached a maximum in the 1930's, and since that

time has been slowly decreasing in size as some farmlands are converted to residential use or abandoned to follow paths of natural succession toward natural habitat types.

Subterranean Habitats

This class includes any underground areas used by species as habitat. In West Virginia there are many hundreds of limestone caves and a small number of sandstone caves. In addition, a number of abandoned deep mines have openings allowing colonization by some cave dwellers such as bats and salamanders.

The caves of the state harbor an incredible array of invertebrate species, many of which are restricted to only a few caves. Eighty-seven globally rare invertebrate SGNC are listed in the introduction to the Cave Invertebrate Fact Sheets found in Section 5-F of this plan. In addition, a number of vertebrate SGNC depend on caves for either part or all of their habitat requirements.

Subgroup	Scientific Name	Common Name	Global Rank	State Rank
Mammal	<i>Myotis sodalist</i>	Indiana Bat	G2	S1
Mammal	<i>Corynorhinus rafinesquii</i>	Eastern Big-eared Bat	G3G4	S1
Mammal	<i>Myotis leibii</i>	Eastern Small-footed Bat	G3	S1
Mammal	<i>Corynorhinus townsendii virginianus</i>	Virginia Big-eared Bat	G4T2	S2
Mammal	<i>Neotoma magister</i>	Allegheny Woodrat	G3G4	S3
Amphibian	<i>Eurycea lucifuga</i>	Cave Salamander	G5	S3
Amphibian	<i>Gyrinophilus subterraneus</i>	WV Spring Salamander	G1Q	S1
Crayfish	<i>Cambarus nerterius</i>	An Underground Crayfish	G2G3	S1

Caves have often been looked at as a threat to livestock and people and a number of entrances, particularly in sink holes, have been filled either intentionally or as a convenient place to dispose of household and other trash. Some caves have been lost to quarrying and the hydrologic regime altered in others. Many cave invertebrates are either aquatic or rely on organic matter carried into the cave by hydrologic forces (streams, ground water or surface flow). Aquifers providing caves with water are poorly documented and once identified will require landscape scale planning to ameliorate any negative influences. Many caves have been gated to prevent the entry of recreational (or other) users to prevent the disruption of breeding or hibernating SGNC bats. Significant losses of some bat species have occurred in the past and many gated caves show a relatively rapid positive population response to the decreased disturbance during critical periods. There has been a direct loss of caves in the

state and considerable alteration to the habitat in others. Assessing the presence of SGNC species and their requirements is ongoing but considerable work is yet required for this nationally significant habitat type in the state.

Some cave dwelling species are found in aquatic systems within caves and others are terrestrial. No classification system is currently being used to separate habitat within caves and such a system may not be needed. The habitat class itself may be adequate, since essentially all conservation of cave species will likely be done on a cave by cave basis (sites) rather than trying to conserve a number of caves across the range of caves occurring in the state (habitat). The conservation of caves with aquatic systems necessitates management planning for the entire watershed or underground aquifer that feeds each system.

Aquatic Habitats

West Virginia has few natural ponds and only a few aquatic SGNC utilize slack water habitats. Consequently the majority of effort must be placed on the streams of the state. To determine which streams harbor SGNC, and what stretches (reaches) of individual streams provide needed habitat, is a crucial question. No stream habitat classification exists that delineates stream reaches to a level adequate to describe where SGNC may occur throughout the state's waters. There are currently at least 206 aquatic SGNC on the list. See the introduction to various species group fact sheets (Section 5-F of the plan) for listings of the Fishes, Crayfishes, Dragonflies, Damselflies, Mussels and Stoneflies that are dependent on aquatic systems.

There have been significant changes to aquatic (stream) habitats across the state over the last two centuries. All the major rivers have been dammed to promote commerce through the shipping of goods by barge resulting in significant changes in flow regimes and both substrate and riparian alterations. The Greenbrier River is the only larger free-flowing river in the state. Declining populations of many fishes and mollusks have been due to the alterations resulting from changes wrought by the damming. Of the estimated 2,000 miles of brook trout streams in the state, 500 miles or 25 % have been lost to habitat alteration largely a result of atmospheric acid deposition. A 1995 EPA fisheries study estimated that 1,100 miles of West Virginia streams have been impacted by acid mine drainage.

Sedimentation is another leading cause of loss of aquatic habitat quality in the state. There are no readily available statistics on the extent of stream degradation but it has been observed to be a significant statewide problem. Many small intermittent and first order streams have been lost to mountain top removal surface mining techniques used primarily in the southwestern counties of the state. A recent (court mandated) study was required to assess this habitat loss. The streams of West Virginia have been degraded by a number of stressors for a very long time and considerable resources and time will be required to assess the SGNC that have been impacted and determine the best avenues to conserve them.

The WV Division of Natural Resources has initiated a project to classify West Virginia streams. The Stream Classification System will incorporate two primary components. One will be an abiotic description derived from a standardized list of parameters and the other component will be a biological assessment, composed of the fish and invertebrate communities present. The ultimate goal will be to have a descriptive system with which any particular stream reach can be assigned to a specific habitat type. Once the habitat requirements for each SGNC have been determined, a mapping of all potential reaches that a particular species may inhabit can then be constructed. Also, reaches, based on their abiotic components, which should provide habitat but do not can be analyzed to find out where the problem lies. This in turn will lead to a plan to ameliorate the issues causing the problem that has eliminated the species from that reach.

What is proposed is quite rigorous and will require the cooperation of many agencies and researchers. The final product will likely take longer than the present planning period. Problems that are identified during the planning period will be assessed to determine what conservation actions are appropriate and possible. The conservation of aquatic habitat is problematic. Any such effort requires a plan at the watershed level to protect water quality, quantity, and stream geomorphology. This will be quite a challenge as the state pursues its classification and conservation agenda. Initial actions should include:

1. The development of a strategy to pursue the Classification Project, including getting buy-in by a variety of partners.
2. Formulation of a standardized methodology for the gathering of the abiotic and biotic components of the system.
3. Creating and centralizing a database for the collected data.
4. Collecting legacy data and new survey data.
5. Conduct annual meetings with partners to assess where the project stands and in what direction it needs to move over the next year.

Summary

The table at the end of this section of the plan summarizes trends in habitat abundance by type. A decision must be made as to which habitats need conservation at the system level. Some systems like the Northern Hardwood Forest and Oak/Hickory Forest are widespread and while they harbor SGNC, they are not in immediate jeopardy themselves. On the other hand the Red Spruce Forest system has several species that are dependent on this type and essentially restricted to it within the state. Examples are the Cheat Mountain Salamander, Virginia Northern Flying Squirrel, Red Crossbills, Northern Saw-

whet Owl and breeding populations of the Pine Siskin. While these may occupy certain microclimates of the forest, there are scattered populations throughout the system. The area occupied by the system itself has, by some accounts, been diminished by over 80 percent from historical levels. In order to conserve the species the system itself needs to be conserved.

The following list contains those systems, chosen to focus upon for the first two year plan period, which are thought to be in need of management because of a narrow distribution, substantial decrease in quantity or quality, or because of some extrinsic threat or threats.

- Red Spruce Forests
- Calcareous Forests and Woodlands
- Shale Barrens
- Limestone Barrens and Glades
- Sandstone Glades
- Hemlock Forests
- All Wetland Types
- Floodplain Forests and Swamps
- Rock Outcrop/Cliffs/Talus
- Caves and Karst
- All Aquatic Systems

Within this planning period, the stability and health of these systems needs to be assessed. Priorities for initial conservation actions need to be determined using a decision matrix that incorporates among other factors: the presence of SGNC, threats, opportunities, etc. In addition, work on quantifying habitat types must continue since it is in a relatively nascent stage in West Virginia.

Researchers and managers in the state must keep an open mind to new ways to quantify habitat until a comprehensive system exists that will be able to determine what the basic measurable parameters are for a particular species habitat. Then an analysis must be made to assess how each habitat fits into a larger landscape picture and what are the natural processes that maintain the landscapes and consequently the habitat systems found there.

Probable past, present, and future trends in aerial coverage of WV ecological systems. Best estimates from expert review						
Type	Logging boom	Post boom	Current status	Current compared to original	Future projection	Conservation priority
Old Fields	increased	increased	decreasing	much more	decreasing	very low
Anthropogenic Grassland	increased	increased	decreasing	much more	decreasing	very low
Caves/Karst	decrease	increased	decreasing	less	decreasing	high
Aquatic Systems (health)	decreased	increased	increasing	less	stable	high
Red spruce forests	decreased	increased	increasing	much less	increasing	high
Northern Hardwoods Forest	decreased	increased	decreasing	more	decreasing	low
Hemlock forests	decreased	increased	decreasing	less	Extirpation?	very high
Mixed mesophytic forests	decreased	increased	increasing	less	increasing	medium
Calcareous Forest and Woodland	decreased	decreased	decreasing	much less	decreasing	very high
Oak/Hickory and Dry/Mesic Oak Forest	decreased	increased	decreasing	less	decreasing	medium
Oak/Heath and Oak/White Pine Forests	decreased	increased	decreasing	more	decreasing	medium
Dry Rocky Pine/Oak Forests and Woodlands	decreased	increased	decreasing	more	decreasing	medium
Hill Country Deciduous Forests	decreased	decreased	increasing	much less	increasing	medium
Shale Barrens	increased	increased	stable	about same	stable	medium
Limestone Barrens and Glades	increased	decreased	decreasing	less	decreasing	very high
Sandstone Glades	stable	stable	decreasing	less	decreasing	High
Heath/Grass Barrens and Balds	increased	increased	decreasing	much more	decreasing	Low
Rock Outcrops/Cliffs/Talus	stable	decreased	stable	about same	stable	High
High Allegheny Swamp	decreased	increased	stable	less	decreasing	High
High Allegheny Bogs and Fens	decreased	increased	stable	more	stable	Medium
Forest Seeps and Vernal Pools	decreased	increased	decreasing	less	decreasing	High
Floodplain Forests and Swamps	decreased	decreased	decreasing	much less	decreasing	very high
Riverscour Communities	stable	decreased	stable	about same	stable	Medium
Marshes and Wet Meadows	increased	decreased	decreasing	less	decreasing	High
Successional Conifer Forests and Woodlands	increased	increased	decreasing	much more	increasing	very low
Successional Deciduous Forest	increased	increased	decreasing	much more	increasing	very low

Section 5. What Should We Do?

Overview

This section of the plan identifies actions that should be taken to conserve fish and wildlife species and their habitats in West Virginia. At the outset, it is important to recognize that, for the hundreds of species not hunted or fished for, vital conservation information on their natural history, abundance and distribution in West Virginia is lacking or seriously incomplete. Before Congress established the State Wildlife Grants program in 2001, there was little funding, and thus staff, available to the states for even a basic inventory of these species and their habitats. A high priority must therefore be generally assigned to obtaining and managing better data for the conservation of these species and habitats.

That said, conservation action cannot responsibly be delayed until the day the datasets are complete, for they never will be. We are, after all, measuring a dynamic resource on a changing landscape. So the most prudent course of action is to simultaneously invest in both areas, that is, to get better data while taking effective conservation action. That is the course this plan proscribes.

The species and species group fact sheets that comprise Section 5-E of this plan take that process to the level of individual species or groups of species. The same is true for the at-risk habitat fact sheets in Section 5-F. For each, needs are identified for surveys, inventories and conservation actions. To the extent possible, those needs have been prioritized. These fact sheets are the core element of this plan. Each is designed to function as a mini-plan within the larger comprehensive plan. This approach will facilitate frequent updates and revisions as better data are obtained and conservation actions are implemented and assessed.

Section 5-A. Potential Conservation Actions

Introduction

There are a number of actions that may be taken to address conservation issues confronting fish and wildlife species. For the purposes of this plan, these are collectively termed *conservation actions*. The Conservation Fact Sheets included in this plan for the species in greatest need of conservation make direct reference to the following array of conservation actions, each of which is discussed in general terms below.

Protecting Key Habitats

When habitats for fish and wildlife species cannot be otherwise adequately protected, public purchase of key tracts of land containing those habitats may be the most appropriate conservation action for those species. If the target species and habitats are extremely restricted, *fee simple purchase* from willing sellers may be the best approach. It is also typically the most expensive of the acquisition mechanisms. More commonly, it is anticipated that implementation of this plan will feature habitat conservation through public purchase or voluntary donations of *conservation easements*. Conservation easements are permanent restrictions on the future use and development of private property. In return for monetary compensation or tax deductions, landowners voluntarily agree to place the easement restrictions in property deeds. The easement follows the chain of title in perpetuity and is thus binding on all future holders of deeds containing such easements. Conservation easements initially cost much less to acquire than property in fee simple, but additional expense must be anticipated to defend the easement conditions over the years with successive deedholders. With both forms of protection, available funding will limit such actions to high priority sites.

Legislation and Regulation

If the conservation issues confronting species and their habitats occur over an area too extensive to be addressed through purchase of key habitats, then protective legislation or regulation may be an effective conservation action. Examples would include limiting the collection of rare species or protecting habitat from damaging practices such as stream channel dredging. In such cases, legislation may be passed or regulations approved by legislative bodies, typically only after adequate public comment and review.

Coordination

Environmental coordination is an effective and efficient conservation action. There are an array of existing state and federal laws that restrict certain private and public sector activities that can affect fish and wildlife species. Examples of these include the federal Clean Water Act (protecting wetlands and

water quality) and the Fish and Wildlife Coordination Act (requiring consideration of wildlife impacts from federal projects). Through implementation of these provisions, degradation of fish and wildlife habitat can be avoided or subsequently mitigated when projects are reviewed by state and federal agencies coordinating with the private sector prior to project implementation.

Restoration of Fish and Wildlife Habitat

When fish and wildlife habitats have been degraded as a result of past activities, active restoration of those habitats can be an important conservation action. Examples of restoration actions would include fencing and planting streambanks to restore riparian areas, removal of invasive species, and stream liming to neutralize acid precipitation. Private landowners, public land managers, watershed organizations, and other conservation groups are often important partners in such restoration projects.

Propagation of Fish and Wildlife Species

When local populations do not exist to repopulate restored habitats, it may be necessary to propagate fish and wildlife species for active reintroduction into these habitats. An example would include mussel propagation to reestablish mussel beds destroyed by a chemical spill or other actions.

Management

Active management of fish and wildlife species and their habitats is a key conservation action. Habitats are dynamic entities and may require periodic management actions, e.g., vegetation management, prescribed fire, or gating of caves, to maintain optimum conditions for fish and wildlife populations.

Education

Sometimes, fish and wildlife species are threatened by simple public ignorance of the role these species play in ecosystems and/or the negative impacts of human activities on those species. In such instances, public information campaigns can be an important conservation action. If those campaigns are effective, they may reduce the need for more active conservation measures, e.g., acquisition or legislation. In other instances, information and education efforts may be required to generate public support for other conservation actions. In either case, education is one of the most important actions that will be taken to address issues confronting Species in Need of Conservation.

Section 5-B. Data Management

Why do we need data? What is the goal?

Data are central to all decision-making processes. We base our actions on what information we have at hand. Have you ever found yourself saying “If I knew more about it, I could give you a better answer.” In the context of this plan, data are a necessary part of identifying SGNC. The WVDNR’s principal source of these data is the agency’s Biological and Conservation Database (BCD). The goal of gathering BCD data is to determine the distribution and status of species needing our assistance to continue to be part of the state’s natural history and to guide specific actions required to allow for their continued existence.

What types of data do we need to make good decisions?

We need data on all aspects of an animal’s distribution, life history, threats to their habitat, and how well they are doing over time (monitoring). From these data we can determine which species we are going to try to assist, what actions we need to do to assist them, and how best to monitor their populations to determine if we are being successful in our mission.

Who collects the data?

Many people across the state and visiting researchers work to gather necessary data. The state’s colleges and universities, natural history clubs, government agencies, and non-governmental organizations all have people that collect a variety of data that, when aggregated, give us a broad understanding of which species are declining and what to do to help bolster their populations.

No single entity can collect all the required data on which to base important and sometimes costly conservation measures. Collection of conservation data is truly an all inclusive activity, needing backyard nature lovers, university researchers, professionals from other agencies, personnel from non-governmental organizations and WVDNR biologists working together to accomplish the task.

How should the data be collected?

Data must be collected in a uniform manner so that it is additive to the existing data. Data collected in a haphazard manner have only limited application despite the effort exerted to gather it. In recent years, increased attention has been directed toward standardized data collection protocols, but much more remains to be done in this area.

What entity should be in charge of aggregating and disseminating data on SGNC?

An important question is who or what organization is best suited to aggregate and disseminate data on SGNC? To answer this question several criteria should be considered. What is the likely longevity of the entity in question? What entity has the resources to aggregate data and maintain access to it? What entity is mandated by law to manage fish and wildlife resources? What entity has a statewide presence?

Government is the most stable entity and one that has both the authority and mandate, on behalf of the people of the state, to manage the resource. Consequently, the government agency charged with management of the state's fish and wildlife resources, the WVDNR, should also be the agency responsible for managing data relevant to those resources. A data management plan should thus be built on the assumption that the WVDNR is the logical entity to accumulate and manage the disbursement of publicly available data for SGNC.

How should we organize data to be most useful?

So how do we make data from a variety of sources available to all users so that we can make informed decisions regarding the state's wildlife in need of conservation? There must be a mechanism in place to compile and authenticate data, and make data available in a searchable fashion. There are many types and forms of data that have been collected in the state over the last century and longer. This previously gathered (legacy) data, as well as data collected in the future, must be gathered and entered into appropriately designed databases. To the extent possible, data should be geo-referenced to facilitate geographic searches and analyzes. Having a search engine that can do a relational query across many databases, based on a variety of input factors, will save time and resources. This approach will allow everyone from school children to university researchers to use the system to maximum advantage. Documentation of species distribution and status over time gives an important indication as to which species are in need of conservation. Taking a snap shot in time is not adequate to perform such an assessment.

How should we share data so that they are most useful?

Data that are not available are essentially useless. This concept is the main driver that has given rise to the notion of scientific publication over the centuries. We must share data to be successful in conserving the state's fauna. The question is how do we do this in the way that makes the most sense?

The advent of the internet has given all of us a venue for sharing. The standardization of databases and sharing data over the internet is the best strategy to maximize the utility of data. For this to be an effective strategy, people

must be willing to freely share their data and get it into institutional memory. Privately hoarded data are of no real value to conservation.

A web-based system that allows for a search of as many databases as possible is likely to be the most efficient approach to data management. Having data readily available will save countless hours by researchers, planners and land conservationists. Considerable time is now being expended by a variety of organizations and individuals because of a lack of centralized data access. However, legislation to protect Species in Greatest Need of Conservation sites from Freedom of Information Act requests must be passed.

Are the data currently being collected adequate to make good decisions about SGNC?

Not really. The existing data on the distribution and status of SGNC are, in many cases, quite old and there are major portions of the state that have not been adequately surveyed for many species. That is why most of the species fact sheets that follow emphasize the need for additional surveys and inventories. Because these data have been and are being collected by multiple individuals, agencies and other entities, there is an urgent need for the development and standardization of data collection protocols.

In addition, the management of data must also be improved and better standardized. There is a substantial backlog of previously collected data that has yet to be input into databases. The structure of the databases themselves is quite dated, e.g., the WVDNR's existing BCD software dates from the mid-1980's. Finally, the degree to which current databases can smoothly interact with one another is an impediment to good analyses and sound decision-making.

What steps need to be taken to better collect and manage data for SGNC?

The WVDNR will develop and implement a Data Management Plan to provide an integrated, web-based resource that will:

- 1) Facilitate and access to fish and wildlife databases
- 2) Link to natural resource information sites
- 3) Act as a state-level coordinating site for natural resource data standards.

The successful development and implementation of a WVDNR Data Management Plan will help standardize, locate, evaluate, and access biological data and information from a distributed network of cooperating data and information sources. The repository will also provide access to software tools to use in analyzing, integrating, and applying biological data.

Key issues that will be addressed in the Data Management Plan include the following:

- 1) Necessary software and hardware upgrades
- 2) Development and implementation of data collection and management standards, especially required metadata
- 3) Data security and archiving protocols
- 4) Web-based access to non-sensitive data
- 5) Establishment of a Data Advisory Team to collaboratively develop the data management system with internal and external users
- 6) Required staff and budget

Development and implementation of a Data Management Plan by the WVDNR has top-level support within the agency. Agency administrators, data managers, and biologists understand that the process of assessing the status of and monitoring the management of SGNC is a data-driven process and that the data must be improved. The discipline that will be required within the WVDNR for implementation of data standards has been previously manifested for employee data management systems. A similar level of discipline will be required for implementation of the Data Management Plan. This is understood and accepted as the investment that must be made to efficiently develop better plans and make better decisions regarding the future management of SGNC.

Section 5-C. Education

Overview

Comprehensive wildlife education and information programs promote a stewardship ethic toward wildlife and the environment and increase public understanding of issues affecting wildlife, especially how human actions affect wildlife and wildlife habitat. Such programs increase public awareness of the opportunities that exist for enjoying wildlife and promote ethical, responsible use and enjoyment of our state's wildlife and botanical resources. Conservation education can inform decision makers, landowners and the general public on the potential impacts of their actions on wildlife and its habitat and how to minimize or mitigate those impacts. In terms of the Wildlife Resources Section (WRS), conservation education and the resulting outreach to children, adults, teachers, landowners, user groups and other natural resource stakeholders will create strong supporters for broader agency goals.

Education is critical to the conservation of Species in Greatest Need of Conservation (SGNC). It must be communicated to the public why these species are important in the ecosystem, and what methods can be used to keep populations of SGNC stable. With greater understanding the public can influence policy decisions as well as support increased funding for conservation initiatives. It is thus imperative that the WRS keep the public informed as to its programs and the reasons behind these programs.

However, with the increasing urbanization of our society, more and more of the general public are becoming disconnected from the resource. Due to federal and state educational mandates, conservation education is no longer a priority in most county school systems. Yet, in a 1998 survey conducted by Responsive Management, Inc. three-quarters of West Virginia respondents felt that much more effort should be spent on educating youngsters about fish and wildlife conservation. Half of the respondents felt that much more effort should be spent on informing the public about West Virginia's fish and wildlife. Currently about 3 percent of the Wildlife Resource Section's (WRS) budget is spent on conservation education, and there is only one employee dedicated to this program. Biologists and managers give educational presentations as time allows, but there is no central coordination. This is primarily due to a lack of federal funding for both wildlife education and recreation involving SGNC.

Education is deemed critical at the national level also. The International Association of Fish and Wildlife Agencies (IAFWA) has identified conservation education as a national priority. The IAFWA's Education, Outreach Diversity Committee has approved (on 3-18-05) the following goals :

- Elevate the value of conservation education. Conservation education will be recognized as a mission-critical management

component of every fish and wildlife agency. An educated, informed and involved citizenry is critical for effective management and protection of natural resources.

- Advance the IAFWA conservation education agenda. To manage fish and wildlife resources effectively, fish and wildlife agencies and partners must establish themselves as leaders in conservation education to develop an informed and involved citizenry.
- Achieve excellence in conservation education. The IAFWA will support and enhance conservation education programs within fish and wildlife agencies and partners by providing resources, training and expertise for optimizing their effectiveness.
- Maximize partnerships. Partnerships, at both national and state levels, have been recognized as a vital component of the conservation education mission. These partnerships will extend and multiply conservation efforts at the state, regional and national level.
- Secure funding. Funding is recognized as critical for conservation education efforts; additional funding sources are needed in order to improve the overall effectiveness of conservation education.

Conservation Education Programs of the Wildlife Resources (WRS) and Law Enforcement (LES) Sections of the WVDNR

In order to keep the public informed and engaged in the resource, the WRS and Law Enforcement Section of the WVDNR have developed many educational programs. They include:

- Hunter Education Program. The Hunter Education Program is mandatory for West Virginia. The program stresses safety in the field, proper handling of firearms, how to track wounded animals and hunter ethics. Several "Special Needs" classes are also taught as well as special hunts for the physically challenged. Conservation Officers also participate in numerous sporting and hunting shows and attend summer camps and other special events, such as the Youth Challenge, to promote hunter education.
- Boater Safety/Education Program. This program is also mandatory for and offered in each of the 55 counties. This course offers training in the proper methods of operating motor boats, appropriate laws governing the use of motorboats, motorboat courtesy and ethics.
- Youth Hunts. Special youth hunting opportunities for waterfowl, squirrel, and white-tailed deer are offered. In April of 2005, a youth spring gobbler season was also initiated.
- Archery in the Schools. This two week curriculum is designed to provide physical education students with an opportunity to learn archery skills within their school's physical education program.

- BOW. The Becoming an Outdoors-Woman program consists of two weekend workshops held in the spring and fall, hosting about 140 participants annually.
- Project WILD. Project WILD is a K-12 supplementary education program which emphasizes wildlife and its habitat. The Section's educational efforts for this program consist of formal teacher educational workshops and informal presentations to schools and civic groups. Adjunct programs include Aquatic Project WILD and Science and Civics, a high school curriculum integrating science and responsible actions on a local level. The activities are correlated with the state learning standards in science, language arts, math and social studies.
- WV State Wildlife Center. This educational facility open to the public focuses on native wildlife within natural enclosures and interpretive trails. Staff are on hand to give educational tours to school groups. About 45,000 people visit this facility annually.
- Media. The WRS sponsors and provides technical assistance and interviews for *West Virginia Wildlife*, a weekly, 90-second TV series shown on six newscasts on two stations in the Charleston market. The *West Virginia Outdoors* radio program is broadcasted over 57 MetroNews affiliated stations. The WVDNR also produces "Your DNR", a weekly TV series featuring interviews with WVDNR personnel to promote and explain DNR activities and policies. This program is seen three times each Wednesday on Charter Communications cable systems throughout West Virginia, Ohio, Kentucky and Virginia.
- *West Virginia Wildlife*. The WRS publishes this free, full-color magazine quarterly which features articles on WRS and LES programs, as well as educational and informative articles on the state's wildlife and plant resources.
- *West Virginia Wildlife Calendar*. The WRS produces a yearly calendar featuring original artwork on the state's wildlife, landscapes, and hunting, fishing and watchable wildlife scenes. This full-color calendar also features short educational articles on each painting, hunting and fishing regulations and seasons, educational articles in the back of the calendar and daily information on seasons, wildlife and natural history information. It sells for \$8.00.
- WVDNR—Wildlife Resources Website. Information is provided about hunting, fishing, wildlife watching, environmental education, law enforcement, news releases, trout stocking reports, hunting and fishing conditions and special pages for children, teachers and those who wish to learn about West Virginia's wildlife and botanical resources.
- The WRS hosts many educational events such as National Hunting & Fishing Day Celebration and Wildlife Diversity Day at the state capitol.
- The WVDNR hosts several educational weekends including: The Wildflower Pilgrimage, Nature Wonder and Winter Wonder Weekends.

- WRS staff gives dozens of presentations annually on a wide range of wildlife and plant topics to schools, camps, and conservation and civic organizations.
- The Wildlife Diversity Program has supported surveys and research for many publications which are then distributed free of charge to schools, colleges and universities, and public libraries. Some of these include: *The Mushrooms of West Virginia and the Central Appalachians*, *The Butterflies of West Virginia and Their Caterpillars*, *Amphibians and Reptiles in West Virginia*, *West Virginia Breeding Bird Atlas*, *West Virginia Birds—Distribution and Ecology*, *West Virginia Wildlife Viewing Guide*, *The Crayfishes of West Virginia* and *The Fishes of West Virginia*.
- The WRS also has published many brochures, fact sheets and checklists that are distributed free to the public or are available online.
- The Wildlife Diversity Program has developed two teaching trunks for teachers in elementary schools, one on bats and the other on neotropical migratory birds.
- The Wildlife Diversity Program coordinates the West Virginia Partners in Flight Working Group. Organized in 1994, this active group is made up of individuals representing universities, state and federal government agencies, conservation groups and the business community. There are three committees: Research and Monitoring, Management and Conservation, and Information and Education. This latter group has recently finished a “Songbird Guide for Landowners.” When published, this will be distributed to foresters, businesses and interested landowners.
- Another program coordinated by the Wildlife Diversity Program is the West Virginia Wild Yards Program. This program encourages homeowners and businesses to create wildlife habitat largely through the use of native plants. Participants receive an information packet and an application. If approved, properties will be entered into the West Virginia Wild Yards Registry. The property owner receives a certificate and a sign that is placed within the habitat to let others know that the property is part of a statewide network of WV Wild Yards.
- The Outdoor Wildlife Learning Sites program, also coordinated by the Wildlife Diversity Program, awards up to \$2,000 to schools to develop outdoor environmental/wildlife laboratories. The goal of the program is to teach ecology and conservation to children, assisting them in their future roles in an ecologically aware society. Over 100 schools have developed these sites in 42 of West Virginia’s 55 counties.
- New in the last year is the WV Master Naturalist Program. This program, through coursework, volunteer opportunities and networking, allows individuals to increase their knowledge and appreciation of the natural world while helping their communities and environment. Training is offered in a broad range of specialties in the fields of natural history and environmental education. The goal of the program is to create a pool of knowledgeable volunteers to educate others and to assist in natural history related projects and research. Currently the Wildlife Diversity

Program along with the Canaan Valley Institute, WVDNR Parks and Recreation Section, Davis and Elkins College and WVU Cooperative Extension Service is offering weekend training sessions, and due to the tremendous interest in this program, is facilitating local chapter formation.

Key Partners

West Virginia Division of Environmental Protection

This Division is charged with administering environmental education programs, litter control and recycling programs; organizing and directing a junior conservation camp; and promoting a variety of other educational activities. All are designed to increase the public awareness of environmental practices, methods of litter control, and available services. Specific programs include: **Public Information Office--West Virginia Youth Environmental Program**. Its slogan is: "Empowering WV's Youth to Become Environmentally Involved Within Their Communities." In Fiscal Year 2004, the program engaged 801 youth groups representing 71,354 members from all 55 counties.

Rehabilitation Environmental Action Plan (REAP) --Adopt-A-Highway/Adopt-A-Spot Program. This is a cooperative program between the WVDEP, WVDNR and WV Division of Highways and was created to improve the appearance of state highways by involving the public in litter removal and control. West Virginia Make It Shine. This program was created with the goal of making WV one of the cleanest states in the nation. It is a multifaceted program which incorporates partnerships of the public and private sector and seeks to promote interaction of all organizations within the state that are interested in the protection and improvement of the state's environment. Recycling Program. A major goal of this program is to educate the public concerning the benefits of recycling.

West Virginia Division of Natural Resources--Parks and Recreation Section

The West Virginia State Parks system promotes conservation and public recreation by preserving and protecting natural areas of unique or exceptional scenic, scientific, cultural, archaeological or historic significance. This section manages 34 state parks, recreational facilities on nine State Forests and four Wildlife Management Areas, the Greenbrier River Trail and North Bend Rail Trail. Several of these facilities have full-time Park Naturalists and Nature Centers designed to educate the public. Through the nature and recreation programs held at state parks and forests, visitors are stimulated to develop an appreciation and awareness of the natural environment. This understanding of natural resources leads to a commitment to the stewardship of these resources.

U.S. Fish & Wildlife Service

Canaan Valley National Wildlife Refuge. This refuge has library resources for educators about wildlife and nature. Field study equipment, field trips and workshops are available for use by educators during refuge visits. The refuge also offers a regular schedule of programs and tours. Exhibits and films may be viewed at the visitor center.

Ohio River Islands National Wildlife Refuge. Refuge staff work with teachers to offer environmental education activities that explore refuge habitats, wildlife and management. Teacher workshops will be offered in the near future to prepare educators to use the area independently. Staff routinely give educational presentations to the public. The Islands offer interpretive self-guided boat tours and a short auto tour.

The National Conservation Training Center (NCTC). The NCTC trains and educates natural resource managers to accomplish the common goal of conserving fish, wildlife, plants and their habitats. It is designed to bring government, non-profit organizations and corporations together to learn new skills, share perspectives and establish networks to move toward field-based solutions built on consensus and mutual interest.

U.S. Forest Service

There are two national forests within West Virginia: the Monongahela National Forest and portions of the George-Washington-Jefferson National Forest. Both offer educational programs to children through their Smokey Bear and Woodsey Owl programs. The Monongahela National Forest has educational facilities at the Cranberry Mountain Nature Center and the Seneca Rocks Discovery Center. Personnel give numerous educational presentations to schools, camps, conservation and civic organizations. This forest also offers a raptor education program complete with live birds.

West Virginia Wildlife Federation

The WV Wildlife Federation is the primary sponsor of the National Hunting & Fishing Days Celebration. The organization publishes "West Virginia Wildlife Notes," dedicated to raising the public's awareness of wise use and the proper management of our state's natural resources and the conservation and restoration of significant natural areas.

Oglebay Good Zoo

Oglebay's Good Zoo in Wheeling is a 30-acre natural site exhibiting 85 species, 200 specimens of WV wildlife and rare species from around the world. It is one of only 210 zoos in the United States that is accredited by the Association of Zoos and Aquariums. The zoo has a professional conservation education department, complete with classrooms, a theater/planetarium, outreach vans that travel to area schools, and an existing audience that recognizes zoo staff as the area's experts in conservation education. Two

educators have Master's degrees in Science Education, and the animal curator has a Master's degree in Wildlife and Fisheries Resource Management. More than 13,000 school children receive formal conservation education programs annually. The Good Zoo staff has long-term partnerships with the WVDNR, U.S. Fish & Wildlife Service, other AZA zoos, and many other conservation organizations. Zoo Staff has more than 30 year's experience in the recruitment and training of teen and adult volunteers as interpreters in conservation education, and in the training of university interns for special projects and research.

Raptor Centers

There are currently three raptor rehabilitation centers in the state. They are the Three Rivers Avian Center, the West Virginia Raptor Rehabilitation Center and the Oglebay Good Zoo. All three centers offer programs on the state's raptors, their role in the environment and responsible stewardship of the resource to schools, parks, conservation and civic organizations, and at special programs around the state.

Canaan Valley Institute (CVI)

CVI works to help communities build upon their assets and implement locally determined solutions for sustainable environments and economies. Assistance may be monetary in the form of training, organizational and technical support or specific ecological approaches. Some of the educational services they provide are: leadership training, conflict resolution training, grant writing workshops, watershed science workshops, building and using a stream table model, natural stream channel design courses, native plant symposiums and educational materials in the form of books and pamphlets.

WVU Cooperative Extension Service

The mission of the WVU Cooperative Extension Service is to form learning partnerships with people of West Virginia to enable them to improve their lives and communities. The Extension Service coordinates the state's 4-H programs, trains volunteers to give presentations on plants, animals and the natural environment to school children and civic groups and helps landowners to learn to use natural resources more wisely. The Extension Service also produces fact sheets on plants and wildlife, also available on their web site.

Related Conservation Education Issues in the WVWCAP

The SGNC fact sheets have identified several education actions important to the conservation of these species. They are:

- Develop educational pamphlets and presentations on many of the SGNC species and species groups, critical habitats, invasive plants and animals, effects of land use practices on terrestrial and aquatic habitats, over collection, trans-locations of species, maintaining biodiversity, and mitigation measures to restore habitat, targeting landowners, industry and conservation organizations.
- Encourage the public to report sightings of some of the rarer SGNC.

Strategies

A comprehensive conservation education strategy has never been developed by the WRS. The following is an overview of the needs and direction of conservation education for the WRS and LES. The focus of this vision is primarily for SGNC, although benefits will accrue to all other species. The actual implementation of this plan is predicated on the availability of federal funding.

- Continue to urge Congress to provide federal funding for conservation education.
- Develop a comprehensive conservation education plan for the WRS and LES.
- Hire additional staff dedicated solely to conservation education. Each of the six districts should have an Education specialist.
- Work toward improved communications among field staff so that educational efforts are better coordinated and delivered to the public.
- Work within the Sections to ensure that conservation education and outreach are an integral part of project planning.
- Continue to develop and distribute wildlife and wildlife habitat educational materials to the public schools, landowners and the general public. Develop public informational materials on wildlife species, management programs and habitat conservation.
- Develop a professional speaker's database for schools, conservation and civic organizations.
- Work within the public school systems to elevate the awareness and status of conservation education.
- Continue to improve and expand information on the WVDNR WRS website.
- Develop an educational grants program that stresses the development of wildlife educational materials for the public school system.
- Develop a coordinated volunteer program, utilizing the Master Naturalist Program, Odonata Atlas, Butterfly Atlas, Breeding Bird Atlas and Wetland Monitoring Program.
- Increase the number of Project Wild Workshops given to teachers in the state.
- Increase the number of OWLS grants awarded to schools around the state.
- Develop wildlife demonstration areas on appropriate DNR owned lands.

- Develop at least three wildlife nature centers/natural history museums strategically placed around the state.
- Continue to develop traveling displays that can be used at schools, colleges and universities, highway rest areas and special events.
- Develop outdoor education fairs such as hawk watching, birding festivals, butterflies, etc.
- Develop a marketing campaign to convince state and community leaders of the quality of life and health benefits that can be gained through expanded wildlife conservation programs and the economic return that will be generated by investing in them.
- Initiate and coordinate an annual meeting with partners to exchange information on educational programs and materials, identify priority education projects, and methods of pooling resources to implement priority education projects.

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Section 5-D. Recreation

Overview

Wildlife-associated recreation is important to the conservation of species in greatest need of conservation (SGNC) because it provides a way to connect wildlife agencies and conservation organizations to the broader general public, more specifically outdoor recreationists. This group includes landowners, user groups such as sportsmen and sportswomen, birders, hikers, climbers, paddlers and nature enthusiasts in general, and increasingly, the urban public. Although providing programs for outdoor recreationists may not directly result in the conservation of SGNC or prevent loss of critical habitat, these programs will create support for the work and mission of the Wildlife Resources Section (WRS) and its partners. By providing recreational opportunities for the public, and placing them in proximity to the resource, individuals will experience the value of the resource. This will, in turn, lead to public influence on policy decisions and increased support for the funding of conservation initiatives.

According to a study conducted by Responsive Management (2005), it is clear that outdoor recreation, especially involving SGNC, is important to West Virginians. “The most popular outdoor recreation activities of West Virginia residents are feeding birds/other wildlife (62 percent), visiting a State or National Park (56 percent), fishing (47 percent) and wildlife viewing near home (45 percent).” Substantial percentages had hiked (40 percent) (Responsive Management 2004) and 30 percent went camping. Thirty-six percent had freshwater fished, 32 percent had hunted, 5 percent had saltwater fished, and three percent had trapped. A large majority of respondents (60 percent) indicated that they, or someone from their household, had traveled to observe wildlife in West Virginia in the past year. And finally, over two-thirds (69 percent) have visited or used West Virginia’s public recreation lands. Three-fourths of state residents reported that public recreation lands are very important to them (Responsive Management 1998). When specifically asked to name types of facilities that the DNR should most emphasize in its planning efforts, the top types of facilities were nature education centers (33 percent), public lands for recreation (29 percent), nature trails with signs (29 percent) and public fishing and boating access (25 percent) (Responsive Management 2004).

Very little of the current WRS budget (less than 2 percent) or staff (less than one full time employee (FTE) are focused on recreation that is not directly tied to hunting and fishing. This is primarily due to a lack of federal funding for recreation involving SGNC. Since more people participate nationally in wildlife watching (54 percent or 44.2 million people-spending \$24.5 billion dollars) (U.S.F.W.S 2005) than in those traditional hunting and fishing activities that have been funded through the Pittman-Robertson and Dingell-Johnson Acts, federal funding is needed to enhance wildlife-associated recreation for SGNC

Current Wildlife-Associated Recreational Programs of the WRS

In order to provide the public with opportunities to enjoy the resource, the WRS has developed the following recreational related programs:

- The WRS, in cooperation with The Defenders of Wildlife, published the *West Virginia Wildlife Viewing Guide* by Mark Damian Duda in 1999. Sixty-three areas are described in this book for the public to view wildlife. Each area is designated with signs erected by the WV Division of Transportation.
- The Wildlife Diversity Program is coordinating the establishment of an Important Bird Areas Program in West Virginia. Sites have been nominated and are currently under review by members of WV Partners in Flight.
- Watchable Wildlife enhancements in the form of interpretive trails, boardwalks, viewing platforms and kiosks have been created at the Green Bottom Wildlife Management Area, the WVDNR managed Lantz Farm Nature Preserve, the WV State Wildlife Center and selected state parks.
- The Wildlife Diversity Program offers competitive grants under the Cooperative Projects Program to organizations and individuals to develop projects featuring wildlife-associated recreation.
- WRS personnel participate in wildlife festivals such as International Migratory Bird Day events, National Hunting and Fishing Days Celebrations and the WV Monarch Butterfly State Festival.

Key Partners

West Virginia Division of Natural Resources—Parks and Recreation

The West Virginia State Parks system promotes conservation and public recreation by preserving and protecting natural areas of unique or exceptional scenic, scientific, cultural, archaeological or historic significance. This section manages 34 state parks, recreational facilities on nine State Forests and four Wildlife Management Areas, the Greenbrier River Trail and North Bend Rail Trail. Through the nature and recreation programs held at state parks and forests, visitors are stimulated to develop an appreciation and awareness of the natural environment. This understanding of natural resources leads to a commitment to the stewardship of these resources. Specifically for wildlife-associated recreation, the Parks and Recreation Section provides nature centers, interpretive trails with boardwalks, observation overlooks, viewing platforms and blinds, kiosks, hiking and horse trails, cross-country skiing trails, lake and river access, fishing ponds, tramways, camp grounds and picnic areas as well as wildlife educational programs.

West Virginia Division of Tourism

The mission of the WV Division of Tourism is to cultivate a world-class travel and tourism industry in West Virginia through the creation of jobs, stimulation of investment, expansion of current tourism attractions and promotion of a positive state image, thereby improving the way of life for West Virginians. Tourism works with the DNR to create programs designed to promote more interest in hunting, fishing and other wildlife-associated recreation. In partnership with the WRS, WVU Cooperative Extension Service and Jackson's Mill, a birding website is being created.

U.S. Fish & Wildlife Service

Canaan Valley National Wildlife Refuge—This refuge, the nation's 500th, is 15,245 acres in size. It boasts a 41 mile road and trail system for wildlife observation, photography and learning about wildlife. Thirty-one miles are for pedestrian use, 23 miles for bicycles, 22 miles for horseback and seven miles for licensed vehicles. The refuge also has a nature center and U.S. F.W.S. staff gives environmental and nature programs throughout the year.

Ohio River Islands National Wildlife Refuge—This refuge has 22 islands along 400 miles of the Ohio River. There are 3300 acres of land, mostly within West Virginia. Most of the islands can only be accessed by boat; however Middle Island can be accessed by car. The refuge offers interpretive self-guided boat tours and a 1.5 mile auto tour on Middle Island. This trail can also be walked, and there is a viewing blind at the wetland to permit close observation of a variety of wildlife species.

U.S. Forest Service

Monongahela National Forest—The Monongahela National Forest encompasses 909,000 acres, and is the fourth largest national forest in 20 northeastern states. There are five wilderness areas and one National Recreation Area, Spruce Knob-Seneca Rocks. There are over 500 miles of hiking trails, 129 miles of warm water fishing and 576 miles of trout streams containing 60 species of nongame fish. There are three small impoundments within the Forest. There are two nature centers, Cranberry Mountain and the Seneca Rocks Discovery Center, and three observation towers. The forest has 75 tree species and 230 species of birds. U.S. F. S. staff routinely gives nature education programs.

George Washington-Jefferson National Forest—This forest encompasses 1.8 million acres of public land. There are 123,384 acres of this forest in West Virginia. The forest has 15 wilderness areas totaling 90,000 acres. There are 32 special interest areas that emphasize dispersed recreational opportunities. The

forest has 40 tree species, over 2,000 herbaceous plants, 200 bird species, 55 mammals and 70 amphibians and reptiles. U.S.F.S. staff also routinely gives nature education programs.

Oglebay Good Zoo

The Good Zoo resides in a 1,200 acre public park, and has a visitation of 150,000 per year. It offers many recreational opportunities, including nature trails. The zoo is continuing to develop new programs that take families on llama pack trips on the nature trails, introduce families to camping, take Girl Scouts outside in the woods at night to use bat detectors or listen to frog calls, and teach families to learn the fun of geo-catching. It also features a 30-acre natural site whose interpretive exhibits include 200 specimens of West Virginia wildlife.

West Virginia University Cooperative Extension Service

The mission of the Extension Service is to form learning partnerships with people of West Virginia to enable them to improve their lives and communities. At Jackson's Mill, Extension staff and partners are preparing plans for the state's first Birding Center, and the possibility of expanding to a state Natural History Center with an arboretum. The center will focus on education and conservation of birds, for the youth of the state as well as adults, and a resource for active birders as well as novices hoping to increase their skills. Jackson's Mill encompasses 525 acres with a variety of habitats; woodlands, wetlands, riparian areas and fields. There are about 100 species of birds present at Jackson's Mill. Some of the suggested plans for the Birding Center include: restoration of a house for the actual center; birding classes; further development of trails; teaching; year around activities at Jackson's Mill; support for needed statewide bird studies; a place to observe and study birds all year long; development of a database for bird study in West Virginia; and use of the Conference Center for regional and national birding meetings. Another purpose of the Center would be to combine all the available information on current birding activities in the state in one place. This Center could eventually generate an annual economic impact of \$150 million for the state.

The Brooks Bird Club

The Brooks Bird Club (BBC), Inc. is an independent, educational, non-profit organization which promotes the study and enjoyment of birds and other elements of the natural world. Its purpose is to inform members and the public of environmental issues, to encourage intelligent use of our natural resources and preservation of our natural heritage. The club undertakes studies which have scientific value, including population and breeding bird surveys. The club has operated the Allegheny Front Migration Observatory on Dolly Sods of the Monongahela National Forest for 47 years. It has also compiled statewide bird, fern and butterfly checklists. In 1999, the BBC published the *Birding Guide to*

West Virginia, describing 47 of the best birding sites around the state. The book details travel information with maps and lists bird species known in each habitat. The WRS sent free copies to colleges and universities, schools and public libraries around the state.

Strategies

A comprehensive wildlife-associated recreation strategy has never been developed by the WRS. The following is an overview of the needs and direction of wildlife-associated recreation for the state. The focus of this vision is primarily for SGNC, although benefits will accrue to all other species. The actual implementation of this plan will be predicated on the availability of federal funding and resources available to plan partners.

- Continue to urge Congress to provide federal funding for wildlife-associated recreation.
- Develop a comprehensive, integrated wildlife-associated recreation plan for the WRS and partners.
- Hire staff dedicated to the development of wildlife-associated recreational opportunities within the state.
- Ensure that wildlife-associated recreation is an integral part of project planning.
- Update the *West Virginia Wildlife Viewing Guide*.
- Continue to improve and expand information on the WVDNR's WRS website related to wildlife-associated recreation in the state. Create links to partner websites.
- Focus media programs to highlight wildlife-associated recreational opportunities.
- Develop more interpretive trails, viewing platforms and blinds for wildlife observation and photography.
- Develop a state Birding Trail and Birding Educational Center with partners, Divisions of Tourism and Parks, and WVU Cooperative Extension Service.
- Develop regional bird guides.
- Develop additional bird lists, birding guides and other animal and plant checklists for selected WMAs, State Forests, State Parks or other state lands.
- Continue to develop and implement the WV Important Birds Areas Program.
- Develop canoe and kayak trails along selected streams and rivers.
- Develop and maintain additional hiking trails on state owned lands.
- Develop the state's first birding festival.
- Coordinate with partners and commercial guiding organizations by providing training workshops and informational materials on existing and soon to be developed watchable wildlife sites, festivals, fairs and wildlife information specific to their areas of operation.

- Continue to develop the WV Master Naturalist Program to train volunteers to help with wildlife festivals, fairs, interpretive, hiking and canoe trails and watchable wildlife trail enhancement and maintenance.
- Develop an eco-tourism marketing campaign with the Division of Tourism to increase awareness of the various wildlife-associated recreational opportunities that exist.
- Develop a marketing campaign to convince state and community leaders of the quality of life and health benefits that can be gained through expanded wildlife-associated recreational programs and the economic return that will be generated by investing in them.
- Enhance the Cooperative Projects Program to continue to provide grants to encourage organizations and individuals to create wildlife viewing and other wildlife-associated recreation projects and to promote nature tourism.
- Initiate and coordinate an annual meeting with partners to exchange information on wildlife-associated recreational projects, identify priority projects, and determine methods of pooling resources to implement priority wildlife-associated recreational projects.

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Section 5-E. Species and Species Group Fact Sheets for Species in Greatest Need of Conservation

Conservation of species that are considered at risk requires a sequence of actions. These fact sheets for Priority One species are constructed in the following sequence:

- The **Status** table shows the ranks given to the species by all groups that listed it as of conservation concern. A summary of the various ranking descriptors used by the groups is in Appendix 1.
- A general description of the **Habitat** follows for each species (usually not a quantifiable description).
- **Site Locations and Site Status** – each known site is shown by major watershed (eight digit federal Hydrologic Unit Code watershed) in which it occurs and whether the information is less than or equal to 20 years old (recent) or greater than 20 years old (historic). In addition, the ownership of the site is given as either in public ownership (government owned lands) or in private hands. Ownership patterns are useful in setting conservation actions for the species.
- The **Data, Survey, Research and Monitoring** needs and subsequent actions for each species or group are outlined. These are the data and information that form the background for the selection of on-the-ground conservation sites.
- The Conservation Process table lists **Issues** that relate to the conservation of each SGNC or group and the various categories of action that may assist in addressing these conservation issues.
- Selected **Conservation Actions** summarize specific actions taken from the previous tables, and compiled and expanded on here, in order to facilitate review of priorities and to establish annual work plans for the species.

These fact sheets form the heart of the *West Virginia Wildlife Conservation Action Plan*.

Birds

There are 314 species of birds that have been recorded from the state and 234 are known to occur in the state essentially each year. One hundred fifty-three species are known to breed here and another 16 are potential breeders. Fifty-five species either migrate through the state or are at least occasional winter residents and seven species are present only in the winter.

Birds are ubiquitous, occurring in all parts of the state from downtown streets to windswept mountain tops. Some bird species are widespread and others restricted to small narrowly distributed specialized habitats. Being a popular group of animals among the public, a lot of attention has been paid to birds by individuals, groups and researchers. Christmas bird counts, century counts, migration counts, mid-winter waterfowl counts, nesting season point counts, and Breeding Bird Survey routes are some of the ongoing efforts to document the distribution and status of birds across the state.

West Virginia, with its vast forests and relatively sparse human population, provides important habitat for many bird species, especially neotropical migrants. The state has seen lower rates of declines in many species than any other state. For one species, the Wood Thrush, West Virginia is one of only two states (the other is Florida) that have experienced a population increase since 1978. With its wealth of quality forested habitats, West Virginia is crucial to sustaining viable populations of many bird species.

West Virginia Partners in Flight (WVPIF) is a partnership of organizations and individuals committed to the conservation of wild birds and their habitats through management, conservation, research, monitoring, information and education. The WVPIF working group, organized in 1994, has ambitious plans. Future activities will focus on identifying and mapping areas of significant breeding populations of priority birds, contacting landowners and developing management plans for these areas. Improved monitoring of priority birds and researching species that are not well understood are also on the agenda. A 40-page booklet, entitled "*West Virginia Songbird Forest Management Guidelines*" has been developed that will be widely distributed to public and private landowners. WV PIF is also working towards a statewide birding trails system and birding center.

Another program, the WV Important Bird Areas Program, aims to identify and conserve sites throughout the state that contain significant habitats for breeding, wintering, and migrating birds. By focusing more attention on the most essential and vulnerable areas the WV IBA program will help to promote *proactive* habitat conservation, playing an integral part in other national efforts such as Partners in Flight and the North American Bird Conservation Initiative. The information gathered in the process of identifying IBA's will guide land use planning and resource management decisions, so that birds and their habitat needs are taken into account.

Critical to the success of the WV IBA program is the participation of many partner organizations, professional ornithologists, birders, students and volunteers. Only through the building of a strong network of grassroots support, in a participatory process, will the program be successful.

Birds identified by the consortium of birders as Species in Greatest Need of Conservation (SGNC) are:

Scientific Name	Common Name
<i>Accipiter gentilis</i>	Northern Goshawk
<i>Aegolius acadicus</i>	Northern Saw-Whet Owl
<i>Aimophila aestivalis</i>	Bachman's Sparrow
<i>Ammodramus henslowii</i>	Henslow's Sparrow

<i>Anas crecca</i>	Green-Winged Teal
<i>Asio flammeus</i>	Short-Eared Owl
<i>Asio otus</i>	Long-Eared Owl
<i>Bartramia longicauda</i>	Upland Sandpiper
<i>Botaurus lentiginosus</i>	American Bittern
<i>Caprimulgus carolinensis</i>	Chuck-Will's-Widow
<i>Caprimulgus vociferus</i>	Whip-Poor-Will
<i>Carduelis pinus</i>	Pine Siskin
<i>Catharus ustulatus</i>	Swainson's Thrush
<i>Chondestes grammacus</i>	Lark Sparrow
<i>Circus cyaneus</i>	Northern Harrier
<i>Cistothorus palustris</i>	Marsh Wren
<i>Cistothorus platensis</i>	Sedge Wren
<i>Contopus cooperi</i>	Olive-Sided Flycatcher
<i>Contopus virens</i>	Eastern Wood Peewee
<i>Dendroica cerulea</i>	Cerulean Warbler
<i>Dendroica discolor</i>	Prairie Warbler
<i>Empidonax flaviventris</i>	Yellow-Bellied Flycatcher
<i>Empidonax virescens</i>	Acadian Flycatcher
<i>Falco peregrinus</i>	Peregrine Falcon
<i>Fulica americana</i>	American Coot
<i>Gallinago delicata</i>	Wilson's Snipe
<i>Gallinula chloropus</i>	Common Moorhen
<i>Haliaeetus leucocephalus</i>	Bald Eagle
<i>Helmitheros vermivorus</i>	Worm-Eating Warbler
<i>Hylocichla mustelina</i>	Wood Thrush
<i>Ixobrychus exilis</i>	Least Bittern
<i>Lanius ludovicianus migrans</i>	Migrant Loggerhead Shrike
<i>Lophodytes cucullatus</i>	Hooded Merganser
<i>Nycticorax nycticorax</i>	Black-Crowned Night-Heron
<i>Nycticorax violaceus</i>	Yellow-Crowned Night-Heron
<i>Oporornis formosus</i>	Kentucky Warbler
<i>Porzana carolina</i>	Sora
<i>Rallus elegans</i>	King Rail
<i>Rallus limicola</i>	Virginia Rail
<i>Seiurus motacilla</i>	Louisiana Waterthrush
<i>Sphyrapicus varius</i>	Yellow-Bellied Sapsucker
<i>Spizella pusilla</i>	Field Sparrow
<i>Thryomanes bewickii altus</i>	Appalachian Bewick's Wren
<i>Tyto alba</i>	Barn Owl
<i>Vermivora chrysoptera</i>	Golden-Winged Warbler
<i>Vermivora pinus</i>	Blue-Winged Warbler
<i>Vermivora ruficapilla</i>	Nashville Warbler

<i>Accipiter cooperii</i>	Cooper's Hawk
<i>Accipiter striatus</i>	Sharp-Shinned Hawk
<i>Actitis macularia</i>	Spotted Sandpiper
<i>Ammodramus savannarum</i>	Grasshopper Sparrow
<i>Anas rubripes</i>	American Black Duck
<i>Ardea herodias</i>	Great Blue Heron
<i>Certhia americana</i>	Brown Creeper
<i>Chordeiles minor</i>	Common Nighthawk
<i>Coccyzus erythrophthalmus</i>	Black-Billed Cuckoo
<i>Colinus virginianus</i>	Northern Bobwhite
<i>Coragyps atratus</i>	Black Vulture
<i>Dendroica coronata</i>	Yellow-Rumped Warbler
<i>Dendroica fusca</i>	Blackburnian Warbler
<i>Dolichonyx oryzivorus</i>	Bobolink
<i>Empidonax alnorum</i>	Alder Flycatcher
<i>Eremophila alpestris</i>	Horned Lark
<i>Limnothlypis swainsonii</i>	Swainson's Warbler
<i>Melanerpes erythrocephalus</i>	Red-Headed Woodpecker
<i>Pandion haliaetus</i>	Osprey
<i>Petrochelidon pyrrhonota</i>	Cliff Swallow
<i>Podilymbus podiceps</i>	Pied-Billed Grebe
<i>Pooecetes gramineus</i>	Vesper Sparrow
<i>Protonotaria citrea</i>	Prothonotary Warbler
<i>Riparia riparia</i>	Bank Swallow
<i>Scolopax minor</i>	American Woodcock
<i>Seiurus noveboracensis</i>	Northern Waterthrush
<i>Spiza americana</i>	Dickcissel

Some of the listed birds, such as the Cerulean Warbler, are still quite common across the state. However, West Virginia is at the heart of their range and since their habitat is dwindling elsewhere, conservation actions need to be initiated. Other species, such as rails, are rare because their required habitat is limited and are consequently at risk because of their small populations.

Seven species are covered individually in fact sheets because there is adequate information and a few specific conservation actions have already been initiated.

Northern Saw-whet Owl
 Barn Owl
 Cerulean Warbler
 Bald Eagle
 Golden-winged Warbler
 Loggerhead Shrike
 Peregrine Falcon

Conservation needs and actions are similar for some groupings of birds because of habitat similarities. Fact sheets have been developed for various groups that share similar habitat requirements; these are broken down into the following habitat specific aggregations:

- Early Successional
- Grasslands
- Wetlands
- Forest Interior
- Northern Hardwood/Spruce Forest
- Other birds (mix of specialized habitats)

A review of the conservation needs for birds, as outlined on the following fact sheets, indicates that initial actions for the listed species are centered on survey, inventory and data management. Despite a considerable emphasis on gathering data on bird distribution and status over the past few decades by a variety of partners, information is still lacking and filling these information gaps is a necessary first step for the future conservation assessment of each species. Standardized data acquisition and management both within the WV DNR Wildlife Resources Section and by all other research partners will greatly assist with these conservation assessments. Centralized and shared information is a prerequisite to the formulation of on-the-ground conservation plans for all listed species.

Because the WRS acts as a statewide repository for information, we rely on partners to share information to maximize understanding of our biological resources. Occasionally researchers are reluctant to share information for fear that the information will be requested from state government via the Freedom of Information Act (FOIA) and used to the detriment of the species involved. For this reason it is believed appropriate to have legislation enacted to protect sensitive rare species information from wide dissemination. This need is expressed across the board on the fact sheets for animal Species in Greatest Need of Conservation.

There is an ongoing need to educate all citizens about the value of the diversity of life in the state and especially the role all SGNC play in the intricate web of life. Education is a unifying theme throughout the actions section of the fact sheets for most species. In addition there is a need to coordinate with land management agencies and other landowners/managers on the use of Best Management Practices for the conservation of biological resources in general as well as specific practices when SGNC are present.

Unfortunately because of the dearth of data on the distribution and status of many individual species, few specific on-the-ground conservation actions have been identified. As additional data are collected, one would anticipate an increasing inventory of specific site-related projects that are desirable for the health and/or continued existence of SGNC throughout the state. In addition, because birds (other than bats) are our most mobile creatures, large blocks of habitat or specific sites for limited habitat types need to be conserved to maintain populations. Plans for larger scale conservation efforts will be addressed during each biennial review and revision.

Taxa: Birds
Common Name: Barn Owl
Scientific name: *Tyto alba*

STATUS

The ranks and information in the chart below indicate the rarity of the Barn Owl in West Virginia. The Barn Owl is listed as a species of concern in West Virginia because of its limited distribution.

Priority Group	Global Rank	State Rank	IUCN Rank	NE Tech Comm	WVPIF	Trend
1*	G5	S1B,S1N	LC	X	IA	Stable

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of the Barn Owl into watersheds and gives the ages of the records (recent is within 20 years) and indicates whether sites are under public or private ownership. The number of records are not indicated in this table. Each watershed listed may have more than one record for the species.

Habitat: Barn Owls typically nest in man-made structures in or near agricultural areas.

Watershed	Record Type	Ownership
Cheat	Historic	Private
Greenbrier	Recent	Private
North Branch	Recent	Private
Lower Ohio Valley	Historic	Public
Potomac	Recent	Private
Shenandoah	Recent	Private
South Branch	Recent	Private
Upper Ohio Valley	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Barn Owl. Because there is inadequate information on the distribution and status of the Barn Owl in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below.

Bolded text indicates primary actions required to identify conservation needs of the Barn Owl.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Public access to general Barn Owl data.	Publish 2 nd edition of <i>the WV Breeding Bird Atlas</i> .
		Provide general Barn Owl data, such as distribution maps, on the internet.
Gather existing data.	Consolidate all existing data from known breeding sites and enter into database.	

Category	Need	Action
Surveys	Early breeding status needs to be determined at known and historical sites.	Conduct breeding surveys on newly identified sites and more extensive breeding surveys at known and historical sites.
	Additional sites need to be identified.	Analyze potential habitat statewide to determine new survey areas.

Category	Need	Action
Monitoring	Monitoring sites.	Continue monitoring known Barn Owl nesting sites in the South Branch and Greenbrier valleys.
	Long-term monitoring sites.	Establish and monitor additional long-term sites at known breeding locations by putting up nest boxes where birds are found, and banding individuals.

Category	Need	Action
Research	Life history – habitat preferences.	Coordinate projects with researchers. Write proposals for needed prospecti and actively seek contractors.
	Life history – dispersal patterns.	

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Barn Owl and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	
Over Collection	
Management Conflicts	Coordination, Education
Invasive Species	
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE BARN OWL AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Consolidate all existing data from known breeding sites and enter into database

Surveys:

- Conduct breeding surveys on newly identified sites and more extensive breeding surveys at known and historical sites.

Monitoring:

- Establish and monitor additional long-term sites at known breeding locations by putting up nest boxes when birds are found, and banding individuals.

Coordination:

- Continue coordination with The Audubon Society in the development of the Important Bird Areas program.
- Work with NRCS to develop Barn Owl nest box practices.
- Work with landowners to continue to identify and report Barn Owls.

Education:

- Educate the public on Barn Owls and their benefits.
- Continue to develop a Barn Owl pellet dissection educational program in public schools.

Legislation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

Management:

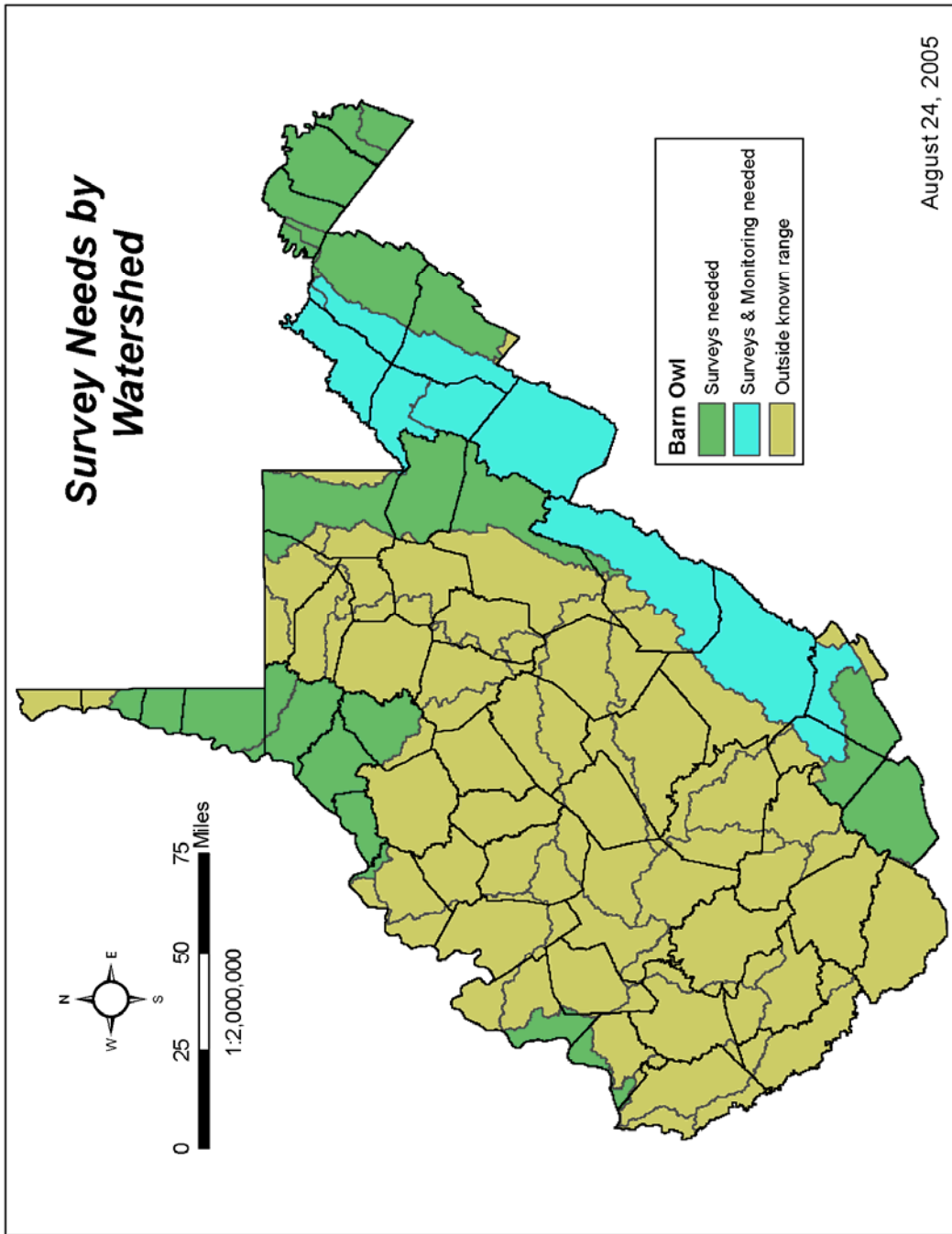
- Work with landowners to maintain known Barn Owl nesting sites.
- Continue to help landowners with Barn Owl relocation efforts when feasible.

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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Birds

Common Name: Cerulean Warbler

Scientific name: *Dendroica cerulea*

STATUS

The ranks and information in the chart below indicate the rarity of the Cerulean Warbler in West Virginia. This species is a candidate for listing by the U.S. Fish and Wildlife Service due to its decline from habitat loss as well as other factors. This species is considered a species of special concern in every state that it occurs.

Priority Group	Global Rank	State Rank	USFWS	IUCN Rank	NE Tech Comm	WV PIF	Trend
1*	G4	S4B	SC	VU A2bc +3bc	X	II	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

Habitat: Cerulean Warblers nest in large expanses of mature deciduous forest containing large, tall trees and extensive vertical vegetation layering.

There are recent records for the Cerulean Warbler in all 29 watersheds, and they occur on both public and privately owned lands.

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Cerulean Warbler. Because there is inadequate information on the distribution and status of the Cerulean Warbler in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Cerulean Warbler.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Public access to data.	Publish 2 nd edition of the <i>WV Breeding Bird Atlas</i> .
		Provide additional information on the DNR Website.
Gather existing data.	Consolidate all existing data from known breeding sites.	

Category	Need	Action
Surveys	Status needs to be determined on all state managed lands.	Conduct breeding surveys on newly acquired state lands and more extensive surveys on larger state managed lands.
	Additional sites need to be surveyed.	Analyze potential habitat statewide to identify new survey areas.

Category	Need	Action
Monitoring	Long-term monitoring.	Establish and monitor long-term sites throughout the state.
	Breeding Bird Survey.	Ensure complete yearly coverage of BBS routes in the state.

Category	Need	Action
Research	Life History- Habitat preferences.	Continue study on the response of Cerulean Warblers to differing timber harvesting regimes.
	Life History- Home range.	Coordinate projects with researchers. Write proposals for needed prospecti and actively seek contractors.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Cerulean Warbler and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	
Over Collection	
Management Conflicts	Coordination
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE CERULEAN WARBLER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Consolidate all existing data from known breeding sites.

Surveys:

- Conduct breeding surveys on newly acquired state lands and more extensive surveys on larger state managed lands.

Monitoring:

- Ensure complete yearly coverage of BBS routes in the state.

Research:

- Continue study on the response of Cerulean Warblers to differing timber harvesting regimes.

Coordination:

- Work with the Forest Service, the Fish and Wildlife Service and the National Park Service to maintain known Cerulean Warbler habitat.
- Work to restore, create and/or manage habitats on state managed lands where Cerulean Warblers may potentially nest.
- Continue coordination with The Audubon Society in the development of the Important Bird Areas program.
- Work with forest landowners to reduce or eliminate activities that may be detrimental to forests. This may include limiting ATV use, encouraging use of Best Management Practices when timbering or engaging in other impacting activities.
- Mitigate against impacts of mining and other development activities in the vicinity of Cerulean Warbler populations.

Education:

- Educate the public about Cerulean Warblers and WV's responsibility in maintaining their populations.
- Publish and distribute the WVPIF's "WV Songbird Forest Management Guidelines" publication.

Legislation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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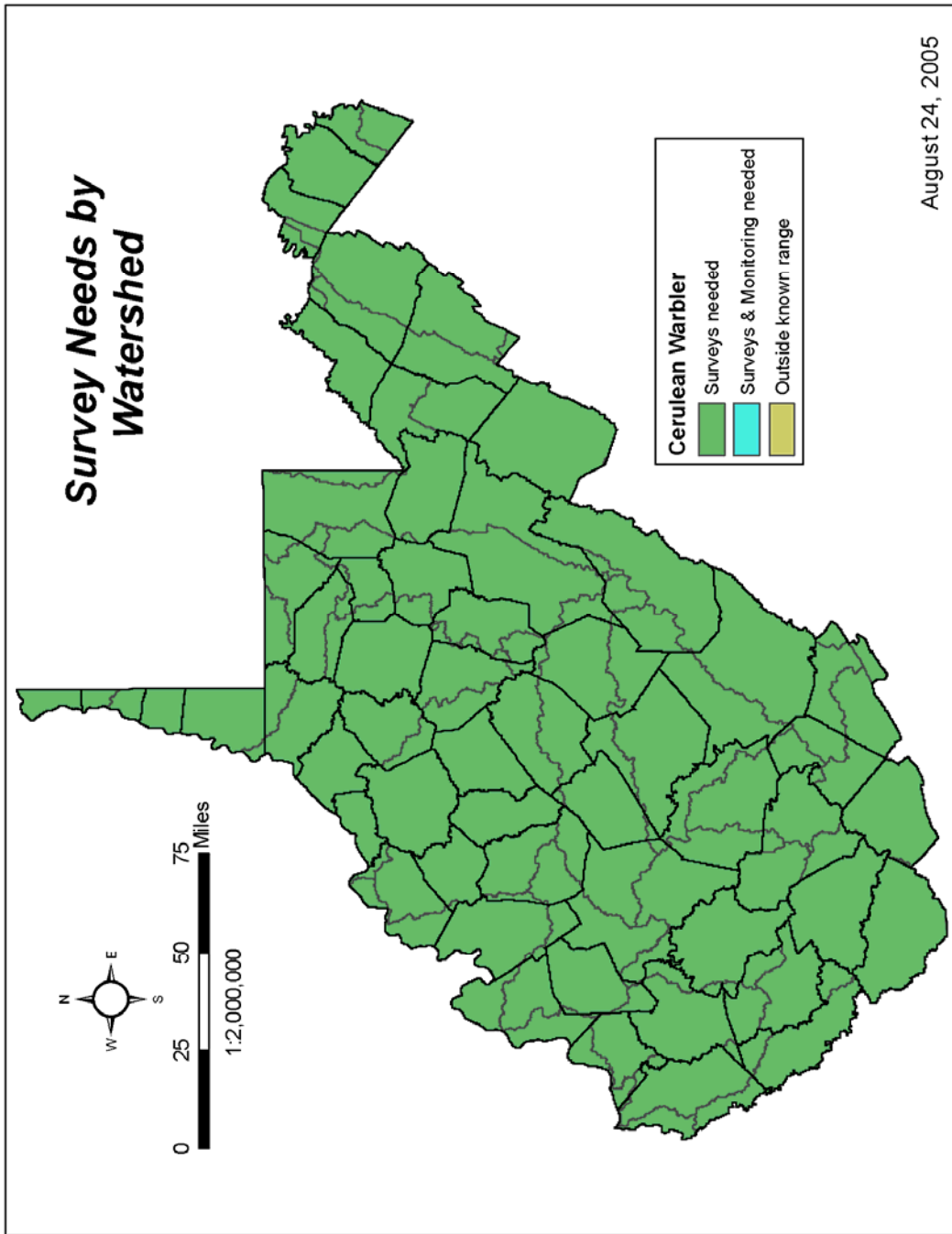
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West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Birds

Common name: Bald eagle

Scientific name: *Haliaeetus leucocephalus*

STATUS

The ranks and information in the chart below indicate the rarity of the Bald Eagle in West Virginia. This species is listed as threatened by the U.S. Fish and Wildlife Service.

Priority Group	Global Rank	State Rank	US FWS	Mon Forest	Jeff Forest	IUCN Rank	CITES	NE Tech Comm	WV PIF	Trend
1*	G4	S2B, S3N	LT	X	X	LC	App I	X	IB	Increasing

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences into watersheds, gives the ages of records (recent is within 20 years) and indicates general habitat for each species. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species.

Habitat: Bald Eagles usually nest in large trees near large streams or lakes. Its migration routes follow river systems or mountain ranges, which run in a general north-south direction. The Bald Eagle winters near large bodies of water, and they are seldom found far from water, except during migration.

Watershed	Record Type	Ownership
Cacapon	Recent	Private
Middle Ohio River Valley	Nest failed in 2001; birds have not returned	Private
North Branch Potomac	Recent	Public
Potomac	Recent	Public
South Branch Potomac	Recent	Public
		Private
Upper Ohio River Valley	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Bald Eagle. Because there is inadequate information on the distribution and status of the Bald Eagle in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Bald Eagle.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Public access to general bald eagle information.	Provide general bald eagle data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Determine status at sites where nests have been lost or eagles have not returned.	Surveys will be conducted with priority given to sites in which the habitat could have been altered since the species was documented.
	Additional survey sites.	Analyze potential habitat along rivers and large water bodies and conduct site visits and aerial surveys.
		Evaluate sites for management needs.

Category	Need	Action
Monitoring	Monitor nesting sites.	Continue visiting nest sites throughout the nesting period to determine nesting success and habitat changes.

Category	Need	Action
Research	Determine effects of poultry industry.	Examine the eagle's feeding habits near poultry facilities and determine potential chemicals in poultry wastes.
	Determine appropriate conservation measures for threats abatement.	Coordinate projects with researchers. Write prospecti needed projects and actively seek contractors.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Bald Eagle and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forestland Management	Coordination , Education, Management
Water Quantity and Quality	Education , Coordination, Management
Harvest	
Management Conflicts	Coordination
Invasive Species	
Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE BALD EAGLE AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.

Surveys:

- Analyze potential habitat along rivers and large water bodies and conduct site visits and aerial surveys.

Monitoring:

- Continue visiting nest sites throughout the nesting period to determine nesting success and habitat changes.

Research:

- Examine the eagle's feeding habits near poultry facilities and determine potential chemicals in poultry wastes.

Coordination:

- Work to maintain contact with Forest Service to determine if forestry practices could impact Bald Eagle nesting sites on Forest Service lands.
- Work with private landowners to protect Bald Eagle nests on their lands.

Management:

- Maintain good water quality in the state's streams and lakes.

Education:

- Educate school groups, landowner groups, etc. on the eagle and the laws protecting it, as well as the importance of conserving biodiversity.

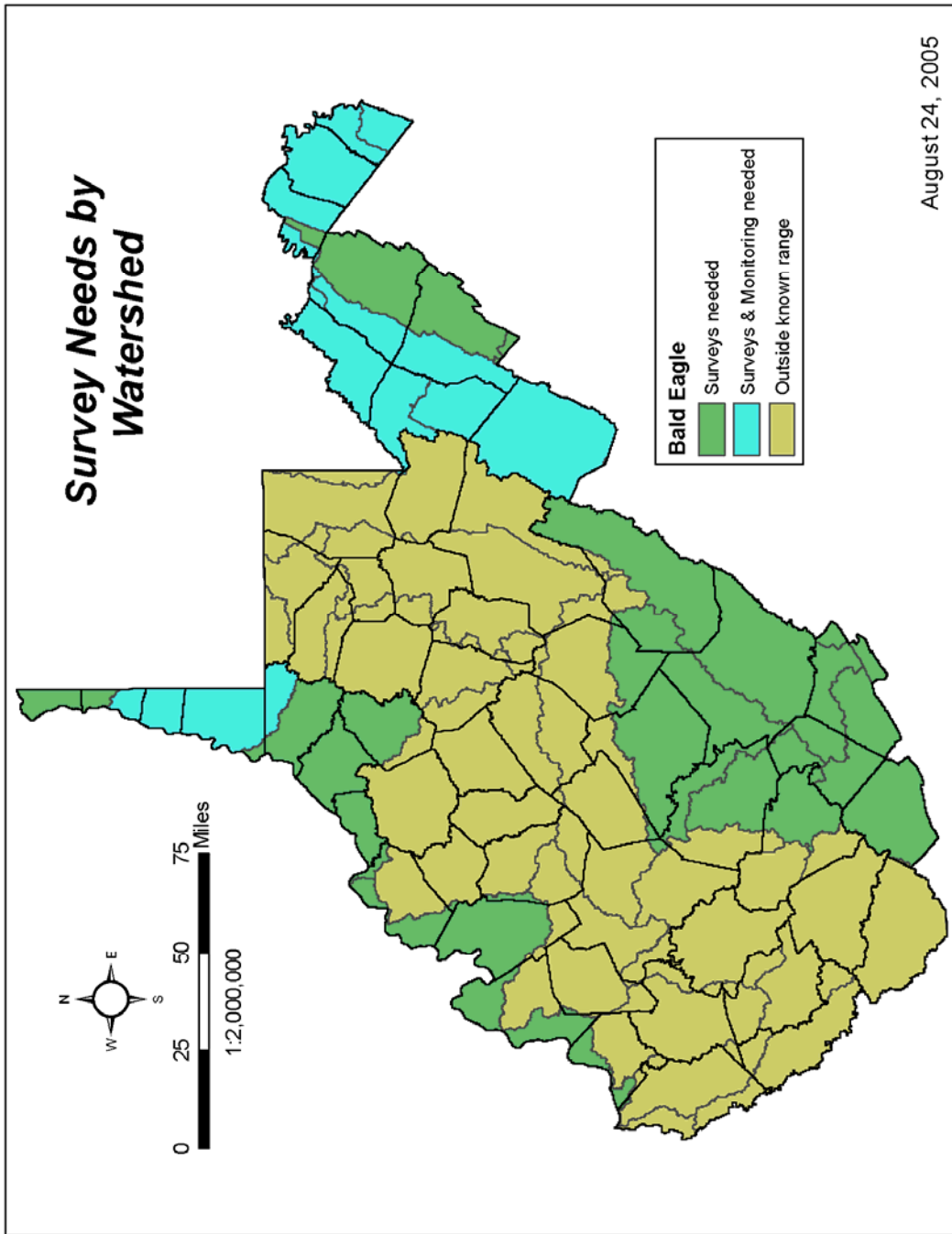
Legislation/Regulation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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Stihler, Craig. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia. August 1, 2005



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Birds

Common Name: Golden-winged Warbler

Scientific name: *Vermivora chrysoptera*

STATUS

The ranks and information in the chart below indicate the rarity of the Golden-winged Warbler in West Virginia. This species is listed as high priority by the West Virginia Partners in Flight Working Group.

Priority Group	Global Rank	State Rank	IUCN Rank	NE Tech Comm	Trend
1*	G4	S2B	NT	X	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION AND HABITAT

Habitat: Golden-winged Warblers nest in early successional forest habitat. In West Virginia this habitat is typically associated with human disturbance – ie: mining and timber harvesting operations.

The Golden-winged Warbler is found in the following Watersheds: Cacapon, North Branch, South Branch, Cheat, Youghiogheny, Dunkard, Monongahela, Tygart, Little Kanawha, Upper Kanawha, Elk, Gauley, Lower New, Upper New, Greenbrier, Lower Guyandotte, Upper Guyandotte, Coal, Big Sandy, Tug Fork, James and Twelve Pole. All records are recent and occur on both public and private lands.

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Golden-winged Warbler. Because there is inadequate information on the distribution and status of the Golden-winged Warbler in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Golden-winged Warbler.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Public access to data.	Publish 2 nd edition of the <i>WV Breeding Bird Atlas</i> .
		Consolidate all existing data from known breeding sites.
		Provide additional information on the DNR Website.

Category	Need	Action
Surveys	Yearly breeding status needs to be determined at known and historical sites.	Conduct breeding surveys on newly identified sites and more extensive surveys on known and historical sites.
	Additional sites need to be surveyed.	Analyze potential habitat statewide to determine new survey areas.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Establish and monitor long-term sites at known breeding locations.

Category	Need	Action
Research	Life history – habitat preference information.	Coordinate projects with researchers. Write proposals for needed prospecti and actively seek contractors.
	Habitat management/manipulation methodology.	

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Golden-winged Warbler and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Education , Coordination, Management
Over Collection	
Management Conflicts	Coordination
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE GOLDEN-WINGED WARBLER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Consolidate all existing data from known breeding sites.

Surveys:

- Conduct breeding surveys on newly identified sites and more extensive surveys on known and historical sites.

Monitoring:

- Establish and monitor long-term sites at known breeding locations.

Coordination:

- Work to restore, create and/or manage early successional sites on state managed lands where Golden-winged Warblers may potentially nest.
- Work with the Forest Service, the Fish and Wildlife Service and the National Park Service to create early successional habitat and/or manage existing early successional habitat appropriate for Golden-winged Warblers on federal lands.
- Continue coordination with The Audubon Society in the development of the Important Bird Areas Program.

- Work with landowners to reduce or eliminate activities that may be detrimental to early successional habitats that support Golden-winged Warblers. This may include limiting ATV use, encouraging use of Best Management Practices when timbering and modifying other impacting activities.
- Mitigate against impacts of mining, oil and gas drilling, road construction and other development activities in the vicinity of Golden-winged Warbler habitat.

Education:

- Educate the public on Golden-winged Warblers and the importance of early successional habitats.

Legislation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

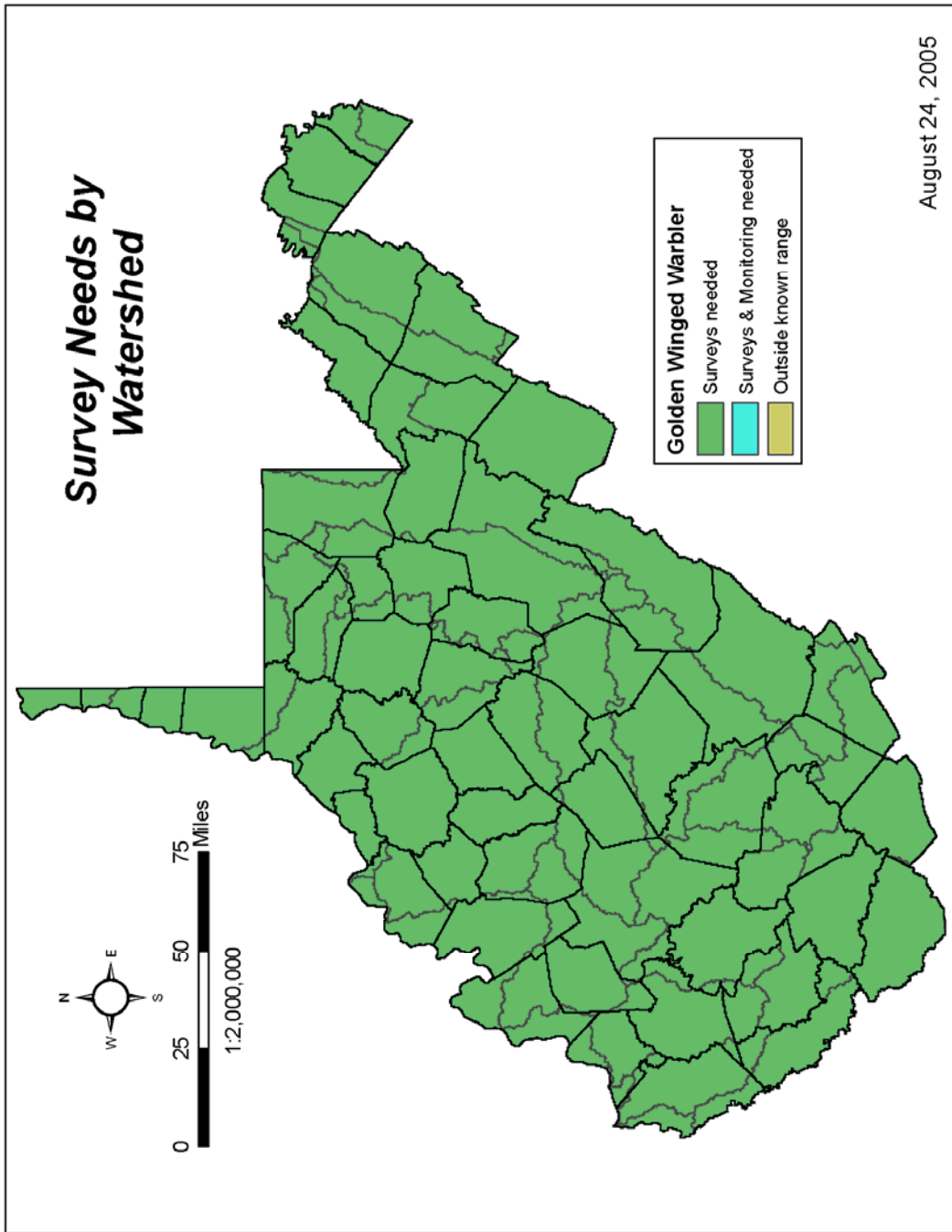
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Rosenberg, K.V., S.E. Barker. *An Atlas of Golden-winged Warbler Populations*. Cornell Laboratory of Ornithology. In Press.

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West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Birds

Common Name: Loggerhead Shrike

Scientific name: *Lanius ludovicianus*

STATUS

The ranks and information in the chart below indicate the rarity of the Loggerhead Shrike in West Virginia. This species is a candidate for federal Endangered Species listing and is listed as a species of concern in every state which it occurs.

Priority Group	Global Rank	State Rank	USFWS	Mon Forest	IUCN Rank	NE Tech Comm	WV PIF	Trend
1*	G4T3Q	S1B,S2N	SC	X	LC	X	IA, II	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences into watersheds, gives the ages of the records (recent is within 20 years) and indicates general habitat for each species. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species.

Habitat: Loggerhead Shrikes require open pasture with scattered trees for nesting.

Watershed	Record Type	Ownership
Shenandoah	Recent Historic	Private
South Branch	Recent Historic	Private
Upper New	Recent Historic	Private
Greenbrier	Recent	Private
North Branch	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Loggerhead Shrike. Because there is inadequate information on the distribution and status of the Loggerhead Shrike in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Loggerhead Shrike.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Public access to general Loggerhead Shrike data.	Publish 2 nd edition of the WV Breeding Bird Atlas.
		Consolidate all existing data from known breeding sites.
		Provide additional information on the DNR Website.

Category	Need	Action
Surveys	Yearly breeding status at known and historical sites needs to be determined.	Conduct breeding surveys on newly identified sites and more extensive surveys on known and historical sites.
	Additional sites need to be surveyed.	Analyze potential habitat statewide to identify new survey areas.

Category	Need	Action
Monitoring	Long-term monitoring.	Establish and monitor long term sites at known breeding locations.

Category	Need	Action
Research	Life history-Habitat preferences.	Support research focusing on year-round habitat usage and nesting.
	Re-introduction.	Investigate feasibility of reintroduction and research potential sites.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Loggerhead Shrike and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded**

actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forestland Management	Coordination , Education, Management
Water Quantity and Quality	
Harvest	
Management Conflicts	Coordination
Invasive Species	Management, Education
Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE LOGGERHEAD SHRIKE AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.

Surveys:

- Conduct breeding surveys on newly accessible sites and more extensive surveys on known and historical sites.

Research:

- Investigate feasibility of reintroduction and research potential sites.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to changes in Loggerhead Shrike habitat. This may include limiting ATV use, maintaining open pasture lands with a few scattered trees and other site related issues.
- Continue coordination with The Audubon Society and the development of the Important Bird Areas program.

Education:

- Educate the public on Loggerhead Shrikes. Encourage the public to report sightings of this rare bird, especially nesting activities.

Legislation:

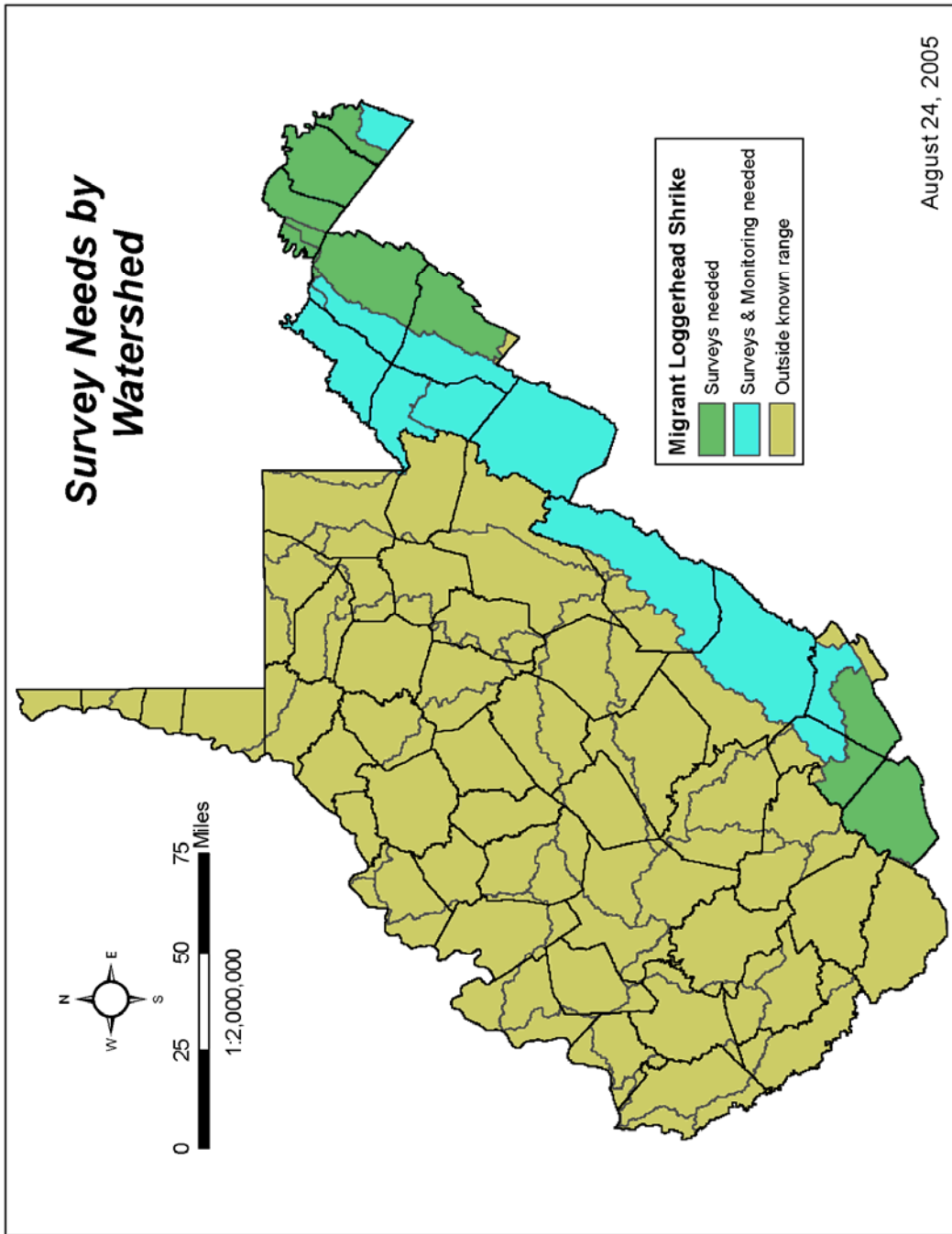
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

Buckelew, A.R., Jr., and G.A. Hall. 1994. *The West Virginia Breeding Bird Atlas*. University of Pittsburgh Press. Pittsburgh, PA.

Mitchell, Donna. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Birds

Common Name: Northern Saw-whet Owl

Scientific name: *Aegolius acadicus*

STATUS

The ranks and information in the chart below indicate the rarity of the Northern Saw-whet Owl in West Virginia. The Northern Saw-whet Owl is listed as a species of concern in West Virginia because of its limited distribution.

Priority Group	Global Rank	State Rank	IUCN Rank	WV PIF	Trend
1*	G5	S2B,S3N	LC	IB	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of the Northern Saw-whet Owl into watersheds and gives the ages of records (recent is within 20 years) and indicates whether sites are in public or private ownership. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species.

Habitat: Northern Saw-whet Owls prefer high elevation red spruce (*Picea rubens*) forests, particularly in association with wetland areas for nesting. This species' migration routes follow mountain ranges that run in a general north-south direction.

Watershed	Record Type	Ownership
Twelve Pole	Historic	Private
Greenbrier	Recent	Public
Cheat	Recent	Public

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Northern Saw-whet Owl. Because there is inadequate information on the distribution and status of the Northern Saw-whet Owl in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Northern Saw-whet Owl.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Public access to general Northern Saw-whet Owl information.	Publish 2 nd edition of the <i>WV Breeding Bird Atlas</i> .
		Provide Website Information.
		Consolidate all existing data from known breeding sites.

Category	Need	Action
Surveys	Yearly breeding status needs to be determined at known and historical sites.	Conduct more extensive breeding surveys at known and historical sites.
	New sites need to be determined.	Analyze potential habitat statewide to determine new survey areas.

Category	Need	Action
Monitoring	Long-term monitoring sites (breeding).	Establish and monitor long term sites at known breeding locations.
	Long-term monitoring sites (migration).	Continue operation of Stuart Knob banding station and establish a second long-term banding station in the southern part of the Monongahela National Forest.

Category	Need	Action
Research	Life history—Habitat preferences.	Develop habitat preference study to identify Northern Saw-whet Owl breeding habitat requirements.
	Life history—Dispersal patterns.	Develop radio telemetry studies to locate natural nesting cavities.
	Life history—Migration routes and timing.	

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Northern Saw-whet Owl and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Education , Coordination, Management
Over Collection	
Management Conflicts	Coordination
Invasive Species	
Damaging Recreation	
Data Protection	

SELECTED ACTIONS FOR THE CONSERVATION OF THE NORTHERN SAW-WHET OWL AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Consolidate all existing data from known breeding sites.

Surveys:

- Conduct more extensive breeding surveys at known and historical sites.

Monitoring:

- Continue operation of Stuart Knob banding station and establish a second long-term banding station in the southern part of the Monongahela National Forest.

Research:

- Develop radio telemetry studies to locate natural nesting cavities.

Coordination:

- Work with landowners to reduce or eliminate activities that may lead to wetland draining and filling. This may also include limiting ATV use or other site related issues. Limit road construction and/or timbering in known Northern Saw-whet Owl habitat during the nesting season.
- Finish the installation of Northern Saw-whet Owl nest boxes in the Monongahela National Forest.

- Continue to coordinate with the Audubon Society and the development of the Important Bird Areas program.

Education:

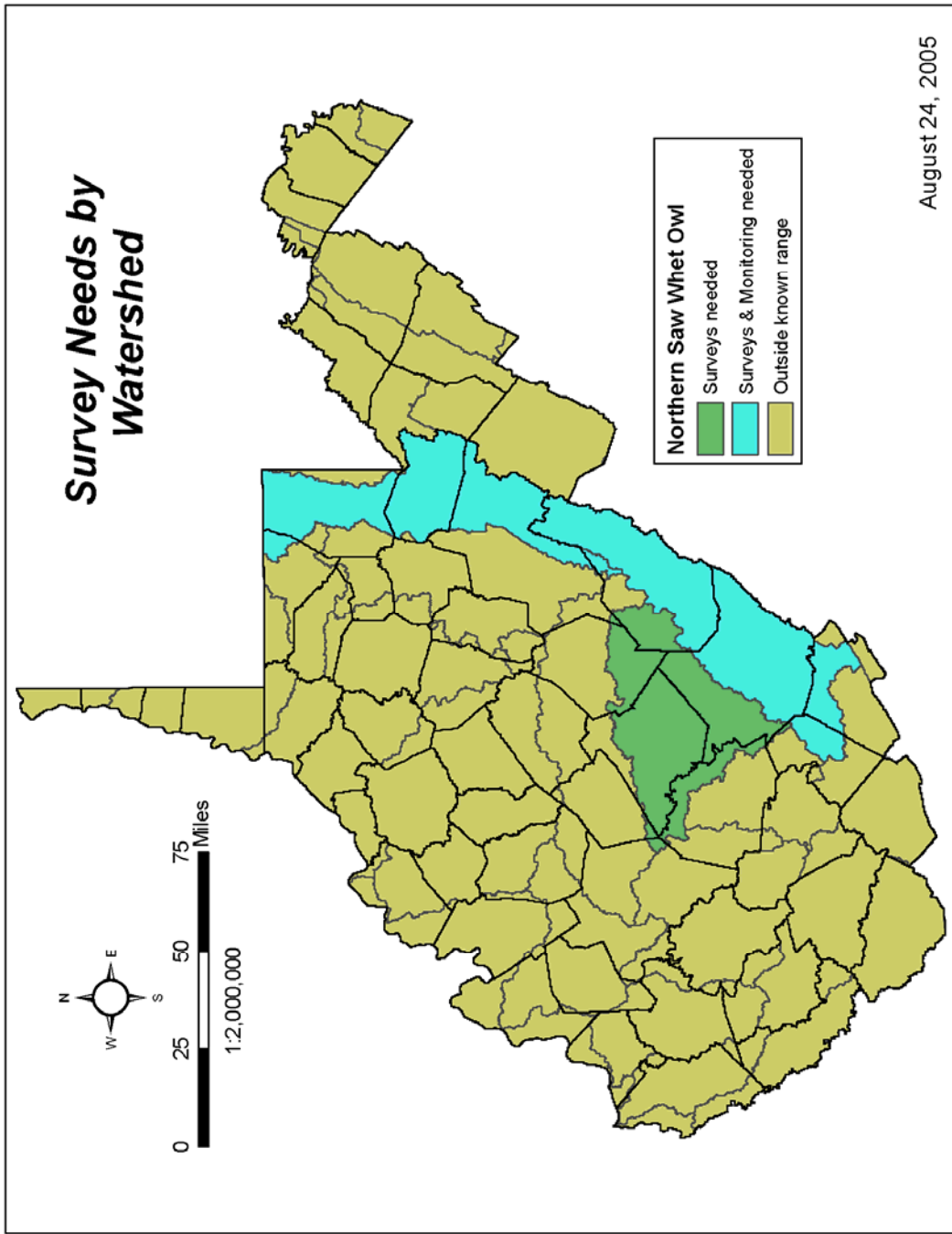
- Educate the public on Northern Saw-whet Owls and their benefits. Report any nest sites found to the WVDNR. Encourage citizens to participate in Northern Saw-whet Owl banding operations.

REFERENCES

O'Malley, Kieran. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

Tallman, Robert. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Birds

Common Name: Peregrine Falcon

Scientific name: *Falco peregrinus*

STATUS

The ranks and information in the chart below indicate the rarity of the Peregrine Falcon in West Virginia.

Priority Group	Global Rank	State Rank	Mon Forest	IUCN Rank	NE Tech Comm	WVPIF	Trend
1*	G4	S1B, 2N	X	LC	X	II	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of Peregrine Falcons into watersheds and gives the ages of the records (recent is within 20 years) and indicates whether sites are under public or private ownership. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species.

Habitat: Peregrine Falcons require extensive cliff habitat for nesting sites.

Watershed	Record Type	Ownership
South Branch	Recent	Public
Gauley	Recent	Public

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Peregrine Falcon. Because there is inadequate information on their distribution and status in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Peregrine Falcon.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Public access to general Peregrine Falcon information.	Make information available on the DNR website.

Category	Need	Action
Surveys	Determine yearly breeding status at known and historical sites.	Conduct breeding surveys on newly identified sites and more extensive surveys on recently active and historical sites.
	Survey additional sites.	Analyze potential habitat statewide to identify new survey areas.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Continue to monitor long-term sites on North Fork Mountain and in the New River Gorge.

Category	Need	Action
Research	Life history.	Initiate a study of Peregrine Falcon feeding preferences.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Peregrine Falcon and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forestland Management	Coordination , Education, Management
Water Quantity and Quality	
Harvest	Education , Legislation/Regulation,
Management Conflicts	Coordination
Invasive Species	
Recreation	Education
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE PEREGRINE FALCON AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.

Monitoring:

- Continue to monitor long-term sites on North Fork Mountain and New River Gorge.

Coordination:

- Work with the Forest Service, the Fish and Wildlife Service and the National Park Service to protect and enhance potential Peregrine Falcon nesting sites on federal land.
- Continue coordination with the Audubon Society and the development of the Important Bird Areas program.

Education:

- Educate the public on Peregrine Falcons.
- Educate landowners on the importance of raptors in the ecosystem and the penalties for harming Peregrine Falcons.

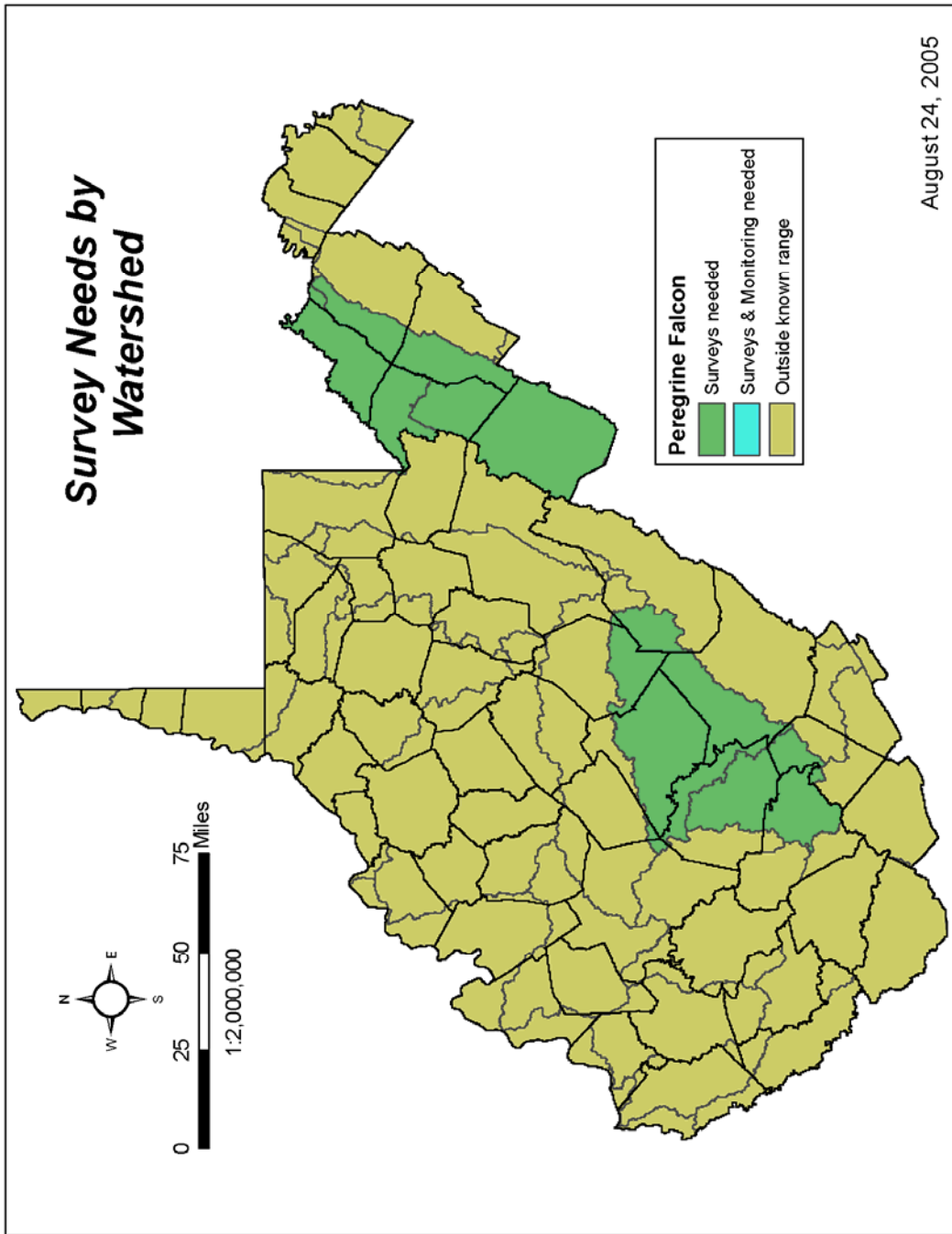
Legislation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

Stihler, Craig. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Birds

Common Name: American Woodcock

Scientific name: *Scolopax minor*

STATUS

The ranks and information in the chart below indicate the rarity of the American Woodcock in West Virginia.

Priority Group	Global Rank	State Rank	NE Tech Comm.	Trend
1*	G5	S4N, S4B	X	Stable

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION AND HABITAT

Habitat: American Woodcock nest in moist early successional forests interspersed with alder thickets and grassy meadows. In West Virginia this habitat is typically associated with higher elevation areas, but suitable habitat is present statewide.

There are recent records for the American Woodcock in all 29 watersheds on both public and privately owned lands.

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the American Woodcock. Because there is inadequate information on the distribution and status of the American Woodcock in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the American Woodcock.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Public access to data.	Publish 2 nd edition of the <i>WV Breeding Bird Atlas</i> .
		Consolidate all existing data from known breeding sites.
		Provide additional information on the DNR Website.

Category	Need	Action
Surveys	Yearly breeding status needs to be determined at known and historical sites.	Conduct breeding surveys on newly identified sites and more extensive surveys on known and historical sites.
	Additional sites need to be surveyed.	Analyze potential habitat statewide to determine new survey areas.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Establish and monitor long-term sites at known breeding locations.

Category	Need	Action
Research	Life history – habitat preferences information.	Coordinate projects with researchers. Write prospecti for needed projects and actively seek contractors.
	Habitat management/manipulation methodology.	

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the American Woodcock and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Education , Coordination, Management
Over Collection	Education, Coordination, Management
Management Conflicts	Coordination
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE AMERICAN WOODCOCK AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Consolidate all existing data from known breeding sites.

Surveys:

- Conduct breeding surveys on newly identified sites and more extensive surveys on known and historical sites.

Monitoring:

- Establish and monitor long-term sites at known breeding locations.

Coordination:

- Work to restore, create and/or manage early successional sites on state managed lands where American Woodcock may potentially nest.
- Work with the Forest Service, the Fish and Wildlife Service and the National Park Service to create early successional habitat and/or manage existing early successional habitat appropriate for American Woodcock on federal lands.
- Continue coordination with The Audubon Society in the development of the Important Bird Areas Program.

- Work with landowners to reduce or eliminate activities that may be detrimental to wetlands and/or early successional habitats that support American Woodcock. This may include limiting ATV use, encouraging use of Best Management Practices when timbering and modifying other impacting activities.
- Mitigate against impacts of mining, oil and gas drilling, road construction and other development activities in the vicinity of American Woodcock habitat.

Education:

- Educate the public on American Woodcock and the importance of early successional habitats.

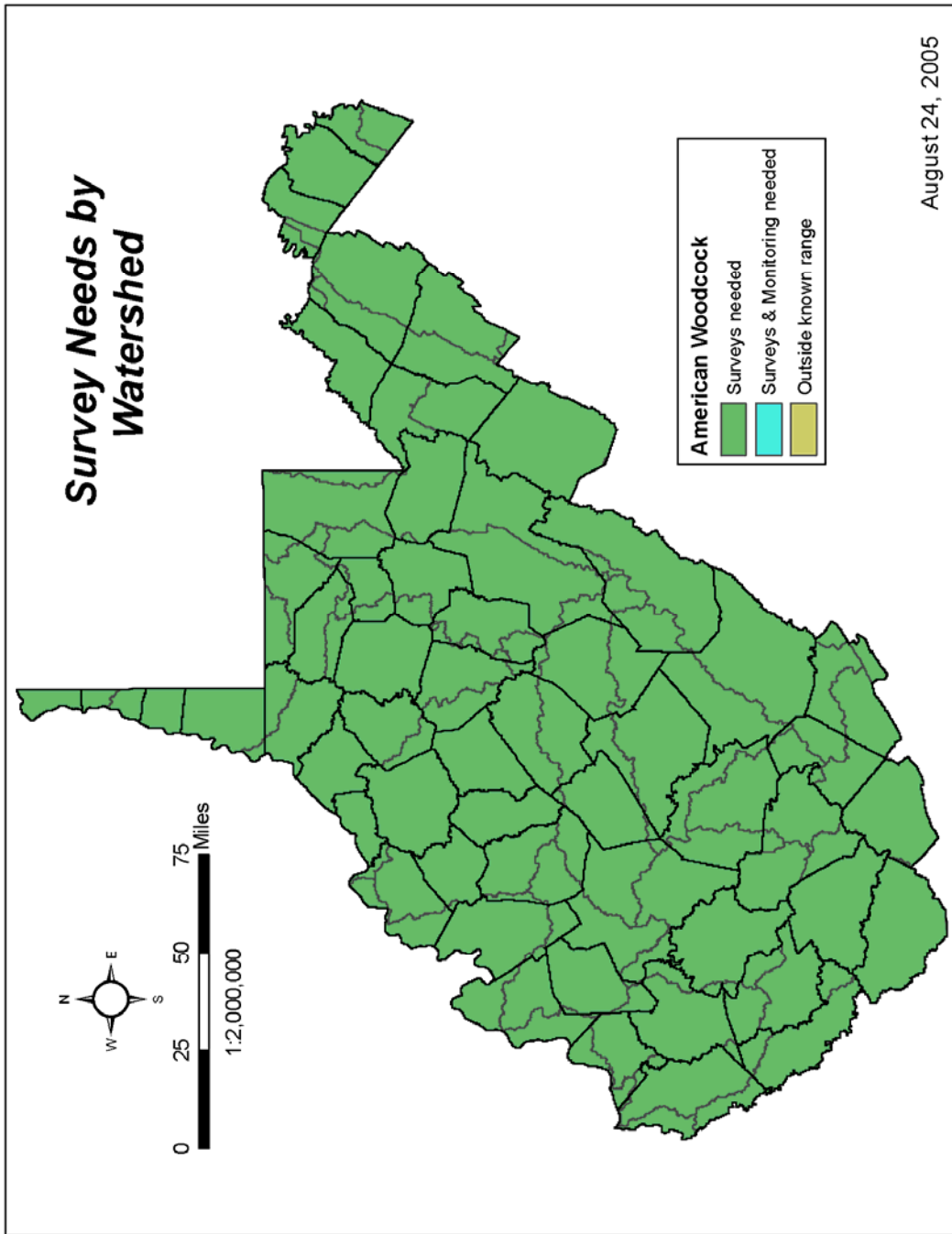
Legislation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

Buckelew, A.R., Jr., and G.A. Hall. 1994. *The West Virginia Breeding Bird Atlas*. University of Pittsburgh Press. Pittsburgh, PA.

Tallman, Robert. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Birds
Group: Early Successional

STATUS

The ranks and information in the chart below indicate the rarity of Early Successional Birds in West Virginia.

Common Name	Priority Rank	Global Rank	State Rank	NE Tech Comm	WV PIF	Trend
Field Sparrow	1*	G5	S4B, S4N	X	II	Declining
Appalachian Bewick's Wren	1	G5T2Q	S1B,S1N	X	IA	Declining
Blue-winged Warbler	1	G5	S4B		II	Declining
Bachman's Sparrow	1	G3	SHB		IA	Declining
Prairie Warbler	1	G5	S4B	X	II	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of Early Successional Birds into watersheds, gives the ages of the records (recent is within 20 years) and indicates the general habitat for each species. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species.

Species	Watershed	Record Type	Habitat
Field Sparrow	All Watersheds	Recent	Early Successional Forest, Shrub/ Scrub
Appalachian Bewick's Wren	All Watersheds except Youghiogheny	Historic	Shrub/Scrub
Blue-winged Warbler	Dunkard	Recent	Early Successional Forest, Shrub/Scrub
	Monongahela		
	West Fork		
	Tygart		
	Upper Ohio Valley		
	Middle Ohio Valley		
	Lower Ohio Valley		

Blue-winged Warbler (con't)	Little Kanawha	Recent	Early Successional Forest, Shrub/Scrub
	Upper Kanawha		
	Lower Kanawha		
	Elk		
	Gauley		
	Greenbrier		
	Lower Guyandotte		
	Upper Guyandotte		
	Coal		
	Big Sandy		
	Tug Fork		
	Twelvepole		
James			
Bachman's Sparrow	Dunkard	Historic	Shrub/Scrub
	Monongahela		
	West Fork		
	Tygart		
	Upper Ohio Valley		
	Middle Ohio Valley		
	Little Kanawha		
Lower Kanawha			
Prairie Warbler	All Watersheds	Recent	Early Successional Forest, Shrub/Scrub

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of Early Successional Birds. Because there is inadequate information on the distribution and status of these birds in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of Early Successional Birds.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Public access to information.	Publish 2nd edition of the WV Breeding Bird Atlas.
		Consolidate all existing data from known breeding sites.
		Analyze and maintain existing point count survey data.
		Provide additional information on the DNR Website.

Category	Need	Action
Surveys	Status needs to be determined on all state and federally managed lands.	Continued coverage of existing PSC routes.
		Focus a percentage of PCS routes on early successional habitats.
	Additional sites need to be surveyed.	Analyze potential habitat statewide to determine new survey areas.

Category	Need	Action
Monitoring	Long-term monitoring sites	Establish and monitor long-term sites at several representative areas throughout the state.
		Monitor known nesting sites for specific species (ie: Field Sparrow).

Category	Need	Action
Research	Habitat requirements, management/manipulation methodology.	Coordinate projects with researchers. Write prospecti for needed projects and actively seek contractors.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with Early Successional Birds and their habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forestland Management	Coordination, Education, Management
Water Quantity and Quality	
Harvest	
Management Conflicts	Coordination
Invasive Species	Education , Management
Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE EARLY SUCCESSIONAL BIRDS AND THEIR HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Publish 2nd edition of the *WV Breeding Bird Atlas*.
- Analyze and maintain of existing point count survey data.

Surveys:

- Analyze potential habitat statewide to determine new survey areas.

Monitoring:

- Establish and monitor long-term sites at representative areas throughout the state.

Coordination:

- Work with the Forest Service, the Fish and Wildlife Service and the National Park Service to create early successional habitat and/or manage existing early successional habitat on federal lands.
- Work to restore, create and/or manage early successional sites on state managed lands.
- Coordinate with the NRCS and willing landowners under the Wildlife Habitat Incentive Program (WHIP) to improve habitat.
- Work with landowners to reduce or eliminate activities that may be detrimental to early successional habitats. This may include limiting ATV use, encouraging use of Best Management Practices when timbering and modifying other impacting activities.
- Continue coordination with the Audubon Society and of the Important Bird Areas program.

Education:

- Educate landowners and utility providers as to the importance of early successional habitats.
- Conduct presentations and create an educational pamphlet on the importance of early successional habitats and how landowners (including mining, quarry, oil and gas etc. interests) can conserve these birds and their habitats.
- Educate landowners about invasive plant species and how to eradicate them.

Legislation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

Buckelew, A.R., Jr., and G.A. Hall. 1994. *The West Virginia Breeding Bird Atlas*. University of Pittsburgh Press. Pittsburgh, PA.

Tallman, Robert. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.

Taxa: Birds
Group: Forest Interior

STATUS

The ranks and information in the chart below indicate the rarity of Forest Interior Birds in West Virginia. West Virginia provides an important source population for all of these species.

Common Name	Priority Group	Global rank	State Rank	NE Tech Comm	WV PIF	Trend
Eastern Wood Peewee	1*	G5	S5B		II	Declining
Chuck-will's-widow	1	G5	S1B		IA	Unknown
Whip-poor-will	1	G5	S3B	X	IC, II	Declining
Acadian Flycatcher	1	G5	S5B		II	Declining
Worm-eating Warbler	1	G5	S5B	X	II	Stable
Wood Thrush	1	G5	S5B	X	II	Stable
Kentucky Warbler	1	G5	S4B	X	II	Declining
Louisiana Waterthrush	1	G5	S5B	X	II	Declining
Cooper's Hawk	2	G5	S3B,S4N		IC	Declining
Sharp-shinned Hawk	2	G5	S3B,S4N		IC	Stable
Black-billed Cuckoo	2	G5	S3B		IC	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of Forest Interior Birds into watersheds, gives the ages of the records (recent is within 20 years) and indicates general habitat for each species. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species.

Species	Watershed	Record Type	Habitat
Eastern Wood Peewee	All Watersheds	Recent	Mixed Deciduous Forest
Chuck-will's-widow	Big Sandy	Recent	Mixed Deciduous Forest
	Tug Fork		
Whip-poor-will	All Watersheds	Recent	Early Successional Forest
Acadian Flycatcher	All Watersheds	Recent	Mature Deciduous Forest
Worm-eating Warbler	Shenandoah	Recent	Mixed Deciduous Forest
	Potomac		
	Cacapon		
	North Branch		
	South Branch		
	Monongahela		
	West Fork		
	Tygart		
	Upper Ohio Valley		
	Lower Ohio Tribs		
	Little Kanawha		
	Lower Kanawha		
	Upper Kanawha		
	Elk		
	Lower New		
	Upper New		
	Greenbrier		
	Lower Guyandotte		
	Upper Guyandotte		
	Big Sandy Tug Fork		
Coal			
Twelvepole			
James			
Dunkard			
Wood Thrush	All Watersheds	Recent	Mixed Deciduous Forest

Kentucky Warbler	All Watersheds except Shenandoah and Youghiogheny	Recent	Mixed Deciduous Forest
Louisiana Waterthrush	All Watersheds	Recent	Riparian Forest
Cooper's Hawk	North Branch	Recent	Mixed Deciduous Forest, Northern Hardwood Forest
	South Branch		
	Cheat		
	Dunkard		
	Monongahela		
	Tygart		
	Upper Ohio Valley		
	Middle Ohio Valley		
	Lower Ohio Valley		
	Gauley		
	Lower New		
	Greenbrier		
	Lower Guyandotte		
	Upper Guyandotte		
	Coal		
	Big Sandy		
Tug Fork			
Twelvepole			
James			
Sharp-shinned Hawk	Potomac	Recent	Mixed Deciduous Forest, Northern Hardwood Forest
	North Branch		
	South Branch		
	Cheat		
	Dunkard		
	Tygart		
	Upper Ohio Tribs		
	Coal		
	Lower Ohio Tribs		
	Gauley		
	Greenbrier		
	Lower Guyandotte		
	Upper Guyandotte		
	Big Sandy		
	Tug Fork		
	Twelvepole		
James			

Black-billed Cuckoo	Middle Ohio Valley	Recent	Mixed Deciduous Forest
	South Branch		
	Lower Kanawha		
	North Branch Potomac		
	Greenbrier		
	Tygart		
	Upper Guyandotte		
	James		
	Twelvepole Tug Fork		
	Upper Kanawha		
	Upper Ohio Valley		
	Lower New		
	Upper New		
	West Fork		
	Cheat		

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of Forest Interior Birds. Because there is inadequate information on the distribution and status of these birds in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of Forest Interior Birds.

Category	Need	Action
Data	Public access to data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
		Publish 2nd edition of the WV <i>Breeding Bird Atlas</i>.
		Consolidate all existing data from known breeding sites.
		Analyze and maintain existing point count survey (PCS) data.
		Provide information on website.

Category	Need	Action
Surveys	Determine status on all state managed lands.	Conduct PCS routes on newly acquired state lands and more extensive surveys on larger state managed lands.
	New sites need to be surveyed.	Continued coverage of existing PCS routes.
		Analyze potential habitat statewide to determine new survey areas.

Category	Need	Action
Monitoring	Long-term monitoring.	Monitor selected sites to assess status of population and any changes to habitat.

Category	Need	Action
Research	Effects of mountaintop removal mining.	Coordinate research projects with researchers. Write prospecti for needed projects and actively seek contractors.
	Response to differing timber harvesting regimes.	
	Habitat requirements, management/manipulation.	

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with Forest Interior Birds and their habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	
Over Collection	
Management Conflicts	Coordination
Invasive Species	Education, Management
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF FOREST INTERIOR BIRDS AND THEIR HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve these species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of these species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of these species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Publish 2nd Edition of the *WV Breeding Bird Atlas*.
- Analyze and maintain existing Point Count Survey (PCS) data.

Surveys:

- Conduct PCS routes on newly acquired state lands and more extensive surveys on larger state managed lands.

Monitoring:

- Monitor selected sites to assess status of population and any changes to habitat.

Coordination:

- Work with the U.S. Forest Service, Fish and Wildlife Service and National Park Service to maintain existing habitats for Forest Interior Birds.
- Work with WVDNR to restore, create and/or manage for Forest Interior Birds on state managed lands.
- Continue coordination with the Audubon Society and the development of the Important Bird Areas program.
- Coordinate with the NRCS and willing landowners under the Wildlife Habitat Incentive Program to improve forest interior habitat.
- Work with forest landowners to reduce or eliminate activities that may be detrimental to forest interior habitats. This may include encouraging use of Best Management Practices when timbering and other site related issues.

Education:

- Educate the public as to the importance of Forest Interior Birds and their habitats.
- Educate the public on WV's role as a source population for Forest Interior Bird species.
- Publish and distribute the WVPIF's "WV Songbird Forest Management Guidelines" to private landowners and industry.
- Educate landowners about invasive plant species and how to eradicate them.

Legislation:

- Pass legislation to protect Species in Greatest Need of Conservation from FOIA requests.

REFERENCES

Buckelew, A.R., Jr., and G.A. Hall. 1994. *The West Virginia Breeding Bird Atlas*. University of Pittsburgh Press. Pittsburgh, PA.

Tallman, Robert. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.

Taxa: Birds
Group: Grassland/Agriculture

STATUS

The ranks and information in the chart below indicate the rarity of birds found in Grassland/ Agricultural habitats in West Virginia. Most of these species are in decline due to limited habitat. Many of these species are listed as species of concern in West Virginia.

Common Name	Priority Group	Global Rank	State Rank	NE Tech Comm	WVPIF	Trend
Henslow's Sparrow	1*	G4	S1B	X	IA	Declining
Short-eared Owl	1	G5	S1B,S2N	X	IB	Unknown
Long-eared Owl	1	G5	S1B,S1N	X	IA	Unknown
Lark Sparrow	1	G5	S1B		IA	Unknown
Upland Sandpiper	1	G5	SHB, S1N	X	IA	Unknown
Grasshopper Sparrow	2	G5	S3B	X	IC	Declining
Northern Bobwhite	2	G5	S3B,S3N	X	IC	Declining
Bobolink	2	G5	S2B		IB	Stable
Horned Lark	2	G5	S2B,S3N		IB	Unknown
Red-headed Woodpecker	2	G5	S2B,S3N		IB	Declining
Vesper Sparrow	2	G5	S3B,S3N	X	IC	Declining
Dickcissel	2	G5	S2B		IB	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of Grassland/Agricultural Birds into watersheds, gives the ages of the records (recent is within 20 years) and indicates general habitat for each species. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. Historically, there were few native grasslands in the state. More have been undoubtedly created as a result of coal mining mitigation and agricultural uses. Whereas it is important to monitor these habitats, they are of lower priority due to their restricted occurrence.

Species	Watershed	Record Type	Habitat
Henslow's Sparrow	North Branch	Historic	Grasslands
	Cheat	Recent	
	Upper Ohio Valley	Recent	
	Upper New	Historic	
	Tug Fork	Recent	
Short-eared Owl	Cheat	Recent	High Elevation Wetlands
	Coal		
Long-eared Owl	Cheat	Historic	Evergreen Forests
	Upper Ohio Valley	Historic	
	Lower Ohio Valley	Historic	
	Gauley	Recent	
Lark Sparrow	South Branch	Historic	Agricultural lands/Pasture Fields
	Lower Ohio Valley	Recent	
Upland Sandpiper	Shenandoah	Historic	Broad open grass areas
	North Branch Potomac		
	Upper Ohio Valley		
	Monongahela		
	Lower Kanawha		
Northern Bobwhite	Upper Ohio Valley	Recent	Agricultural lands Shrub/Scrub
	North Branch		
	South Branch		
	Cheat		
	West Fork		
	Tug Fork		
	Upper Ohio Valley		
	Lower Ohio Valley		
	Little Kanawha		
	Lower Kanawha		
	Lower Guyandotte		
	Coal		
	Big Sandy		
Twelvepole			

Species	Watershed	Record Type	Habitat
Bobolink	North Branch	Recent	Grasslands/Agricultural lands
	Cheat		
	Youghiogheny		
	Upper Ohio Valley		
	Elk		
	Gauley		
	Greenbrier		
Horned Lark	South Branch	Recent	Agriculture lands
	Twelvepole		
	Cheat		
	Lower Ohio Valley		
	Lower Guyandotte		
Red-headed Woodpecker	Potomac	Recent	Agricultural lands/Grasslands
	South Branch		
	Tygart		
	Middle Ohio Valley		
	Greenbrier		
	Big Sandy		
	Tug Fork		
Vesper Sparrow	Potomac	Recent	Grasslands
	North Branch		
	South Branch		
	Cheat		
	Upper New		
	Greenbrier		
Dickcissel	South Branch	Recent	Agricultural Lands/Grasslands
	Middle Ohio Valley		
	Little Kanawha		

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of Grassland/Agriculture Birds. Because there is inadequate information on the distribution and status of these birds in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of Grassland/Agricultural Birds.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Public access to data.	Publish 2 nd edition of the <i>WV Breeding Bird Atlas</i> .
		Consolidate all existing data from known breeding sites.
		Analysis and upkeep of existing point count survey (PCS) data.
	Provide additional information on the DNR Website.	

Category	Need	Action
Surveys	Status needs to be determined on all state and federally managed lands.	Continued surveys of existing PCS routes.
		Focus a percentage of PCS routes on grassland habitats.
	Additional sites need to be surveyed.	Analyze potential habitat statewide to determine new survey areas.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Establish and monitor long-term sites at several representative areas throughout the state.
		Monitor known nesting sites for specific species (i.e., Henslow's Sparrow).

Category	Need	Action
Research	Habitat requirements, management/manipulation.	Coordinate projects with researchers. Write proposals for needed prospecti and actively seek contractors.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with Grassland/Agricultural Birds and their habitats. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	
Over Collecting	
Management Conflicts	Coordination
Invasive Species	Management , Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF GRASSLAND/AGRICULTURE BIRDS AND THEIR HABITATS

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve these species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of these species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of these species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.

Surveys:

- Analyze potential habitat statewide to identify new survey areas.

Monitoring:

- Establish and monitor long-term sites at representative areas throughout the state.

Coordination:

- Work with the Forest Service, the Fish and Wildlife Service and the National Park Service to develop and/or manage existing grassland sites.
- Work to restore, create and/or manage grassland sites on state managed lands where Grassland/Agricultural Birds may potentially nest.
- Work with private landowners to reduce or eliminate activities that may be detrimental to Grassland/Agriculture Birds. This may include limiting ATV use, delaying harvest or mowing or modifying other impacting activities.
- Continue coordination with the Audubon Society in the development of the Important Bird Areas program.

Education:

- Conduct presentations and create an educational pamphlet on the importance of grassland habitats and how landowners (including mining, quarry, oil and gas, etc. interests) can conserve these birds and their habitats.
- Create an educational pamphlet for the general public and industry on the benefits of planting warm season grasses for Grassland/Agricultural Birds.
- Educate landowners about invasive plant species and how to eradicate them.

Legislation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

Buckelew, A.R., Jr., and G.A. Hall. 1994. *The West Virginia Breeding Bird Atlas*. University of Pittsburgh Press. Pittsburgh, PA.

Tallman, Robert. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.

Taxa: Birds

Group: Northern Hardwood/Spruce Forest

STATUS

The ranks and information in the chart below indicate the rarity of Northern Hardwood/Spruce Forest Birds in West Virginia.

Common Name	Priority Group	Global Rank	State Rank	NE Tech Comm	WVPIF	Trend
Northern Goshawk	1	G5	S1B,S1N		IA	Unknown
Pine Siskin	1	G5	S1B,S4N		IB	Unknown
Swainson's Thrush	1	G5	S1B		IA	Stable
Northern Harrier	1	G5	S1B,S3N	X	IB	Unknown
Olive-sided Flycatcher	1	G4	S1B		IA	Declining
Yellow-bellied Flycatcher	1	G5	S1B		IA	Declining
Yellow-bellied Sapsucker	1	G5	S1B,S3N		IB	Unknown
Brown Creeper	2	G5	S3B,S4N		IC	Unknown
Yellow-rumped Warbler	2	G5	S3B,S3N		IC	Stable
Blackburnian Warbler	2	G5	S3B		IC	Declining
Swainson's Warbler	2	G4	S2B		IB	Increasing
Northern Waterthrush	2	G5	S2B		IB	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of Northern Hardwood/Spruce Forest Birds into watersheds, gives the ages of the records (recent is within 20 years) and indicates the general habitat for each species. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species.

Species	Watershed	Record Type	Habitat
Northern Goshawk	Cheat	Recent	Northern Hardwood/Red Spruce Forest
	Tygart		
	Elk		
	Gauley		
Pine Siskin	Cheat	Recent	Red Spruce Forest Pine Plantations
	Monongahela		
	Gauley		
	Greenbrier		
Swainson's Thrush	Cheat	Recent	Northern Hardwood/Red Spruce Forest
	Tygart		
	Elk		
	Gauley		
Northern Harrier	Cheat	Recent	Grassland/Agricultural Fields
	Lower Ohio Valley	Historic	
	Gauley		
Olive-sided Flycatcher	Cheat	Recent	High Elevation Wetlands
	Gauley		
	Greenbrier		
Yellow-bellied Sapsucker	Cheat	Recent	Northern Hardwood Forest
	Tygart		
	Gauley		
	Greenbrier		
Brown Creeper	Cheat	Recent	Northern Hardwood Forest/Mixed Deciduous Forest
	Tygart		
	Gauley		
	Greenbrier		
Yellow-rumped Warbler	Cheat	Recent	Northern Hardwood/Red Spruce Forest
	Tygart		
	Elk		
	Gauley		
Blackburnian Warbler	Cheat	Recent	Northern Hardwood/Red Spruce Forest
	Tygart		
	Elk		
	Gauley		
	Greenbrier		

Species	Watershed	Record Type	Habitat
Swainson's Warbler	Upper Kanawha	Recent	Moist Cove/Rhododendron Forest
	Elk		
	Lower New		
	Lower Guyandotte	Recent	Moist Cove/Rhododendron Forest
	Upper Guyandotte		
	Tug Fork		
Northern Waterthrush	Cheat	Recent	High Elevation Wetlands
	Youghiogheny		
	Tygart		
	Elk		
	Gauley		
	Greenbrier		

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of Northern Hardwood/Spruce Forest Birds. Because there is inadequate information on the distribution and status of these birds West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of Northern Hardwood/Spruce Forest Birds.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Public access to data.	Publish the 2 nd edition of the <i>WV Breeding Bird Atlas</i> .
		Consolidate all existing data from known breeding sites.
		Provide information on Website.

Category	Need	Action
Surveys	Status needs to be determined on all state and federally managed lands.	Continued coverage of existing Point Count Survey (PCS) routes.
		Focus PCS routes on specific representative habitats.
	Additional sites need to be surveyed.	Analyze potential habitat to identify new survey areas.
		Inventory potential new sites for Northern Saw-whet Owl, Northern Goshawk, Yellow-bellied Flycatcher and Olive-sided Flycatcher.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Establish and monitor long-term sites at representative areas throughout the state.
		Monitor known nesting sites for specific species (ie: Northern Goshawk)

Category	Need	Action
Research	Response to differing timber harvesting regimes.	Coordinate research projects with researchers. Write prospecti for needed projects and actively seek contractors.
	Habitat requirements, management/manipulation.	

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with Northern Hardwood/Spruce Forest Birds and their habitats. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	
Over Collecting	
Management Conflicts	Coordination
Invasive Species	Education , Management
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF NORTHERN HARDWOOD/SPRUCE FOREST BIRDS AND THEIR HABITATS

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve these species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of these species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of these species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.

Surveys:

- Continue coverage of existing PCS routes.

Monitoring:

- Establish and monitor long-term sites at representative areas throughout the state.

Coordination:

- Work with the U.S. Forest Service, Fish and Wildlife Service and National Park Service to maintain existing high elevation forest areas.
- Coordinate within the Wildlife Resources Section DNR to restore, create and/or manage northern hardwoods/spruce forest sites on Wildlife Management Areas.
- Continue coordination with the Audubon Society in the development of the Important Bird Areas program.
- Work with forest landowners to reduce or eliminate activities that may be detrimental to high elevation habitats. This may include encouraging use of Best Management Practices when timbering and other site related issues.

Management:

- Restore red spruce habitats.

Education:

- Educate the public as to the importance of high elevation forest habitats.
- Publish and distribute the WV Partners in Flight “WV Songbird Forest Management Guidelines” to private landowners and industry.
- Educate landowners about invasive plant species and how to eradicate them.

Legislation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

Buckelew, A.R., Jr., and G.A. Hall. 1994. *The West Virginia Breeding Bird Atlas*. University of Pittsburgh Press. Pittsburgh, PA.

Tallman, Robert. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.

Taxa: Birds
Group: Other

STATUS

The ranks and information in the chart below indicate the rarity of several Other Birds in West Virginia that are found in a variety of habitats and are of conservation concern. These species are limited in their distribution in the state largely due to their specific habitat requirements.

Common Name	Priority Group	Global Rank	State Rank	WV PIF	Trend
Wilson's Snipe	1*	G5	S1B,S1N	IA	Unknown
Common Nighthawk	2	G5	S3B	IC	Declining
Black Vulture	2	G5	S3B,S4N	IC	Increasing
Cliff Swallow	2	G5	S3B	IC	Declining
Bank Swallow	2	G5	S2B	IB	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences into watersheds, gives the ages of the records (recent is within 20 years) and indicates general habitat for each species. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species.

Species	Watershed	Record Type	Habitat
Wilson's Snipe	Potomac	Recent	Wet Grassland
	North Branch		
	Cheat		
Common Nighthawk	North Branch	Recent	Urban Rooftops
	Cheat		
	Upper Ohio Valley		
	Middle Ohio Valley		
	Lower Ohio Valley		

Species	Watershed	Record Type	Habitat
Black Vulture	Shenandoah	Recent	Various
	Potomac		
	Cacapon		
	North Branch		
	South Branch		
	James		
Cliff Swallow	South Branch	Recent	Man-made Structures
	Cheat		
	Upper Ohio Valley		
	Middle Ohio Valley		
	Lower Ohio Valley		
	Little Kanawha		
	Big Sandy		
	Tug Fork		
Bank Swallow	Middle Ohio Valley	Recent	Riparian/Stream Banks
	Lower Ohio Valley		
	Upper New		
	Greenbrier		
	Coal		
	Tug Fork		

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of Other Birds. Because there is inadequate information on the distribution and status of these birds in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of Other Birds.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Public access to data information.	Publish 2nd edition of <i>The WV Breeding Bird Atlas</i>.
		Consolidate existing data from known breeding sites.
		Maintain existing point count survey (PCS) data.
		Make additional website information available on the DNR website.

Category	Need	Action
Surveys	Status needs to be determined on all state and federally managed lands.	Continued coverage of existing PCS routes.
		Investigate reports of nesting sites for Wilson's Snipe, Black Vulture, Cliff and Bank Swallows.
	Additional sites need to be surveyed.	Analyze potential habitat statewide to identify new survey areas.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Establish and monitor long-term sites at representative areas throughout the state.

Category	Need	Action
Research	Habitat requirements, management/manipulation methodology.	Coordinate research projects with researchers. Write proposals for needed projects and actively seek contractors.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with Other Birds and their habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Education , Coordination, Management
Over Collection	Legislation/Regulation , Education
Management Conflicts	Coordination
Invasive Species	Education, Management,
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF OTHER BIRDS AND THEIR HABITATS

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve these species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of these species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Publish 2nd edition of the *WV Breeding Bird Atlas*.

Surveys:

- Investigate reports of nesting sites for Wilson's Snipe, Black Vulture, Cliff and Bank Swallows.

Coordination:

- Work with the U.S. Forest Service, Fish and Wildlife Service and National Park Service to maintain existing habitats.
- Work to restore, create and/or manage habitats for the development of Other Birds on state managed lands.
- Continue coordination with the Audubon Society and the Important Bird Areas program.
- Work with landowners to reduce or eliminate activities that may be detrimental to these birds. Encourage landowners to create nesting habitat for some of these species.

Education:

- Educate the public on these species.

Legislation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

Buckelew, A.R., Jr., and G.A. Hall. 1994. *The West Virginia Breeding Bird Atlas*. University of Pittsburgh Press. Pittsburgh, PA.

Tallman, Robert. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.

Taxa: Birds
Group: Wetland Birds

STATUS

Whereas many species may be addressed individually, wetlands are such a distinct and limited habitat within the state that it makes sense to take a habitat approach with this group of birds. Their status and distribution is variable, but the need to conserve wetlands across the state is the unifying feature of their collective conservation. An analysis of existing breeding locations for each species will reveal which individual wetlands are of highest priority to protect, manage and/or restore. There are 23 species of birds considered Species of Greatest Need of Conservation that are included in the list of Wetland Birds.

Common Name	Priority Group	Global Rank	State Rank	NE Tech Comm	WV PIF	Trend
American Bittern	1*	G4	S1B, S1N	X	IA	Declining
American Coot	1	G5	S1B, S3N		IB	Unknown
Black-crowned Night-heron	1	G5	SHB		IA	Decreasing
Common Moorhen	1	G5	S1B		IA	Declining
Green-winged Teal	1	G5	SHB, S2N		IB	Unknown
Hooded Merganser	1	G5	S1B, S4N		IB	Unknown
King Rail	1	G4G5	S1B		IA	Declining
Least Bittern	1	G5	S1B		IA	Declining
Marsh Wren	1	G5	S1B		IA	Declining
Nashville Warbler	1	G5	S1B		IA	Unknown
Sedge Wren	1	G5	S1B	X	IA	Declining
Sora	1	G5	S1B, S1N		IA	Declining
Virginia Rail	1	G5	S1B, S1N		IA	Declining
Yellow-crowned Night-heron	1	G5	SPB, S1N		IA	Unknown
Alder Flycatcher	2	G5	S3B, S4N		IC	Stable
American Black Duck	2	G5	S2B, S4N	X	IB	Unknown
American Woodcock	2	G5	S4N, S4B	X		Stable
Great Blue Heron	2	G5	S2B, S4N		IB	Increasing
Osprey	2	G5	S2B, S2N		IB	Increasing
Pied-billed Grebe	2	G5	S2B, S4N	X	IB	Stable

Prothonotary Warbler	2	G5	S2B		IB	Unknown
Spotted Sandpiper	2	G5	S3B		IC	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of Wetland Birds into watersheds, gives the ages of the records (recent is within 20 years) and indicates general habitat for each species. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species.

Species	Watershed	Record Type	Habitat
American Bittern	Cheat	Historic	Marsh
American Coot	Middle Ohio Valley	Historic	Marsh/open water
	Kanawha		
Black-crowned Night-heron	Upper Ohio Valley	Historic	Marsh, streams, river backwaters
Common Moorhen	Shenandoah	Historic	Marsh
	Lower Kanawha		
Green-winged Teal	Cheat	Historic	Marsh/open water
	Tygart		
Hooded Merganser	Lower Ohio Valley	Recent	Marsh
	Tygart		
	Upper Ohio Valley	Historic	
King Rail	Lower Ohio Valley	Recent	Marsh
	Twelvepole		
	Shenandoah	Historic	
Least Bittern	Middle Ohio Valley	Recent	Marsh
	Shenandoah	Historic	
Marsh Wren	Shenandoah	Historic	Marsh
	Middle Ohio Valley		
	Cheat		
Nashville Warbler	Cheat	Recent	Shrubby borders of bogs
	North Branch Potomac	Historic	
Sedge Wren	Lower Kanawha	Historic	Marsh
	Tygart	Recent	
Sora	North Branch Potomac	Recent	Marsh
Virginia Rail	North Branch Potomac	Recent	Cattail and sedge marshes
Yellow-crowned Night-heron	No Breeding Records		Marsh
Alder Flycatcher	Cheat	Recent	Alder thickets
	Rocky Marsh Run		

American Black Duck	Cheat	Recent	Marsh
	South Branch Potomac		
	Upper Ohio Valley		
	Dunkard Creek		
	Monongahela		
	Lower Ohio Valley		
	Lower Kanawha		
	Tug Fork		
	West Fork		
	Tygart		
	Cheat		
	North Fork		
	Potomac		
	Cacapon		
Gauley			
Great Blue Heron	Upper Ohio Valley	Recent	Trees near marshes, rivers, streams, swamps
	Middle Ohio Valley		
	Tug Fork		
	Cheat		
	Big Sandy		
	James		
Osprey	Sleepy Creek	Recent	Trees near open water
Pied-billed Grebe	Little Kanawha	Recent	Marsh
	Lower Ohio Valley		
	Guyandotte		
Prothonotary Warbler	Potomac	Recent	Trees adjacent to rivers, streams
	Middle Ohio Valley		
	Lower Ohio Valley		
	Twelvepole		
	Upper Guyandotte		
Spotted Sandpiper	Potomac	Recent	Streambanks
	Lower Ohio Valley	Historic	
	Upper Ohio Valley		

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of Wetland Birds. Because there is inadequate information on the distribution and status of these birds in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below.

Bolded text indicates primary actions required to identify conservation needs of Wetland Birds.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Public access to data.	Gather all existing data on breeding records and important migration stopover wetlands.
		Publish the 2nd edition of the WV Breeding Bird Atlas.
		Provide website information on wetlands and the birds that use them.

Category	Need	Action
Surveys	Status needs to be determined at historic sites.	Conduct surveys to determine presence of species.
	Determine primary and secondary conservation boundaries for priority wetlands (breeding sites).	Conduct surveys to map appropriate habitat boundaries.
	Additional sites need to be surveyed.	Analyze potential habitat statewide for each species to identify new survey areas.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Identify and establish monitoring sites.

Category	Need	Action
Research	Research priorities need to be identified through consultation with regional bird experts.	Coordinate research projects. Write prospecti for needed projects and actively seek contractors.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with Wetland Birds and their habitats. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Education , Coordination, Management
Over Collection	Legislation/Regulation , Education
Management Conflicts	Coordination
Invasive Species	Education , Management
Damaging Recreation	Education
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF WETLAND BIRDS AND THEIR HABITATS

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve these species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of these species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of these species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Publish the 2nd edition of the *WV Breeding Bird Atlas*.

Surveys:

- Conduct surveys to determine presence of species.

Coordination:

- Work with the U.S. Forest Service, Fish & Wildlife Service and National Park Service to develop and/or manage existing wetland sites.
- Work to restore, create and/or manage wetland sites on state managed lands where wetland birds may potentially nest.

- Work with private landowners to reduce or eliminate activities that may be detrimental to wetland birds. This may include working with forest landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in wetlands. This also may include limiting ATV use, encouraging use of Best Management Practices when timbering, avoiding draining and filling wetlands and modifying procedures when engaging in other impacting activities.
- Continue coordination with the Audubon Society and the development of the Important Bird Areas program.
- Mitigate for impacts of mining and other development activities in the vicinity of wetlands.
- Coordinate with USFWS and willing landowners under the Partnerships for Wildlife program to improve habitat.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) on wetlands.
- Develop an educational pamphlet on the value of wetlands to wildlife and landowners.
- Meet with landowners to discuss the value of conserving wetlands.

Legislation:

- Review harvest regulations on wetland game bird species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

Buckelew, A. R. and Hall, G. A. 1994. *West Virginia Breeding Bird Atlas*. University of Pittsburgh Press, Pittsburgh, PA 15260

Hall, George A. 1983. *West Virginia Birds*. Carnegie Museum of Natural History, 4400 Forbes Ave. Pittsburgh, PA 15213

WV Partners in Flight Working Group. 2005. Personal Communication.

Butterflies

One hundred twenty-eight species of butterflies are known from the state. Most species are residents but some are migratory or move into the state during years with warmer than average temperatures. Butterfly species are found across the state depending on climatic suitability and larval host plant abundance. Thirty-one species are included on the list of Species in Greatest Need of Conservation.

Scientific Name	Common Name
<i>Calephelis borealis</i>	Northern Metalmark
<i>Callophrys polios</i>	Hoary Elfin
<i>Callophrys irus</i>	Frosted Elfin
<i>Colias interior</i>	Pink-Edged Sulphur
<i>Speyeria diana</i>	Diana
<i>Speyeria atlantis</i>	Atlantis Fritillary
<i>Boloria selene myrina</i>	Myrina Fritillary
<i>Speyeria idalia</i>	Regal Fritillary
<i>Euchloe olympia</i>	Olympia Marble
<i>Chlosyne harrisii</i>	Harris's Checkerspot
<i>Cylopsis gemma</i>	Gemmed Satyr
<i>Pyrgus wyandot</i>	Grizzled Skipper
<i>Erynnis martialis</i>	Mottled Duskywing
<i>Erynnis lucilius</i>	Columbine Duskywing
<i>Atrytonopsis hianna</i>	Dusted Skipper
<i>Autochton cellus</i>	Golden-Banded Skipper
<i>Euphyes bimacula</i>	Two-Spotted Skipper
<i>Euphyes conspicua</i>	Black Dash
<i>Hesperia metea</i>	Cobweb Skipper
<i>Lycaena epixanthe</i>	Bog Copper
<i>Lycaena hyllus</i>	Bronze Copper
<i>Phyciodes batesii</i>	Tawny Crescent
<i>Phyciodes cocyta</i>	Northern Crescent
<i>Polygonia faunus smythi</i>	Green Comma
<i>Polygonia progne</i>	Gray Comma
<i>Eroria laeta</i>	Early Hairstreak
<i>Parrhasius malbum</i>	White-M Hairstreak

<i>Satyrium caryaevorum</i>	Hickory Hairstreak
<i>Satyrium edwardsii</i>	Edwards' Hairstreak
<i>Fixsenia favonius ontario</i>	Northern Hairstreak
<i>Staphylus hayhurstii</i>	Hayhurst's Scallopwing

Several species are severely limited in their range in the state including the Black Dash, Grizzled Skipper and the Bog Copper. Unfortunately, the beautiful Regal Fritillary is likely extirpated from the state. Despite the compilation of existing information and the subsequent publication of the *Butterflies of West Virginia and Their Caterpillars* (Allen 1997) the distribution and status of many species is still poorly documented.

A review of the conservation needs for butterflies, as outlined on the following fact sheets, indicates that initial actions for the listed species are centered on survey, inventory and data management. Information on the distribution and status of many butterflies is lacking and filling these information gaps is a necessary first step for the future conservation assessment of each species. Standardized data acquisition and management both within the WV DNR Wildlife Resources Section and by all other research partners will greatly assist with these conservation assessments. Centralized and shared information is a prerequisite to the formulation of on-the-ground conservation plans for all listed species.

Because the WRS acts as a statewide repository for information, we rely on partners to share information to maximize understanding of our biological resources. Occasionally researchers are reluctant to share information for fear that the information will be requested from state government via the Freedom of Information Act (FOIA) and used to the detriment of the species involved. For this reason it is believed appropriate to have legislation enacted to protect sensitive rare species information from wide dissemination. This need is expressed across the board on the fact sheets for animal species in greatest need of conservation.

References

Allen, Thomas. 1997. *The Butterflies of West Virginia and Their Caterpillars*.
University of Pittsburgh Press, Pittsburgh, PA. 387 pp.

Taxa: Butterflies
Common name: Regal Fritillary
Scientific name: *Speyeria idalia*

STATUS

The ranks and information in the chart below indicate the rarity of the Regal Fritillary in West Virginia. This species is listed as rare and in need of conservation and many groups monitor its status. It is considered a species of concern in every state in which it occurs. Habitat for this species has declined in West Virginia and in other states. It is predicted that the Regal Fritillary could disappear east of the Mississippi.

Priority Group	Global Rank	State Rank	Jeff Forest	Trend
1*	G3	S1	X	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Regal Fritillary into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether sites are in public or private ownership.

Habitat: The Regal Fritillary prefers grasslands adjacent to boggy or marshy areas or damp meadows in West Virginia. The grasslands that appear to support populations are those at higher elevations, including the tops of hills where wind currents are strongest. This species nectars on a variety of plants such as Milkweed species, Butterfly Weed, Ironweed, Joe-pye Weed, Thistle, Aster and Boneset. Violet species are the only larval host plant for the Regal Fritillary.

Watershed	Site Name	Record Type	Ownership
Greenbrier	Gap Mills	Recent	Private
Monongahela	Fort Martin	Recent	Private
	Katy-Near Fairmont	Unknown	Private
Cacapon	Hampshire- Course's Nursery	Historic	Private
West Fork	Jackson's Mill	Unknown	Public
Youghiogheny	Eglon	Historic	Private
North Branch Potomac	Mineral-Nancy Hanks Memorial	Historic	Private
Middle Ohio River Valley	Point Pleasant	Historic	Private

South Branch Potomac	Pendleton	Historic	Unknown
Unknown	Braxton	Historic	Unknown
Elk	Clay	Unknown	Unknown

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Regal Fritillary. Because there is inadequate information on the distribution and status of the Regal Fritillary in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Regal Fritillary.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Existing data needs to be entered into a database with coordinates added.	Continue contract to capture existing butterfly data; Tom Allen's data require coordinates.
	Public access to data.	Provide general butterfly information, such as distribution maps, on the WVDNR website.

Category	Need	Action
Surveys	Update status of historic sites.	Target historic sites and sites with appropriate habitat or in same geographical area.
	Survey new sites.	Analyze potential habitat to identify new survey areas.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Monitor known sites.

Category	Need	Action
Research	Life history.	Identify research needs as more surveys are conducted.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Regal Fritillary and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation

Issues	Actions
Habitat Loss	Coordination, Education, Management
Forest Health	Coordination, Education, Management
Water Quantity and Quality	Coordination, Education, Management
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE REGAL FRITILLARY AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Continue contract to capture existing butterfly data; Tom Allen's data require coordinates.

Surveys:

- Target historic sites and sites with appropriate habitat to identify new survey areas.
- Analyze potential habitat to identify new survey areas.

Coordination:

- Coordinate with private landowners under the Landowner Incentive Program.

Education:

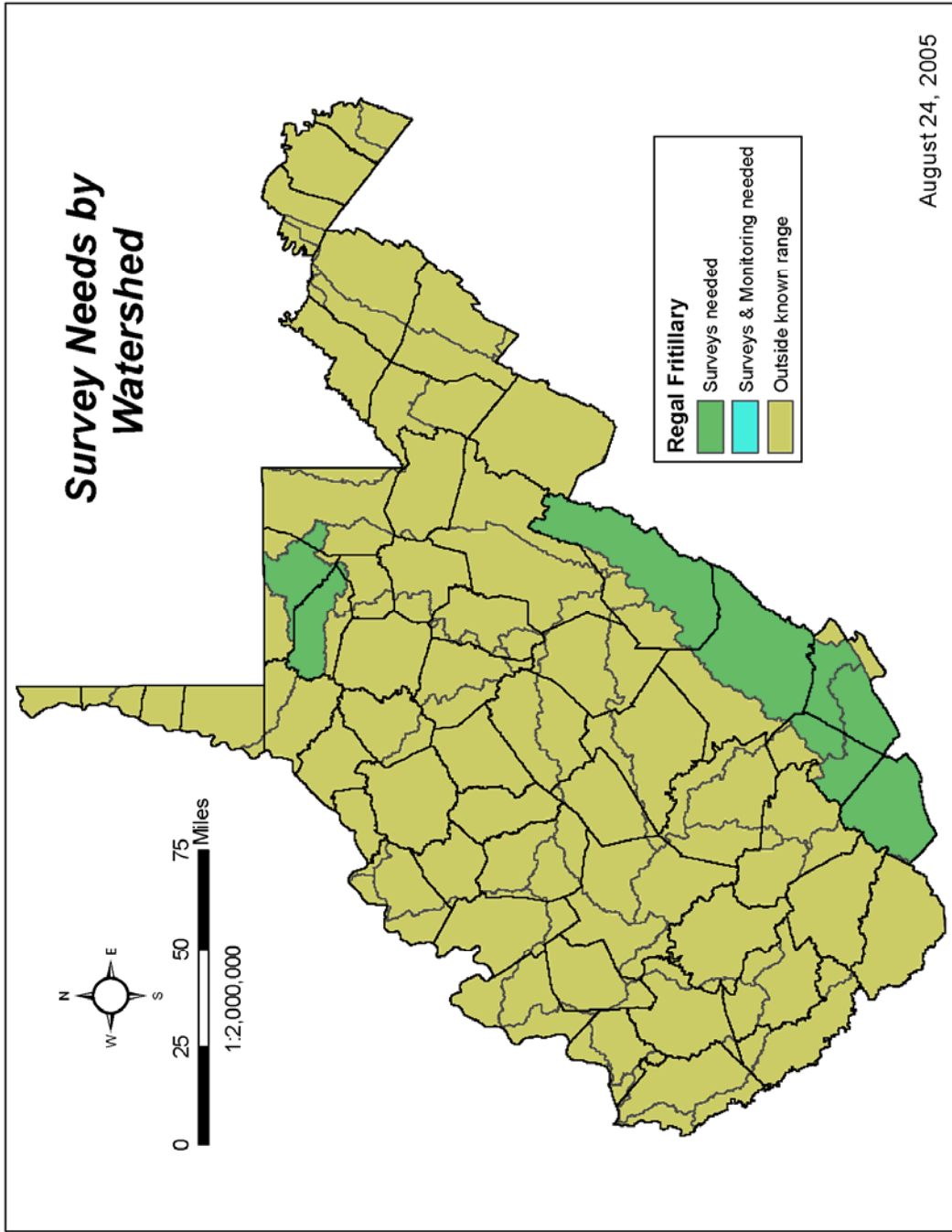
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Regal Fritillary sites. General information on the importance of invertebrate groups and general biodiversity should be included.

Legislation/Regulation:

- Develop and introduce legislation to include Butterflies and other Terrestrial Insects in the definition of wildlife.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

- Allen, Thomas. 1997. *The Butterflies of West Virginia and their Caterpillars*. University of Pittsburgh Press, Pittsburgh, PA. 387 pp.
- Allen, Thomas. 2005. Personal Communication. Retired, West Virginia Division of Natural Resources, Elkins, WV.
- NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: April 13, 2005).
- West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Butterflies
Common name: Diana
Scientific name: *Speyeria diana*

STATUS

The ranks and information in the chart below indicate the rarity of the Diana Butterfly in West Virginia. The Diana is listed as rare and in need of conservation in West Virginia because many of the records are historic. It is considered a species of concern in every state in which it occurs and its status is monitored by many groups.

Priority Group	Global Rank	State Rank	USFWS	Mon Forest	Jeff Forest	Trend
1*	G3G4	S2S3	SC	X	X	Stable

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Diana Butterfly into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether sites are in public or private ownership.

Habitat: The Diana Butterfly is a forest species inhabiting the southern mountainous areas of West Virginia. It prefers moist and well-shaded forests with rich soils. This species utilizes small openings and roadsides in search of nectar plants, but will not stray far from the woods. They are usually found nectaring along woodland edges. Diana Butterflies use Violet species as larval hosts and nectar on Milkweeds, Thistles and other species.

Watershed	Site Name	Record Type	Ownership
Coal	Fork Creek WMA	Recent	Public
	Dennison Fork	Recent	Private
Gauley	Cranberry Glades	Recent	Public
	Gauley River	Recent	Public
	Koontz Bend	Recent	Public
	Nallen	Historic	Private
	Quinwood	Recent	Private
	Summersville	Recent	Public
	Babcock State Park	Recent	Public
Greenbrier	Onemile Run	Recent	Public

James	Waiteville	Recent	Private
Lower Guyandotte	Big Ugly WMA	Recent	Public
Lower New	New River Gorge Park	Recent	Public
	Beauty Mountain	Historic	Private
	Beury Mountain	Historic	Private
	Prince	Recent	Public
Tug Fork	Chadwick Tract	Recent	Private
	Skygusty South	Recent	Private
Upper Guyandotte	MAN	Recent	Public
	Mullens	Recent	Private
	Twin Falls State Park	Recent	Public
Upper Kanawha	East Of Charleston	Recent	Private
Upper New	Athens	Historic	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Diana Butterfly. Because there is inadequate information on the distribution and status of the Diana Butterfly in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Diana Butterfly.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Existing data needs to be entered into a database with coordinates added.	Continue contract to capture existing butterfly data; Tom Allen's data require coordinates.
	Public access to data.	Provide general butterfly information, such as distribution maps, on the WVDNR website.

Category	Need	Action
Surveys	Update status of historic sites.	Target historic sites and sites with appropriate habitat or in the same geographical area.
	Survey new sites.	Analyze potential habitat in southern WV to identify new survey areas (species only breeds south of Rt. 60).

Category	Need	Action
Monitoring	Long-term species monitoring.	Establish sites at known locations; monitor regularly. Population size fluctuates greatly from year to year.

Category	Need	Action
Research	Life history.	Identify research needs as more surveys are conducted.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Diana Butterfly and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling.

Issues	Actions
Habitat Loss	Coordination, Education, Management
Forest Health	Coordination, Education, Management
Water Quantity and Quality	
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE DIANA BUTTERFLY AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Continue to contract capture existing butterfly data; Tom Allen's data requires coordinates.

Surveys:

- Target historic sites and sites with appropriate habitat or in the same geographical area.
- Analyze potential habitat in southern WV to identify new survey areas (species only breeds south of Rt. 60).

Coordination:

- Work with forest landowners to reduce or eliminate activities that may be detrimental to Diana Butterfly sites. This includes maintaining host and nectar species while encouraging use of Best Management Practices when timbering, mining, or engaged in other impacting activities.

Education:

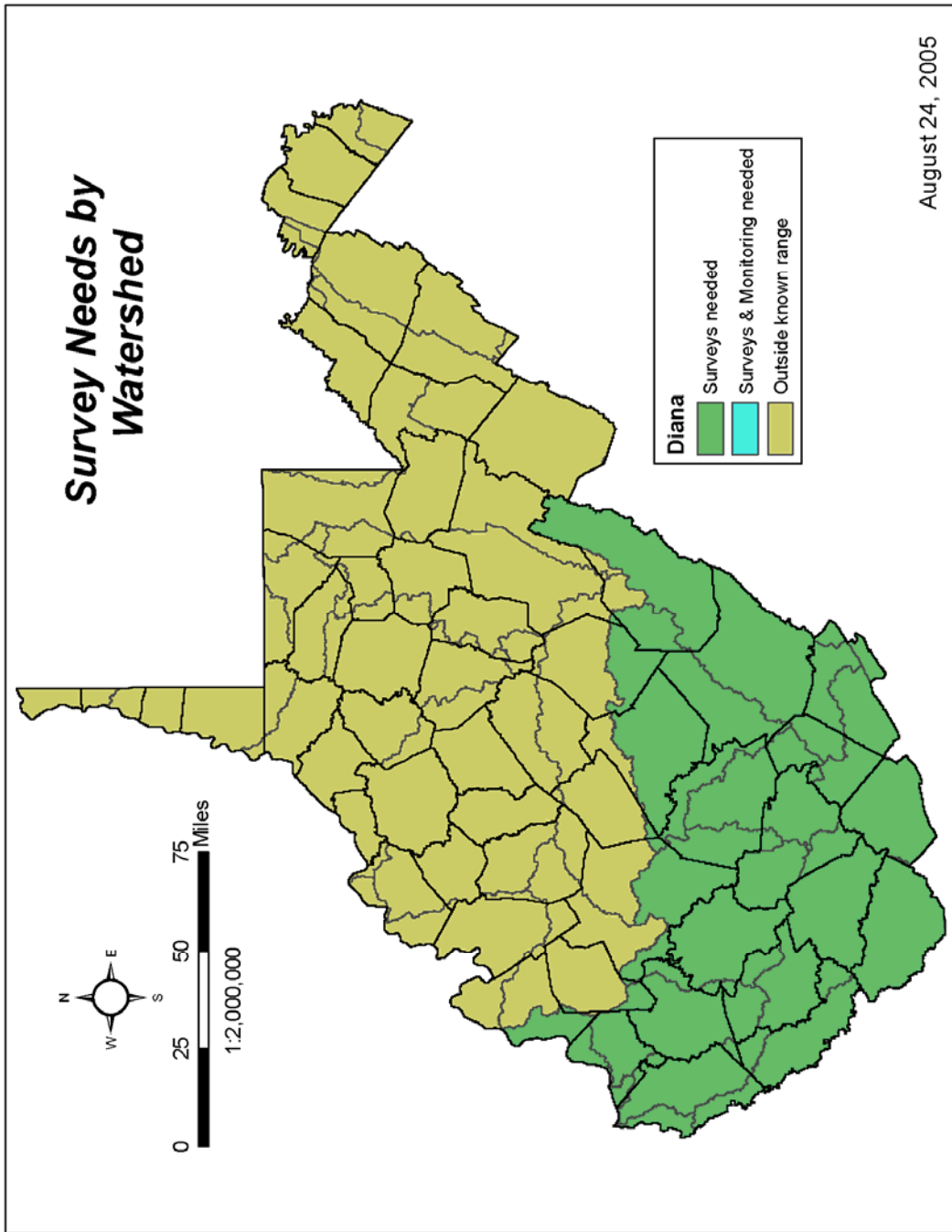
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Diana Butterfly sites. General information on the importance of invertebrate groups and general biodiversity should be included.

Legislation:

- Develop and introduce legislation to include Butterflies and other Terrestrial Insects in the definition of wildlife.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

- Allen, Thomas. 1997. *The Butterflies of West Virginia and their Caterpillars*. University of Pittsburgh Press, Pittsburgh, PA. 387 pp.
- Allen, Thomas. 2005. Personal Communication. Retired, West Virginia Division of Natural Resources, Elkins, WV.
- NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: April 13, 2005).
- West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Butterflies
Common name: Green Comma
Scientific name: *Polygonia faunus smythi*

STATUS

The ranks and information in the chart below indicate the rarity of the Green Comma Butterfly in West Virginia. The Green Comma is listed as rare and in need of conservation because of the scarcity of records. It is considered a species of concern in every state in which it occurs.

Priority Group	Global Rank	State Rank	Trend
1*	G5T3T4	S1	Stable

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Green Comma into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether the sites are in public or private ownership.

Habitat: The Green Comma prefers northern hardwood forest habitats with an association of spruce and is usually found along roadways, trails, or streams. The amount of spruce present may vary. At higher elevations in the eastern mountains, Beech-Maple-Birch with a Spruce component is a typical forest type preferred by this species. It is reported to feed on damp soil, tree sap, rotten fruit, dung and carrion, as well as flower nectar. The Green Comma selects Willows, Birch and Alders over much of its range; however, the Appalachian population may feed on Gooseberry as well.

Watershed	Site Name	Record Type	Ownership
Cheat	Sinks Of Gandy	Recent	Public
South Branch Potomac	Spruce Knob	Recent	Public
Unknown	Fayette County	Historic	Unknown

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Green Comma. Because there is inadequate information on the distribution and status of the Green Comma in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Green Comma.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Existing data needs to be entered into a database with coordinates added.	Continue contract to capture existing butterfly data; Tom Allen's data require coordinates.
	Public access to data.	Provide general butterfly information, such as distribution maps, on the WVDNR website.

Category	Need	Action
Surveys	Update status of historic species.	Target historic sites and sites with appropriate habitat or in same geographical area.
	Survey new sites.	Analyze potential habitat to identify new survey areas such as the northern end of Canaan Valley

Category	Need	Action
Monitoring	Long-term species monitoring.	Establish sites at known locations; monitor regularly.

Category	Need	Action
Research	Life history.	Identify research needs as more surveys are conducted.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Green Comma and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management
Forest Health	Coordination, Education, Management
Water Quantity and Quality	
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE GREEN COMMA AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Continue contract to capture existing butterfly data; Tom Allen’s data requires coordinates.

Surveys:

- Analyze potential habitat to determine new survey areas such as the northern end of Canaan Valley.

Coordination:

- Work with forest landowners to reduce or eliminate activities that may be detrimental to Green Comma sites. This includes maintaining host and nectar species while

encouraging use of Best Management Practices when timbering, mining, or engaged in other impacting activities.

Education:

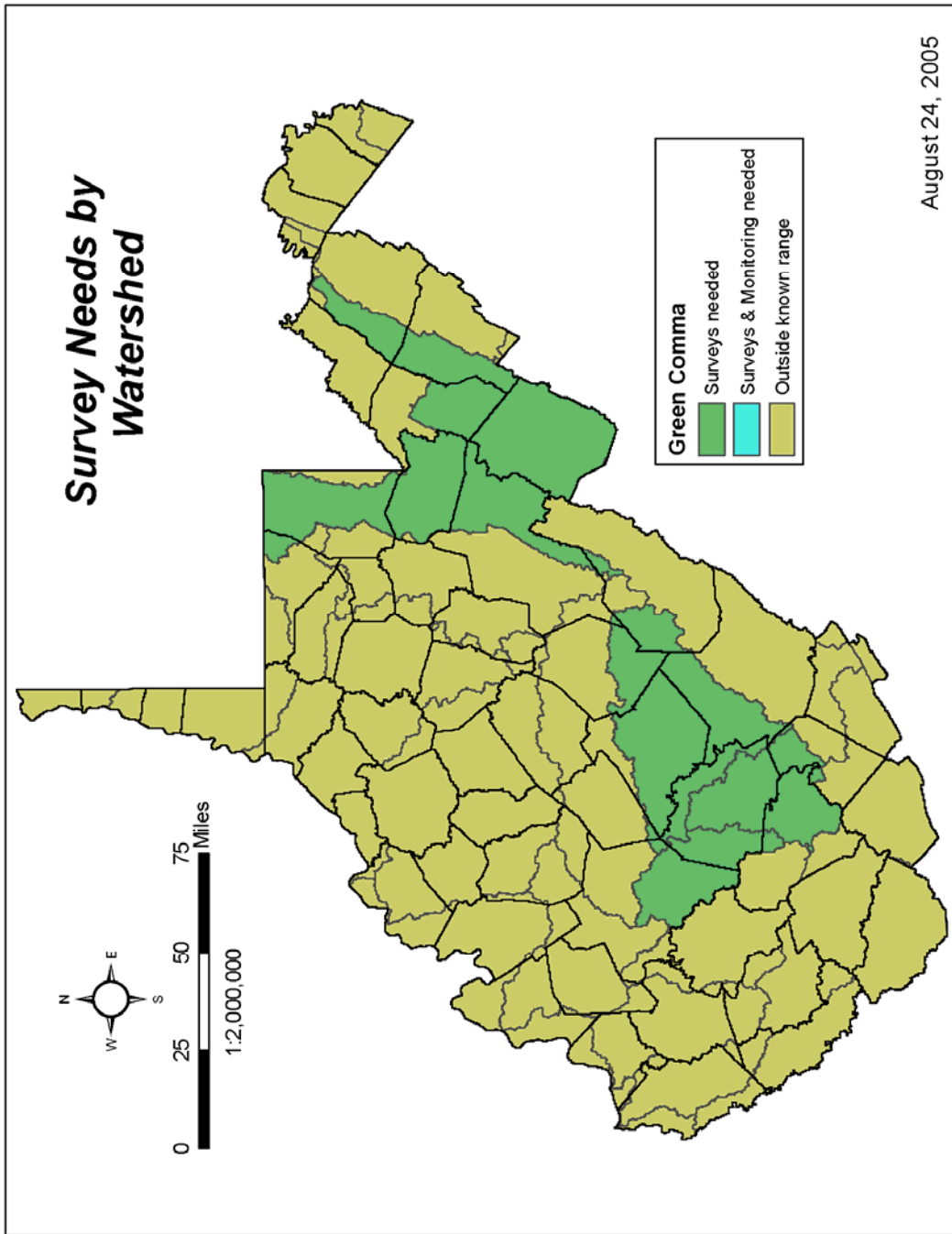
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Green Comma sites. General information on the importance of invertebrate groups and general biodiversity should be included.

Legislation:

- Develop and introduce legislation to include Butterflies and other Terrestrial Insects in the definition of wildlife.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOI A requests.

REFERENCES

- Allen, Thomas. 1997. *The Butterflies of West Virginia and their Caterpillars*. University of Pittsburgh Press, Pittsburgh, PA. 387 pp.
- Allen, Thomas. 2005. Personal Communication. Retired, West Virginia Division of Natural Resources, Elkins, WV.
- NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: April 13, 2005).
- West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Butterflies

Common name: Mottled Duskywing

Scientific name: *Erynnis martialis*

STATUS

The ranks and information in the chart below indicate the rarity of the Mottled Duskywing in West Virginia. The Mottled Duskywing is listed as rare and in need of conservation because of the scarcity of records. It is considered a species of concern in every state in which it occurs.

Priority Group	Global Rank	State Rank	Trend
1*	G3G4	S2	Stable

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Mottled Duskywing into watersheds and gives the ages of the records (recent is within 20 years) and indicates whether sites are in public or private ownership.

Habitat: The Mottled Duskywing prefers wooded uplands or open woods and woodland edges, often on acid soil where the terrain is hilly. Since the species occurs mainly along roads, it utilizes plants found along forest edges such as *Houstonia*, *Gromwell*, *Dogbane* and *New Jersey Tea*. *New Jersey Tea* is also the larval host plant.

Watershed	Site Name	Record Type	Ownership
Lower Guyandotte	Big Ugly WMA	Recent	Public
South Branch Potomac	Springfield WMA	Historic	Public
Coal	Fork Creek WMA	Recent	Public
Greenbrier	Big Draft Rd.	Recent	Private
	Greenbrier Mountain	Recent	Private
Lower New	Babcock State Park	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Mottled Duskywing. Because there is inadequate information on the distribution and status of the Mottled Duskywing in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Mottled Duskywing.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Existing data needs to be entered into a database with coordinates added.	Continue contract to capture existing butterfly data; Tom Allen's data require coordinates.
	Public access to data.	Provide general butterfly information, such as distribution maps, on the WVDNR website.

Category	Need	Action
Surveys	Update recent sites.	Surveys are needed with detailed habitat documentation. Even though records are considered recent, all are from the 1980s.
	Survey new sites.	Analyze potential habitat to find good stands of New Jersey Tea along un-mowed gravel mountain roads.

Category	Need	Action
Monitoring	Long-term species monitoring sites.	Establish sites at known locations; monitor regularly.

Category	Need	Action
Research	Life history.	Identify research needs as more surveys are conducted.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Mottled Duskywing and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management
Forest Health	Coordination, Education, Management
Water Quantity and Quality	
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE MOTTLED DUSKYWING AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Continue contract to capture existing butterfly data; Tom Allen's data requires coordinates.

Surveys:

- Surveys are needed with detailed habitat documentation. Even though records are considered recent, all are from the 1980s.
- Analyze potential habitat to identify stands of New Jersey Tea along un-mowed gravel mountain roads.

Coordination:

- Work with forest landowners to reduce or eliminate activities that may be detrimental to Mottled Duskywing sites. This includes maintaining host and nectar species while encouraging use of Best Management Practices when timbering, mining or engaged in other impacting activities.
- Coordinate with Department of Highways to limit or restrict mowing of host plants that grow along roadsides.

Education:

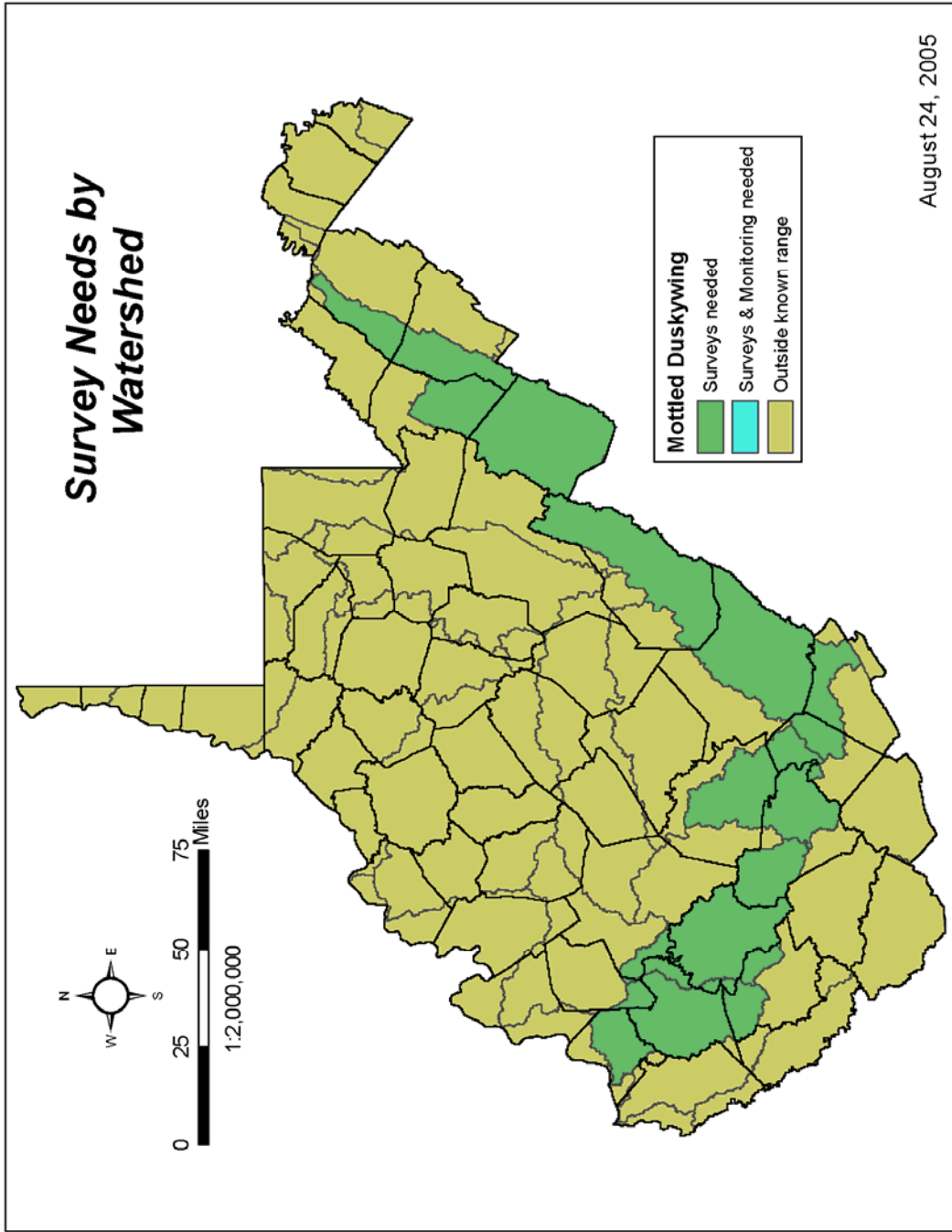
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Mottled Duskywing sites. General information on the importance of invertebrate groups and general biodiversity should be included.

Legislation:

- Develop and introduce legislation to include Butterflies and other Terrestrial Insects in the definition of wildlife.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

- Allen, Thomas. 1997. *The Butterflies of West Virginia and their Caterpillars*. University of Pittsburgh Press, Pittsburgh, PA. 387 pp.
- Allen, Thomas. 2005. Personal Communication. Retired, West Virginia Division of Natural Resources, Elkins, WV.
- NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: April 13, 2005).
- West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Butterflies

Common name: Pink-edged Sulphur

Scientific name: *Colias interior*

STATUS

The ranks and information in the chart below indicate the rarity of the Pink-edged Sulphur in West Virginia. This species only occurs at high elevations in West Virginia. It also occurs in the higher elevations in Maryland, Virginia and Pennsylvania and it is monitored and considered extremely rare in all four states where populations occur.

Priority Group	Global Rank	State Rank	Trend
1*	G5T1T2	S1S2	Stable

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of Pink-edged Sulphurs into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether the sites are in public or private ownership.

Habitat: The Pink-edged Sulphur is commonly found in fields and along road banks where it nectars on Red Clover, Heal-all, Field Basil, Dandelion, Bird's-foot-trefoil, Ox-eye Daisy and Bristly Sarsaparilla. It is also often associated with rocky balds, bogs and barrens. In West Virginia this species uses Blueberry species as its larval host plant.

Watershed	Site Name	Record Type	Ownership
Cheat	Brown Mountain Bog	Recent	Public
	North Hollows	Recent	Public
	Fisher Spring Run Bog	Recent	Public
	Roaring Plains	Recent	Public
	Backbone Mountain	Recent	Public
	Blackwater Falls State Park	Recent	Public
North Branch Potomac	Helmic Run Bog	Recent	Private

Watershed	Site Name	Record Type	Ownership
South Branch Potomac	Grassy Mountain	Recent	Private
	Panther Knob	Recent	Public
	North Fork Mountain - High Knob	Recent	Public
	Spruce Knob	Recent	Public
	Brushy Mountain	Recent	Public
Youghiogheny	Cranesville Swamp	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Pink-edged Sulphur. Because there is inadequate information on the distribution and status of the Pink-edged Sulphur in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Pink-edged Sulphur.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Existing data needs to be entered into a database with coordinates added.	Continue ongoing contract to capture existing butterfly data; Tom Allen's data require coordinates.
	Public access to data.	Provide general butterfly information, such as distribution maps, on the WVDNR website.

Category	Need	Action
Surveys	Determine extent of potential habitat for recent occurrences.	Conduct detailed habitat documentation with site visits and possible surveys.
	Survey new sites.	Analyze potential habitat above 3,500 ft. to identify new survey areas.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Select sites and setup a standardized monitoring protocol.

Category	Need	Action
Research	Life history.	Identify research needs as more surveys are conducted.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Pink-edged Sulphur and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management
Forest Health	Coordination, Education, Management
Water Quantity and Quality	
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE PINK-EDGED SULPHUR AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Continue ongoing contract to capture existing butterfly data; Tom Allen's data requires coordinates.

Surveys:

- Analyze potential habitat above 3,500 ft. to identify new survey areas.

Coordination:

- Work with forest landowners to reduce or eliminate activities that may be detrimental to Pink-edged Sulphur sites. This includes maintaining host and nectar species while encouraging use of Best Management Practices when timbering, mining, or engaged in other impacting activities.

Education:

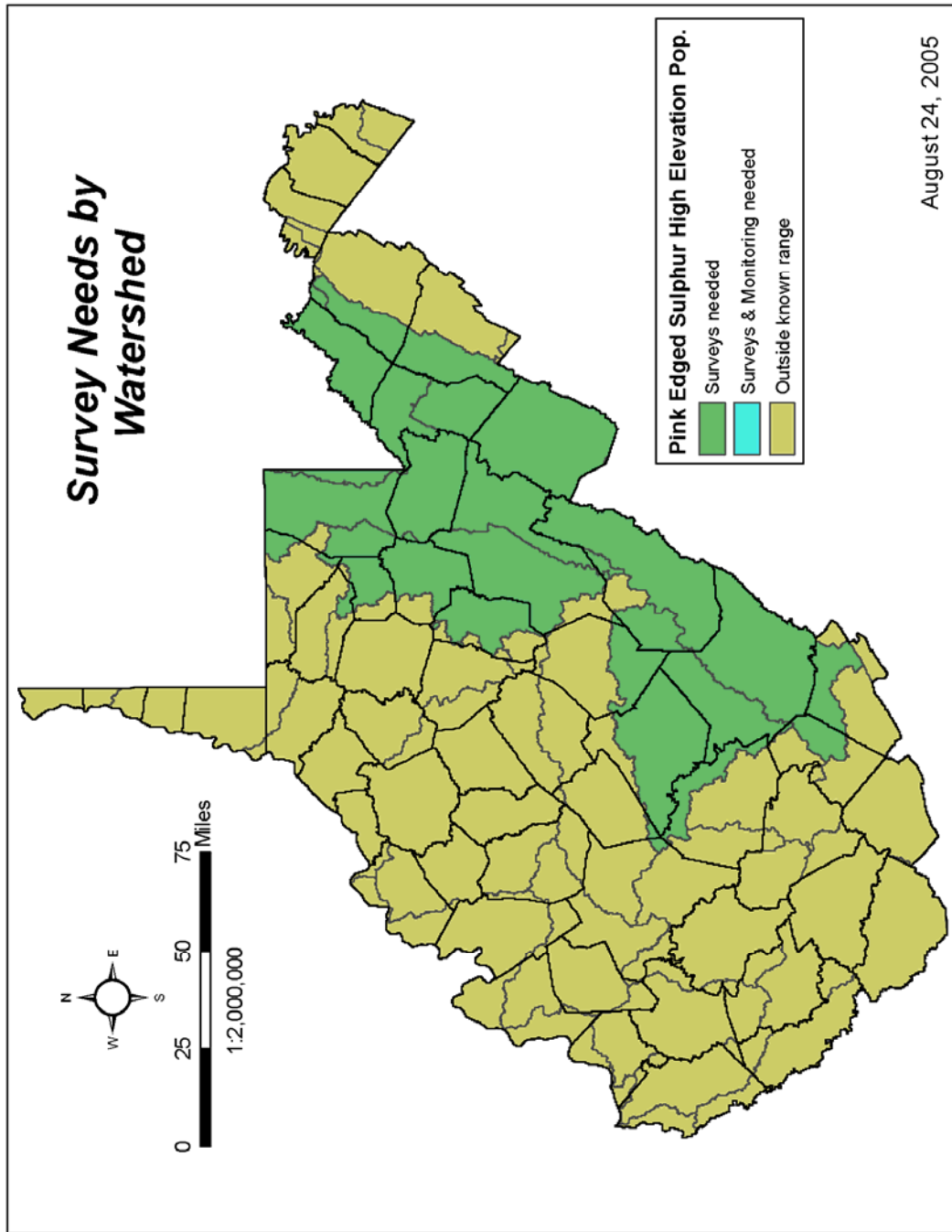
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Pink-edged Sulphur sites. General information on the importance of invertebrate groups and general biodiversity should be included.

Legislation:

- Develop and introduce legislation to include Butterflies and other Terrestrial Insects in the definition of wildlife.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

- Allen, Thomas. 1997. *The Butterflies of West Virginia and their Caterpillars*. University of Pittsburgh Press, Pittsburgh, PA. 387 pp.
- Allen, Thomas. 2005. Personal Communication. Retired, West Virginia Division of Natural Resources, Elkins, WV.
- NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: April 13, 2005).
- West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Butterflies
Common name: Frosted Elfin
Scientific name: *Callophrys irus*

STATUS

The ranks and information in the chart below indicate the rarity of the Frosted Elfin Butterfly in West Virginia. The Frosted Elfin is listed as rare and in need of conservation in West Virginia because of the scarcity of records. It is considered a species of concern in every state in which it occurs and its status is monitored by many groups.

Priority Group	Global Rank	State Rank	Jeff Forest	Trend
1*	G3	S1	X	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Frosted Elfin into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether the sites are in public or private ownership.

Habitat: The Frosted Elfin is found in open areas along woodland edges and roads, brushy fields, and in open oak-pine habitats. In West Virginia it has been observed nectaring on dewberry and blackberry flowers. Lupine and wild indigo are the primary larval host plant for the Frosted Elfin.

Watershed	Site Name	Record Type	Ownership
Tygart Valley	Arnold Hill Road	Recent	Private
	Kings Run Road	Recent	Private

DECISION MAKING PROCESS – NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Frosted Elfin. Because there is inadequate information on the distribution and status of the Frosted Elfin in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below.

Bolded text indicates primary actions required to identify conservation needs of the Frosted Elfin.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Existing data needs to be entered into a database with coordinates added.	Continue contract to capture existing butterfly data; Tom Allen's data require coordinates.
	Public access to data.	Provide general butterfly information, such as distribution maps, on the WVDNR website.

Category	Need	Action
Surveys	Update distribution status.	Target historic sites and sites with appropriate habitat in the same geographical area.
		Analyze potential habitat to find good stands of <i>Baptisia tinctoria</i> , Yellow Wild Indigo, on shaley slopes

Category	Need	Action
Monitoring	Long-term species monitoring.	Establish monitoring program at known locations; monitor regularly.

Category	Need	Action
Research	Life history.	Identify research needs as more surveys are conducted.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Frosted Elfin and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management
Forest Health	Coordination, Education, Management
Water Quantity and Quality	
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	Management, Education
Recreation	
Damaging Recreation	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE FROSTED ELFIN AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Continue to contract to capture existing butterfly data; Tom Allen’s data requires coordinates.

Coordination:

- Work with forest landowners to reduce or eliminate activities that may be detrimental to Frosted Elfin sites. This includes maintaining host and nectar species while encouraging use of Best Management Practices when timbering, mining, and other site related issues pertaining to habitat loss and forestland management.
- Coordinate with landowners to limit mowing at known sites.

Education:

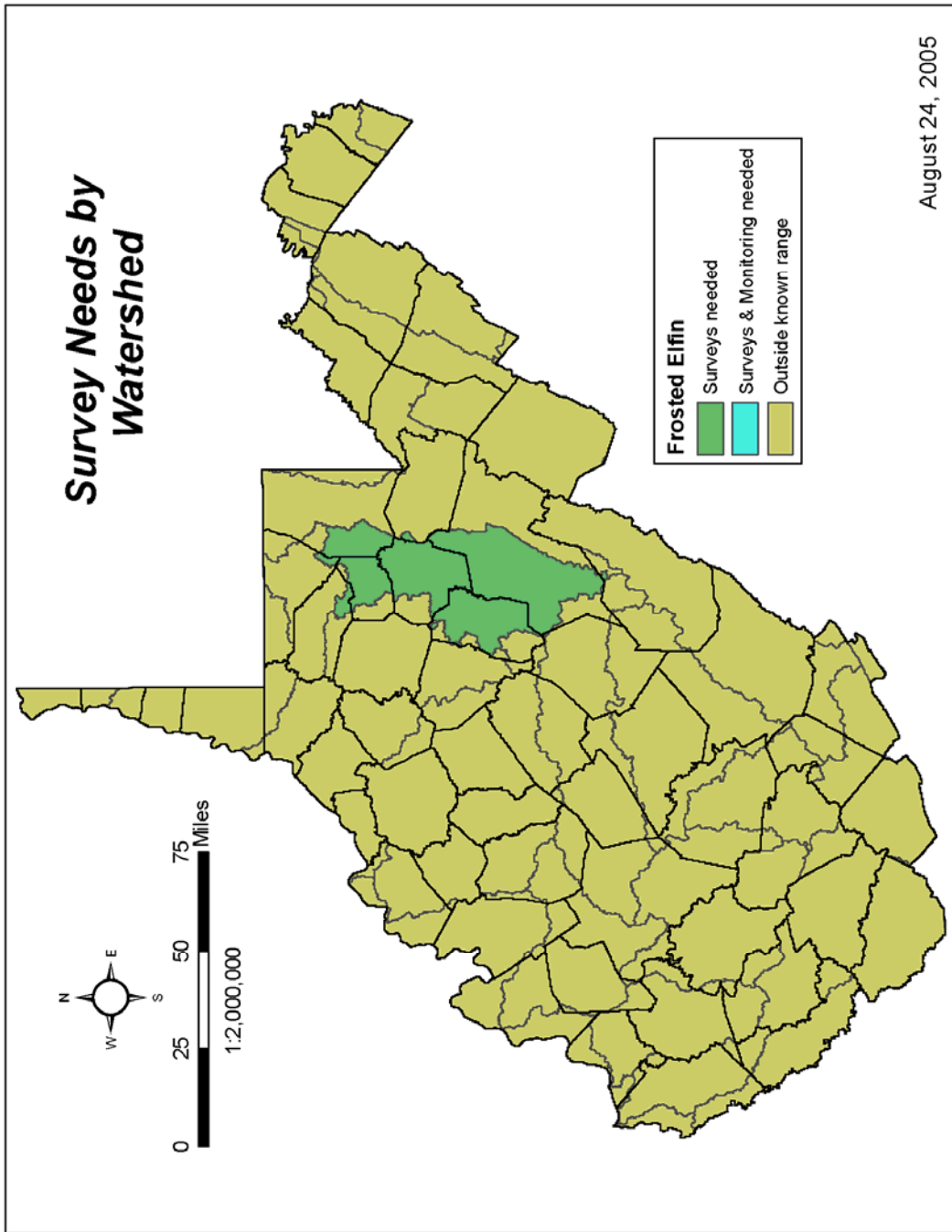
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Frosted Elfin sites. General information on the importance of invertebrate groups and general biodiversity should be included.

Legislation:

- Develop and introduce legislation to include Butterflies and other Terrestrial Insects in the definition of wildlife.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

- Allen, Thomas. 1997. *The Butterflies of West Virginia and their Caterpillars*. University of Pittsburgh Press, Pittsburgh, PA. 387 pp.
- Allen, Thomas. 2005. Personal Communication. Retired, West Virginia Division of Natural Resources, Elkins, WV.
- NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: April 13, 2005).
- West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Butterflies

Common name: Grizzled Skipper

Scientific name: *Pygrus wyandot*

STATUS

The ranks and information in the chart below indicate the rarity of the Grizzled Skipper in West Virginia. This species is listed as rare and in need of conservation because of its extreme decline in all documented sites but one. The one current site is under threat by a housing development. It is considered a species of concern in every state in which it occurs and its status is monitored by many groups.

Priority Group	Global Rank	State Rank	USFWS	Mon Forest	Jeff Forest	Trend
1*	G2	S1	SC	X	X	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Grizzled Skipper into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether the sites are in public or private ownership.

Habitat: The Grizzled Skipper is generally found on open or semi-open shale slopes in close proximity to woodlands. It can be found along trails through oak woods or shale barrens, semi-open clearings, or power- and gas-line rights-of-way. They nectar on low growing flowers found in open or woodland habitats including Canada Cinquefoil, Strawberry, Spring Beauty, Bird's Foot Violet and Phlox. The Grizzled Skipper uses Cinquefoil species as larval hosts.

Watershed	Site Name	Record Type	Ownership
Elk	Charleston	Historic	Private
Greenbrier	Greenbrier Mountain	Recent	Private
North Branch Potomac	Larenim Park	Recent	Public
	Ridgeville Shale Barren	Recent	Private
	Wild Meadow Run	Historic	Private
South Branch Potomac	South Branch River Road Powerline	Recent	Private
	Lick Run Shale Barren	Recent	Private
	Junction Substation	Recent	Private
	Camp Run Tributary Shale Barren	Recent	Private
	Purgitsville Church	Historic	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

In 2004 each known site (except the Charleston site) was visited and the species was found at only one of the sites. Eight new sites were also visited and no Grizzled Skippers were found. The survey was conducted during optimal weather conditions and within the known flight period. The host and nectaring plants were also in flower. Below are the needs and actions for this species based mostly on the results of this current field study. **Bolded** text indicates initial actions required to identify conservation needs of the Grizzled Skipper.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Existing data needs to be entered into a database with coordinates added.	Continue contract to capture existing butterfly data; Tom Allen's data require coordinates.
	Public access to data.	Provide general butterfly information, such as distribution maps, on the WVDNR website.

Category	Need	Action
Survey	Survey extirpated sites.	Identify extirpated sites with appropriate habitat for possible species restoration projects.
	Survey extant site.	Obtain new landowner permission to continue surveying extant site.
	Shale barren surveys.	Target species during any shale barren project.
	Survey new sites.	Visit new potential sites identified in 2004 survey.

Category	Need	Action
Monitoring	Long-term species monitoring sites.	Obtain landowner permission; continue to monitor current site.
		Identify possible sites as new butterfly data becomes available.

Category	Need	Action
Research	Life history.	Identify research needs as more surveys are conducted.
	Taxonomy.	Develop prospectus to conduct genetic studies to determine if WV populations are genetically unique.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Grizzled Skipper and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Restoration, Coordination, Education, Management
Forest Health	Coordination, Education, Management
Water Quantity and Quality	
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE GRIZZLED SKIPPER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Contract to capture existing butterfly data; Tom Allen's data requires coordinates.

Surveys:

- Identify extirpated sites with appropriate habitat for possible species restoration projects
- Obtain new landowner permission to continue surveying extant site.
- Visit new potential sites identified in 2004 survey.

Restoration:

- Develop prospectus to restore species in extirpated areas.

Coordination:

- Work with current landowner of the only known site for this species to determine options to preserve species or site (maintain roads and Cinquefoil; restrict development etc.).

Education:

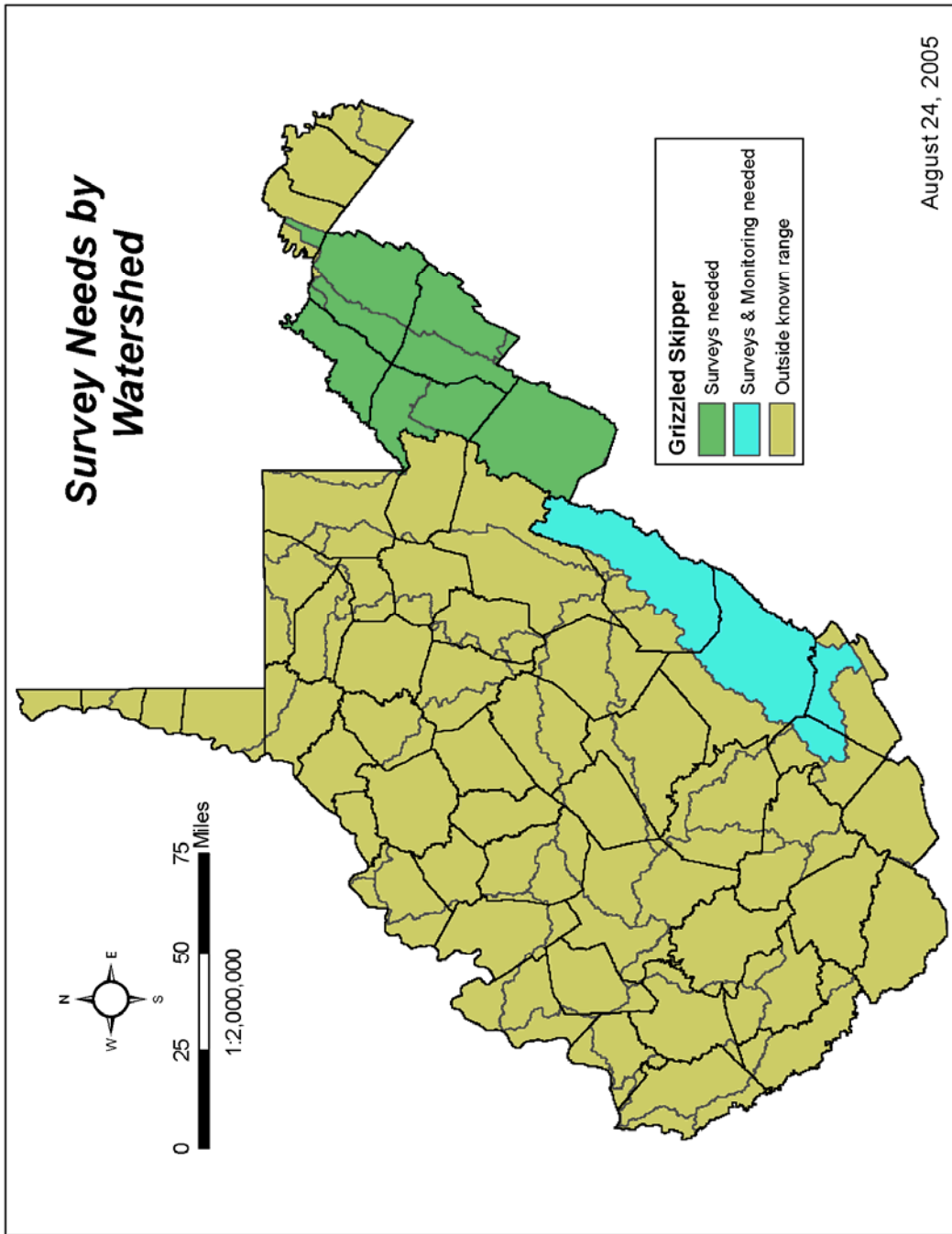
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Grizzled Skipper sites. General information on the importance of invertebrate groups and general biodiversity should be included.

Legislation:

- Develop and introduce legislation to include Butterflies and other Terrestrial Insects in the definition of wildlife.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

- Allen, Thomas. 1997. *The Butterflies of West Virginia and their Caterpillars*. University of Pittsburgh Press, Pittsburgh, PA. 387 pp.
- Allen, Thomas. 2005. Personal Communication. Retired, West Virginia Division of Natural Resources, Elkins, WV.
- NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: April 13, 2005).
- West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Butterflies

Common name: Northern Metalmark

Scientific name: *Calephelis borealis*

STATUS

The ranks and information in the chart below indicate the rarity of the Northern Metalmark Butterfly in West Virginia. The Northern Metalmark is listed as rare and in need of conservation because of the scarcity of records. It is considered a species of concern in every state in which it occurs.

Priority Group	Global Rank	State Rank	Trend
1*	G3G4	S1	Stable

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Northern Metalmark into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether the sites are in public or private ownership.

Habitat: The Northern Metalmark is usually found along wooded areas close to streams, ponds, or lakes and is often associated with limestone or shale barren areas. It is most often encountered in openings along roads passing through woodlands, which may be mixed deciduous forests or scrub oak-pine shale barren habitats. The Northern Metalmark nectars on a variety of flowers such as Yarrow, Ox-eye Daisy, Black-eyed Susan, Goldenrod, Fleabane and Butterfly Weed. Its larval host plant is Squaw-weed.

Watershed	Site Name	Record Type	Ownership
Greenbrier	Big Draft Road	Recent	Private
West Fork	Stonecoal Lake	Recent	Public
North Branch Potomac	Larenim Park	Recent	Public
	Ridgeville	Historic	Private
Upper New	Pipestem State Park Site	Recent	Public

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Northern Metalmark. Because there is inadequate information on the distribution and status of the Northern Metalmark in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Northern Metalmark.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Existing data needs to be entered into a database with coordinates added.	Continue ongoing contract to capture existing butterfly data; Tom Allen's data require coordinates.
	Public access to data.	Provide general butterfly information, such as distribution maps, on the WVDNR website.

Category	Need	Action
Surveys	Shale barren surveys.	Target all shale barren species when conducting shale barren projects.
	Update status of historic sites.	Target historic sites and sites with appropriate habitat or in same geographical area.
	Survey new sites.	Analyze potential habitat to identify new survey areas.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Once enough locations have been identified, select monitoring sites and determine standardized protocol and conduct monitoring.

Category	Need	Action
Research	Life history.	Identify research needs as more surveys are conducted.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Northern Metalmark and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management
Forest Health	Coordination, Education, Management
Water Quantity and Quality	Coordination, Education, Management
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE NORTHERN METALMARK AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Continue ongoing contract to capture existing butterfly data; Tom Allen's data requires coordinates.

Surveys:

- Target all shale barren species when conducting shale barren projects.
- Target historic sites and sites with appropriate habitat or in same geographical area.

Coordination:

- Work with forest landowners to reduce or eliminate activities that may be detrimental to Northern Metalmark sites. This includes maintaining host and nectar species while encouraging use of Best Management Practices when timbering and other site related issues pertaining to habitat loss and forestland management.
- Coordinate with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc.) in streams and wetlands where Northern Metalmarks occur.

Education:

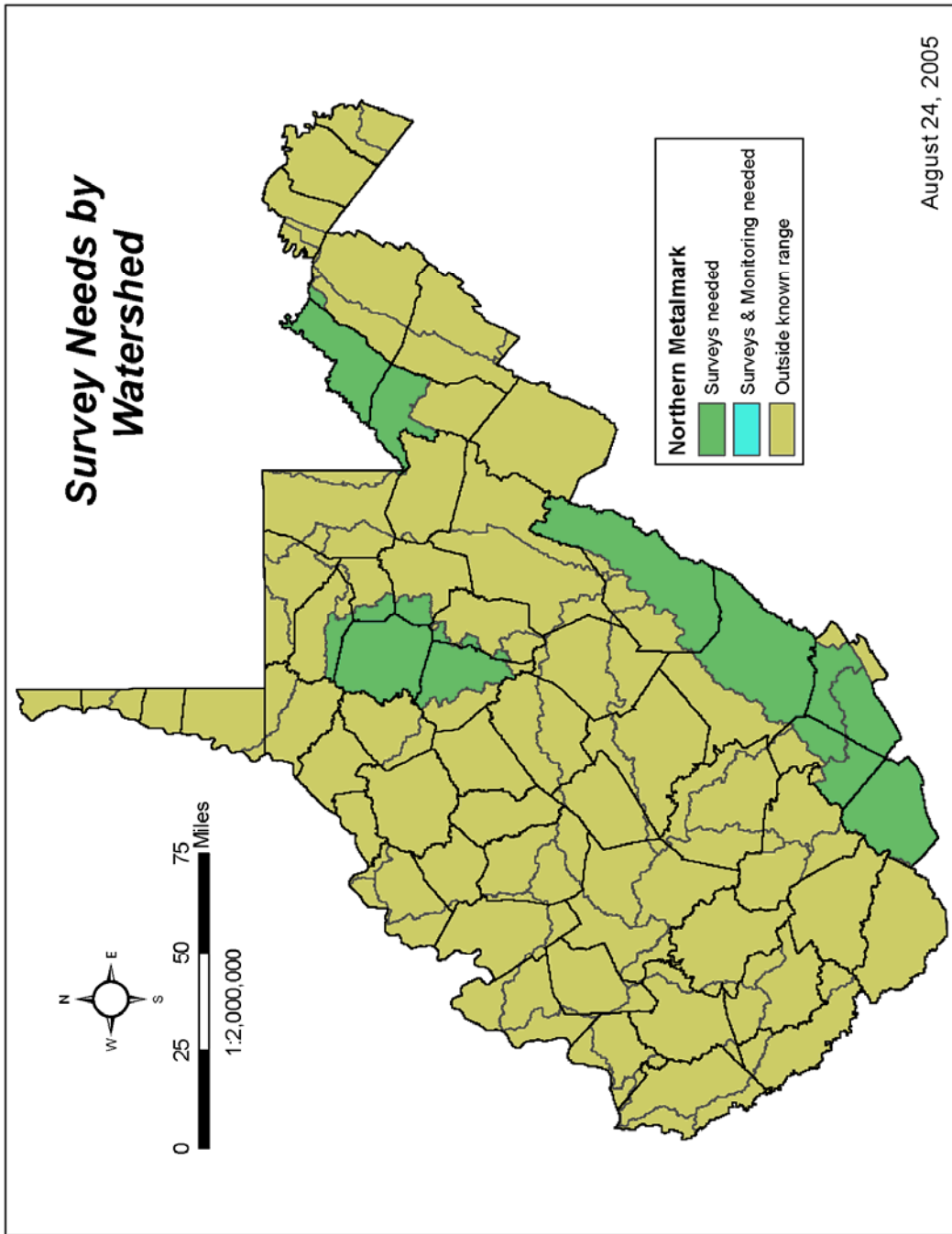
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Northern Metalmark sites. They should include general information on the importance of invertebrate groups and general biodiversity.

Legislation:

- Develop and introduce legislation to include Butterflies and other Terrestrial Insects in the definition of wildlife.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

- Allen, Thomas. 1997. *The Butterflies of West Virginia and their Caterpillars*. University of Pittsburgh Press, Pittsburgh, PA. 387 pp.
- Allen, Thomas. 2005. Personal Communication. Retired, West Virginia Division of Natural Resources, Elkins, WV.
- NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: April 13, 2005).
- West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Butterflies
Group: Other

STATUS

Butterflies are not considered wildlife under the current definition of wildlife as stated in Chapter 20 of the West Virginia Code and therefore have no legal protection. However, the Natural Heritage Program is charged with the documentation and conservation of rare West Virginia species. There are a total of 31 species of Butterflies on the Species in Greatest Need of Conservation list. Eight of these are globally rare and are discussed in separate fact sheets. The remaining 23 species are addressed here as a group since their needs and actions are similar.

Scientific Name	Common Name	Priority Group	Global Rank	State Rank	Trend
<i>Atrytonopsis hianna</i>	Dusted Skipper	2*	G4G5	S1	Stable
<i>Autochton cellus</i>	Golden-banded Skipper	2	G4	S1S2	Stable
<i>Boloria selene myrina</i>	Myrina Fritillary	2	G5T5	S3	Stable
<i>Callophrys polios</i>	Hoary Elfin	2	G5	SH	Unknown
<i>Chlosyne harrisii</i>	Harris's Checkerspot	2	G4	S2	Stable
<i>Cyllopsis gemma</i>	Gemmed Satyr	2	G5	S2S3	Stable
<i>Euphyes conspicua</i>	Black Dash	2	G4	S1	Stable
<i>Erora laeta</i>	Early Hairstreak	2	G4	S2	Stable
<i>Erynnis lucilius</i>	Columbine Duskywing	2	G4	S2	Declining
<i>Euchloe olympia</i>	Olympia Marble	2	G4G5	S2S3	Stable
<i>Euphyes bimacula</i>	Two-spotted Skipper	2	G4	S1	Declining
<i>Fixsenia favonius ontario</i>	Northern Hairstreak	2	G4T4	S1S2	Unknown
<i>Hesperia metea</i>	Cobweb Skipper	2	G4G5	S2S3	Stable
<i>Lycaena epixanthe</i>	Bog Copper	2	G4G5	S1	Stable
<i>Lycaena hyllus</i>	Bronze Copper	2	G5	S2	Stable
<i>Parrhasius malbum</i>	White-M Hairstreak	2	G5	S2	Stable
<i>Phyciodes batesii</i>	Tawny Crescent	2	G4	SH	Unknown
<i>Phyciodes cocyta</i>	Northern Crescent	2	G5	S2	Stable
<i>Polygonia progne</i>	Gray Comma	2	G5	S3	Stable
<i>Satyrrium caryaeorum</i>	Hickory Hairstreak	2	G4	S2	Stable

<i>Satyrrium edwardsii</i>	Edwards' Hairstreak	2	G4	S2	Stable
<i>Speyeria atlantis</i>	Atlantis Fritillary	2	G5	S3	Stable
<i>Staphylus hayhurstii</i>	Hayhurst's Scallopwing	2	G5	S1	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places each butterfly Species in Greatest Need of Conservation into watersheds and gives the ages of the records (recent is within 20 years). The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. The table also reflects what type of habitat each species utilizes.

Species	Watershed	Record Type	Habitat
Dusted Skipper	West Fork	Recent	Old Fields, Woodland Openings, Pine-Oak Barrens, Right-Of-Ways
	Gauley		
Golden-Banded Skipper	Lower Guyandotte	Recent Historic	Moist, Wooded Areas Along Streams or Wetlands, Steep, Shaded Hollows
	Coal		
	Lower Kanawha		
Myrina Fritillary	Greenbrier	Recent Historic	Wet Meadows and Marshes
	Shenandoah		
	Cheat		
	Tygart		
Hoary Elfin	Upper Kanawha	Historic	Dry, Sandy Areas, Woodland Edges, Ridges, Rocky Slopes
Harris's Checkerspot	Greenbrier	Recent Historic	Wetland Areas, Marshes and Bogs
	Cheat		
	Tygart		
Gemmed Satyr	Coal	Recent Historic	Woodland Species Prefers Moist to Wet, Semi-Open Areas Along Streams and Trails
	Little Kanawha		
	West Fork		
Black Dash	Youghiogheny	Recent Historic	Wet Marshy Areas
	Cheat		
Early Hairstreak	Cheat	Recent Historic	Mixed Hardwoods Found in Openings Along Roads, Trails and Clearings
	South Branch Potomac		
	Potomac		
	Upper New		
	Lower New		
	James		

	Greenbrier		
	Coal		
Columbine Duskywing	South Branch Potomac	Recent	Rocky, Wooded Ravines, Gorges, Limestone Outcrops, Woodland Edges or Glades Along Shale Slopes
	North Branch Potomac		
	Shenandoah		
Olympia Marble	Upper Kanawha	Recent Historic	Semi-Open, Scrub Oak-Pine with Exposed Shale Slopes; Oak-Pine Forests in Western WV
	Cacapon		
	South Branch Potomac		
	North Branch Potomac		
Two-Spotted Skipper	Greenbrier	Recent	Wet, Sedge Meadows, Marshes, Bogs that are close to Woods
	Cheat		
Northern Hairstreak	South Branch Potomac	Recent Historic	Dry, Oak Woodlands, Edges and Openings, Shale Barrens
Cobweb Skipper	South Branch Potomac	Recent	Shale Barrens, Pine-Oak Barrens, Cedar-Oak Glades
	West Fork		
Bog Copper	Youghiogheny	Recent	Acidic Bogs with Cranberry
Bronze Copper	Lower Ohio Valley	Recent Historic	Moist to Wet Lowland Meadows, Usually Near Streams, Rivers, or Ponds
	Tygart		
	Greenbrier		
	Cheat		
White-M Hairstreak	Lower New	Recent	Oak Forests along Woodland Clearings, Trails, Etc.
	Greenbrier		
	Coal		
	Elk		
	Monongahela		
	Youghiogheny		
	Cheat		
Tawny Crescent	Upper Kanawha	Historic	Dry, Rocky Sites, Pastures on tops of Mountains
Northern Crescent	Coal	Recent	Semi-Open, Moist Woodlands along Streams; Shale Barrens
	South Branch		
	Potomac		
	Upper Guyandotte		
Gray Comma	Youghiogheny	Recent Historic	Deciduous Woodlands along Gravel Roads, Trails, Clearings
	Middle Ohio Valley		
	Greenbrier		
	South Branch Potomac		
	James		
	Cheat		
Hickory Hairstreak	Potomac	Recent	Deciduous Woodlands With Hickory, along
	South Branch Potomac		

	Youghiogheny		Small Clearings or Roads
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Edwards Hairstreak	James	Recent Historic	Scrub, Oak Thickets or Oak-Pine Shale Barrens, found along Edges
	South Branch Potomac		
	Greenbrier		
Atlantis Fritillary	Cheat	Recent Historic	High Mountain Pastures, Fields, Bogs, Meadows, Roadsides
	Youghiogheny		
	Greenbrier		
Hayhurst's Scallopwing	Shenandoah	Recent	Along Creeks or Railroad Tracks in Wooded Areas

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of Butterflies. Because there is inadequate information on the distribution and status of Butterflies in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below.

Bolded text indicates primary actions required to identify conservation needs of Butterflies.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Butterfly atlas.	Use volunteers to collect data and publish a WV Butterfly Atlas.
	Existing data needs to be entered into database with coordinates added.	Continue contract to capture existing Butterfly data; Tom Allen's data require coordinates.
	Public access to data.	Provide general Butterfly information, such as distribution maps, on the WVDNR website.

Category	Need	Action
Surveys	Update status of historic sites.	Target historic sites and sites with appropriate habitat or in same geographical area.
	Survey new sites.	Analyze potential habitat for each species of concern to identify new survey areas.

Category	Need	Action
Monitoring	Long-term species monitoring.	Examine all current Butterfly sites to identify areas of high diversity. Establish monitoring stations at these sites and statewide to represent a diversity of habitat types and regions.

Category	Need	Action
Research	Life history.	Identify research needs as more surveys are conducted.
	Environmental factors.	Determine the impacts of invasive plants on host and nectar species.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with Butterflies and their habitats. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management
Forest Health	Coordination, Education, Management
Water Quantity and Quality	Coordination, Education, Management
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF BUTTERFLIES AND THEIR HABITATS

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve these species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current

knowledge on the distribution, status and conservation needs of these species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of these species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Continue contract to capture existing butterfly data; Tom Allen's data requires coordinates.

Surveys:

- Target historic sites and sites with appropriate habitat or in same geographical area.
- Analyze potential habitat for each species of concern to identify new survey areas.

Coordination:

- Work with forest landowners to reduce or eliminate activities that may be detrimental to Butterflies sites. This includes maintaining host and nectar species while encouraging use of Best Management Practices when timbering, mining, and other site related issues pertaining to habitat loss and forestland management.
- Coordinate with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc.) in streams and wetlands where rare Butterflies occur.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Butterflies sites. They should include general information on the importance of invertebrate groups and general biodiversity.

Legislation:

- Develop and introduce legislation to include Butterflies and other Terrestrial Insects in the definition of wildlife.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

- Allen, Thomas. 1997. *The Butterflies of West Virginia and their Caterpillars*. University of Pittsburgh Press, Pittsburgh, PA. 387 pp.
- Allen, Thomas. 2005. Personal Communication. Retired, West Virginia Division of Natural Resources, Elkins, WV.
- NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: April 13, 2005).
- West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.

Cave Invertebrates

WV is home to hundreds of caves and some of the most important karst topography in the eastern United States. Many invertebrate animals have colonized these caves. Because of the isolated nature of these closed systems, these invertebrates have evolved into many species. Eighty-seven globally rare invertebrate species have been identified as Species in Greatest Need of Conservation. Despite this seemingly lengthy list of species we still do not have a comprehensive knowledge of the species and their distribution in the caves of the state.

Scientific Name	Common Name
<i>Anthrobia monmouthia</i>	A Spider
<i>Antrolana lira</i>	Madison Cave Isopod
<i>Apochthonius paucispinosus</i>	Dry Fork Valley Cave Pseudoscorpion
<i>Arrhopalites sp 2</i>	A Collembola
<i>Arrhopalites sp 3</i>	A Collembola
<i>Bathyphantes weyeri</i>	A Cave Spider
<i>Caecidotea cannula</i>	An Isopod
<i>Caecidotea franzi</i>	Franz's Cave Isopod
<i>Caecidotea holsingeri</i>	Greenbrier Valley Cave Isopod
<i>Caecidotea pricei</i>	Price's Cave Isopod
<i>Caecidotea simonini</i>	An Isopod
<i>Caecidotea sinuncus</i>	An Isopod
<i>Chitrella regina</i>	Royal Syarinid Pseudoscorpion
<i>Conotyla vista</i>	A Cave Millipede
<i>Crangonyx sp 2</i>	An Amphipod
<i>Fontigens sp 1</i>	McClung Cavesnail
<i>Fontigens tartarea</i>	Organ Cavesnail
<i>Fontigens turritella</i>	Greenbrier Cavesnail
<i>Geocentrophora cavernicola</i>	Cave Flatworm
<i>Haplotaxis brinkhursti</i>	An Oligochaete
<i>Horologion speokites</i>	Arbuckle Cave Ground Beetle
<i>Islandiana sp 1</i>	A Spider
<i>Islandiana speophila</i>	Cavern Sheet-Web Spider
<i>Kleptochthonius henroti</i>	Greenbrier Valley Cave Pseudoscorpion
<i>Kleptochthonius hetricki</i>	Organ Cave Pseudoscorpion
<i>Kleptochthonius orpheus</i>	Orpheus Cave Pseudoscorpion
<i>Kleptochthonius proserpinae</i>	Proserpina Cave Pseudoscorpion
<i>Litocampa fieldingi</i>	Diplura
<i>Litocampa sp 1</i>	Diplura
<i>Macrocotyla hoffmasteri</i>	Hoffmaster's Cave Flatworm
<i>Nesticus tennesseeensis</i>	A Cave Spider
<i>Phagocata angusta</i>	A Cave Planarian
<i>Phanetta subterranea</i>	A Spider
<i>Poecilophysis wolmsdorfensis</i>	A Cave Mite
<i>Porrhomma cavernicola</i>	Appalachian Cave Spider

<i>Pseudanophthalmus fuscus</i>	A Cave Beetle
<i>Pseudanophthalmus grandis elevatus</i>	A Cave Beetle
<i>Pseudanophthalmus grandis grandis</i>	A Cave Beetle
<i>Pseudanophthalmus grandis orthosulc</i>	A Cave Beetle
<i>Pseudanophthalmus grandis ssp 1</i>	A Cave Beetle
<i>Pseudanophthalmus hadenoecus</i>	Timber Ridge Cave Beetle
<i>Pseudanophthalmus higginbothami</i>	A Cave Beetle
<i>Pseudanophthalmus hypertrichosis</i>	A Cave Beetle
<i>Pseudanophthalmus krekeri</i>	Rich Mountain Cave Beetle
<i>Pseudanophthalmus lallemanti</i>	Lallemant's Cave Beetle
<i>Pseudanophthalmus montanus</i>	Dry Fork Valley Cave Beetle
<i>Pseudanophthalmus potomaca potomaca</i>	South Branch Valley Cave Beetle
<i>Pseudanophthalmus potomaca senecae</i>	Seneca Cave Beetle
<i>Pseudanophthalmus sp 1</i>	A Beetle
<i>Pseudanophthalmus sp 2</i>	A Beetle
<i>Pseudanophthalmus sp 3</i>	A Beetle
<i>Pseudanophthalmus subaequalis</i>	Greenbrier Valley Cave Beetle
<i>Pseudosinella certa</i>	Gandy Creek Cave Springtail
<i>Pseudosinella gisini</i>	A Springtail
<i>Pseudosinella orba</i>	A Cave Springtail
<i>Pseudosinella sp 1</i>	A Springtail
<i>Pseudosinella testa</i>	Shelled Cave Springtail
<i>Pseudotremia fulgida</i>	Greenbrier Valley Cave Millipede
<i>Pseudotremia lusciosa</i>	Germany Valley Cave Millipede
<i>Pseudotremia princeps</i>	South Branch Valley Cave Millipede
<i>Pseudotremia sp 1</i>	General Davis Cave Millipede
<i>Rhagidia varia</i>	A Cave Mite
<i>Sinella agna</i>	A Springtail
<i>Sphalloplana culveri</i>	Culver's Planarian
<i>Stygobromus allegheniensis</i>	Allegheny Cave Amphipod
<i>Stygobromus biggersi</i>	Biggers' Cave Amphipod
<i>Stygobromus cooperi</i>	Cooper's Cave Amphipod
<i>Stygobromus culveri</i>	Culver's Cave Amphipod
<i>Stygobromus emarginatus</i>	Greenbrier Cave Amphipod
<i>Stygobromus franzi</i>	Franz's Cave Amphipod
<i>Stygobromus gracilipes</i>	Shenandoah Valley Cave Amphipod
<i>Stygobromus morrisoni</i>	Morrison's Cave Amphipod
<i>Stygobromus nanus</i>	Pocahontas Cave Amphipod

<i>Stygobromus parvus</i>	Minute Cave Amphipod
<i>Stygobromus pollostus</i>	An Amphipod
<i>Stygobromus redactus</i>	An Amphipod
<i>Stygobromus sp 1</i>	An Amphipod
<i>Stygobromus sp 2</i>	Coburn Cave Amphipod
<i>Stygobromus sp 3</i>	Dyers Cave Amphipod
<i>Stygobromus spinatus</i>	Spring Cave Amphipod
<i>Stygobromus tenuis potomacus</i>	Potomac Groundwater Amphipod
<i>Stylodrilus beattiei</i>	An Oligochaete
<i>Trichodrilus culveri</i>	An Oligochaete
<i>Trichopetalum krekeleri</i>	West Virginia Blind Cave Millipede
<i>Trichopetalum packardi</i>	Packard's Blind Cave Millipede
<i>Trichopetalum weyeri</i>	Grand Caverns Blind Cave Millipede
<i>Trichopetalum whitei</i>	Luray Caverns Blind Cave Millipede

In 2004, Dr. David Culver (one of the few available experts in this group) visited 112 caves in Greenbrier, Monroe and Pocahontas counties to survey for cave obligate invertebrates. He identified 34 cave limited species. Six of these are new species, either collected for the first time or undescribed species from prior collections. Considering that there are many hundreds of caves, this study highlights the lack of knowledge we have about the existence, status and distribution of these invertebrates.

Few people have the expertise to identify cave invertebrates. These species, belonging to a variety of invertebrate groups, are seldom seen and less often collected. Many require close examination under a dissecting scope to obtain a definitive identification. As colleges and universities move away from organismal studies into a more molecular curriculum, there are fewer and fewer good field biologists coming from our nation's educational system, making recruitment of invertebrate specialists about as easy as catching a greased pig with your hands tied behind your back.

A review of the conservation needs for cave invertebrates as a group, as outlined on the following fact sheets, indicates that initial actions for the listed species are centered on survey, inventory and data management. Information on the distribution and status of many cave invertebrates is lacking and filling these information gaps is a necessary first step for the conservation assessment of each species. Standardized data acquisition and management both within the WV DNR Wildlife Resources Section and by all other research partners will greatly assist with these conservation assessments. Centralized and shared information is a prerequisite to the formulation of on-the-ground conservation plans for all listed species.

Because the WRS acts as a statewide repository for information, we rely on partners to share information to maximize understanding of our biological resources. Occasionally researchers are reluctant to share information for fear that the information will be requested from state government via the Freedom of Information Act (FOIA) and used to the detriment of the species involved. For this reason it is believed appropriate to have legislation enacted to protect sensitive rare species information from wide dissemination. This need is expressed across the board on the fact sheets for animal Species in Greatest Need of Conservation.

There is an ongoing need to educate all citizens about the value of the diversity of life in the state and especially the role all SGNC play in the intricate web of life. Education is a unifying theme throughout the actions section of the fact sheets for most species. In addition there is a need to coordinate with land management agencies and other landowners/managers on the use

of best management practices for the conservation of biological resources in general as well as specific practices when SGNC are present.

Unfortunately because of the dearth of data on the distribution and status of many individual species, few specific on-the-ground conservation actions have been identified. As additional data are collected, one would anticipate an increasing inventory of specific site-related projects that are desirable for the health and/or continued existence of SGNC throughout the state.

Taxa: Cave Invertebrates

Common name: Madison Cave Isopod

Scientific name: *Antrolana lira*

STATUS

The ranks and information in the chart below indicate the rarity of the Madison Cave Isopod in West Virginia. This species is listed as threatened by the U.S. Fish and Wildlife Service.

Priority Group	Global Rank	State Rank	USFWS	IUCN Rank	NE Tech. Comm.	Trend
1*	G2G4	S1	LT	VU D2	X	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of the Madison Cave Isopod into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether the sites are in public or private ownership. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species.

Habitat: The Madison Cave Isopod inhabits underground lakes and deep karst aquifers where it lives in the groundwater. In West Virginia it has been documented from one cave that descends to the groundwater table and from a well.

Watershed	Record Type	Ownership
Shenandoah	Recent	Private
Potomac	Recent	Public

DECISION MAKING PROCESS – NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Madison Cave Isopod. Because there is inadequate information on the status of the Madison Cave Isopod, the first step in its conservation is to gain a better understanding of its current status, habitat use and genetic background. Needs and actions for each category are outlined below.

Bolded text indicates primary actions required to identify conservation needs of the Madison Cave Isopod.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Public access to general cave invertebrate information.	Provide general Madison Cave Isopod data, such a distribution maps, on the internet.

Category	Need	Action
Surveys	Survey for new sites.	Survey wells, caves and any other areas accessible to groundwater in Jefferson and Berkeley counties, especially in areas of high threats.

Category	Need	Action
Monitoring	Monitor existing sites.	Monitor populations to establish trends (increasing, decreasing, stable). Monitor water quality and any changes to the surrounding area that may affect the groundwater.

Category	Need	Actions
Research	Determine effects of development, agriculture and the poultry industry on groundwater.	Conduct water quality studies throughout the karst region of Berkeley and Jefferson counties.
	Genetic analysis.	Collect specimens to determine the relationships between populations, including those in Virginia.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There several conservation issues associated with the Madison Cave Isopod and its habitat. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Acquisition, Management
Forest Health	
Water Quantity and Quality	Coordination, Legislation/Regulation
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE MADISON CAVE ISOPOD AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.

Surveys:

- Survey wells, caves and any other areas accessible to groundwater in Jefferson and Berkeley counties, especially in areas of high threats.

Research:

- Conduct water quality studies throughout the karst region of Berkeley and Jefferson counties.
- Collect specimens to determine the relationships between populations, including those in Virginia.

Acquisition:

- Obtain an easement for the cave and a buffer area where the Madison Cave Isopod is found.

Coordination:

- Encourage landowners and developers to follow Best Management Practices to avoid excessive siltation and contaminants from reaching the groundwater.

- Work with local Public Service Districts to minimize impacts to groundwater (address more sewage and fewer septic systems, restrict development, etc.).

Education:

- Educate the public regarding the importance of maintaining good water and effects of allowing contaminants to enter into groundwater systems.
- Provide relevant data to planning boards, commissions, etc. in Jefferson and Berkeley counties.

Legislation/Regulation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

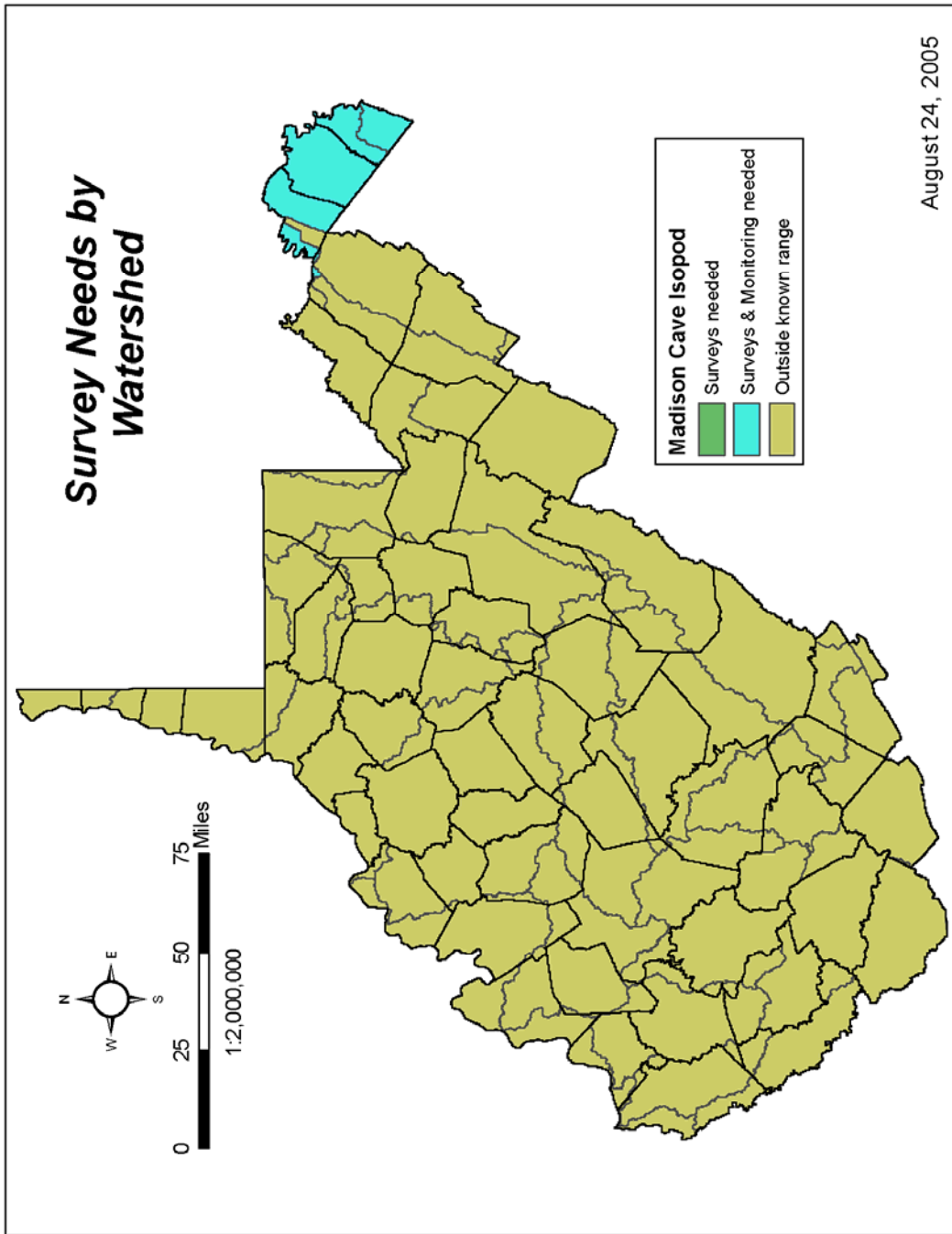
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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Invertebrates
Group: Cave invertebrates

STATUS

Currently, there are 87 Cave Obligate Invertebrate species in West Virginia. Fifty-nine percent of those are found only in West Virginia while many are endemic to one cave or watershed. Most of the others are only found in West Virginia, Virginia, Pennsylvania and Maryland. Due to the extreme rarity of these species they were all placed in Priority Group 1.

Subgroup	Scientific	Common	Global Rank	State Rank	USFWS	Mon Forest	Jeff Forest	IUCN Rank
Amphipod	<i>Crangonyx sp 2</i>	An Amphipod	G2*	SU				
Amphipod	<i>Stygobromus allegheniensis</i>	Allegheny Cave Amphipod	G4	S1				
Amphipod	<i>Stygobromus biggersi</i>	Biggers' Cave Amphipod	G2G4	S1	SC			
Amphipod	<i>Stygobromus cooperi</i>	Cooper's Cave Amphipod	G1	S1	SC			VU D2
Amphipod	<i>Stygobromus culveri</i>	Culver's Cave Amphipod	G1G2	S1	SC	X		
Amphipod	<i>Stygobromus emarginatus</i>	Greenbrier Cave Amphipod	G3	S3		X		VU D2
Amphipod	<i>Stygobromus franzi</i>	Franz's Cave Amphipod	G2G3	SU				
Amphipod	<i>Stygobromus gracilipes</i>	Shenandoah Valley Cave Amphipod	G2G4	S1			X	
Amphipod	<i>Stygobromus morrisoni</i>	Morrison's Cave Amphipod	G2G3	S1	SC			VU D2
Amphipod	<i>Stygobromus nanus</i>	Pocahontas Cave Amphipod	G1	S1	SC	X		
Amphipod	<i>Stygobromus parvus</i>	Minute Cave Amphipod	G1G2	S1	SC	X		VU D2
Amphipod	<i>Stygobromus pollostus</i>	An Amphipod	G2G3	S1				
Amphipod	<i>Stygobromus redactus</i>	An Amphipod	G1	S1	SC			
Amphipod	<i>Stygobromus sp 1</i>	An Amphipod	G2	S1S2				
Amphipod	<i>Stygobromus sp 2</i>	Coburn Cave Amphipod	G1	S1				
Amphipod	<i>Stygobromus sp 3</i>	Dyers Cave Amphipod	G1	S1				
Amphipod	<i>Stygobromus spinatus</i>	Spring Cave Amphipod	G3	S3	SC			VU D2
Amphipod	<i>Stygobromus tenuis potomacus</i>	Potomac Groundwater Amphipod	G4T3T4	S1				
Annelid	<i>Haplotaxis brinkhursti</i>	An Oligochaete	G1G2	SU				

Annelid	<i>Stylodrilus beattiei</i>	An Oligochaete	G2G3	S1				
Annelid	<i>Trichodrilus culveri</i>	An Oligochaete	G1G2	S1				
Beetle	<i>Horologion speokites</i>	Arbuckle Cave Ground Beetle	GH	SH	SC			
Beetle	<i>Pseudanophthalmus fuscus</i>	A Cave Beetle	G2G3	S2		X		
Beetle	<i>Pseudanophthalmus grandis elevatus</i>	A Cave Beetle	G3T2	S1				
Beetle	<i>Pseudanophthalmus grandis grandis</i>	A Cave Beetle	G3T3	S3				
Beetle	<i>Pseudanophthalmus grandis orthosulc</i>	A Cave Beetle	G3T1	S1				
Beetle	<i>Pseudanophthalmus grandis ssp 1</i>	A Cave Beetle	G3T?	S1				
Beetle	<i>Pseudanophthalmus hadenoecus</i>	Timber Ridge Cave Beetle	G1	S1	SC	X		
Beetle	<i>Pseudanophthalmus higginbothami</i>	A Cave Beetle	G2G3	S2				
Beetle	<i>Pseudanophthalmus hypertrichosis</i>	A Cave Beetle	G3	S3		X		
Beetle	<i>Pseudanophthalmus krekeleri</i>	Rich Mountain Cave Beetle	G1	SX	SC			
Beetle	<i>Pseudanophthalmus lallemanti</i>	Lallemant's Cave Beetle	G1	S1	SC			
Beetle	<i>Pseudanophthalmus montanus</i>	Dry Fork Valley Cave Beetle	G1	S1	SC	X		
Beetle	<i>Pseudanophthalmus potomaca potomaca</i>	South Branch Valley Cave Beetle	G2T2	S1	SC			
Beetle	<i>Pseudanophthalmus potomaca senecae</i>	Seneca Cave Beetle	G2T1	S1	SC			
Beetle	<i>Pseudanophthalmus sp 1</i>	A Beetle	G1	S1				
Beetle	<i>Pseudanophthalmus sp 2</i>	A Beetle	G1	S1				
Beetle	<i>Pseudanophthalmus sp 3</i>	A Beetle	G1	S1				
Beetle	<i>Pseudanophthalmus subaequalis</i>	Greenbrier Valley Cave Beetle	G1	S1	SC			
Diplura	<i>Litocampa fieldingi</i>	Diplura	G2G3	S2				
Diplura	<i>Litocampa sp 1</i>	Diplura	G1	S1				
Flatworm	<i>Geocentrophora cavernicola</i>	Cave Flatworm	G3G4	SH				
Flatworm	<i>Macrocotyia hoffmasteri</i>	Hoffmaster's Cave Flatworm	G2G3	S3		X		
Isopod	<i>Antrolana lira</i>	Madison Cave Isopod	G2G4	S1	LT			VU D2
Isopod	<i>Caecidotea cannula</i>	An Isopod	G3	S1		X		

Isopod	<i>Caecidotea franzi</i>	Franz's Cave Isopod	G2G3	S1				
Isopod	<i>Caecidotea holsingeri</i>	Greenbrier Valley Cave Isopod	G3	S3		X		
Isopod	<i>Caecidotea pricei</i>	Price's Cave Isopod	G3G4	S1				
Isopod	<i>Caecidotea simonini</i>	An Isopod	G1	S1		X		
Isopod	<i>Caecidotea sinuncus</i>	An Isopod	G1	S1		X		
Millipede	<i>Conotyla vista</i>	A Cave Millipede	G1G2	SU				
Millipede	<i>Pseudotremia fulgida</i>	Greenbrier Valley Cave Millipede	G2G3	S2		X		
Millipede	<i>Pseudotremia lusciosa</i>	Germany Valley Cave Millipede	G1	S1		X		
Millipede	<i>Pseudotremia princeps</i>	South Branch Valley Cave Millipede	G1	S1		X		
Millipede	<i>Pseudotremia sp 1</i>	General Davis Cave Millipede	G1?	S1				
Millipede	<i>Trichopetalum krekeri</i>	West Virginia Blind Cave Millipede	G1	S1		X		
Millipede	<i>Trichopetalum packardi</i>	Packard's Blind Cave Millipede	G3Q	S2				
Millipede	<i>Trichopetalum weyeri</i>	Grand Caverns Blind Cave Millipede	G3Q	S2		X		
Millipede	<i>Trichopetalum whitei</i>	Luray Caverns Blind Cave millipede	G2G3Q	S1		X		
Mite	<i>Poecilophysis wolmsdorffensis</i>	A Cave Mite	G3	SU				
Mite	<i>Rhagidia varia</i>	A Cave Mite	G3	SU				
Planaria	<i>Phagocata angusta</i>	A Cave Planarian	G1G2	SU		X		
Planaria	<i>Sphalloplana culveri</i>	Culver's Planarian	G1	S1	SC	X		
Pseudoscorpion	<i>Apochthonius paucispinosus</i>	Dry Fork Valley Cave Pseudoscorpion	G1	S1	SC	X		
Pseudoscorpion	<i>Chitrella regina</i>	Royal Syarinid Pseudoscorpion	G1	S1	SC			
Pseudoscorpion	<i>Kleptochthonius henroti</i>	Greenbrier Valley Cave Pseudoscorpion	G1G2	S1	SC			
Pseudoscorpion	<i>Kleptochthonius hetricki</i>	Organ Cave Pseudoscorpion	G1	S1	SC			
Pseudoscorpion	<i>Kleptochthonius orpheus</i>	Orpheus Cave Pseudoscorpion	G1	S1	SC		X	

Pseudoscorpion	<i>Kleptochthonius proserpinae</i>	Proserpina Cave Pseudoscorpion	G1	S1	SC			
Snail	<i>Fontigens sp 1</i>	McClung Cavesnail	G1	S1				
Snail	<i>Fontigens tartarea</i>	Organ Cavesnail	G2	S2		X		
Snail	<i>Fontigens turritella</i>	Greenbrier Cavesnail	G1	S1				VU D2
Spider	<i>Anthrobia monmouthia</i>	Spider	G3G4	S2				
Spider	<i>Bathyphantes weyeri</i>	A Cave Spider	G3G4	S1				
Spider	<i>Islandiana sp 1</i>	A Spider	G1	S1				
Spider	<i>Islandiana speophila</i>	Cavern Sheet-web Spider	G1	S1	SC			
Spider	<i>Nesticus tennesseensis</i>	A Cave Spider	G2G4	SU				
Spider	<i>Phanetta subterranea</i>	A Spider	G4	S3				
Spider	<i>Porrhomma cavernicola</i>	Appalachian Cave Spider	G4G5	S2				
Springtail	<i>Arrhopalites sp 2</i>	A Collembola	G1	S1				
Springtail	<i>Arrhopalites sp 3</i>	A Collembola	G1	S1				
Springtail	<i>Pseudosinella certa</i>	Gandy Creek Cave Springtail	G1	S1		X		
Springtail	<i>Pseudosinella gisini</i>	A Springtail	G3	S3		X		
Springtail	<i>Pseudosinella orba</i>	A Cave Springtail	G3G4	S1				
Springtail	<i>Pseudosinella sp 1</i>	A Springtail	G1	S1				
Springtail	<i>Pseudosinella testa</i>	Shelled Cave Springtail	G1G2	S1				
Springtail	<i>Sinella agna</i>	A Springtail	G2G3	S1		X		

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places each Cave Invertebrate Species in Greatest Need of Conservation into watersheds and gives the ages of the records (recent is within 20 years). The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. It also describes the species as aquatic or terrestrial. Since many cave invertebrate species are without common names, scientific names are used in this chart.

Group	Species	Watershed	Record type	Habitat
Amphipods	<i>Stygobromus biggersi</i>	Potomac	Historic	Aquatic
	<i>Stygobromus gracilipes</i>	Potomac	Recent Historic	Aquatic
		Shenandoah		
	<i>Stygobromus allegheniensis</i>	Cacapon	Recent Historic	Aquatic
	<i>Stygobromus emarginatus</i>	Elk	Recent Historic	Aquatic
		Greenbrier		
Cheat				
Amphipods (con't)		Upper New		
		Tygart Valley		
	<i>Stygobromus morrisoni</i>	Cacapon	Recent Historic	Aquatic
		South Branch Potomac		
	<i>Stygobromus spinatus</i>	Greenbrier	Recent Historic	Aquatic
		Upper New		
	<i>Stygobromus cooperi</i>	Potomac	Historic	Aquatic
	<i>Stygobromus franzi</i>	NO RECORDS		Aquatic
	<i>Stygobromus tenuis potomacus</i>	NO RECORDS		Aquatic
	<i>Stygobromus parvus</i>	Greenbrier	Recent Historic	Aquatic
		Tygart Valley		
		Cheat		
	<i>Stygobromus redactus</i>	Greenbrier	Historic	Aquatic
	<i>Stygobromus nanus</i>	Greenbrier	Historic	Aquatic
	<i>Stygobromus culveri</i>	Cheat	Recent	Aquatic
<i>Stygobromus pollostus</i>	Greenbrier	Historic	Aquatic	
<i>Stygobromus</i> sp. 1	Potomac	Historic	Aquatic	
<i>Crangonyx</i> sp. 2	Upper New	Historic	Aquatic	
	Greenbrier			

Annelids	<i>Haplotaxis brinkhursti</i>	Greenbrier	Recent	Terrestrial
	<i>Stylodrilus beattiei</i>	Greenbrier	Recent	Terrestrial
	<i>Trichodrilus culveri</i>	Greenbrier	Recent	Terrestrial
Beetles	<i>Pseudanophthalmus lallemanti</i>	Greenbrier	Recent	Terrestrial
	<i>Pseudanophthalmus grandis grandis</i>	Greenbrier	Recent Historic	Terrestrial
	<i>Pseudanophthalmus higginbothami</i>	Greenbrier	Historic	Terrestrial
	<i>Pseudanophthalmus grandis orthosulc</i>	Upper New	Historic	Terrestrial
	<i>Pseudanophthalmus grandis</i> sp. 1	Greenbrier	Historic	Terrestrial
	<i>Pseudanophthalmus hypertrichosis</i>	Greenbrier	Recent Historic	Terrestrial
Upper New				
Elk				
Tygart Valley				
Beetles (con't)	<i>Pseudanophthalmus fuscus</i>	Greenbrier	Recent Historic	Terrestrial
		Upper New		
	<i>Pseudanophthalmus potomaca senecae</i>	South Branch Potomac	Historic	Terrestrial
	<i>Pseudanophthalmus grandis elevatus</i>	Greenbrier	Recent Historic	Terrestrial
	<i>Pseudanophthalmus montanus</i>	Cheat	Historic	Terrestrial
	<i>Pseudanophthalmus potomaca potomaca</i>	South Branch Potomac	Historic	Terrestrial
	<i>Pseudanophthalmus</i> 1	Upper New	Historic	Terrestrial
	<i>Pseudanophthalmus</i> 2	Cheat	Historic	Terrestrial
	<i>Pseudanophthalmus</i> 3	Greenbrier	Historic	Terrestrial
	<i>Horologion speokites</i>	Greenbrier	Historic	Terrestrial
	<i>Pseudanophthalmus hadenoecus</i>	South Branch Potomac	Historic	Terrestrial
	<i>Pseudanophthalmus krekeri</i>	NO RECORDS		Terrestrial
	<i>Pseudanophthalmus subaequalis</i>	Greenbrier	Historic	Terrestrial
Dipluras	<i>Litocampa</i> sp 1	Upper New	Historic	Aquatic
	<i>Litocampa fieldingi</i>	Greenbrier	Recent Historic	Aquatic
		Upper New	Historic	
Flatworms	<i>Macrocotyla hoffmasteri</i>	South Branch Potomac	Historic	Aquatic
		Greenbrier	Recent Historic	
		Cheat	Historic	
	<i>Geocentrophora cavernicola</i>	South Branch Potomac	Historic	Aquatic

Isopods	<i>Caecidotea pricei</i>	Potomac	Recent Historic	Aquatic
		Shenandoah		
	<i>Caecidotea franzi</i>	North Branch Potomac	Recent	Aquatic
	<i>Caecidotea holsingeri</i>	Greenbrier	Recent Historic	Aquatic
		Upper New		
		Elk		
		Cheat		
	<i>Caecidotea cannula</i>	Tygart Valley		
<i>Caecidotea cannula</i>	Cheat	Recent Historic	Aquatic	
<i>Caecidotea simonini</i>	Cheat	Recent Historic	Aquatic	
<i>Caecidotea sinuncus</i>	South Branch Potomac	Historic	Aquatic	
Millipedes	<i>Pseudotremia fulgida</i>	Greenbrier	Recent Historic	Terrestrial
	<i>Pseudotremia lusciosa</i>	South Branch Potomac	Historic	Terrestrial
	<i>Pseudotremia princeps</i>	South Branch Potomac	Recent Historic	Terrestrial
	<i>Pseudotremia</i> sp 1	Greenbrier	Historic	Terrestrial
	<i>Trichopetalum krekeleri</i>	Cheat	Historic	Terrestrial
		Cacapon		Terrestrial
	<i>Trichopetalum packardi</i>	Greenbrier	Historic	Terrestrial
		Upper New		
	<i>Trichopetalum weyeriensis</i>	Greenbrier	Recent Historic	Terrestrial
		South Branch Potomac		
Elk				
<i>Trichopetalum whitei</i>	South Branch Potomac	Historic	Terrestrial	
Planaria	<i>Phagocata angusta</i>	Cheat	Historic	Aquatic
	<i>Sphalloplana culveri</i>	Cheat	Historic	Aquatic
Pseudoscorpions	<i>Apochthonius paucispinosus</i>	Cheat River	Historic	Terrestrial
	<i>Kleptochthonius henroti</i>	Greenbrier	Recent Historic	Terrestrial
	<i>Kleptochthonius hetricki</i>	Greenbrier	Historic	Terrestrial
	<i>Kleptochthonius orpheus</i>	Greenbrier	Historic	Terrestrial
	<i>Kleptochthonius proserpinae</i>	Greenbrier	Historic	Terrestrial
	<i>Chitrella regina</i>	Greenbrier	Historic	Terrestrial

Snails	<i>Fontigens tartarea</i>	Greenbrier	Recent Historic	Terrestrial
		Cheat		
		Tygart Valley		
		Upper New		
		Elk		
<i>Fontigens turritella</i>	Greenbrier	Historic	Terrestrial	
<i>Fontigens</i> sp 1	Greenbrier	Historic	Terrestrial	
Spiders	<i>Porrhomma cavernicola</i>	Potomac	Recent Historic	Terrestrial
		South Branch Potomac		
		Greenbrier		
		Upper New		
		Elk		
		Tygart Valley		
<i>Anthrobia monmouthia</i>	Greenbrier	Recent Historic	Terrestrial	
Spiders (con't)		Upper New		
	<i>Islandiana speophila</i>	South Branch Potomac	Historic	Terrestrial
	<i>Islandiana</i> sp 1	Upper New	Historic	Terrestrial
	<i>Nesticus tennesseensis</i>	NO RECORDS		Terrestrial
	<i>Phanetta subterranea</i>	South Branch Potomac	Recent Historic	Terrestrial
		Greenbrier		
		Upper New		
Elk				
Cheat				
Tygart Valley				
<i>Bathyphantes weyeri</i>	Upper New	Recent Historic	Terrestrial	
	South Branch Potomac			
Springtails	<i>Pseudosinella gisini</i>	Greenbrier	Recent Historic	Terrestrial
		Upper New		
		Elk		
	<i>Pseudosinella orba</i>	Upper New	Historic	Terrestrial
	<i>Pseudosinella certa</i>	Cheat	Historic	Terrestrial
	<i>Pseudosinella</i> sp 1	Upper New	Historic	Terrestrial
	<i>Arrhopalites</i> sp 2	Greenbrier	Historic	Terrestrial
<i>Arrhopalites</i> sp 3	Upper New	Historic	Terrestrial	

	<i>Sinella agna</i>	Elk	Recent Historic	Terrestrial
		Greenbrier		
		Cheat		
		Tygart Valley		

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of Cave Invertebrates. Because there is inadequate information on the distribution and status of Cave Invertebrates in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of Cave Invertebrates.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Coordinate data.	Determine coordinates for all caves.
	Public access to general cave invertebrate information.	Provide general Cave Invertebrate data, such as distribution maps, on the internet.

Category	Need	Action
Survey	Determine status at historic sites.	Surveys should be conducted with priority given to threatened sites.
	Survey new sites.	Determine areas with high densities of rare species and survey surrounding caves; survey more caves in Jefferson, Berkeley and Morgan counties; determine geographical data gaps and survey areas with little to no data.

Category	Need	Action
Monitoring	Long-term species monitoring sites.	Monitor caves with high diversity of rare species every 2-4 years or caves which are the most threatened.

Category	Need	Action
Research	Life history.	Narrow down species microhabitat requirements as survey information becomes available; abundance studies also needed.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with Cave Invertebrates and their habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management
Forest Health	Coordination, Education, Management
Water Quantity and Quality	Coordination, Education, Management
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	Education
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF CAVE INVERTEBRATES AND THEIR HABITATS

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve these species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of these species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of these species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Determine coordinates for all caves.

Surveys:

- Surveys should be conducted with priority given to threatened sites.

Monitoring:

- Monitor caves with high diversity of rare species every 2-4 years or caves which are the most threatened.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc.) in watersheds with priority caves.
- Coordinate with willing landowners to obtain conservation easements to protect high diversity caves.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc.) in the watershed of priority caves. Include information on the importance of invertebrate groups and general biodiversity.

Legislation/Regulation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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Crayfish

Crayfish, crawdads, or mudbugs are familiar inhabitants of the state's waterways and wetlands. Children delight in catching them while wading around in streams and adults often catch them for use as fish bait. Some crayfish species live in streams while others live in burrows and construct the mud chimneys that we see in low moist areas. Crayfish are generally inactive during the day, unless disturbed, and use the nighttime to prowl around in search of mates and food. In general, crayfish feed opportunistically on a wide variety of plant and animal materials. They are very helpful in breaking down dead plant material (detritus) that is resistant to decomposition. Crayfish are also an important food source for many animals such as fish, aquatic salamanders and raccoons.

There are over 450 species of crayfish worldwide. Just over half of these are found in North America with the highest diversity inhabiting the Appalachian Mountains. Twenty-one species can be found in West Virginia, five that are burrowers and 16 that inhabit streams and rivers of varying sizes. The burrowers make their homes in the ground in a variety of places such as streamsides, ditches, backyards, or parking lots. Crayfish populations in these burrows can be quite large with extensive highways for underground travel. Some of these can be spotted above ground in chimneys that are found outside the burrow entrances. Stream dwelling crayfish hide under the rocky substrate for protection from predators.

Two of the 21 species are considered to be exotics, introduced in the state from other regions of the United States. *Orconectes virilis* was first recorded in 1970 from the New River in Summers County. Now it has spread into the southwestern counties where it threatens the narrow range of *C. veteranus*. It also now occurs in the Eastern Panhandle where it threatens the Spinycheek Crayfish (*Orconectes limosus*). *Orconectes rusticus* was first recorded in 1978 in Fourpole Creek and has become established in Beech Fork Lake (Tom Jones, 1989, pers. comm. in Jezerinac et. al. 1995). Both species are likely to become more widespread, and because of their aggressive colonizing ability, are likely to diminish populations of other native crayfishes.

Eight species are considered to be in need of conservation. Water quality, competition with introduced species (often from bait bucket introductions) and stream alterations (channelizing, dredging and damming) are the greatest threats to the stream dwelling species.

Scientific Name	Common Name
<i>Cambarus elkensis</i>	Elk River Crayfish
<i>Cambarus nerterius</i>	An Underground Crayfish
<i>Cambarus veteranus</i>	A Crayfish
<i>Cambarus chasmodactylus</i>	New River Crayfish
<i>Cambarus longulus</i>	A Crayfish
<i>Cambarus monongalensis</i>	A Crayfish
<i>Fallicambarus fodiens</i>	A Crayfish
<i>Orconectes limosus</i>	Spinycheek Crayfish
<i>Procambarus acutus</i>	White River Crayfish

Within the group of crayfishes in need of conservation, the underground crayfish (*Cambarus nerturius*) is restricted to 15 caves in Greenbrier and Pocahontas counties, *Cambarus monongalensis* and *Fallicambarus fodiens* are burrowers, and the others live in streams or rivers. The New River Crayfish is likely the state's largest species and is restricted to the Greenbrier watershed. The Elk River Crayfish is endemic to the Elk River and a few tributaries in Nicholas, Webster, Pocahontas and Braxton counties.

A review of the conservation needs for crayfishes, as outlined on the following fact sheets, indicates that initial actions for the listed species are centered on survey, inventory and data management. Information on the distribution and status of many of the crayfishes is lacking and filling these information gaps is a necessary first step for the future conservation assessment of each species. Standardized data acquisition and management both within the WV DNR Wildlife Resources Section and by all other research partners will greatly assist with these conservation assessments. Centralized and shared information is a prerequisite to the formulation of on-the-ground conservation plans for all listed species.

Because the WRS acts as a statewide repository for information, we rely on partners to share information to maximize understanding of our biological resources. Occasionally researchers are reluctant to share information for fear that the information will be requested from state government via the Freedom of Information Act (FOIA) and used to the detriment of the species involved. For this reason it is believed appropriate to have legislation enacted to protect sensitive rare species information from wide dissemination. This need is expressed across the board on the fact sheets for animal Species in Greatest Need of Conservation.

There is an ongoing need to educate all citizens about the value of the diversity of life in the state and especially the role all SGNC play in the intricate web of life. Education is a unifying theme throughout the actions section of the fact sheets for most species. In addition there is a need to coordinate with land management agencies and other landowners/managers on the use of Best Management Practices for the conservation of biological resources in general as well as specific practices when SGNC are present. Water quality and invasive crayfishes are important considerations for the conservation of species in this group.

Unfortunately because of the dearth of data on the distribution and status of many individual species, few specific on-the-ground conservation actions have been identified. As additional data are collected, one would anticipate an increasing inventory of specific site-related projects that are desirable for the health and/or continued existence of SGNC throughout the state.

References

Jones, Tom. 2005. Personal Communication. Marshall University, West Virginia.

Jezerinac, R.F., G.W. Stocker, and D.C. Tarter. 1995. *Crayfishes of West Virginia*. Ohio Biological Survey, Columbus, OH. 193 pp.

Taxa: Crayfish

Common name: No common name

Scientific name: *Cambarus veteranus*

STATUS

The ranks and information in the chart below indicate the rarity of *Cambarus veteranus* in West Virginia. This species is listed as rare and in need of conservation and its status is monitored by many groups. It is considered extremely imperiled in West Virginia because it has only been captured in a few creeks, and in recent years it can not be found. The last specimen was taken in Huff Creek in 2000. It has been surveyed for almost every year since that date and due to intense flooding and dredging of the stream the habitat has been altered dramatically. Invasive species have taken over as well. It is a species of concern in every state in which it occurs (only West Virginia, Virginia and Kentucky).

Priority Group	Global Rank	State Rank	USFWS	IUCN Rank	AFS	Status
1*	G3G4	S1	SC	VU B1+2c	Threatened	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of *Cambarus veteranus* into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether sites are in public or private ownership.

Habitat: The only place where *C. veteranus* used to be marginally abundant was Huff Creek which is moderate in width (10-20 m), has bedrock, cobble, boulder and sand as a substrate, and permanent, fast-flowing water. Specimens were more abundant in pools with current than in riffles, and were captured under large, often flat, rocks lying on sand and gravel.

Watershed	Site Name	Record Type	Ownership
Upper Guyandotte River	Indian Creek	Recent	Private
	Brier Creek	Historic	Private
	Turkey Creek	Historic	Private
	Pinnacle Creek	Recent	Private
	Still Run	Historic	Private
	Barkers Creek	Historic	Private
	Huff Creek	7 Sites Along Creek-1 Recent	Private
Upper New River	Crane Creek	Historic	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the *Cambarus veteranus*. Because there is inadequate information on the distribution and status of *Cambarus veteranus* in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of *Cambarus veteranus*.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Public access to general crayfish information	Provide general crayfish data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Determine status at historic sites	Surveys have been conducted since 2000, severe flooding has impacted surveys and habitat. Surveys need to be conducted in ideal survey conditions.
	Determine length of stream occupied at each recent occurrence	Huff Creek is the only recent occurrence; the extent of suitable habitat needs to be determined in Huff Creek.
	Survey new sites	GIS analysis has been conducted to determine best potential sites. Those areas need to be surveyed as well as dives conducted in larger rivers.

Category	Need	Action
Monitoring	Long-term monitoring sites	If species is found, set up a long-term monitoring site and try to maintain streambed / habitat conditions.

Category	Need	Action
Research	All life history aspects and if found-abundance estimates and habitat studies	Coordinate research projects with researchers and write prospecti for needed projects and actively seek contractors.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with *Cambarus veteranus* and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Education , Coordination, Management, Restoration
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF *CAMBARUS VETERANUS* AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.

Surveys:

- Surveys have been conducted since 2000, severe flooding has impacted surveys and habitat. Surveys need to be conducted in ideal survey conditions.
- Huff Creek is the only recent occurrence; the extent of suitable habitat needs to be determined in Huff Creek.
- GIS analysis has been conducted to determine best potential sites. Those areas need to be surveyed as well as dives conducted in larger rivers.

Monitoring:

- If species is found, set up a long-term monitoring site and try to maintain streambed / habitat conditions.

Research:

- Coordinate research projects with researchers and write proposals for needed projects and actively seek contractors.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, mining practices, etc.) in streams that harbor *Cambarus veteranus*.
- Work with landowners to allow surveying/monitoring for *Cambarus veteranus* on their lands.
- Assess effects of stream modifications, such as dam construction, re-channelization, valley fills and bank stabilization on rivers and streams as projects may arise.
- Mitigate against impacts of mining, chemical pollution, nutrient loading, etc. in streams.

Education:

- Educate the public as to the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) in West Virginia streams. Provide information to discourage the over-collection of Crayfishes.
- Educated the public as to the problems related to moving Crayfish species from one watershed to another, as well as the problems with non-native Crayfishes out-competing our native species.

Legislation/Regulation:

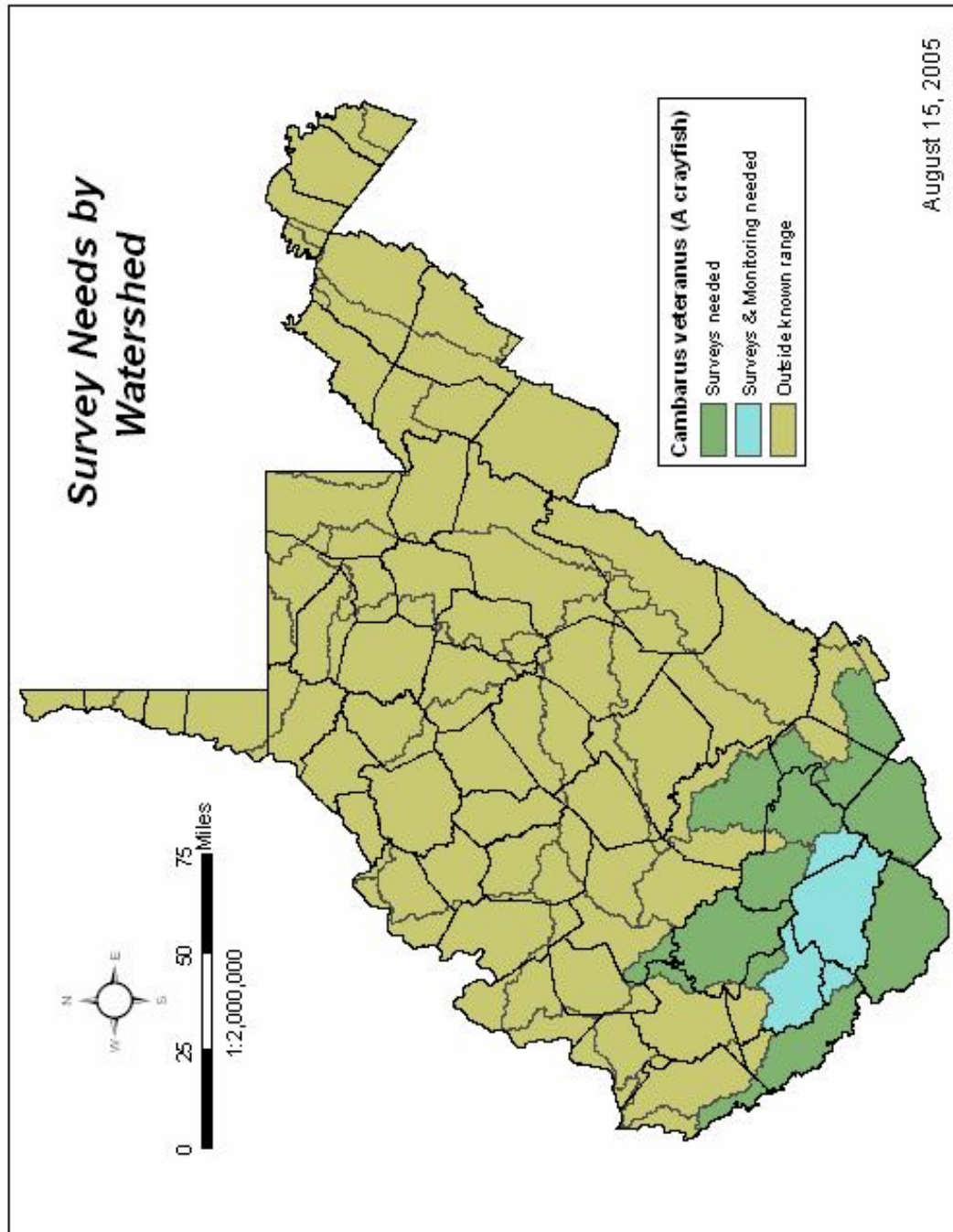
- Develop appropriate regulations restricting the collection of Crayfishes as fish bait.
- Pass legislation to protect Species in Greatest Need of Conservation from FOIA requests.

Restoration:

- Restore habitat in Huff Creek by replacing larger substrate within the stream that was removed during flood recovery.
- *Cambarus veteranus* cannot be re-located, explore the possibility of a reintroduction project through propagation from Kentucky or Virginia populations.

REFERENCES

- Channel, Katherine. 2003. *Implementation of Spatial-temporal focus to predict habitat locations and distribution of Cambarus veteranus*. Unpublished Master's thesis. Marshall University, Huntington, WV.
- Jezerinac, R.F., G.W. Stocker, and D.C. Tarter. 1995. *Crayfishes of West Virginia*: Ohio Biological Survey, Columbus, OH. 193 pp.
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- West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Crayfish
Common name: An Underground Crayfish
Scientific name: *Cambarus nerterius*

STATUS

The ranks and information in the chart below indicate the rarity of *Cambarus nerterius* in West Virginia. This species is listed as rare and in need of conservation and its status is monitored by many groups. It is endemic to caves within the Greenbrier and Elk river drainages in West Virginia.

Priority Group	Global Rank	State Rank	Mon Forest	IUCN Rank	AFS	Trend
1*	G2G3	S1	X	VU B1+2c, D1	E	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of *Cambarus nerterius* into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether the site is in public or private ownership.

Habitat: *Cambarus nerterius* inhabits cave waters from the entrances to areas where light never penetrates. Most are seen in pools with current and under rock shelves.

Watershed	Site Name	Record Type	Ownership
Greenbrier	Higginbothams #1 Cave	Recent	Private
	Fuller Cave	Recent	Private
	General Davis Cave	Recent	Private
	Ludington Cave	Recent	Private
	McClung Cave	Recent	Private
	Bransfords Cave	Recent	Private
	Sinks Of Culverson Creek	Historic	Private
	McFerrin Cave	Historic	Private
	Hinkles Unus Cave	Recent	Private
	Piercy's Mill Cave	Recent	Private
	Piercy's Cave	Recent	Private

	Matt's Black Cave	Recent	Private
	Buckeye Cave	Historic	Private
	US 219 Cave	Recent	Private
	Nellie's Cave	Recent	Private
	Spencer Cave	Recent	Private
	Clyde Cochrane Sinks Cave	Historic	Private
	Fuells Fruit Cave	Recent	Private
Elk	My Cave	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of *Cambarus nerterius*. Because there is inadequate information on the distribution and status of *Cambarus nerterius* in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of *Cambarus nerterius*.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Public access to general crayfish information.	Provide Cave Crayfish information, such as distribution maps, on the WVDNR website.

Category	Need	Action
Surveys	Determine status at historic sites.	Survey historic caves to determine presence of species.
	Determine status of invasive species.	Survey caves to determine presence of invasive species or an increase of common native species.
	Survey new sites	Survey nearby caves and watersheds at current sites.

Category	Need	Action
Monitoring	Long-term monitoring.	Set up a long-term monitoring project at the most threatened 2-3 caves throughout range.

Category	Need	Action
Research	All life history aspects.	Coordinate with researchers to choose a cave to do a mark-recapture, abundance study.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with *Cambarus nerterius* and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Education , Coordination, Management
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF CAMBARUS NERTERIUS AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.

Surveys:

- Survey historic caves to determine presence of species.
- Survey caves to determine presence of invasive species or an increase of common native species.
- Survey nearby caves and watersheds at current sites.

Monitoring:

- Set up a long-term monitoring project at the most threatened 2-3 caves throughout range.

Research:

- Coordinate with researchers to choose a cave to do a mark-recapture, abundance study.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc.) in streams that support *Cambarus nerterius*. This may include encouraging use of Best Management Practices when timbering, during road construction or when engaged in other impacting activities. Work with private and public landowners to conserve *Cambarus nerterius* populations and allow surveying/monitoring on their lands.
- Mitigate against impacts of development, chemical pollution, nutrient loading, etc. to streams.

Education:

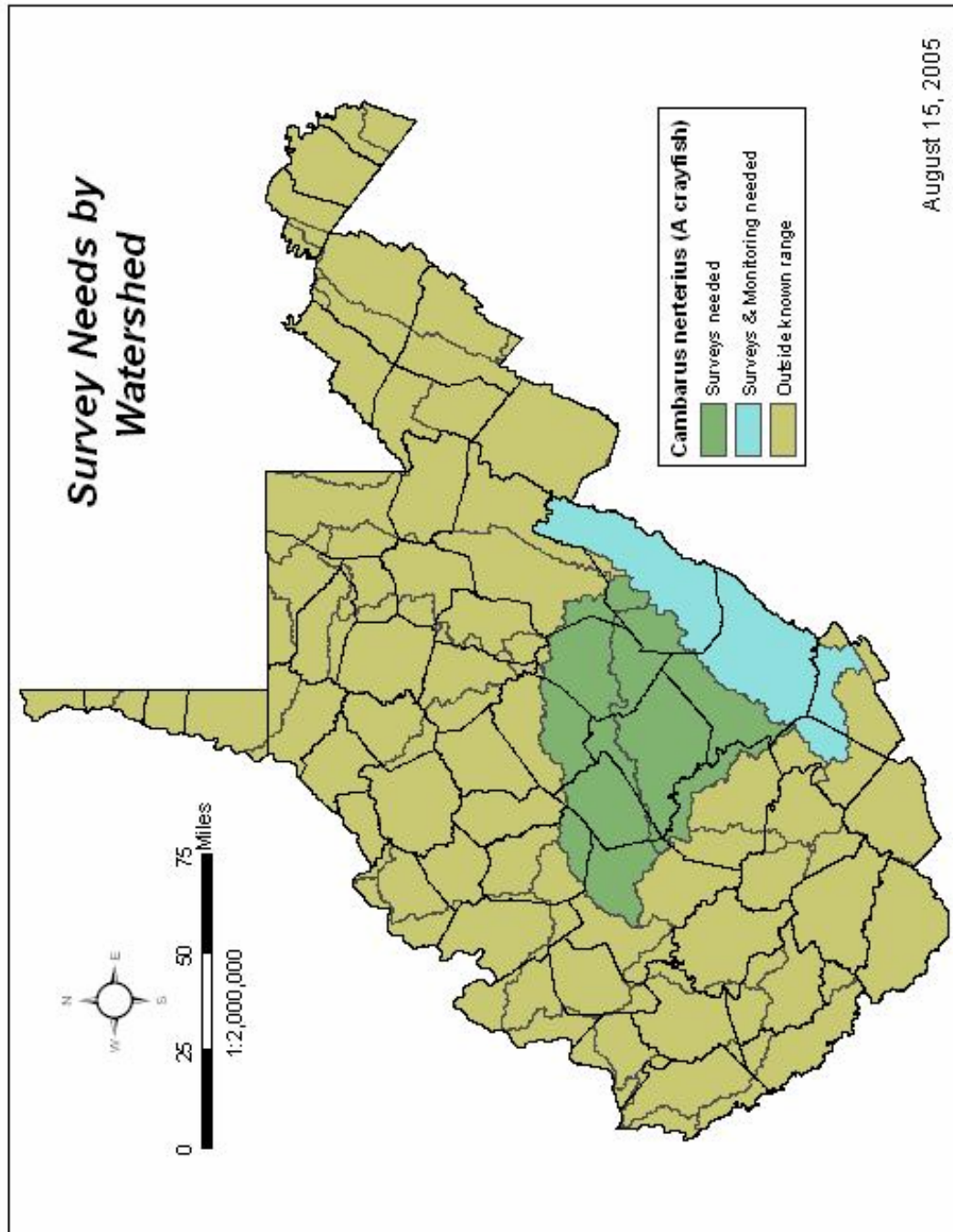
- Educate the public as to the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) in West Virginia streams. Provide information to discourage the over-collection of Crayfishes.
- Educated the public as to the problems related to moving Crayfish species from one watershed to another, as well as the problems with non-native Crayfishes out-competing our native species.

Legislation/Regulation:

- Develop appropriate regulations restricting the collection of Crayfishes as fish bait.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

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- Hobbs, H.H. Jr. 1964. *A new cave-dwelling crayfish from the Greenbrier drainage system, West Virginia (Decapoda, Astacidae)*. Proc. Biol. Soc. Washington 77:1889 – 194.
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- Jones, Tom. 2005. Personal Communication. Marshall University, Huntington, WV.
- NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: April 13, 2005).
- West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Crayfish

Common name: Elk River Crayfish

Scientific name: *Cambarus elkensis*

STATUS

The ranks and information in the chart below indicate the rarity of the Elk River Crayfish in West Virginia. This species is listed as rare and in need of conservation and its status is monitored by many groups. It is endemic to the Elk River drainage in West Virginia.

Priority Group	Global Rank	State Rank	IUCN Rank	AFS	Trend
1*	G2	S1	VU B1+2c	T	Stable

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Elk River Crayfish into a watershed, gives the ages of the records (recent is within 20 years) and indicates whether sites are in public or private ownership.

Habitat: The Elk River Crayfish is found under loose rocks in riffles or in pools that have currents.

Watershed	Site Name	Record Type	Ownership
Elk	Elk River - Co. Rt. 26	3 sites along river- 1 Historic	Private
	Back Fork Elk	Recent	Private
	Leatherwood Creek	Recent	Private
	Old Field Fork	Recent	Private
	Slaty Fork	Recent	Private
	Right Fork Holly River	Recent	Private
	Left Fork Holly River	Recent	Private
	Laurel Fork - Holly River State Park	Recent	Public
	Birch River	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Elk River Crayfish. Because there is inadequate information on the distribution and status of the Elk River Crayfish in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Elk River Crayfish.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Public access to general crayfish information.	Provide Elk River Crayfish information, such as distribution maps, on the WVDNR website.

Category	Need	Action
Surveys	Determine extent of population.	Survey points along creek to determine if the crayfish occurs throughout each stream or is restricted to certain reaches.
	Survey new sites.	Survey surrounding streams within the Elk River drainage and neighboring Gauley River drainage (specimen found in 2005 could be <i>elkensis</i> and is being verified); perhaps dive in larger pools.
	Determine status of invasive species.	Survey <i>C. elkensis</i> sites for invasive species or an increase of common native species.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Monitor Holly River site and a possible site along the Elk River to make sure the species is not impacted by possible threats or invasive species.

Category	Need	Action
Research	Determine impacts of invasive species.	Conduct a species interaction/competition study.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Elk River Crayfish and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Education , Coordination, Management
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE ELK RIVER CRAYFISH AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.

Surveys:

- Survey points along creek to determine if the crayfish occurs throughout each stream or is restricted to certain reaches.
- Survey surrounding streams within the Elk River drainage and neighboring Gauley River drainage (specimen found in 2005 could be *elkensis* and is being verified); perhaps dive in larger pools.
- Survey *C. elkensis* sites for invasive species or an increase of common native species.

Monitoring:

- Monitor Holly River site and a possible site along the Elk River to make sure the species is not impacted by possible threats or invasive species.

Research:

- Conduct a species interaction/competition study.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc.) in streams that support the Elk River Crayfish. This may include encouraging use of Best Management Practices when timbering, during road construction or when engaged in other impacting activity.
- Work with private and public landowners to conserve Elk River Crayfish populations and allow surveying/monitoring on their lands.
- Coordinate with Holly River State Park staff to maintain current sites within the Park, and to continue surveys and monitoring within Park boundaries.
- Assess effects of stream modifications, such as dam construction, rechannelization and bank stabilization on rivers and streams as projects arise.
- Mitigate against impacts of mining, chemical pollution, nutrient loading, etc. in streams.

Education:

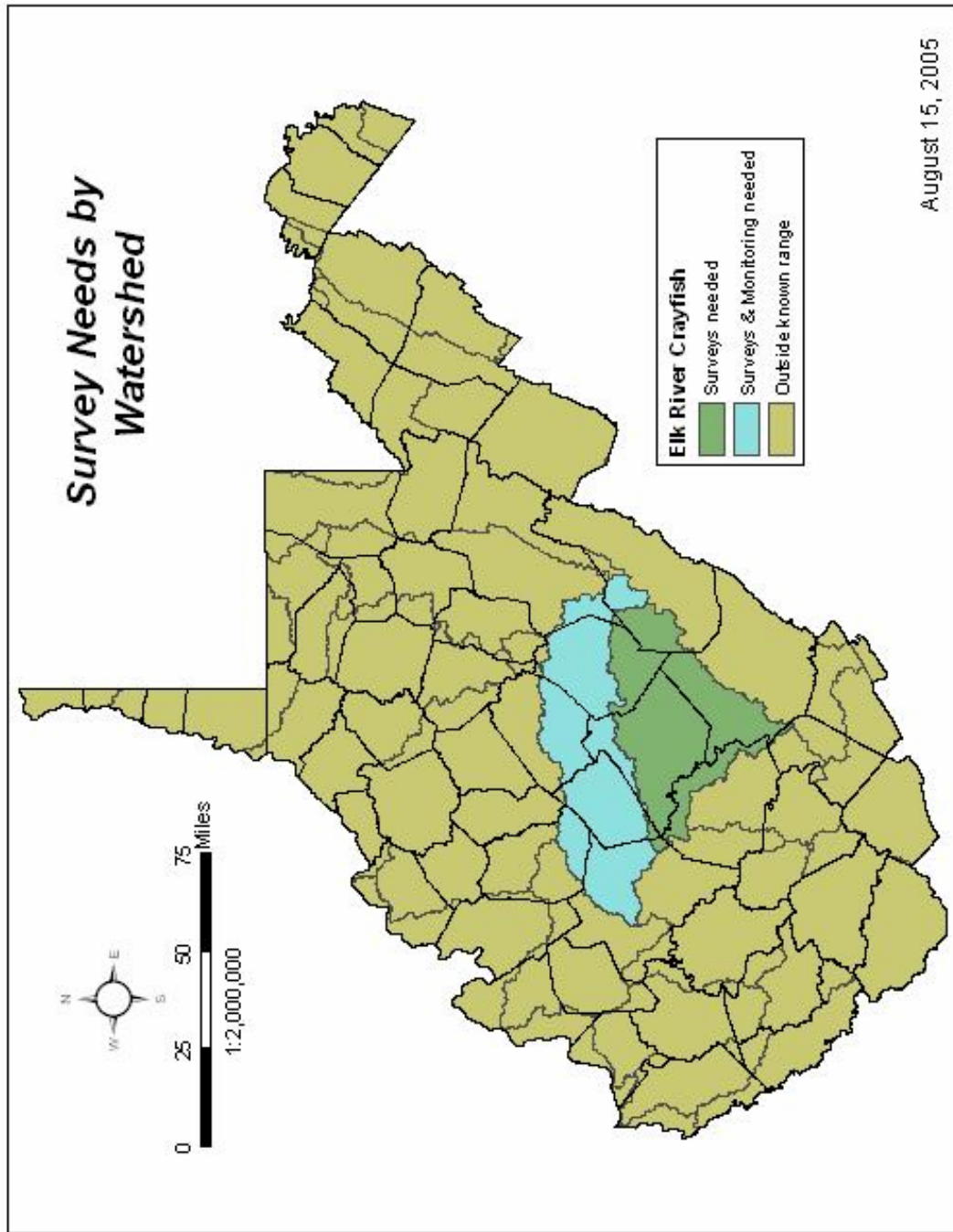
- Educate the public about the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc.) in West Virginia streams. Provide information to discourage the over-collection of Crayfishes.
- Educated the public as to the problems related to moving Crayfish species from one watershed to another, as well as the problems with non-native Crayfishes out-competing our native species.

Legislation/Regulation:

- Develop appropriate regulations restricting the collection of Crayfishes as fish bait.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

- Jezerinac, R.F., G.W. Stocker, and D.C. Tarter. 1995. *Crayfishes of West Virginia*. Ohio Biological Survey, Columbus, OH. 193 pp.
- Jones, Tom. 2005. Personal Communication. Marshall University, Huntington, WV.
- NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: April 13, 2005).
- West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Crustacea
Group: Crayfish

STATUS

The ranks and information in the chart below indicate the rarity and status of SGCN crayfish in West Virginia. A statewide survey for crayfish was conducted in the 1980's and published in the *Crayfishes of West Virginia*. Smaller projects have been conducted since then; however, data will need to be updated in the next few years.

Scientific Name	Common Name	Priority Group	Global Rank	State Rank	Trend
<i>Orconectes limosus</i>	Spinycheek Crayfish	2*	G4G5	S1	Declining
<i>Cambarus longulus</i>	A Crayfish	2	G5	S1	Stable
<i>Cambarus chasmodactylus</i>	New River Crayfish	2	G4	S3	Stable
<i>Cambarus monongalensis</i>	A Crayfish	2	G5	S3	Unknown
<i>Fallicambarus fodiens</i>	A Crayfish	2	G5	S1	Unknown
<i>Procambarus acutus</i>	White River Crayfish	2	G5	SU	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places each species of crayfish into watersheds and describes the habitat. The number of recent (within 20 years) versus historic records is also given. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. Since some crayfish species are without common names, scientific names are used in this chart.

Species	Watershed	Record Type	Habitat
<i>Cambarus chasmodactylus</i>	Greenbrier River	Recent Historic	Larger streams (> 10 m wide) are preferred and more abundant in clean waters; found in current and pools with current.
<i>Cambarus longulus</i>	James River	Recent	Small to moderately wide (3-10 m) streams having fast flowing water with sand, gravel, cobble and bedrock substrates.

<i>Cambarus monongalensis</i>	Cheat	Recent Historic	Primary burrower on wooded hillsides, seeps, springs, roadside ditches; presence of deciduous woods is important.
	Dunkard		
	Elk		
	Gauley		
	Greenbrier		
	Little Kanawha		
	Middle Ohio Valley		
	Upper Ohio Valley		
	Monongahela		
	Tygart		
	South Branch Potomac		
	West Fork		
<i>Procambarus acutus</i>	Middle Ohio Valley	Recent	Low-gradient streams or lakes with mud or clay bottoms.
<i>Fallicambarus fodiens</i>	Lower Ohio Valley	Recent	Primary burrower; two WV locations are in a corn field and a swamp.
<i>Orconectes limosus</i>	Potomac	Recent	Moderately wide to large streams (10-100 m) having silt, sand, gravel and cobble substrates; requires silt and most are found in shallow depressions in pools with current.

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Crayfishes. Because there is inadequate information on the distribution and status of Crayfishes in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of Crayfishes.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Collection at Ohio State needs identified and data entered into the database with coordinate data.	Contract museum staff or other contractors to supply data on West Virginia specimens.
	Public access to general crayfish information.	Provide general Crayfish data, such as distribution maps, on the internet.

Category	Need	Action
Survey	Determine status at historic sites.	Visit all historic sites if possible to determine presence of species, giving priority to threatened sites.
	Determine status of invasive species.	Survey creeks and rivers to determine presence of invasive species or an increase of common native species at rare species sites.
	Survey new sites.	For <i>Procambarus</i>, <i>Fallicambarus</i>, <i>Orconectes</i>, and <i>C. monongalensis</i> - survey areas or creeks to extend range and determine distribution in the state.

Category	Need	Action
Monitoring	Long-term species monitoring sites.	Set up monitoring site and note abundance of <i>Orconectes virilis</i>, <i>Cambarus longulus</i> and other crayfishes. Monitor every 3-5 years depending on threats.
		Determine possible sites as new crayfish data becomes available.

Category	Need	Action
Research	Life history.	Most species require research on habitat requirements. Also needed are abundance studies, effect of invasive species and decreased water pollution.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with Crayfishes and their habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Education , Coordination, Management
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF CRAYFISHES AND THEIR HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Contract museum staff or other contractors to supply data on West Virginia specimens.

Surveys:

- Visit all historic sites if possible to determine presence of species- giving priority to threatened sites.
- Survey creeks and rivers to determine presence of invasive species or an increase of common native species at rare species sites.
- For *Procambarus*, *Fallicambarus*, *Orconectes*, and *C. monongalensis* - survey areas or creeks to extend range and determine distribution in the state.

Monitoring:

- Set up monitoring site and note abundance of *Orconectes virilis*, *Cambarus longulus* and other Crayfishes. Monitor every 3-5 years depending on threats.

Research:

- Most species require research on habitat requirements. Abundance studies, effect of invasive species and decreased water pollution is also needed.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in streams. This may include encouraging use of Best Management Practices when timbering or during road construction and other site related issues.
- Work with private and public landowners to conserve Crayfish populations and allow surveying/monitoring on their lands.
- Assess effects of stream modifications, such as dam construction, rechannelization and bank stabilization on rivers and streams as projects may arise.
- Mitigate against impacts of mining, chemical pollution, nutrient loading, etc. in streams.

Education:

- Educate the public as to the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) in West Virginia streams. Provide information to discourage the over-collection of Crayfishes.
- Educate the public as to the problems related to moving Crayfish species from one watershed to another, as well as the problems with non-native Crayfishes out-competing our native species.

Legislation/Regulation:

- Develop appropriate regulations restricting the collection of Crayfishes as fish bait.
- Pass legislation to protect Species in Greatest Need of Conservation from FOIA requests.

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Dragonflies and Damselflies (Odonates)

Dragonflies and damselflies are collectively in the insect order Odonata and are commonly referred to as Odonates. There are 44 damselfly and 102 dragonfly species and subspecies reported from West Virginia.

Despite the often showy nature of the state's Odonates, there is relatively little documented about their occurrence, distribution and status. This leaves room for the finding of additional species and new distribution records from those already known from the state. A statewide Odonate atlas project is underway which will assist with determining the current status of the state's Odonates.

Existing collections and literature have been reviewed and 72 species of dragonflies and damselflies (almost half of the total number) are considered to be Species in Greatest Need of Conservation. Six of these are globally rare and the remaining 66 species are species for which there is insufficient information to classify as to a particular status. This is a long list of species and is undoubtedly a result of a general lack of surveys. As more information becomes available, hopefully the list of rare Odonates in West Virginia will shorten.

Scientific Name	Common Name	Habitat
	Dragonflies	
<i>Aeshna verticalis</i>	Green-striped Darner	Ponds, Streams
<i>Aeshna canadensis</i>	Canada Darner	Ponds, Lakes, Streams
<i>Aeshna interrupta interrupta</i>	Variable Darner	Ponds, Lakes, Streams
<i>Aeshna tuberculifera</i>	Back-tipped Darner	Streams, Ponds
<i>Anax longipes</i>	Comet Darner	Ponds
<i>Celithemis fasciata</i>	Banded Pennant	Ponds, Lakes
<i>Cordulegaster diastatops</i>	Delta-spotted Spiketail	Streams, Forest Seeps
<i>Cordulegaster erronea</i>	Tiger Spiketail	Forest Seeps
<i>Cordulia shurtleffi</i>	American Emerald	Ponds, Lakes
<i>Dromogomphus armatus</i>	Southeastern Spinyleg	Streams
<i>Dromogomphus spoliatus</i>	Flag-tailed Spinyleg	Ponds, Lakes, Rivers
<i>Epiaeschna heros</i>	Swamp Darner	Ponds, Streams, Swamps
<i>Erpetogomphus designatus</i>	Eastern Ringtail	Streams, Rivers
<i>Erythrodiplax minuscula</i>	Little Blue Dragonlet	Ponds, Lakes, Rivers
<i>Gomphus adelphus</i>	Moustached Clubtail	Streams, Rivers
<i>Gomphus descriptus</i>	Harpoon Clubtail	Streams, Rivers
<i>Gomphus fraternus</i>	Midland Clubtail	Streams, Rivers
<i>Gomphus lineatifrons</i>	Splendid Clubtail	Rivers
<i>Gomphus rogersi</i>	Sable Clubtail	Streams
<i>Gomphus vastus</i>	Cobra Clubtail	Streams, Rivers
<i>Ladona julia</i>	Chalk-fronted Corporal	Ponds, Streams
<i>Lanthus parvulus</i>	Northern Pygmy Clubtail	Streams, Rivers
<i>Lanthus vernalis</i>	Southern Pygmy Clubtail	Streams, Rivers
<i>Leucorrhinia glacialis</i>	Crimson-ringed Whiteface	Ponds, Bogs
<i>Leucorrhinia hudsonica</i>	Hudsonian Whiteface	Ponds, Bogs
<i>Leucorrhinia proxima</i>	Red-waisted Whiteface	Ponds

<i>Libellula auripennis</i>	Golden-winged Skimmer	Ponds, Bogs
<i>Libellula deplanata</i>	Blue Corporal	Ponds, Lakes
<i>Libellula flavida</i>	Yellow-sided Skimmer	Forest Seeps
<i>Libellula quadrimaculata</i>	Four Spotted Skimmer	Ponds, Lakes, Streams
<i>Macromia alleghaniensis</i>	Allegheny River Cruiser	Streams, Rivers
<i>Macromia taeniolata</i>	Royal River Cruiser	Lakes, Streams, Rivers
<i>Nasiaeschna pentacantha</i>	Cyrano Darner	Ponds, Streams, Swamps
<i>Neurocordulia obsoleta</i>	Umber Shadowdragon	Lakes, Streams, Rivers
<i>Neurocordulia yamaskanensis</i>	Stygian Shadowdragon	Lakes, Rivers
<i>Ophiogomphus carolus</i>	Riffle Snaketail	Streams, Rivers
<i>Ophiogomphus mainensis fastigiatus</i>	Maine Snaketail	Streams, Rivers
<i>Somatochlora williamsoni</i>	Williamson's Emerald	Lakes, Streams
<i>Somatochlora elongata</i>	Ski-tailed Emerald	Ponds, Streams
<i>Somatochlora forcipata</i>	Forcipate Emerald	Streams, Swamps
<i>Somatochlora linearis</i>	Mocha Emerald	Streams
<i>Somatochlora provocans</i>	Treetop Emerald	Forest Seeps
<i>Stylurus plagiatu</i> s	Russet-tipped Clubtail	Lakes, Streams, Rivers
<i>Stylurus scudder</i> i	Zebra Clubtail	Streams, Rivers
<i>Stylurus spiniceps</i>	Arrow Clubtail	Rivers
<i>Sympetrum corruptum</i>	Variegated Meadowhawk	Ponds, Streams, Vernal Pools, Forest Seeps
<i>Sympetrum internum</i>	Cherry-faced Meadowhawk	Ponds, Lakes, Streams, Bogs, Marshes
<i>Sympetrum obtrusum</i>	White-faced Meadowhawk	Ponds, Streams, Bogs, Marshes
<i>Sympetrum semicin</i> ctum	Band-winged Meadowhawk	Marshes, Forest Seeps
<i>Sympetrum ambiguum</i>	Blue-faced Meadowhawk	Marshes, Swamps
<i>Sympetrum janeae</i>	Jane's Meadowhawk	Ponds, Lakes, Streams, Bogs, Marshes
<i>Tachopteryx thoreyi</i>	Gray Petaltail	Forest Seeps
<i>Tetragoneuria canis</i>	Beaverpond Baskettail	Ponds, Lakes, Streams
<i>Tramea carolina</i>	Carolina Saddlebags	Ponds, Lakes
	Damselflies	
<i>Calopteryx amata</i>	Superb Jewelwing	Streams
<i>Calopteryx angustipennis</i>	Appalachian Jewelwing	Streams
<i>Enallagma antennatum</i>	Rainbow Bluet	Streams, Lakes
<i>Enallagma boreale</i>	Boreal Bluet	Streams, Swamps, Bogs, Marshes
<i>Enallagma cyathigerum vernale</i>	Northern Bluet	Ponds, Swamps, Bogs, Marshes
<i>Enallagma vesperum</i>	Vesper Bluet	Lakes, Streams
<i>Hetaerina titia</i>	Smoky Rubyspot	Streams, Rivers
<i>Ischnura prognata</i>	Furtive Forktail	Ponds
<i>Lestes congener</i>	Spotted Spreadwing	Ponds, Swamps, Bogs, Marshes
<i>Lestes d. disjunctus</i>	Common Spreadwing	Ponds, Swamps, Bogs, Marshes

<i>Lestes dryas</i>	Emerald Spreadwing	Ponds, Swamps, Bogs, Marshes
<i>Lestes forcipatus</i>	Sweetflag Spreadwing	Ponds, Lakes, Streams
<i>Lestes inaequalis</i>	Elegant Spreadwing	Ponds, Lakes, Streams
<i>Lestes unguiculatus</i>	Lyre-tipped Spreadwing	Ponds, Rivers
<i>Lestes vigilax</i>	Swamp Spreadwing	Ponds, Swamps, Bogs, Marshes
<i>Nehalennia gracilis</i>	Sphagnum Sprite	Bogs
<i>Nehalennia irene</i>	Sedge Sprite	Marshes, Vernal Pools
<i>Telebasis byersi</i>	Duckweed Firetail	Ponds, Swamps

Odonates eat flying insects, including mosquitoes, and should be regarded as a welcome addition around our streams, rivers, ponds and lakes. Each species of Odonate has a particular habitat that is favored by the aquatic larval stage. These habitats range from spring seeps in the forest to large rivers like the Ohio. A number of species are partial to the quiet waters of ponds and lakes.

Threats to Odonates are any activities that affect water quality where the larvae live including sedimentation, point source pollution, non-point source pollution, acid mine drainage, eutrophication, toxic spills, channel modification, etc.

A review of the conservation needs for Odonates, as outlined on the following fact sheets, indicates that initial actions for the listed species are centered on survey, inventory and data management. Information on the distribution and status of many Odonates is lacking and filling these information gaps is a necessary first step for the future conservation assessment of each species. Standardized data acquisition and management both within the WV DNR Wildlife Resources Section and by all other research partners will greatly assist with these conservation assessments. Centralized and shared information is a prerequisite to the formulation of on-the-ground conservation plans for all listed species.

Because the WRS acts as a statewide repository for information, we rely on partners to share information to maximize understanding of our biological resources. Occasionally researchers are reluctant to share information for fear that the information will be requested from state government via the Freedom of Information Act (FOIA) and used to the detriment of the species involved. For this reason it is believed appropriate to have legislation enacted to protect sensitive rare species information from wide dissemination. This need is expressed across the board on the fact sheets for animal Species in Greatest Need of Conservation.

There is an ongoing need to educate all citizens about the value of the diversity of life in the state and especially the role all SGNC play in the intricate web of life. Education is a unifying theme throughout the actions section of the fact sheets for most species. In addition there is a need to coordinate with land management agencies and other landowners/managers on the use of Best Management Practices for the conservation of biological resources in general as well as specific practices when SGNC are present.

Unfortunately because of the dearth of data on the distribution and status of many individual species, few specific on-the-ground conservation actions have been identified. As additional data are collected, one would anticipate an increasing inventory of specific site-related projects that are desirable for the health and/or continued existence of SGNC throughout the state.

References

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Taxa: Odonates
Common name: Spadderdock Darner
Scientific name: *Aeshna mutata*

STATUS

The ranks and information in the chart below indicate the rarity of the Spadderdock Darner in West Virginia. This species is listed as rare and in need of conservation in every state in which it occurs.

Priority Group	Global Rank	State Rank	Status
1*	G3G4	S1	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of Spadderdock Darners into watersheds and gives the ages of the records (recent is within 20 years) and indicates whether sites are in public or private ownership.

Habitat: The Spadderdock Darner utilizes fishless ponds, usually with water lilies and occasionally bog ponds. One individual in West Virginia was documented along a seep near a creek in a forest.

Watershed	Site Name	Record Type	Ownership
Gauley	Cranberry Glades Wilderness Area	Recent	Public
Tygart Valley	Valley Bend Wetland WMA	Recent	Public

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Spadderdock Darner. Because there is inadequate information on the distribution and status of the Spadderdock Darner in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Spadderdock Darner.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Dragonfly atlas.	Coordinate volunteer Odonate survey from 2005-2008; publish data in a WV Odonate Atlas.
	Public access to data.	Provide general Dragonfly information, such as distribution maps, on the WVDNR website.

Category	Need	Action
Survey	Survey new sites.	Identify potential wetlands that could support this species and conduct surveys.

Category	Need	Action
Monitoring	Long-term species monitoring.	Monitor Valley Bend Wetland for presence of species every 2 to 3 years.
		Determine possible new monitoring sites as new location data becomes available.

Category	Need	Action
Research	Life history.	Coordinate projects with researchers and/or contractors; all natural history data is needed for species.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Spadderdock Darner and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Education , Coordination, Management
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE SPADDERDOCK DARNER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Coordinate Odonate survey from 2005-2008; publish data in a WV Odonate Atlas.

Surveys:

- Identify potential wetlands that could support this species and conduct surveys.

Coordination:

- Work with the U.S. Forest Service and WMA staff to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in streams and wetlands with Spadderdock Darners.
- Encourage use of Best Management Practices when timbering and other site related issues that lead to habitat loss and decreased water quality.
- Mitigate for impacts of land use activities, such as stream channel modification, that may alter the habitat for the Spadderdock Darner.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) on Spadderdock Darner wetlands and streams. General information on the importance of invertebrate groups and general biodiversity should be included.

Legislation:

- Develop and introduce legislation to include Odonates and other Terrestrial Insects in the definition of wildlife.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

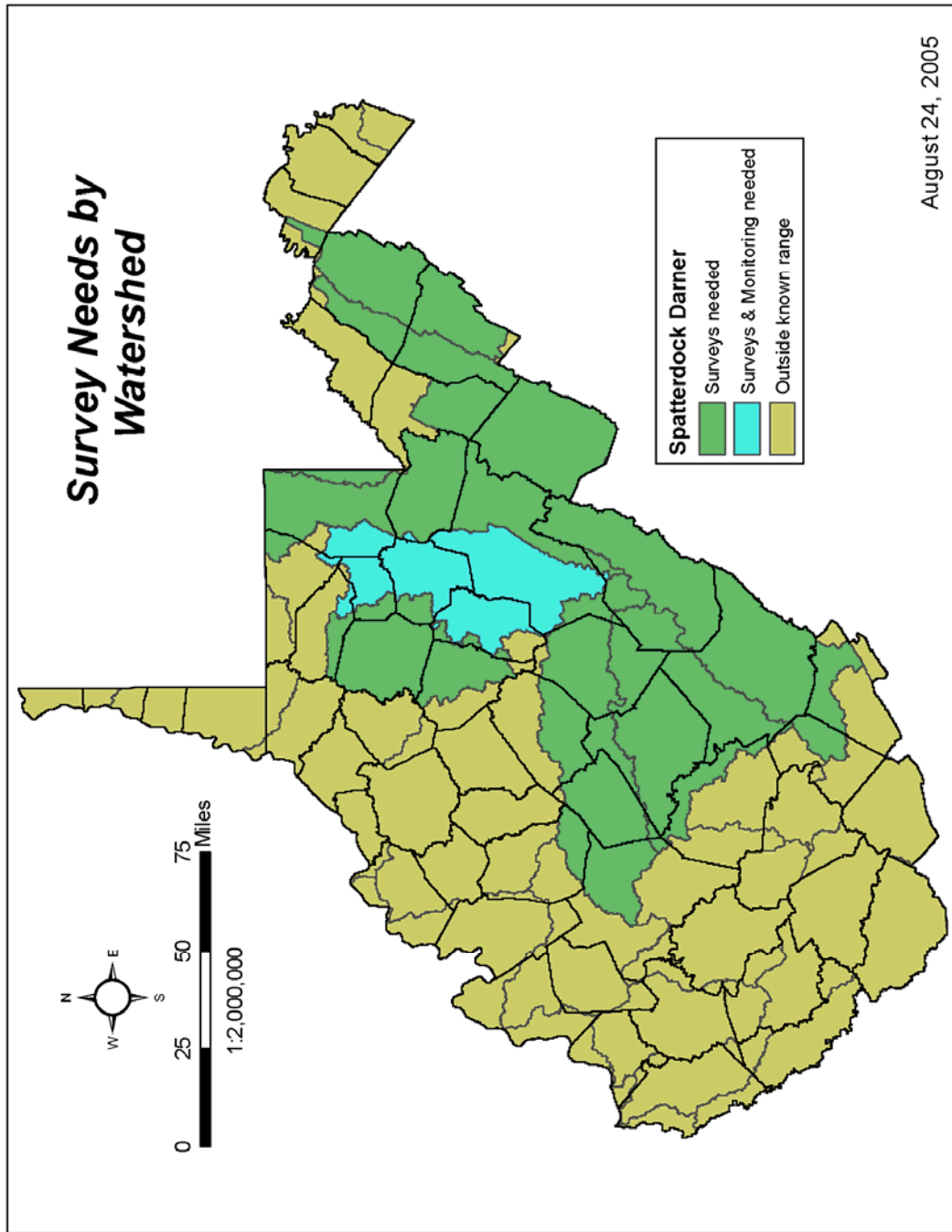
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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Odonates

Common name: Spine-crowned Clubtail

Scientific name: *Gomphus abbreviatus*

STATUS

The ranks and information in the chart below indicate the rarity of the Spine-crowned Clubtail in West Virginia. This species is listed as rare and in need of conservation in every state in which it occurs.

Priority Group	Global Rank	State Rank	Trend
1*	G3G4	S1	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Spine-crowned Clubtail into watersheds and gives the ages of records (recent is within 20 years) and indicates whether sites are under public or private ownership.

Habitat: The Spine-crowned Clubtail inhabits clean streams and rivers, either sand or rock-bottomed, but with muck deposits.

Watershed	Site Name	Record Type	Ownership
Cheat	Dry Fork	Historic	Public
Cacapon	Ice Mountain	Historic	Public
	Cacapon River	Historic	Private
	North River	Historic	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Spine-crowned Clubtail. Because there is inadequate information on the distribution and status of the Spine-crowned Clubtail in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Spine-crowned Clubtail.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Dragonfly atlas.	Coordinate volunteer Odonate survey from 2005-2008; publish data in a WV Odonate Atlas.
	Public access to data.	Provide general Dragonfly information, such as distribution maps, on the WVDNR website.

Category	Need	Action
Survey	Survey historic sites.	Survey historic sites to determine presence of species.
	Survey new sites.	Identify potential rivers/creeks that could support this species and conduct surveys; historic sites are of priority.

Category	Need	Action
Monitoring	Long-term species monitoring.	Determine possible new monitoring sites as new location data become available.

Category	Need	Action
Research	Life history.	Coordinate projects with researchers and/or contractors; all natural history data is needed for species.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Spine-crowned Clubtail and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Education , Coordination, Management
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE SPINE-CROWNED CLUBTAIL AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Coordinate volunteer Odonate survey from 2005-2008; publish data in a WV Odonate Atlas.

Surveys:

- Survey historic sites to determine presence of species.
- Identify potential rivers/creeks that could support this species and conduct surveys; historic sites are of priority.

Coordination:

- Work with the U.S. Forest Service and WMA staff to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc.) in streams and wetlands with Spine-crowned Clubtails.
- Encourage use of Best Management Practices when working in riparian zones and other site related issues that lead to habitat loss and decreased water quality.
- Mitigate for impacts of land use activities, such as stream channel modification, that may alter the habitat for the Spine-crowned Clubtail.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc.) on Spine-crowned Clubtail wetlands and streams. General information on the importance of invertebrate groups and general biodiversity should be included.

Legislation/Regulation:

- Develop and introduce legislation to include adult Odonates and other Terrestrial Insects in the definition of wildlife.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

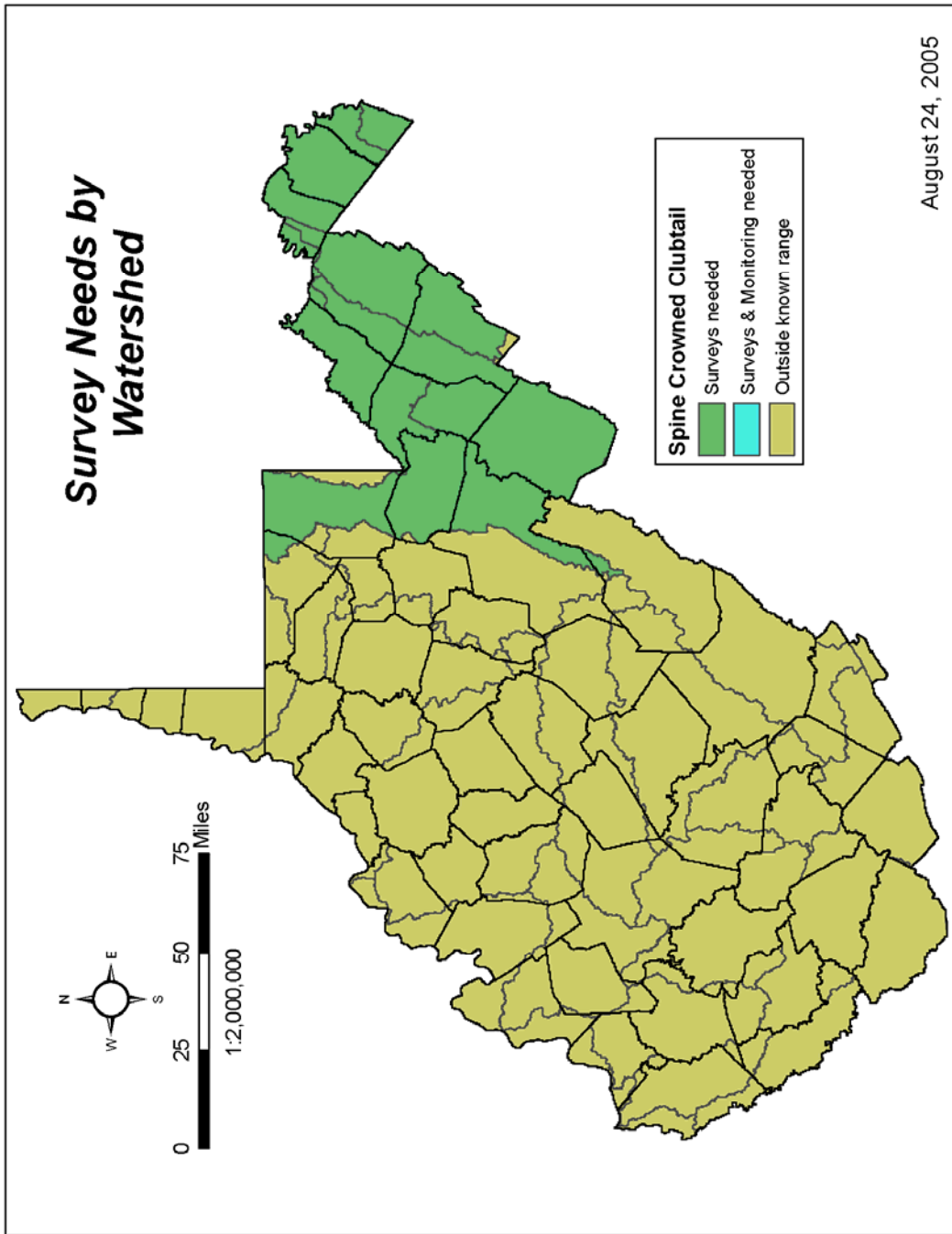
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West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Odonates
Common name: Rapids Clubtail
Scientific name: *Gomphus quadricolor*

STATUS

The ranks and information in the chart below indicate the rarity of the Rapids Clubtail in West Virginia. This species is listed as rare and in need of conservation in every state in which it occurs.

Priority Group	Global Rank	State Rank	Trend
1	G3G4	S2S3	Unknown

*The letters and/or numbers in the chart refer to each group’s designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Rapids Clubtail into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether sites are in public or private ownership.

Habitat: The Rapids Clubtail inhabits large streams and rivers with gravel in rocky riffles or rapids, but has also been recorded from sluggish mud-bottomed rivers.

Watershed	Site Name	Record Type	Ownership
Greenbrier	Greenbrier River- Anthony	Recent	Private
	Greenbrier River- Renick	Recent	Private
	Greenbrier River- Clover Lick	Historic	Private
	West Fork of Greenbrier River	Historic	Public
Little Kanawha	Little Kanawha River	Historic	Private
Tygart Valley	Junction of Buckhannon and Tygart Rivers	Recent	Private
North Branch Potomac	Patterson Creek	Historic	Private
South Branch Potomac	South Branch Potomac-Smoke Hole	Historic	Public
Tug Fork	Tug Fork River	Historic	Private
Middle Ohio Valley	Bull Creek	Historic	Private
Cacapon	North River	Historic	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Rapids Clubtail. Because there is inadequate information on the distribution and status of the Rapids Clubtail in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Rapids Clubtail.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Dragonfly atlas.	Volunteer Odonate survey from 2005-2008, publish data in WV Odonate Atlas.
	Public access to data.	Provide general dragonfly information, such as distribution maps, on the WVDNR website.

Category	Need	Action
Survey	Survey historic sites.	Revisit historic sites to determine presence of species.
	Survey new sites.	Determine potential rivers/creeks that could support this species and conduct surveys, but updating historic sites are of priority.

Category	Need	Action
Monitoring	Long-term species monitoring.	Monitor areas along the Greenbrier River for presence of species every 2-3 years.
		Determine possible new monitoring sites as new location data becomes available.

Category	Need	Action
Research	Life history.	Coordinate research projects with researchers and/or contractors; all natural history data is needed for this species.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Rapids Clubtail and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Education , Coordination, Management
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE RAPIDS CLUBTAIL AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Coordinate the volunteer Odonate survey from 2005-2008; publish data in a WV Odonate Atlas.

Surveys:

- Revisit historic sites to determine presence of species.
- Determine potential rivers/creeks that could support this species and conduct surveys, but updating historic sites are of priority.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in streams and wetlands with Rapids Clubtails.
- Encourage use of Best Management Practices when working in riparian zones and other site related issues that lead to habitat loss and decreased water quality.
- Mitigate for impacts of land use activities, such as stream channel modification, that may alter the habitat for the Rapids Clubtail.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc.) on Rapids Clubtail wetlands and streams. Presentation should include general information on the importance of invertebrate groups and general biodiversity.

Legislation:

- Develop and introduce legislation to include adult Odonates and other Terrestrial Insects in the definition of wildlife.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

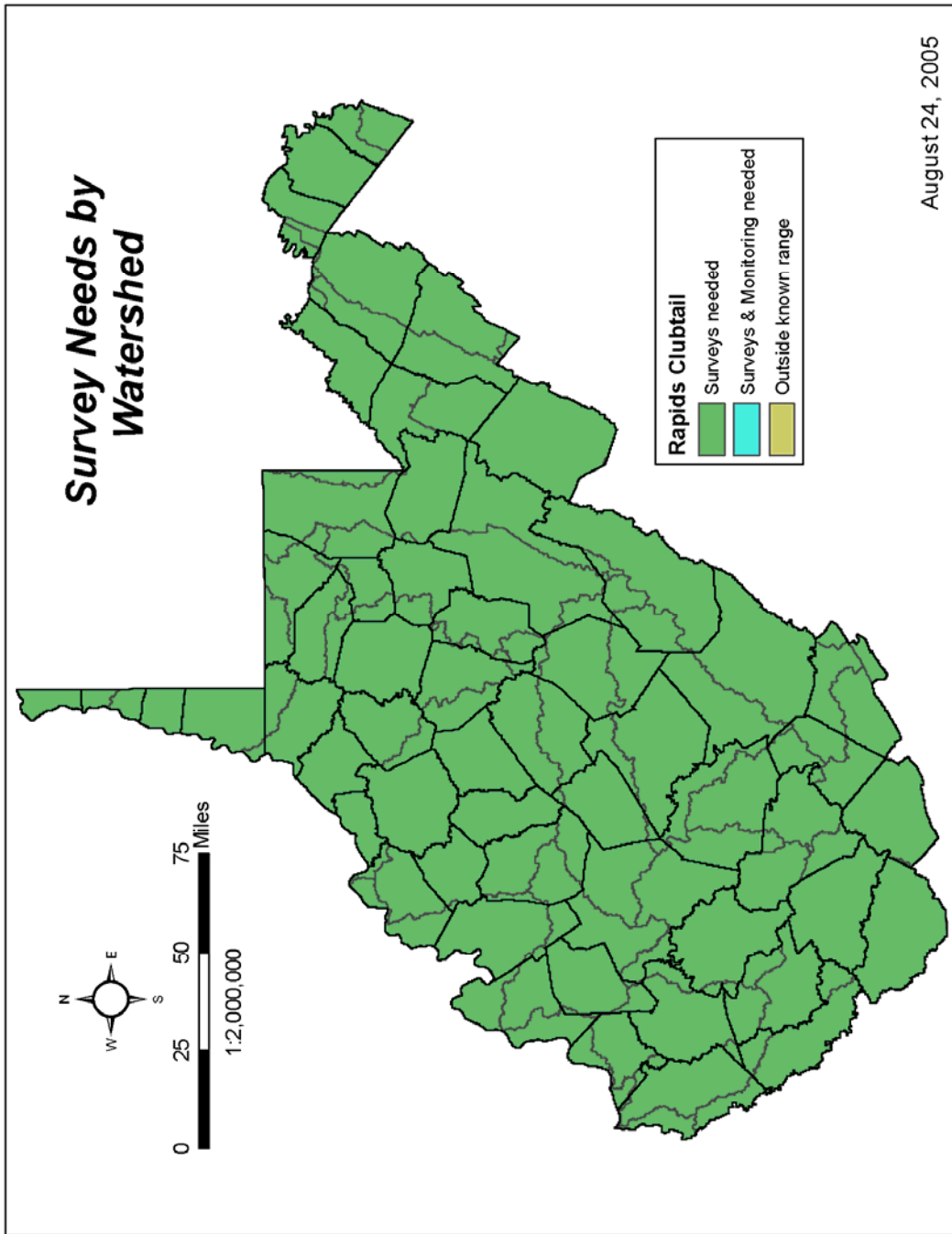
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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Odonates

Common name: Green-faced Clubtail

Scientific name: *Gomphus viridifrons*

STATUS

The ranks and information in the chart below indicate the rarity of the Green-faced Clubtail in West Virginia. This species is listed as rare and in need of conservation in every state in which it occurs.

Priority Group	Global Rank	State Rank	Jeff Forest	Trend
1*	G3G4	S2	X	Stable

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of Green-faced Clubtails into watersheds, and gives the ages of the records (recent is within 20 years) and indicates whether sites are in public or private ownership.

Habitat: The Green-faced Clubtail utilizes clear rocky rivers and streams with a mixture of gravelly sand and silt among rocks.

Watershed	Site Name	Record Type	Ownership
Gauley	Cranberry Glades Wilderness Area	Recent	Public
Greenbrier	Greenbrier River- Anthony	Recent	Public
	Greenbrier River- Renick	Recent	Public
	Greenbrier River- Clover Lick	Recent	Public
New	New River	Recent	Public
Little Kanawha	North Bend State Park	Historic	Public
South Branch Potomac	South Branch of Potomac River	Recent	Private
Cacapon	Ice Mountain	Historic	Private
	Cacapon River	Historic	Private
Tygart Valley	Tygart Valley River	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Green-faced Clubtail. Because there is inadequate information on the distribution and status of the Green-faced Clubtail in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Green-faced Clubtail.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Dragonfly atlas.	Coordinate volunteer Odonate survey from 2005-2008; publish data in a WV Odonate Atlas.
	Future data will be collected using standardized procedures.	All surveys will have site and species forms and coordinates will be obtained using GPS.
	Public access to data.	Provide general dragonfly information, such as distribution maps, on the WVDNR website.

Category	Need	Action
Survey	Survey historic sites.	Return to historic sites to determine presence of species.
	Survey new sites.	Identify potential rivers/creeks that could support this species and conduct surveys. Revisiting historic sites is a priority.

Category	Need	Action
Monitoring	Long-term species monitoring.	Monitor areas along the Greenbrier River for presence of species every 2-3 years.
		Determine possible new monitoring sites as new location data becomes available.

Category	Need	Action
Research	Life history.	Coordinate research projects with researchers and/or contractors; all natural history data is needed for this species.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Green-faced Clubtail and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and

commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Education , Coordination, Management
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE GREEN-FACED CLUBTAIL AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Coordinate volunteer Odonate survey from 2005-2008; publish data in a WV Odonate Atlas.

Surveys:

- Return to historic sites to determine presence of species.
- Determine potential rivers/creeks that could support this species and conduct surveys. Revisiting historic sites is a priority.

Coordination:

- Work with the U.S. Forest Service and DNR land managers to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in streams and wetlands with Green-faced Clubtails.
- Encourage use of Best Management Practices when working in riparian zones and other site related issues that lead to habitat loss and decreased water quality.
- Mitigate for impacts of land use activities, such as stream channel modification, that may alter the habitat for the Green-faced Clubtail.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) on Green-faced Clubtail wetlands and streams. General information on the importance of invertebrate groups and general biodiversity should be included.

Legislation/Regulation:

- Develop and introduce legislation to include adult Odonates and other Terrestrial Insects in the definition of wildlife.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

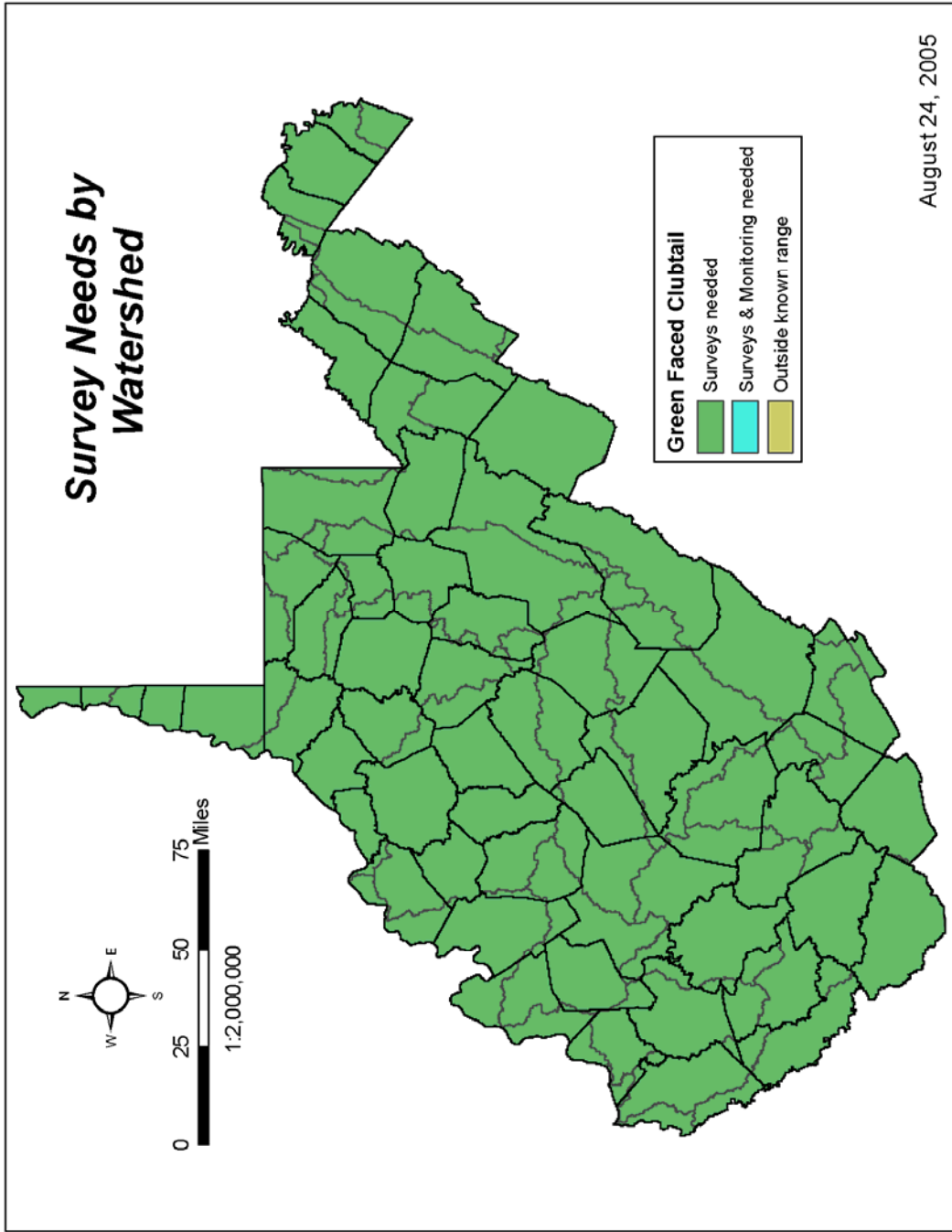
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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Odonates

Common name: Allegheny Snaketail

Scientific name: *Ophiogomphus alleghaniensis*

STATUS

The ranks and information in the chart below indicate the rarity of the Allegheny Snaketail in West Virginia. This species is listed as rare and in need of conservation in every state in which it occurs. There are some taxonomic issues with this species and many differing opinions. It is considered a distinct species by some taxonomists, a subspecies of *O. incurvatus* by others and a subspecies of *O. mainensis* by others.

Priority Group	Global Rank	State Rank	USFWS	Jeff Forest	IUCN Rank	Trend
1	G3Q	S1	SC	X	LR/nt	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Allegheny Snaketail into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether sites are in public or private ownership.

Habitat: The Allegheny Snaketail inhabits clear streams with sandy or gravelly riffles.

Watershed	Site Name	Record Type	Ownership
Upper New	Rich Creek	Historic	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Allegheny Snaketail. Because there is inadequate information on the distribution and status of the Allegheny Snaketail in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Allegheny Snaketail.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Dragonfly atlas.	Coordinate the volunteer Odonate survey from 2005-2008; publish data in a WV Odonate Atlas.
	Public access to data.	Provide general dragonfly information, such as distribution maps, on the WVDNR website.

Category	Need	Action
Survey	Survey historic sites.	Return to Rich Creek to determine presence of species.
	Survey new sites.	Determine potential rivers/creeks that could support this species and conduct surveys; revisiting the historic site is of priority.

Category	Need	Action
Monitoring	Long-term species monitoring.	If the species is found at Rich Creek, monitor population every 2-3 years.
		Determine possible new monitoring sites if new location data becomes available.

Category	Need	Action
Research	Life history- Habitat requirements.	Determine habitat requirements if more survey information becomes available.
	Taxonomic issues.	Determine if it is a distinct species or a subspecies of <i>O. incurvatus</i> or <i>O. mainensis</i> .

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Allegheny Snaketail and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Education , Coordination, Management
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE ALLEGHENY SNAKETAIL AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Coordinate volunteer Odonate survey from 2005-2008; publish data in a WV Odonate Atlas.

Surveys:

- Survey Rich Creek to determine presence of species.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in streams and wetlands with Allegheny Snaketails.
- Encourage use of Best Management Practices when working in riparian zones and other site related issues that lead to habitat loss and decreased water quality.
- Mitigate for impacts of land use activities, such as stream channel modification, that may alter the habitat of the Allegheny Snaketail.

Education:

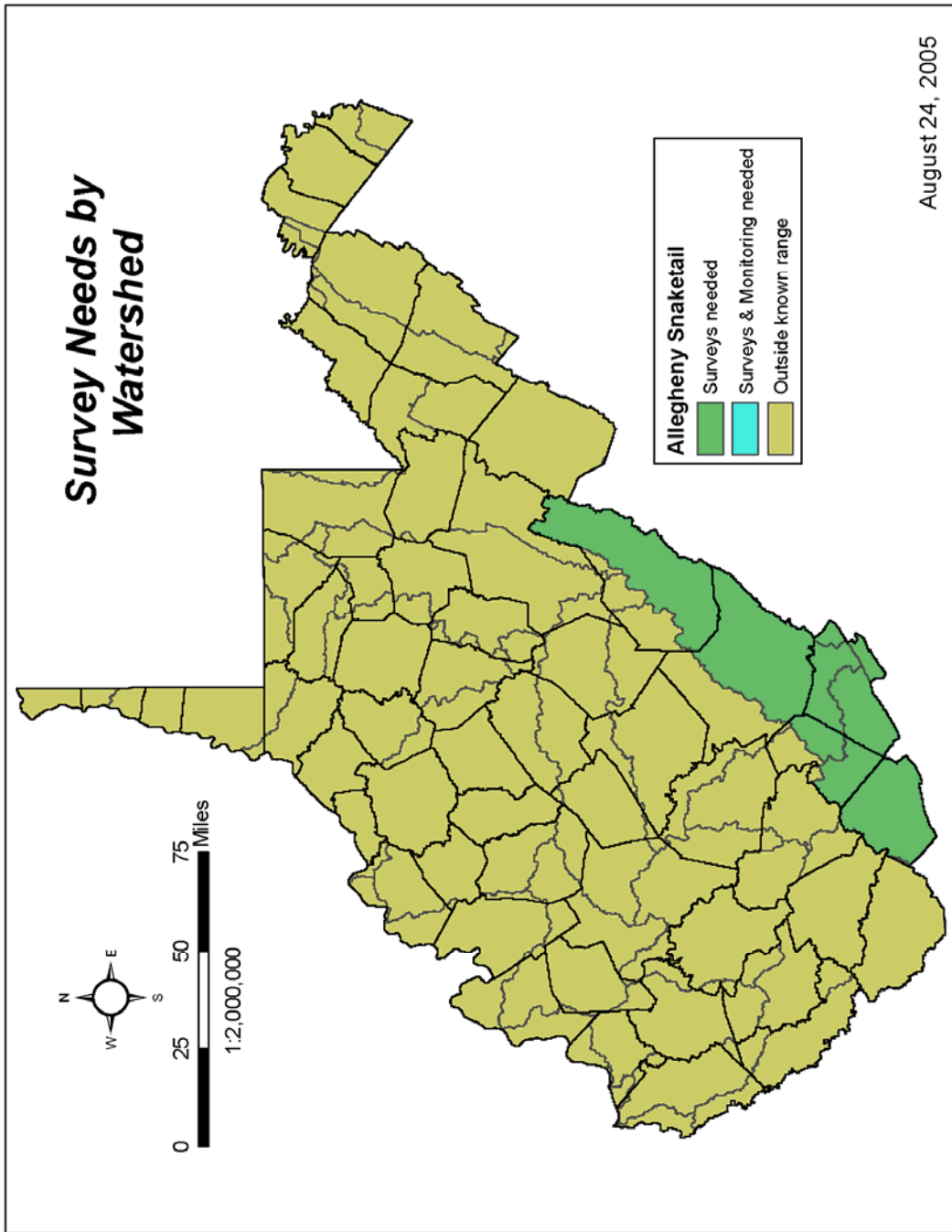
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) on Allegheny Snaketail wetlands and streams. General information on the importance of invertebrate groups and general biodiversity should be included.

Legislation:

- Develop and introduce legislation to include adult Odonates and other Terrestrial Insects in the definition of wildlife.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Odonates
Common name: Elusive Clubtail
Scientific name: *Stylurus notatus*

STATUS

The ranks and information in the chart below indicate the rarity of the Elusive Clubtail in West Virginia. This species is listed as rare and in need of conservation in every state in which it occurs. It is considered extirpated in three states.

Priority Group	Global Rank	State Rank	Trend
1	G3	S1	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of Elusive Clubtails into a watershed, gives the age of the record (recent is within 20 years) and indicates whether the site is in public or private ownership.

Habitat: The Elusive Clubtail usually inhabits large rivers and large lakes, often with sandy bottoms, sometimes with silt and gravel.

Watershed	Survey Site	Record Type	Ownership
Middle Ohio Valley	Ohio River- Buckley Island	Recent	Public

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Elusive Clubtail. Because there is inadequate information on the distribution and status of the Elusive Clubtail in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Elusive Clubtail.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Dragonfly atlas.	Coordinate volunteer Odonate survey from 2005-2008; publish data in a WV Odonate Atlas.
	Public access to data.	Provide general Dragonfly information, such as distribution maps, on the WVDNR website.

Category	Need	Action
Survey	Survey current site.	Resurvey to obtain another voucher specimen. The first and only specimen collected had just emerged.
	Survey new sites.	Survey along the Ohio River and on the islands. Survey other large rivers such as the Kanawha, Monongahela and Potomac.

Category	Need	Action
Monitoring	Long-term species monitoring.	Identify possible new monitoring sites as new location data become available.

Category	Need	Action
Research	Life history.	Coordinate projects with researchers and/or contractors; all natural history data is needed for species.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Elusive Clubtail and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Education , Coordination, Management
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE ELUSIVE CLUBTAIL AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Volunteer Odonate survey from 2005-2008; publish data in a WV Odonate Atlas.

Surveys:

- Resurvey to obtain another voucher specimen.
- Survey along the Ohio River and on the islands. Survey other large rivers such as the Kanawha, Monongahela and Potomac.

Coordination:

- Work with Ohio River Islands NWR to maintain habitat that can support the Elusive Clubtail.
- Encourage use of Best Management Practices when working in riparian zones and other site related issues that lead to habitat loss and decreased water quality.
- Mitigate for impacts of land use activities, such as stream channel modification, that may alter the habitat for the Elusive Clubtail.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) on Elusive Clubtail streams. General information on the importance of invertebrate groups and general biodiversity should be included.

Legislation:

- Develop legislation to include adult Odonates and other Terrestrial Insects in the definition of wildlife.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

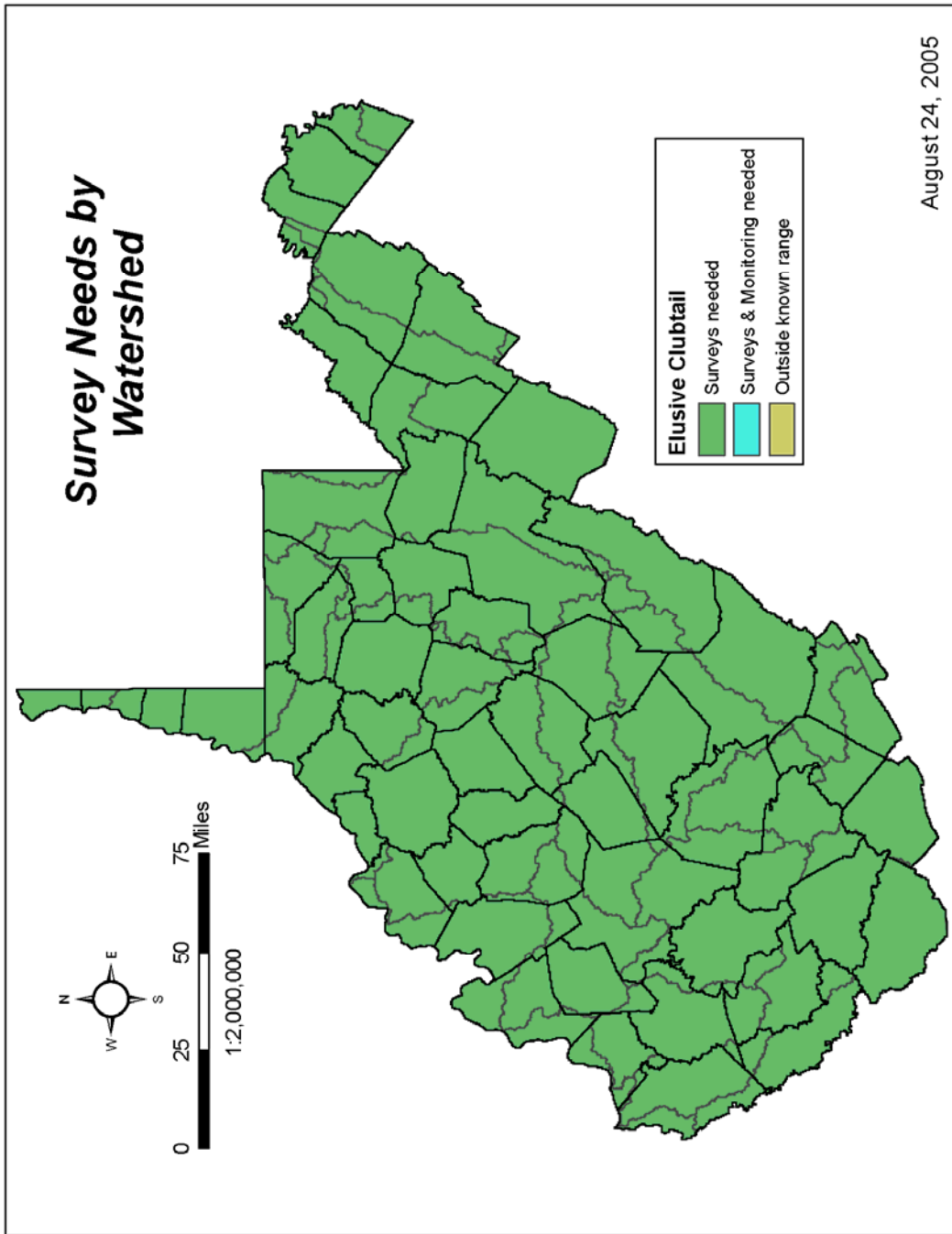
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West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Group: Odonata**Common Name:** Dragonflies and Damselflies**STATUS**

There are a total of 77 species of Odonata on the Species in Greatest Need of Conservation list. Six of these are globally rare and they are discussed in separate fact sheets. The remaining 71 species are addressed here as a group since their needs and conservation actions are similar. This is a long list of rare species and is undoubtedly a product of a lack of survey information. As more information becomes available through survey, the number of rare Odonates in West Virginia should shorten.

Scientific Name	Common Name	Priority Group	Global Rank	State Rank	Trend
Dragonflies:					
<i>Aeshna verticalis</i>	Green-striped Darner	2*	G5	S2	Unknown
<i>Aeshna canadensis</i>	Canada Darner	2	G5	S1	Unknown
<i>Aeshna interrupta interrupta</i>	Variable Darner	2	G5T5	SR	Unknown
<i>Aeshna tuberculifera</i>	Back-tipped Darner	2	G4	S2	Unknown
<i>Anax longipes</i>	Comet Darner	2	G5	S1	Unknown
<i>Celithemis fasciata</i>	Banded Pennant	2	G5	S3	Unknown
<i>Cordulegaster diastatops</i>	Delta-spotted Spiketail	2	G5	S2	Unknown
<i>Cordulegaster erronea</i>	Tiger Spiketail	2	G4	S1	Unknown
<i>Cordulia shurtleffi</i>	American Emerald	2	G5	S3	Unknown
<i>Dromogomphus armatus</i>	Southeastern Spinyleg	2	G4	SR	Unknown
<i>Dromogomphus spoliatus</i>	Flag-tailed Spinyleg	2	G4G5	S2S3	Unknown
<i>Epiaeschna heros</i>	Swamp Darner	2	G5	S3	Unknown
<i>Erpetogomphus designatus</i>	Eastern Ringtail	2	G5	S2	Unknown
<i>Erythrodiplax minuscula</i>	Little Blue Dragonlet	2	G5	S1	Unknown
<i>Gomphus adelphus</i>	Moustached Clubtail	2	G4	S2	Unknown
<i>Gomphus descriptus</i>	Harpoon Clubtail	2	G4	S3	Unknown
<i>Gomphus fraternus</i>	Midland Clubtail	2	G5	S1	Unknown
<i>Gomphus lineatifrons</i>	Splendid Clubtail	2	G4	S2	Unknown
<i>Gomphus rogersi</i>	Sable Clubtail	2	G4	S1S2	Unknown

<i>Gomphus vastus</i>	Cobra Clubtail	2	G5	S2	Unknown
<i>Ladona Julia</i>	Chalk-fronted Corporal	2	G5	S1	Unknown
<i>Lanthus parvulus</i>	Northern Pygmy Clubtail	2	G4	S2	Unknown
<i>Lanthus vernalis</i>	Southern Pygmy Clubtail	2	G4	S1	Unknown
<i>Leucorrhinia glacialis</i>	Crimson-ringed Whiteface	2	G5	S1	Unknown
<i>Leucorrhinia hudsonica</i>	Hudsonian Whiteface	2	G5	S1	Unknown
<i>Leucorrhinia proxima</i>	Red-waisted Whiteface	2	G5	SR	Unknown
<i>Libellula auripennis</i>	Golden-winged Skimmer	2	G5	S1	Unknown
<i>Libellula deplanata</i>	Blue Corporal	2	G5	S1	Unknown
<i>Libellula flavida</i>	Yellow-sided Skimmer	2	G5	SH	Unknown
<i>Libellula quadrimaculata</i>	Four Spotted Skimmer	2	G5	SH	Unknown
<i>Macromia alleghaniensis</i>	Allegheny River Cruiser	2	G4	S3	Unknown
<i>Macromia taeniolata</i>	Royal River Cruiser	2	G5	S2	Unknown
<i>Nasiaeschna pentacantha</i>	Cyrano Darner	2	G5	SH	Unknown
<i>Neurocordulia obsoleta</i>	Umber Shadowdragon	2	G4	SR	Unknown
<i>Neurocordulia yamaskanensis</i>	Stygian Shadowdragon	2	G5	S2	Unknown
<i>Ophiogomphus carolus</i>	Riffle Snaketail	2	G5	S1	Unknown
<i>Ophiogomphus mainensis fastigiatus</i>	Maine Snaketail	2	G4	S2	Unknown
<i>Somatochlora williamsoni</i>	Williamson's Emerald	2	G5	SR	Unknown
<i>Somatochlora elongata</i>	Ski-tailed Emerald	2	G5	S2	Unknown
<i>Somatochlora forcipata</i>	Forcipate Emerald	2	G5	S1	Unknown
<i>Somatochlora linearis</i>	Mocha Emerald	2	G5	SH	Unknown
<i>Somatochlora provocans</i>	Treetop Emerald	2	G4	S1	Unknown
<i>Stylurus plagiatus</i>	Russet-tipped Clubtail	2	G5	SH	Unknown
<i>Stylurus scudderi</i>	Zebra Clubtail	2	G4	SH	Unknown
<i>Stylurus spiniceps</i>	Arrow Clubtail	2	G5	SH	Unknown
<i>Sympetrum corruptum</i>	Variiegated Meadowhawk	2	G5	SR	Unknown
<i>Sympetrum internum</i>	Cherry-faced Meadowhawk	2	G5	S2	Unknown

<i>Sympetrum obtrusum</i>	White-faced Meadowhawk	2	G5	S2	Unknown
<i>Sympetrum semicinctorum</i>	Band-winged Meadowhawk	2	G5	S3	Unknown
<i>Sympetrum ambiguum</i>	Blue-faced Meadowhawk	2	G5	S1	Unknown
<i>Sympetrum janeae</i>	Jane's Meadowhawk	2	G5	S1	Unknown
<i>Tachopteryx thoreyi</i>	Gray Petaltail	2	G4	S2	Unknown
<i>Tetragoneuria canis</i>	Beaverpond Baskettail	2	G5	S1S2	Unknown
<i>Tramea carolina</i>	Carolina Saddlebags	2	G5	S2	Unknown
Damselflies:					
<i>Calopteryx amata</i>	Superb Jewelwing	2	G4	S2	Unknown
<i>Calopteryx angustipennis</i>	Appalachian Jewelwing	2	G4	S2	Unknown
<i>Enallagma antennatum</i>	Rainbow Bluet	2	G5	S2	Unknown
<i>Enallagma boreale</i>	Boreal Bluet	2	G5	S1	Unknown
<i>Enallagma cyathigerum vernale</i>	Northern Bluet	2	G5	S2	Unknown
<i>Enallagma vesperum</i>	Vesper Bluet	2	G5	SH	Unknown
<i>Hetaerina titia</i>	Smoky Rubyspot	2	G5	SH	Unknown
<i>Ischnura prognata</i>	Furtive Forktail	2	G4	SH	Unknown
<i>Lestes congener</i>	Spotted Spreadwing	2	G5	S3	Unknown
<i>Lestes d. disjunctus</i>	Common Spreadwing	2	G5T5	S2S3	Unknown
<i>Lestes dryas</i>	Emerald Spreadwing	2	G5	S3	Unknown
<i>Lestes forcipatus</i>	Sweetflag Spreadwing	2	G5	SH	Unknown
<i>Lestes inaequalis</i>	Elegant Spreadwing	2	G5	S2	Unknown
<i>Lestes unguiculatus</i>	Lyre-tipped Spreadwing	2	G5	SH	Unknown
<i>Lestes vigilax</i>	Swamp Spreadwing	2	G5	S2	Unknown
<i>Nehalennia gracilis</i>	Sphagnum Sprite	2	G5	S2	Unknown
<i>Nehalennia irene</i>	Sedge Sprite	2	G5	S3	Unknown
<i>Telebasis byersi</i>	Duckweed Firetail	2	G5	S1	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places each Odonate species of concern into watersheds and gives the ages of the records (recent is within 20 years). The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. The table also reflects what type of habitat each species utilizes. For ease of communication, scientific names are used in this table.

Scientific Name	Watershed	Record Type	Habitat
Dragonflies:			
<i>Aeshna verticalis</i>	Cheat	Recent Historic	Marshy, Swampy Ponds, Slow Streams
	Youghiogheny		
	Tygart,		
	North Branch Potomac		
<i>Aeshna canadensis</i>	Youghiogheny	Recent	Ponds, Lakes, Sluggish Streams
<i>Aeshna interrupta interrupta</i>	Lower New	Historic	Ponds, Lakes, Sluggish Streams
<i>Aeshna tuberculifera</i>	Youghiogheny	Recent Historic	Vegetated Streams, Acidic Ponds
	Cheat		
	Upper New		
	Lower New		
	Little Kanawha		
<i>Anax longipes</i>	Tygart	Historic	Grassy Ponds
	Little Kanawha		
<i>Celithemis fasciata</i>	Greenbrier	Recent	Ponds, Lakes
<i>Cordulegaster diastatops</i>	Gauley	Recent Historic	Seepages, Small Streams
	Cheat		
	Youghiogheny		
	Lower New		
<i>Cordulegaster erronea</i>	South Branch Potomac	Recent Historic	Small Spring Trickles
	Lower Kanawha		
	Lower New		

<i>Cordulia shurtleffi</i>	Cheat	Recent Historic	Boggy Lakes
	Gauley		
	Tygart		
	Greenbrier		
	Upper Guyandotte		
	Cacapon		
	Little Kanawha		
<i>Dromogomphus armatus</i>	Greenbrier	Historic	Small To Medium Creeks
<i>Dromogomphus spoliatus</i>	Elk	Historic	Mud-Bottomed Rivers and Lakes, Ponds
	Lower Ohio		
	Twelve Pole		
	South Branch Potomac		
	North Branch Potomac		
	Cacapon		
	Little Kanawha		
	Upper Guyandotte		
<i>Epiaeschna heros</i>	Cheat	Recent Historic	Woodland Ponds, Slow Streams, Swamps
	Youghiogheny		
	Greenbrier		
	Little Kanawha		
	Middle Ohio Valley		
<i>Erpetogomphus designatus</i>	NO RECORDS		Rivers, Streams
<i>Erythrodiplax minuscula</i>	Greenbrier	Recent	Vegetated Ponds, Lakes, Sluggish Backwaters
	South Branch Potomac	Historic	
<i>Gomphus adelphus</i>	Cheat	Recent Historic	Rocky Streams, Rivers
	Greenbrier		
	South Branch Potomac		

<i>Gomphus descriptus</i>	Cheat	Recent Historic	Rocky Streams, Rivers
	Gauley		
	South Branch Potomac		
	North Branch Potomac		
	Coal		
	Lower New		
	Little Kanawha		
	Elk		
	Greenbrier		
<i>Gomphus fraternus</i>	Greenbrier	Historic	Rivers, Large Streams, Clay or Fine Silt Bottoms
	Middle Ohio Valley		
<i>Gomphus lineatifrons</i>	Greenbrier	Recent Historic	Rocky Rivers
	North Branch Potomac		
	Cacapon		
<i>Gomphus rogersi</i>	Greenbrier	Recent Historic	Rocky, Some Sand, Forested Streams
	Lower New		
<i>Gomphus vastus</i>	Greenbrier	Recent Historic	Larger Rivers, Streams
	Middle Ohio Valley		
	Little Kanawha		
<i>Ladona Julia</i>	Cheat	Recent	Marshy Ponds, Slow Streams
	Greenbrier		
<i>Lanthus parvulus</i>	Cheat	Recent Historic	Small, Rocky Creeks and Rivers
	Gauley		
	Greenbrier		
	Lower New		
	North Branch Potomac		
<i>Leucorrhinia glacialis</i>	Cheat	Recent	Vegetated Ponds, Bogs

<i>Leucorrhinia hudsonica</i>	Cheat	Recent Historic	Marshy Ponds, Bogs
	South Branch Potomac		
<i>Leucorrhinia proxima</i>	Little Kanawha	Historic	Marshy Or Boggy Ponds
<i>Libellula auripennis</i>	Cheat	Recent	Grassy Ponds, Bogs
	Youghiogheny		
<i>Libellula deplanata</i>	Greenbrier	Recent	Ponds, Lakes
<i>Libellula flavida</i>	Cheat	Historic	Mucky, Boggy Seeps
	Youghiogheny		
	Coal		
<i>Libellula quadrimaculata</i>	Middle Ohio Tributaries	Historic	Ponds, Lakes, Slow Streams
<i>Macromia alleghaniensis</i>	Elk	Historic	Streams and Rivers
	Middle Ohio Valley		
	Lower Ohio Valley		
	Greenbrier		
	Cacapon		
	North Branch Potomac		
	Little Kanawha		
<i>Macromia taeniolata</i>	Elk	Historic	Clean Rivers, Streams, Lakes
	Cacapon		
	North Branch Potomac		
	South Branch Potomac		
	Lower New		
<i>Nasiaeschna pentacantha</i>	Middle Ohio Valley	Historic	Swamps, Wooded Ponds, Sluggish Streams
<i>Neurocordulia obsoleta</i>	Middle Ohio Valley	Recent Historic	Clean Rivers, Streams, Lakes
	Greenbrier		

<i>Neurocordulia yamaskanensis</i>	Greenbrier	Recent Historic	Clean Lakes, Large Rivers
	Elk		
	Lower New		
	Upper Guyandotte		
<i>Ophiogomphus carolus</i>	Greenbrier	Recent Historic	Clear, Rapid Sandy or Rocky Streams And Rivers
	Cacapon		
<i>Ophiogomphus mainensis fastigiatus</i>	Cheat	Recent Historic	Forested Rocky Streams and Rivers
	Greenbrier		
	South Branch Potomac		
<i>Somatochlora elongata</i>	Cheat	Recent Historic	Slow to Moderately Moving Streams, Marshy Ponds
	Gauley		
<i>Somatochlora forcipata</i>	Cheat	Recent	Small Boggy Streams and Swamps
<i>Somatochlora linearis</i>	Cheat	Recent	Small Forest Streams
	Upper Guyandotte		
	Lower Kanawha		
<i>Somatochlora provocans</i>	NO SITE DATA	Historic	Forest Seeps and Trickles
<i>Somatochlora williamsoni</i>	Little Kanawha	Historic	Slow Streams and Lakes
<i>Stylurus plagiatus</i>	North Branch Potomac	Historic	Rivers, Streams and Lakes
<i>Stylurus scudderii</i>	Lower New	Historic	Streams and Small Rivers
<i>Stylurus spiniceps</i>	Tygart	Historic	Large Rivers
	Little Kanawha		
<i>Sympetrum ambiguum</i>	Lower Ohio Valley	Recent	Marshes, Swamps
<i>Sympetrum corruptum</i>	South Branch Potomac	Historic	Ponds, Pools, Slow Streams, Springs
<i>Sympetrum internum</i>	Cheat	Recent	Ponds, Lakes, Marshes, Bogs, Slow Streams
	Greenbrier		
	Potomac		
<i>Sympetrum janeae</i>	Potomac	Historic	Ponds, Lakes, Marshes, Bogs, Slow Streams

<i>Sympetrum obtrusum</i>	Cheat	Recent Historic	Ponds, Marshes, Bogs, Sluggish Streams
	Youghiogheny		
	Greenbrier		
	Potomac		
	North Branch Potomac		
<i>Sympetrum semicinctum</i>	Cheat	Recent Historic	Marshy Wetlands, Seepages
	Cacapon		
	Youghiogheny		
	Coal		
<i>Tachopteryx thoreyi</i>	Greenbrier	Recent	Seepages
	Lower New		
<i>Tetragoneuria canis</i>	Cheat	Recent Historic	Boggy or Marshy Ponds, Lakes, Slow Streams
	Gauley		
	Youghiogheny		
<i>Tramea carolina</i>	Cheat	Recent	Vegetated Ponds, Lakes
	Greenbrier		
	Lower Kanawha		
Damselflies:			
<i>Calopteryx amata</i>	Cheat	Recent	Clear, Cold Streams
	Greenbrier		
	Youghiogheny		
	Gauley		
<i>Calopteryx angustipennis</i>	Cacapon	Recent Historic	Rapid Riffles of Larger Streams
	Gauley		
	Tygart		
	South Branch Potomac		
	North Branch Potomac		

<i>Enallagma antennatum</i>	Lower Ohio Valley	Historic	Slow Streams or Lakes Near Stream Inlets
	Upper Ohio Valley		
	Twelve Pole		
	North Branch Potomac		
	Greenbrier		
	Youghiogheny		
<i>Enallagma boreale</i>	Cacapon	Recent Historic	Still-Water Habitats and Slow Streams
	Cheat		
<i>Enallagma cyathigerum vernale</i>	Cheat	Recent Historic	Still-Water Habitats
	Gauley		
	Greenbrier		
	Youghiogheny		
<i>Enallagma vesperum</i>	NO RECORDS		Small Lakes and Slow Streams
<i>Hetaerina titia</i>	Shenandoah	Historic	Streams and Rivers
	Little Kanawha		
<i>Ischnura prognata</i>	Potomac	Historic	Shaded Swampy Ponds
<i>Lestes congener</i>	Tygart	Recent Historic	Still-Water Habitats
	Youghiogheny		
	Greenbrier		
	Cacapon		
	Little Kanawha		
	Upper New		
<i>Lestes d. disjunctus</i>	Youghiogheny	Recent Historic	Still-Water Habitats
	Cheat		
	Tygart		
	North Fork Potomac		
<i>Lestes dryas</i>	North Fork Potomac	Historic	Still-Water Habitats
	Little Kanawha		

<i>Lestes forcipatus</i>	Youghiogheny	Historic	Ponds, Marshy Lakes, Slow Streams
	Greenbrier		
	Lower New		
<i>Lestes inaequalis</i>	Tygart	Recent Historic	Ponds, Lakes, Slow Streams
	Greenbrier		
	Upper New		
<i>Lestes unguiculatus</i>	Cacapon	Historic	Open Small Pond or Slough
<i>Lestes vigilax</i>	Upper Ohio Valley	Recent Historic	Still-Water Habitats
	Tygart		
	Greenbrier		
	Potomac		
	Youghiogheny		
<i>Nehalennia gracilis</i>	Greenbrier	Recent Historic	Sphagnum Habitats
	Cheat		
<i>Nehalennia Irene</i>	Gauley	Recent Historic	Marshes, Vernal Pools
	Greenbrier		
	Cheat		
	Youghiogheny		
	North Fork		
<i>Telebasis byersi</i>	Lower Ohio Valley	Recent	Duckweed Ponds, Swamps

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of Odonates. Because there is inadequate information on the distribution and status of Odonates in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of Odonates.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Dragonfly atlas.	Coordinate a volunteer Odonata survey from 2005-2008, publish data in a WV Odonate Atlas.
	Capture existing, outstanding data with coordinates.	Capture data including coordinate information.
	Public access to data.	Provide general Odonate information, such as distribution maps, on the WVDNR website.

Category	Need	Action
Surveys	Update status of historically known species.	Target historic known sites and sites with appropriate habitat or in same geographical area. Use statewide volunteers in WV Odonate Atlas program.
	Increase number of species documented in West Virginia.	Survey rivers, streams and wetlands along the state border. Use statewide volunteers in WV Odonate Atlas program.
	Survey new sites	Analyze potential habitat statewide to determine new survey areas. Use statewide volunteers in WV Odonate Atlas program.

Category	Need	Action
Monitoring	Long-term species monitoring sites.	Look at all current Odonate sites to determine if an area of high diversity exists and establish monitoring stations. Potential prototypical sites are Valley Bend Wetland, Dolly Sods & Green Bottom WMAs. Establish sites statewide to represent a diversity of habitat types and regions.

Category	Need	Action
Research	Life history- Habitat requirements.	Determine habitat requirements of selected species.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with Odonates and their habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Education , Coordination, Management
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF ODONATE SPECIES OF GREATEST CONSERVATION NEED AND THEIR HABITATS

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve these species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of these species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of these species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Coordinate volunteer Odonate survey from 2005-2008; publish data in a WV Odonate Atlas.
- Capture data including coordinate information.

Surveys:

- Target historic sites and sites with appropriate habitat or in same geographical area. Use statewide volunteers in WV Odonate Atlas program.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in streams and wetlands with Odonates. Encourage use of Best Management Practices when working in riparian zones and other site related issues that lead to habitat loss and decreased water quality.
- Assess effects of possible dam construction on rivers and streams as projects may arise.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc.) on Odonate species, wetlands and streams. Presentations should include general information in the importance of invertebrate groups and general biodiversity.

Legislation:

- Develop and introduce legislation to include adult Odonates and other Terrestrial Insects in the definition of wildlife.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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Fish

The West Virginia fish fauna is composed of 24 families, 61 genera and 180 species (including three hybrids). This diverse fauna is largely represented by minnows (60 species) and darters (27 species). Additionally, suckers, catfishes and sunfishes comprise a large part of the fauna. The West Virginia fish fauna also includes many primitive fishes, such as lampreys and sturgeon. Lampreys include parasitic and nonparasitic species, many of which live the majority of their lives in a larval form. Some of our headwater species are Pleistocene relicts, and currently have restricted headwater ranges owing to warmer climates. Cold water relicts include Pearl Dace, Redside Dace, Checkered Sculpin and Bluestone Sculpin. Seven species are likely to have been extirpated from the state: Shovelnose and Lake Sturgeons, Bigmouth Shiner, Pugnose Minnow, Blue Catfish, Mississippi Silvery Minnow, and Longnose Sucker. These have been lost primarily through major habitat alteration from dam construction and increased pollution.

Lampreys, minnows, suckers, madtoms, sculpins, and darters are among the least understood groups of fishes within West Virginia waters. These six groups comprise 53 of the 72 Species in Greatest Need of Conservation (SGNC) fishes (See Table below). Minnows and Suckers include a diversity of species that range from large river habitats to high elevation headwater streams. Madtoms are small Catfishes that occur in large to medium-sized river habitats, whereas Sculpins are small benthic fishes that range from medium-sized river habitats to cold headwater streams. Darters occur in large to medium river habitats, as well as in small headwater streams. The lower Elk River contains the largest diversity of Darters, where 18 species coexist including eight of the 16 SGNC Darters.

Fishes in West Virginia occur in three major drainage categories: Ohio Basin tributaries, Upper Potomac River tributaries, and upper James River tributaries. Within these basins, the majority of fish diversity occurs in several drainages. Within the Ohio Basin, the Elk and Little Kanawha River systems support a high diversity of fishes. The mainstem Ohio and Kanawha Rivers support a diverse large river fish assemblage. The New River system supports eight endemic species of fishes. On the Atlantic slope, the Potomac drainage and upper James River drainage support many unique fishes.

Although many of the SGNC fishes are undoubtedly declining, most are poorly understood due to a lack of information. Future studies on the ecology, life history and range distributions of these poorly understood fishes are needed to conserve and manage SGNC fishes in West Virginia.

Many conservation issues threaten the diversity of the West Virginia fish fauna. Currently, 72 taxa of fishes are Species in Greatest Need of Conservation (SGNC). These SGNC species are an important component of biodiversity and aquatic ecosystems in West Virginia. Fishes are indicators of aquatic ecosystem health, and species declines reflect habitat losses or poor water quality. Anthropogenic and natural losses of stream habitat contribute, in part, to the high proportion of SGNC fishes in West Virginia. Acidification and sedimentation are two of the largest contributors to habitat loss in West Virginia waters. Other forms of land disturbances also contribute cumulatively to habitat degradation, including land development, dams, wetland losses, road construction, oil and gas drilling, chemical pollution, nutrient loads, domestic wastes and invasive species.

Scientific Name	Common name
<i>Ameiurus melas</i>	Black Bullhead
<i>Noturus eleutherus</i>	Mountain Madtom
<i>Noturus stigmosus</i>	Northern Madtom
<i>Anguilla rostrata</i>	American Eel

<i>Cottus carolinae</i>	Banded Sculpin
<i>Cottus cognatus</i>	Slimy Sculpin
<i>Cottus sp 1</i>	Bluestone Sculpin
<i>Cottus girardi</i>	Potomac Sculpin
<i>Esox americanus vermiculatus</i>	Grass Pickerel
<i>Fundulus diaphanus</i>	Banded Killifish
<i>Polyodon spathula</i>	Paddlefish
<i>Umbra limi</i>	Central Mudminnow
<i>Ichthyomyzon greeleyi</i>	Mountain Brook Lamprey
<i>Ichthyomyzon fossor</i>	Northern Brook Lamprey
<i>Lampetra aepyptera</i>	Least Brook Lamprey
<i>Ichthyomyzon bdellium</i>	Ohio Lamprey
<i>Ichthyomyzon unicuspis</i>	Silver Lamprey
<i>Lampetra appendix</i>	American Brook Lamprey
<i>Lepomis gulosus</i>	Warmouth
<i>Lepomis humilis</i>	Orangespotted Sunfish
<i>Macrhybopsis hyostoma</i>	Speckled Chub
<i>Macrhybopsis storeriana</i>	Silver Chub
<i>Nocomis leptocephalus</i>	Bluehead Chub
<i>Pararhinichthys bowersi</i>	Cheat Minnow
<i>Pimephales vigilax</i>	Bullhead Minnow
<i>Phenacobius teretulus</i>	Kanawha Minnow
<i>Hybognathus regius</i>	Eastern Silvery Minnow
<i>Exoglossum laurae</i>	Tonguetied Minnow
<i>Clinostomus elongatus</i>	Redside Dace
<i>Phoxinus erythrogaster</i>	Southern Redbelly Dace
<i>Phoxinus oreas</i>	Mountain Redbelly Dace
<i>Margariscus margarita</i>	Pearl Dace
<i>Cyprinella analostana</i>	Satinfin Shiner
<i>Notropis blennioides</i>	River Shiner
<i>Notropis boops</i>	Bigeye Shiner
<i>Notropis scabriceps</i>	New River Shiner
<i>Notropis procne</i>	Swallowtail Shiner
<i>Lythrurus ardens</i>	Blueside Shiner
<i>Luxilus cornutus</i>	Common Shiner
<i>Lythrurus umbratilis</i>	Redfin Shiner
<i>Notropis amoenus</i>	Comely Shiner
<i>Notropis ariommus</i>	Popeye Shiner
<i>Notropis buechanani</i>	Ghost Shiner
<i>Crystallaria asprella</i>	Crystal Darter
<i>Percina notogramma</i>	Stripeback Darter

<i>Etheostoma tippecanoe</i>	Tippecanoe Darter
<i>Percina gymnocephala</i>	Appalachia Darter
<i>Percina peltata</i>	Shield Darter
<i>Percina phoxocephala</i>	Slenderhead Darter
<i>Percina shumardi</i>	River Darter
<i>Etheostoma longimanum</i>	Longfin Darter
<i>Percina copelandi</i>	Channel Darter
<i>Percina evides</i>	Gilt Darter
<i>Percina macrocephala</i>	Longhead Darter
<i>Percina sciera</i>	Dusky Darter
<i>Etheostoma pellucidum</i>	Eastern Sand Darter
<i>Etheostoma camurum</i>	Bluebreast Darter
<i>Etheostoma maculatum</i>	Spotted Darter
<i>Etheostoma olmstedi</i>	Tessellated Darter
<i>Etheostoma osburni</i>	Candy Darter
<i>Erimyzon oblongus</i>	Creek Chubsucker
<i>Cycleptus elongatus</i>	Blue Sucker
<i>Thoburnia rhotoecca</i>	Torrent Sucker
<i>Ictiobus cyprinellus</i>	Bigmouth Buffalo
<i>Ictiobus niger</i>	Black Buffalo
<i>Carpiodes carpio</i>	River Carpsucker
<i>Carpiodes velifer</i>	Highfin Carpsucker
<i>Moxostoma carinatum</i>	River Redhorse
<i>Hiodon tergisus</i>	Mooneye
<i>Hiodon alosoides</i>	Goldeye
<i>Salvelinus fontinalis</i>	Brook Trout

A review of the conservation needs for fishes, as outlined on the following fact sheets, indicates that initial actions for the listed species are centered on survey, inventory and data management. Information on the distribution and status of many fishes is lacking and filling these information gaps is a necessary first step for the future conservation assessment of each species. Standardized data acquisition and management both within the WV DNR Wildlife Resources Section and by all other research partners will greatly assist with these conservation assessments. Centralized and shared information is a prerequisite to the formulation of on-the-ground conservation plans for all listed species.

Because the WRS acts as a statewide repository for information, we rely on partners to share information to maximize understanding of our biological resources. Occasionally researchers are reluctant to share information for fear that the information will be requested from state government via the Freedom of Information Act (FOIA) and used to the detriment of the species involved. For this reason it is believed appropriate to have legislation enacted to protect sensitive rare species information from wide dissemination. This need is expressed across the board on the fact sheets for animal Species in Greatest Need of Conservation.

There is an ongoing need to educate all citizens about the value of the diversity of life in the state and especially the role all SGNC play in the intricate web of life. Education is a unifying theme throughout the actions section of the fact sheets for most species. In addition there is a

need to coordinate with land management agencies and other landowners/managers on the use of best management practices for the conservation of biological resources in general as well as specific practices when SGNC are present. Water quality is a primary concern and information on specific practices that can be implemented to diminish pollution in streams is a critical and ongoing need.

Unfortunately because of the dearth of data on the distribution and status of many individual species, few specific on-the-ground conservation actions have been identified. As additional data are collected, one would anticipate an increasing inventory of specific site-related projects that are desirable for the health and/or continued existence of SGNC throughout the state. Because of the interconnectedness of aquatic systems, planning for conservation of fishes is likely to incorporate planning at a watershed scale. This will be a challenge for the many conservation partners across the state.

Taxa: Fishes

Common Name: Brook Trout

Scientific name: *Salvelinus fontinalis*

STATUS

The ranks and information in the chart below indicate the status of the Brook Trout in West Virginia. This species is listed as a Species in Greatest Need of Conservation because it is an indicator of high elevation streams that have been heavily impacted by acid precipitation and other habitat loss considerations.

Priority Group	Global Rank	State Rank	Trend
1*	G5	S4	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table lists the watersheds in which the Brook Trout occurs and indicates whether the streams are in public or private ownership.

Habitat: Brook Trout typically occur in high elevation cool mountain streams with a maximum average high temperature of about 65 degrees Fahrenheit.

Watershed	Record Type	Ownership
Elk River	Recent	Public/Private
Greenbrier	Recent	Public/Private
North Branch Potomac	Recent	Public/Private
South Branch Potomac	Recent	Public/Private
Cheat	Recent	Public/Private
Tygart	Recent	Public/Private
West Fork	Recent	Private
Gauley	Recent	Public/Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Brook Trout. Because there is inadequate information on the distribution and status of the Brook Trout in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below.

Bolded text indicates primary actions required to identify conservation needs of the Brook Trout.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled.	Compile existing data and integrate it into the agency database.
	Provide public access to general fish information.	Develop and publish a WV Fish Atlas.
		Complete an update of the <i>Fishes of West Virginia</i> .
	Provide general fish data, such as distribution maps, on the internet.	

Category	Need	Action
Surveys	Determine status at historic sites.	Surveys are needed on selected private lands to determine status in poorly sampled regions of the state.
	Determine the length of stream occupied at each recent occurrence.	Evaluate habitat and determine what may separate populations within the same river system.

Category	Need	Action
Monitoring	Develop a long-term monitoring protocol.	Survey a percentage of streams within each occupied watershed each year to determine status.
		Monitor sites across the array of watersheds to determine changes to habitat.

Category	Need	Action
Research	Assess habitat degradation.	Determine parameters for describing levels of stream degradation.
		Create a methodology to prioritize streams for restoration.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Brook Trout and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition
Forest Health	Coordination, Education
Water Quantity and Quality	Coordination, Education, Legislation/Regulation, Management, Restoration
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	
Damaging Recreation	Legislation/Regulation, Education
Data Protection	

SELECTED ACTIONS FOR THE CONSERVATION OF THE BROOK TROUT AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge of the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Compile existing data and integrate it into the agency database.
- Develop a WV Fish Atlas and publish.

Surveys:

- Surveys are needed on selected private lands to determine status in poorly sampled regions of the state.

Monitoring:

- Survey a percentage of streams within each occupied watershed each year to determine status.
- Monitor sites across the array of watersheds to determine changes to habitat.

Research:

- Determine parameters for describing levels of stream degradation.
- Create a methodology to prioritize streams for restoration.

Coordination:

- Work with forest landowners, watershed groups, state and federal regulators, NGOs and others to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc.) in Brook Trout streams. This includes encouraging the use of Best Management Practices when timbering and conducting other site altering operations.
- Perform stream restoration activities on streams based on degradation criteria.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc.) in the Elk River.
- Educate students, teachers and citizens to the importance of stream fishes through presentations, pamphlets, etc.

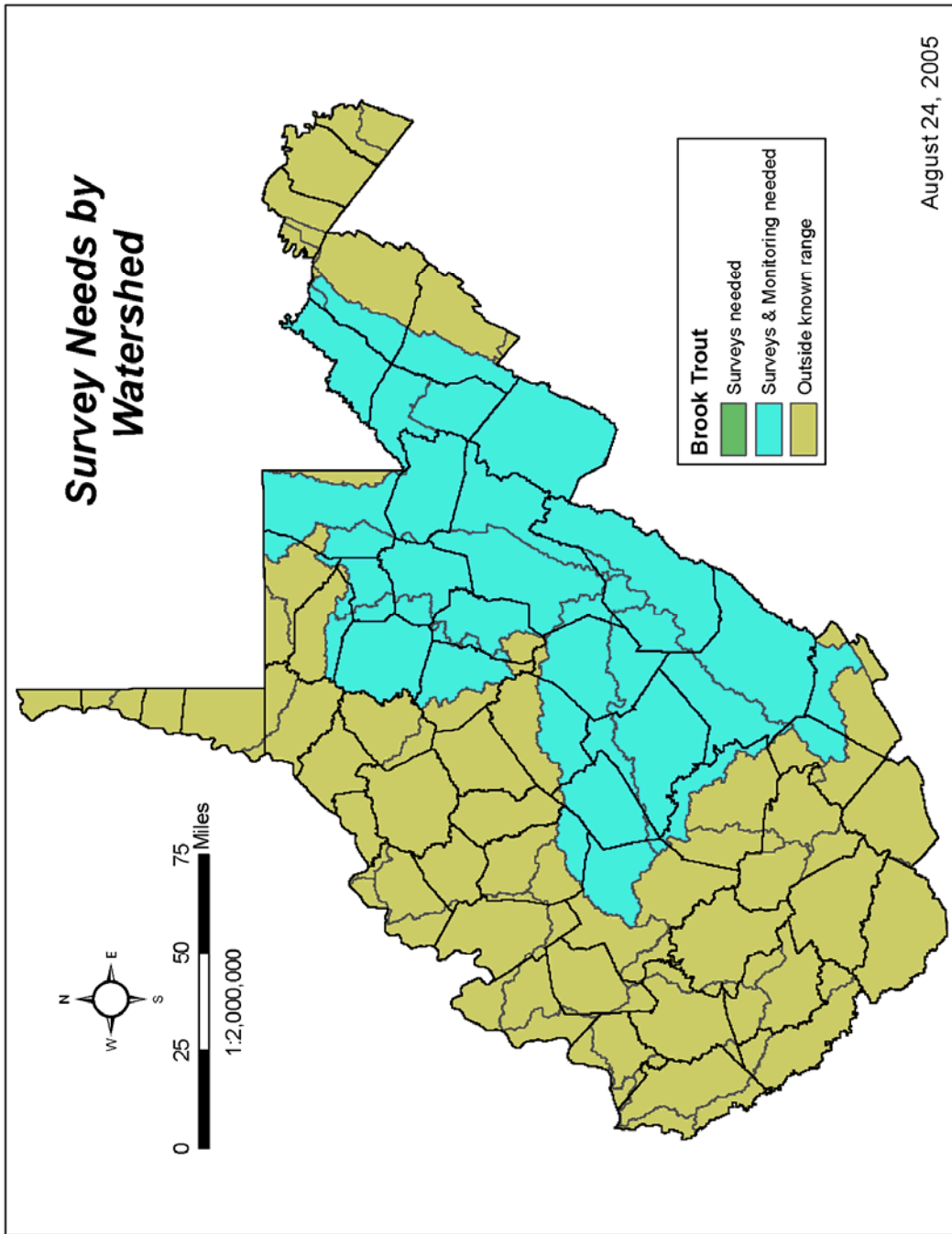
Legislation/Regulation:

- Enforce rules regarding the transportation and release of fishes between watersheds.
- Maintain and enforce creel limits or other harvest regulations.

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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Fishes

Common Name: Appalachia Darter

Scientific name: *Etheostoma gymnocephala*

STATUS

The ranks and information in the chart below present information on the Appalachia Darter in West Virginia. This species is endemic to the New River drainage in North Carolina, Virginia and West Virginia. It is supposedly fairly common in Virginia and North Carolina waters, but in West Virginia it is sporadic and rare.

Priority Group	Global Rank	State Rank	Mon Forest	Jeff Forest	Trend
1*	G4	S1	X	X	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Appalachia Darter into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether sites are in public or private ownership.

Habitat: The Appalachia Darter is usually found in the riffles and riffle-runs of small to moderate sized streams during the spring-summer and in deeper waters in the fall.

Watershed	Site Name	Record Type	Ownership
Gauley River	Gauley River and Tributaries	Recent	Private
New River	Bluestone River and Piney Creek	Historic	Private
Greenbrier River	Main stem and Tributaries	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Appalachia Darter. Because there is inadequate information on the distribution and status of the Appalachia Darter in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Appalachia Darter.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data compiled into database with coordinates.	Compile existing data and enter it into a database.
	Public access to general fish information.	Develop and maintain a WV Fish Atlas.
		Provide general fish data, such as distribution maps, on the internet.
		Complete an update of the <i>Fishes of West Virginia</i> .

Category	Need	Action
Surveys	Determine distribution and status of species in the state.	Survey streams where it was previously known and others with suitable habitat.
	Determine length of stream occupied at each recent occurrence.	Evaluate habitat and determine barriers that would separate populations within the same river system.

Category	Need	Action
Monitoring	Long-term monitoring.	Identify and prioritize potential sites; implement regular surveys at selected sites.
		Monitor existing sites to determine status of population and changes to habitat.

Category	Need	Action
Research	Survey methods.	Determine most effective survey method for each habitat type.
	Life history.	Identify and prioritize research needs, develop prospecti and solicit contracted research studies.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Appalachia Darter and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition,
Forest Health	Coordination, Education, Management, Restoration, Acquisition
Water Quantity and Quality	Coordination, Education, Management, Legislation/Regulation, Restoration
Over Collection	Legislation/Regulation, Education
Management Conflicts	Coordination
Invasive Species	Management, Education, Legislation/Regulation, Coordination, Restoration
Damaging Recreation	Education, Coordination, Acquisition, Legislation/Regulation
Data Protection	Legislation/Regulation

Selected Actions for the Conservation of Appalachia Darter and Its Habitat

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Compile existing data and enter it into a database.
- Develop and maintain a WV Fish Atlas and publish.

Surveys:

- Survey streams where it was previously known and others with suitable habitat.

Monitoring:

- Identify and prioritize potential monitoring sites; implement regular surveys at selected sites.

Coordination:

- Work with forest landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in streams with Appalachia Darters. This may include limiting ATV use, encouraging use of Best Management Practices when timbering or engaged in other impacting activities.
- Assess effects of possible dam construction on rivers and streams as projects may arise.
- Mitigate for impacts of mining and other development activities in the vicinity of Appalachia Darter streams.

Education:

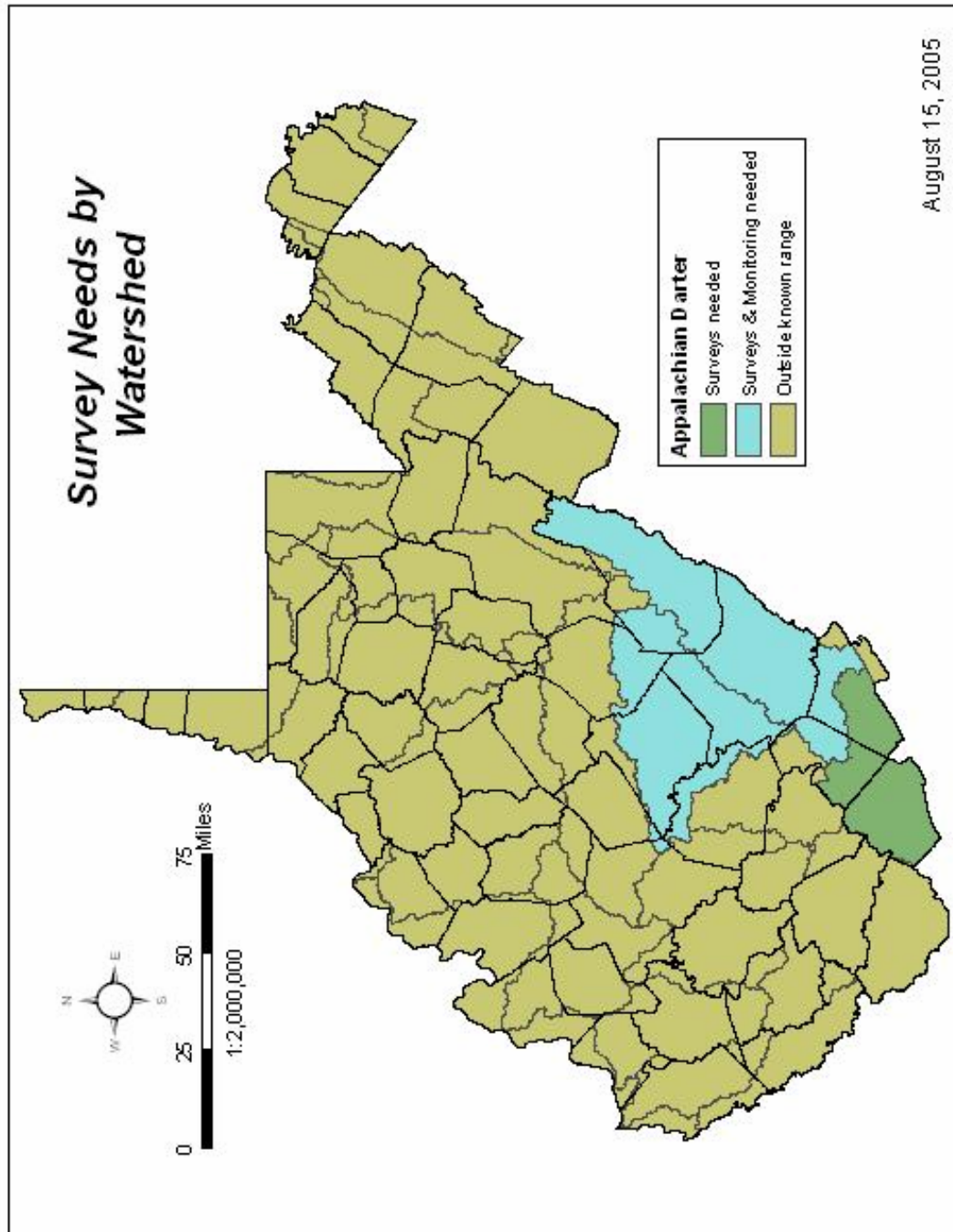
- Educate landowners to best stream practices to limit erosion, nutrient and solid waste loading, and chemical pollution
- Educate students, teachers and citizens to the importance of stream fishes through presentations, pamphlets, etc.

Legislation/Regulation:

- Enforce rules regarding the transportation and release of fishes between watersheds.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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- Welsh, Stuart. 2005. Personal Communication. West Virginia University Cooperative Fish and Wildlife Unit, Morgantown, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Fishes

Common Name: Bluestone Sculpin

Scientific name: *Cottus* sp. cf. Broadband Sculpin 1

STATUS

This as yet unnamed Sculpin is a newly recognized taxon, endemic to the New River system in the Ridge and Valley Province. It is restricted to the extreme upper Bluestone River system in Virginia and West Virginia (Jenkins & Burkhead 1993).

The ranks and information in the chart below indicate the rarity of the West Virginia Bluestone Sculpin population. This species is endemic to the upper Bluestone River drainage of New River (upper Kanawha River basin) in VA and WV. Populations are locally common in the Virginia portion of the Bluestone River, but it is rare in WV, known only from two sites.

Priority Group	Global Rank	State Rank	Trend
1*	G2	S1	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Bluestone Sculpin into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether sites are under public or private ownership.

Habitat: This species is found in rocky substrates (gravel to boulders) of high volume springs, small creeks and rivers usually ranging from 1 to 10m in width. Juveniles and adults are found in the runs and riffles of streams with cool to cold waters.

Watershed	Site Name	Record Type	Ownership
Bluestone	Bluestone River	Recent	Private

DECISION MAKING PROCESS – NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Bluestone Sculpin. Because there is inadequate information on the distribution and status of the Bluestone Sculpin in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Bluestone Sculpin.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data compiled into a database with coordinates.	Compile existing data.
	Public access to general fish information.	Develop and maintain a WV Fish Atlas.
		Provide general fish data, such as distribution maps, and life history information on the internet.
	Complete an update of the <i>Fishes of WV</i> .	

Category	Need	Action
Surveys	Determine status at historic sites.	Survey spring fed streams in the Bluestone River drainage that have not been sampled recently.
	Determine length of stream occupied at each recent occurrence.	Evaluate habitat and determine barriers that would separate populations within the same river system.

Category	Need	Action
Monitoring	Long-term monitoring.	Identify and prioritize potential monitoring sites.
		Monitor selected sites regularly to determine status of population and changes to habitat.

Category	Need	Action
Research	Life history.	Identify and prioritize research needs; develop prospecti and solicit contractual research studies.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Bluestone Sculpin and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition,
Forest Health	Coordination, Education, Management, Restoration, Acquisition
Water Quantity and Quality	Coordination, Education, Management, Legislation/Regulation, Restoration
Over Collection	
Management Conflicts	Coordination
Invasive Species	Management, Education, Legislation/Regulation, Coordination, Restoration
Damaging Recreation	Education, Coordination, Acquisition, Legislation/Regulation
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF BLUESTONE SCULPIN AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Compile existing data.
- Develop and maintain a WV Fish Atlas.

Surveys:

- Survey spring fed streams in the Bluestone River drainage that have not been sampled recently.

Monitoring:

- Identify and prioritize potential monitoring sites.
- Monitor selected sites regularly to determine population status and changes to habitat.

Coordination:

- Work with forest landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc.) in streams with Bluestone Sculpins. This may include limiting ATV use, encouraging use of Best Management Practices when timbering or engaged in other impacting activities.
- Assess effects of possible dam construction on rivers and streams as projects may arise.
- Mitigate for impacts of mining and other development activities in the vicinity of Bluestone Sculpin streams.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) on Bluestone Sculpin streams.
- Educate students, teachers and citizens to the importance of stream fishes and the potential problems of introducing non-indigenous fauna through presentations, pamphlets, etc.

Legislation/Regulation:

- Enforce rules regarding the transportation and release of fishes between watersheds.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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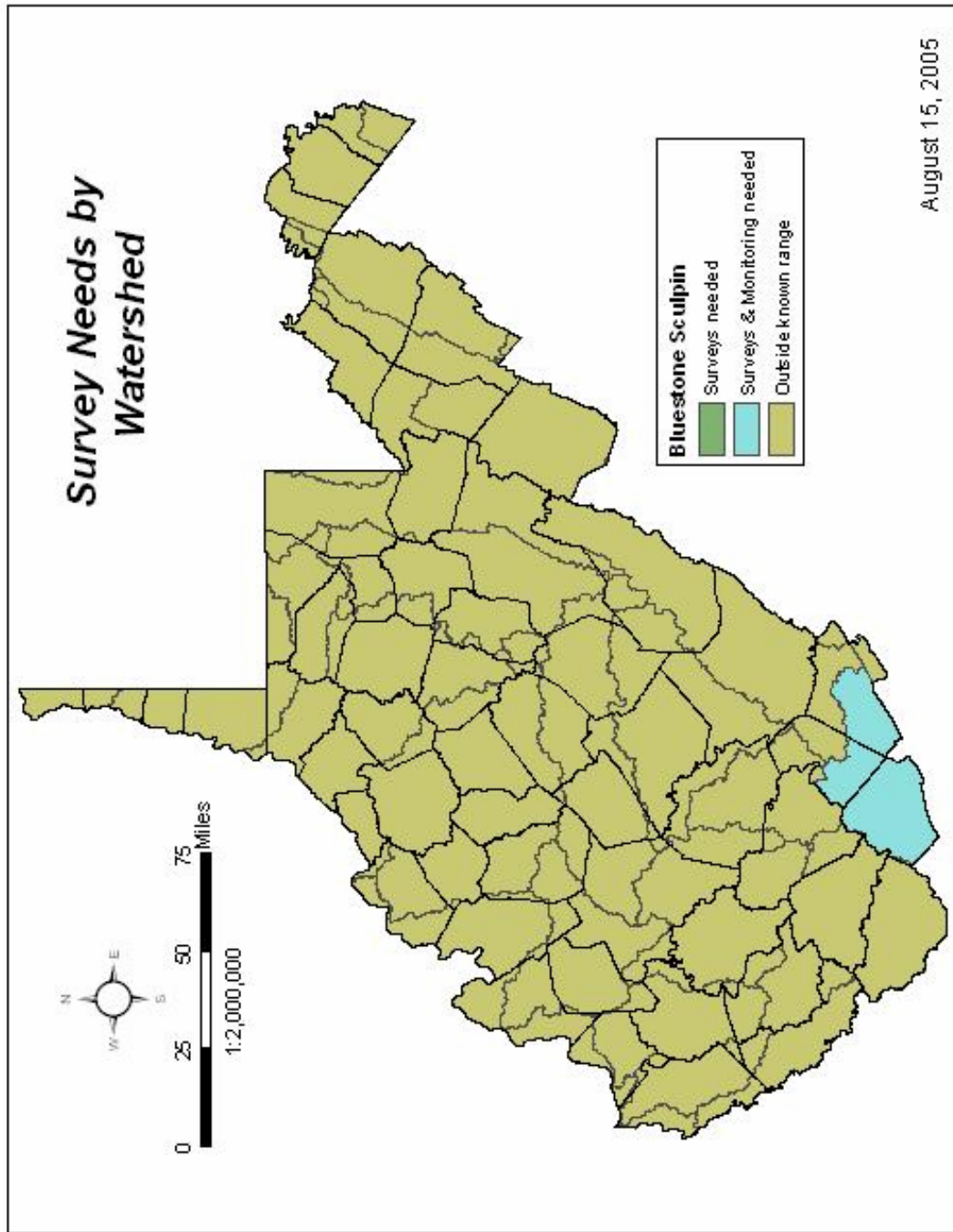
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Welsh, Stuart. 2005. Personal Communication. West Virginia University Cooperative Fish and Wildlife Unit, Morgantown, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Fishes

Common Name: River Darter

Scientific name: *Percina shumardi*

STATUS

The ranks and information in the chart below indicate the rarity of the River Darter in West Virginia. This species is listed as rare and a species of concern for West Virginia because of the scant data available for the species (5 records total; 4 recent, 1 historic). It is known from only the main channel Ohio River, one minor tributary of the Ohio and the Little Kanawha River.

Priority Group	Global Rank	State Rank	Trend
1*	G5	S1	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the River Darter into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether sites are in public or private ownership.

Habitat: This species' preferred habitat is somewhat variable. The literature describes it as generally found in deep chutes of fast rivers over rocky, coarse substrates. However, in West Virginia, it is usually collected from slack water and low gradient streams and rivers. Apparently, this darter is somewhat tolerant of turbid stream conditions.

Watershed	Site Name	Record Type	Ownership
Ohio River	Ohio River and Minor Tributaries	Recent	Private
Little Kanawha	Little Kanawha	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the River Darter. Because there is inadequate information on the distribution and status of the River Darter in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates initial actions required to identify conservation needs of the River Darter.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled into a database.	Compile existing data and enter it into a database.
	Public access to general fish information.	Develop and maintain a WV Fish Atlas.
		Complete an update of the <i>Fishes of West Virginia</i> .
	Provide general fish data, such as distribution maps, on the internet.	

Category	Need	Action
Surveys	Determine the distribution and status in the state.	Conduct surveys of historical sites and survey potential habitat in other streams.
	Determine length of stream occupied at each recent occurrence.	Evaluate habitat and determine what may separate populations within the same river system.

Category	Need	Action
Monitoring	Long-term monitoring	Identify and prioritize monitoring sites.
		Monitor chosen sites to determine status of population and any changes in habitat.

Category	Need	Action
Research	Life history	Identify and prioritize research needs, develop prospecti and solicit contractual research studies.
	Survey methods	Determine most effective survey method for each habitat type.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the River Darter and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition,
Forest Health	Coordination, Education, Management, Restoration, Acquisition
Water Quantity and Quality	Coordination, Education, Management, Legislation/Regulation, Restoration
Over Collection	Legislation/Regulation, Education
Management Conflicts	Coordination
Invasive Species	Management, Education, Legislation/Regulation, Coordination, Restoration
Damaging Recreation	Education, Coordination, Acquisition, Legislation/Regulation
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF RIVER DARTERS AND THEIR HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Compile existing data and enter it into a database.
- Develop and maintain a WV Fish Atlas.

Surveys:

- Conduct surveys of historical sites and survey potential habitat in other streams.

Monitoring:

- Identify and prioritize monitoring sites.

Research:

- Determine the most effective survey method for each habitat type.

Coordination:

- Work with forest landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc.) in River Darter streams. This includes encouraging the use of Best Management Practices when timbering or engaged in other impacting activities.
- Assess effects of possible dam construction on rivers and streams as projects may arise.
- Mitigate for impacts of mining and other development activities in River Darter streams.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) in River Darter streams.
- Educate students, teachers and citizens to the importance of stream fishes through presentations, pamphlets, etc.

Legislation/Regulation:

- Enforce rules regarding the transportation and release of fishes between watersheds.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

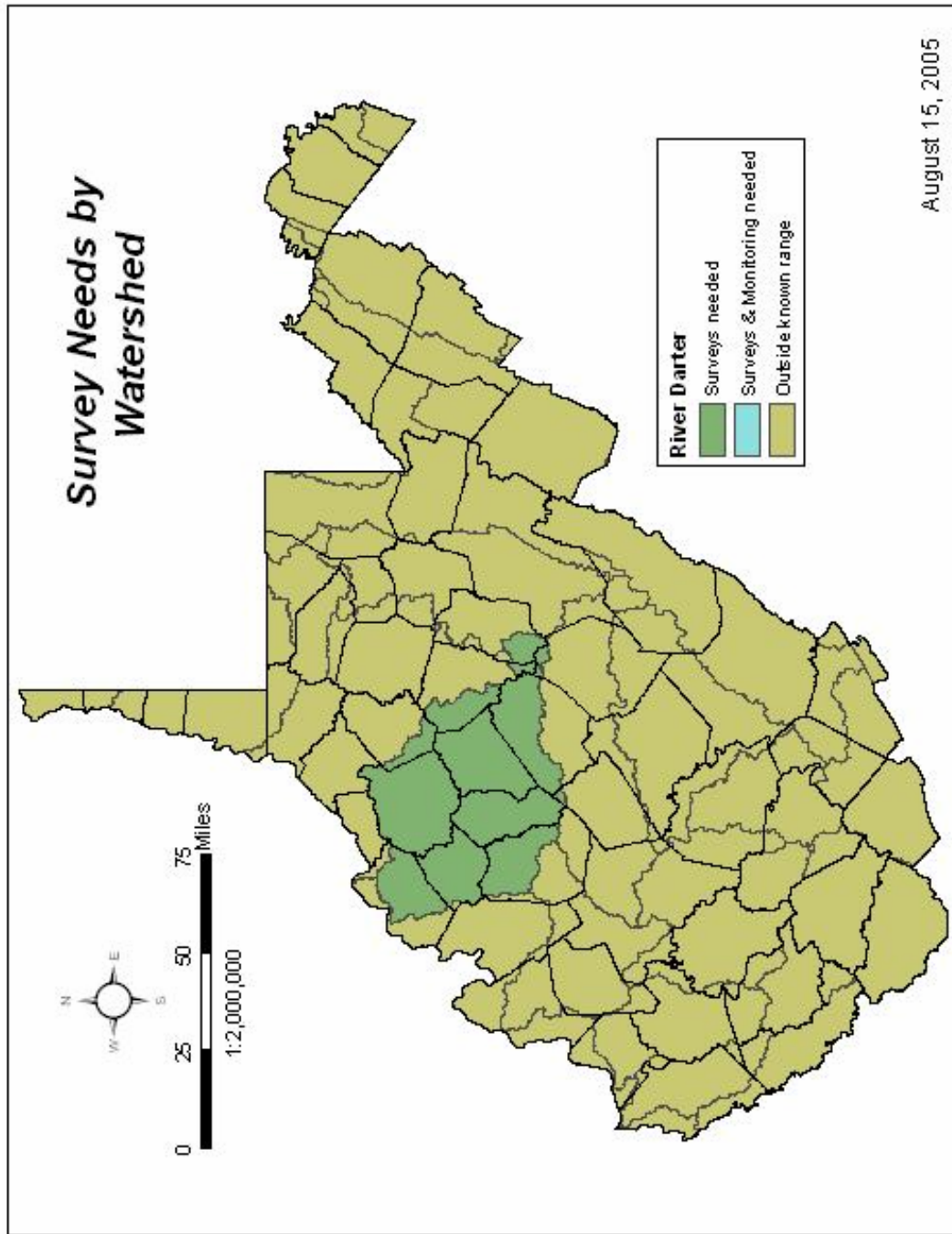
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Welsh, Stuart. 2005. Personal Communication. West Virginia University Cooperative Fish and Wildlife Unit, Morgantown, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Fishes

Common Name: Mountain Brook Lamprey

Scientific name: *Ichthyomyzon greeleyi*

STATUS

The ranks and information in the chart below outlines which agencies or groups consider the Mountain Brook Lamprey to be of concern in West Virginia. This species is listed as rare and a species of concern for West Virginia because of the scant data available for the species (2 historic records). It is known from only the Little Kanawha River and Middle Island Creek.

Priority Group	Global Rank	State Rank	Jeff Forest	NE Tech Comm.	Trend
1*	G3G4	S1	X	X	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Mountain Brook Lamprey into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether sites are under public or private ownership.

Habitat: Larval lampreys live in mud or sandy banks in small creeks. Adults spawn in clean, rocky riffles.

Watershed	Site Name	Record Type	Ownership
Middle Island Creek	Middle Island Creek	Recent	Private
Little Kanawha	Little Kanawha	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Mountain Brook Lamprey. Because there is inadequate information on the distribution and status of the Mountain Brook Lamprey in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Mountain Brook Lamprey.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled into a database.	Compile existing data and enter it into a database.
	Public access to general fish information.	Develop and maintain a WV Fish Atlas and publish.
		Complete an update of the <i>Fishes of West Virginia</i> .
	Provide general fish data, such as distribution maps, on the internet.	

Category	Need	Action
Surveys	Determine distribution and status in the state.	Conduct surveys of historical sites and other sites with potential habitat.
	Determine length of stream occupied at each recent occurrence.	Evaluate habitat and determine what may separate populations within the same river system.

Category	Need	Action
Monitoring	Long-term monitoring.	Identify and prioritize monitoring sites.
		Regularly monitor chosen sites to determine status of population and any changes to habitat.

Category	Need	Action
Research	Life history.	Identify and prioritize research needs, develop prospecti and solicit contractual research studies.
	Survey methods.	Determine most effective survey method for each habitat type.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Mountain Brook Lamprey and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition
Forest Health	Coordination, Education
Water Quantity and Quality	Coordination, Education, Legislation/Regulation, Management, Restoration
Over Collection	Legislation/Regulation, Education
Management Conflicts	Coordination
Invasive Species	Management, Education, Legislation/Regulation, Coordination, Restoration
Damaging Recreation	Legislation/Regulation, Education
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE MOUNTAIN BROOK LAMPREY AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Compile existing data and enter it into a database.
- Develop and maintain a WV Fish Atlas.

Surveys:

- Conduct surveys of historical sites and other sites with potential habitat.

Research:

- Identify and prioritize research needs, develop prospecti, solicit contractors and research studies.
- Determine most effective survey method for each habitat type.

Coordination:

- Work with forest landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in watersheds harboring this species. This includes encouraging the use of Best Management Practices when timbering.
- Assess effects of possible dam construction on rivers and streams as projects may arise.
- Mitigate for impacts of development activities in the occupied watersheds.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) in occupied watersheds.
- Educate students, teachers and citizens to the importance of stream fishes through presentations, pamphlets, etc.

Legislation/Regulation:

- Enforce rules regarding the transportation and release of fishes between watersheds.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

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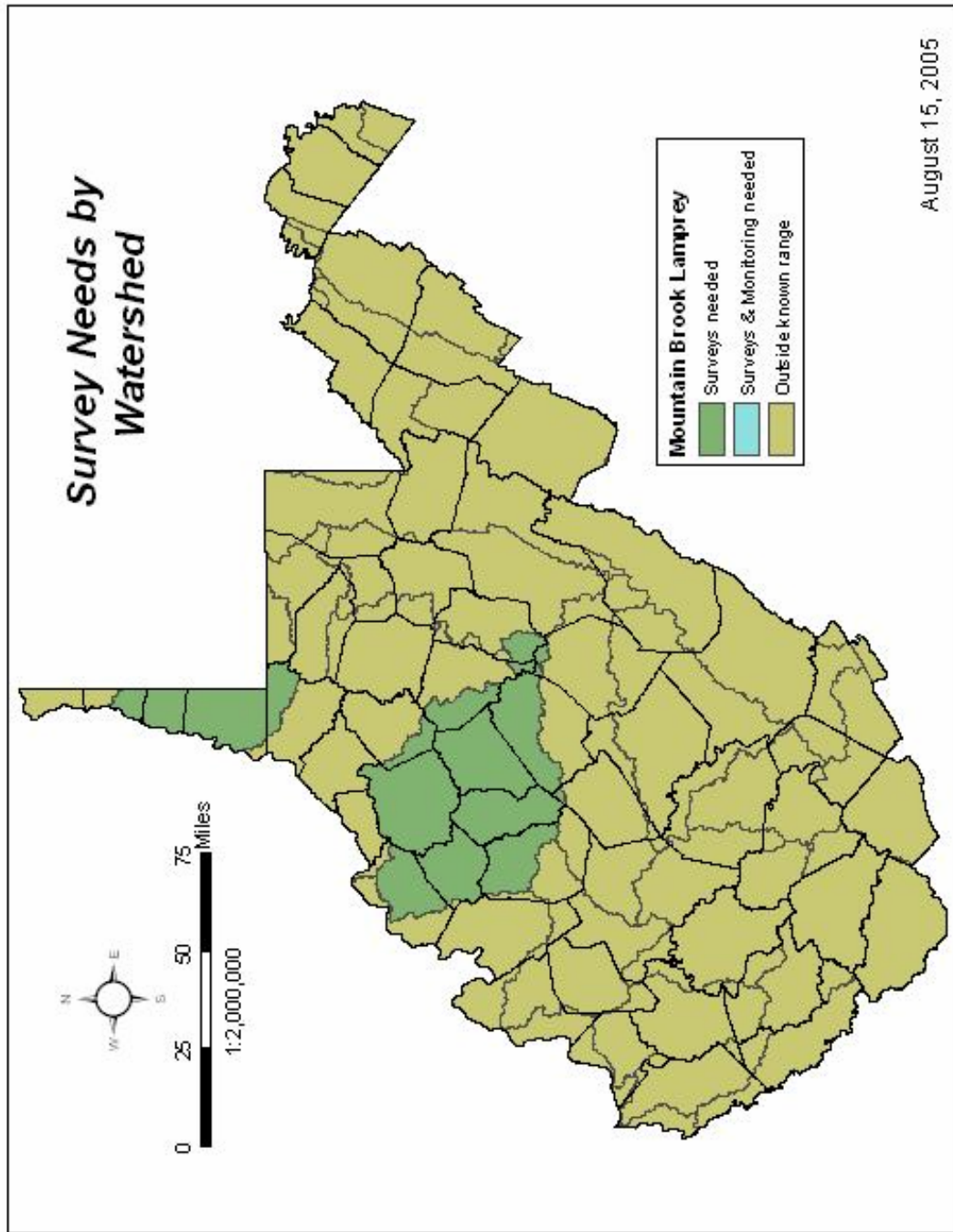
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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Fishes

Common Name: Kanawha Minnow

Scientific name: *Phenacobius teretulus*

STATUS

The ranks and information in the chart below indicate the rarity of the Kanawha Minnow in West Virginia. This species is endemic to the New River drainage of the upper Kanawha River in NC, VA and WV. It is reported as fairly common in VA and NC waters, but is sporadic and rare in WV.

Priority Group	Global Rank	State Rank	Mon Forest	Jeff Forest	IUCN Rank	AFS	Trend
1*	G3G4	S1	X	X	VU DU	SC	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Kanawha Minnow into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether sites are in public or private ownership.

Habitat: The Kanawha Minnow is usually found in rocky riffles and runs of medium to large streams.

Watershed	Site Name	Record Type	Ownership
Gauley River	Williams River	Historic	Public
	Laurel Creek of Cherry River	Historic	Public/Private
Greenbrier River	East Fork of Greenbrier River	Recent	Public/Private
	West Fork of Greenbrier River	Recent	Public/Private
New River	Indian Creek	Historic	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Kanawha Minnow. Because there is inadequate information on the distribution and status of the Kanawha Minnow in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Kanawha Minnow.

Category	Need	Action
Data	Standardized data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled into a database.	Compile existing data and enter into a database.
	Public access to general fish information.	Develop and maintain a WV Fish Atlas.
		Complete an update of <i>The Fishes of West Virginia</i> .
		Provide general fish data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Determine distribution and status in the state.	Conduct surveys of historical sites and other sites with potential habitat.
	Determine length of stream occupied at each recent occurrence.	Evaluate habitat and determine what may separate populations within the same river system.

Category	Need	Action
Monitoring	Long-term monitoring.	Identify and prioritize potential monitoring sites.
		Monitor chosen sites regularly to determine status of population and any changes to habitat.

Category	Need	Action
Research	Life history.	Identify and prioritize research needs, develop prospecti and solicit contractual research studies.
	Survey methods.	Determine most effective survey method for each habitat type.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Kanawha Minnow and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition,
Forest Health	Coordination, Education, Management, Restoration, Acquisition
Water Quantity and Quality	Coordination, Education, Management, Legislation/Regulation, Restoration
Over Collection	Legislation/Regulation, Education
Management Conflicts	Coordination
Invasive Species	Management, Education, Legislation/Regulation, Coordination, Restoration
Damaging Recreation	Education, Coordination, Acquisition, Legislation/Regulation
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE KANAWHA MINNOW AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Compile existing data and enter it into a database.
- Develop and maintain a WV Fish Atlas.

Surveys:

- Conduct surveys of historical sites and other sites with potential habitat.

Monitoring:

- Identify and prioritize potential monitoring sites.

Research:

- Determine most effective survey method for each habitat type.

Coordination:

- Work with forest landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in watersheds harboring this species. This includes encouraging the use of Best Management Practices when timbering.
- Assess effects of possible dam construction on rivers and streams as projects may arise.
- Mitigate for impacts of development activities in the occupied watersheds.

Education:

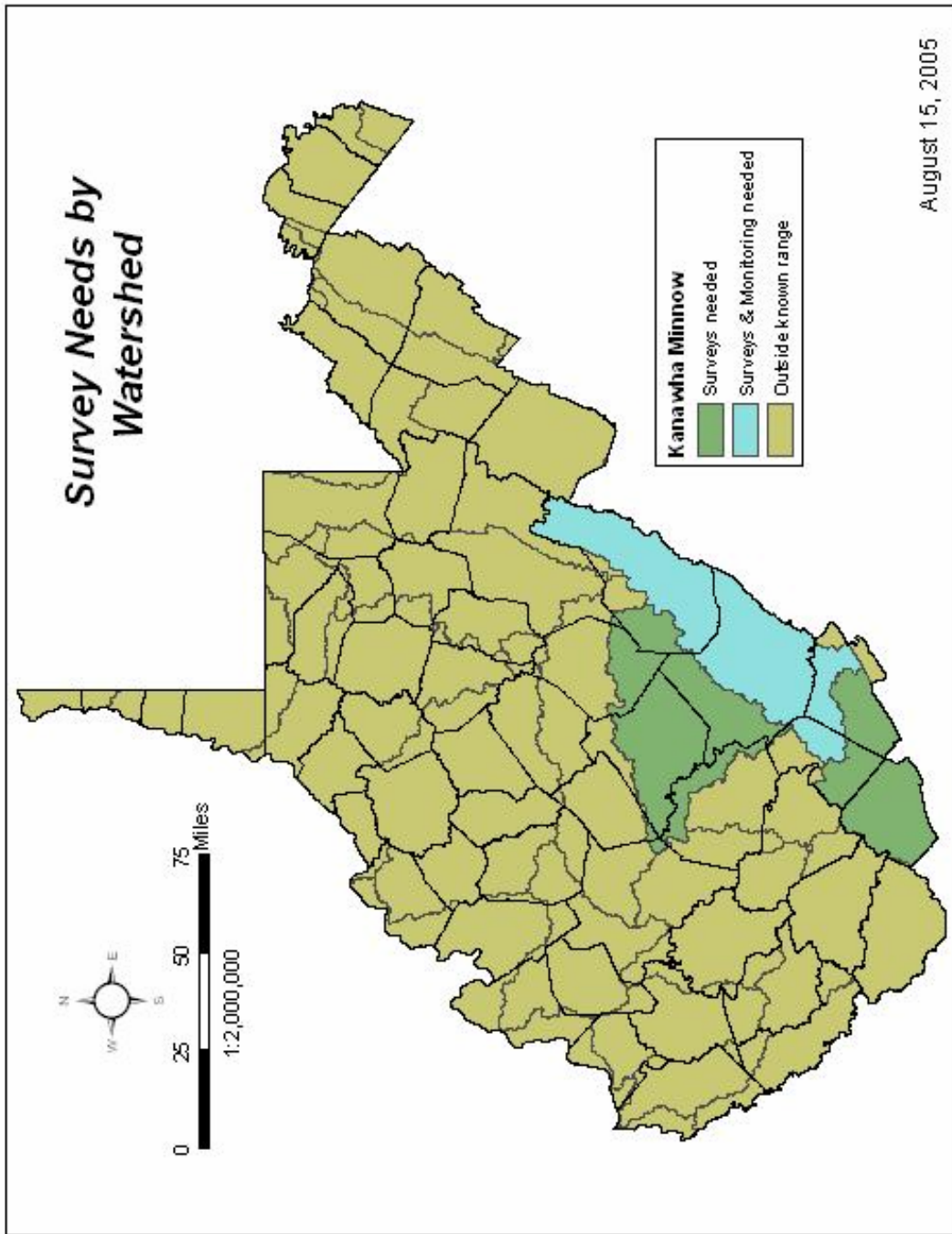
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) in occupied watersheds.
- Educate students, teachers and citizens to the importance of stream fishes through presentations, pamphlets, etc.
- Inform anglers and others about the harmful effects of introducing invasive fishes into West Virginia waters.

Legislation/Regulation:

- Enforce rules regarding the transportation and release of fishes between watersheds.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

- Cincotta, Dan. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.
- Cincotta, D.A. 1990. *Fishes*. Pages vi-34A in J. Crum, editor. *Vertebrate Species of Concern*. WV Division of Natural Resources, Charleston.
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- Stauffer, J. R., Jr., J.M. Boltz, L. R. White. 1995. *The Fishes of West Virginia*. Proceedings of the Academy of Natural Sciences of Philadelphia 146:1-389.
- Welsh, Stuart. 2005. Personal Communication. West Virginia University Cooperative Fish and Wildlife Unit, Morgantown, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Fishes

Common Name: Lake Sturgeon

Scientific name: *Acipenser fulvescens*

STATUS

The ranks and information in the chart below indicate the status of the Lake Sturgeon in West Virginia. This species is listed as a species of concern in West Virginia because it was extirpated from the state in the mid-1900s and there is a desire to reestablish the species.

Priority Group	Global Rank	State Rank	AFS	Trend
1*	G5	SX	SC	Extirpated

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of the Lake Sturgeon into watersheds, gives the ages of records (recent is within 20 years) and indicates whether sites are in public or private ownership.

Habitat: The Lake Sturgeon inhabits large rivers over clean sand, gravel and rock substrates, avoiding soft muddy bottoms where mollusks and insects are scarce.

Watershed	Record Type
Ohio	Historic
Lower Kanawha	Historic

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the reestablishment and consequent conservation of the Lake Sturgeon.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled.	Compile existing data and integrate it into the agency database.
	Provide public access to general fish information.	Develop and establish a WV Fish Atlas.
		Complete an update of the <i>Fishes of West Virginia</i> .
	Provide general fish data, such as distribution maps, on the internet.	

Category	Need	Action
Surveys	Surveys are needed for monitoring of introduced populations.	Lake sturgeon will be surveyed using gill nets in reaches that have received sturgeon introductions.

Category	Need	Action
Monitoring	Develop a long-term monitoring protocol.	Establish long-term monitoring sites.
		Mark stocked fish with passive integrated transponder (PIT) tags.
		Monitor sites to determine status of population and changes to habitat.

Category	Need	Action
Research	Life history information.	Establish priority list of research needs and implement high priority studies.
	Efficient, effective monitoring methods.	Research, develop and implement an appropriate monitoring methodology.

Category	Need	Action
Reintroduction	Reestablish species in the Ohio and Kanawha Rivers.	Determine a source for eggs or fingerlings.
		Rear young at Palestine and Apple Grove State Fish Hatcheries.
		Annually introduce approximately 1,000 fish in the Ohio and Kanawha rivers.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Lake Sturgeon and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition
Forest Health	
Water Quantity and Quality	Coordination, Education, Legislation/Regulation, Management, Restoration
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	Legislation/Regulation, Education
Data Protection	

SELECTED ACTIONS FOR THE CONSERVATION OF THE LAKE STURGEON AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to reestablish and conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge of the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Compile existing data and integrate it into the agency database.

Surveys:

- Lake sturgeon will be surveyed using gill nets in reaches that have received sturgeon introductions.

Monitoring:

- Establish long-term monitoring sites.
- Mark stocked fish with passive integrated transponder (PIT) tags.
- Monitor sites to determine status of population and changes to habitat.

Research:

- Research, develop and implement an appropriate monitoring methodology.

Reintroduction:

- Determine a source for eggs or fingerlings.
- Rear young at Palestine and Apple Grove State Fish Hatcheries.
- Annually introduce approximately 1,000 fish in the Ohio and Kanawha rivers.

Coordination:

- Work with management agencies so that all are aware of the reintroduction effort and will work cooperatively to avoid detrimental activities in the Ohio and Lower Kanawha rivers.

Education:

- Conduct presentations and create an educational pamphlet outlining the reintroduction effort.
- Educate anglers about the program so they will immediately return to the water any Lake Sturgeon caught.

Legislation/Regulation:

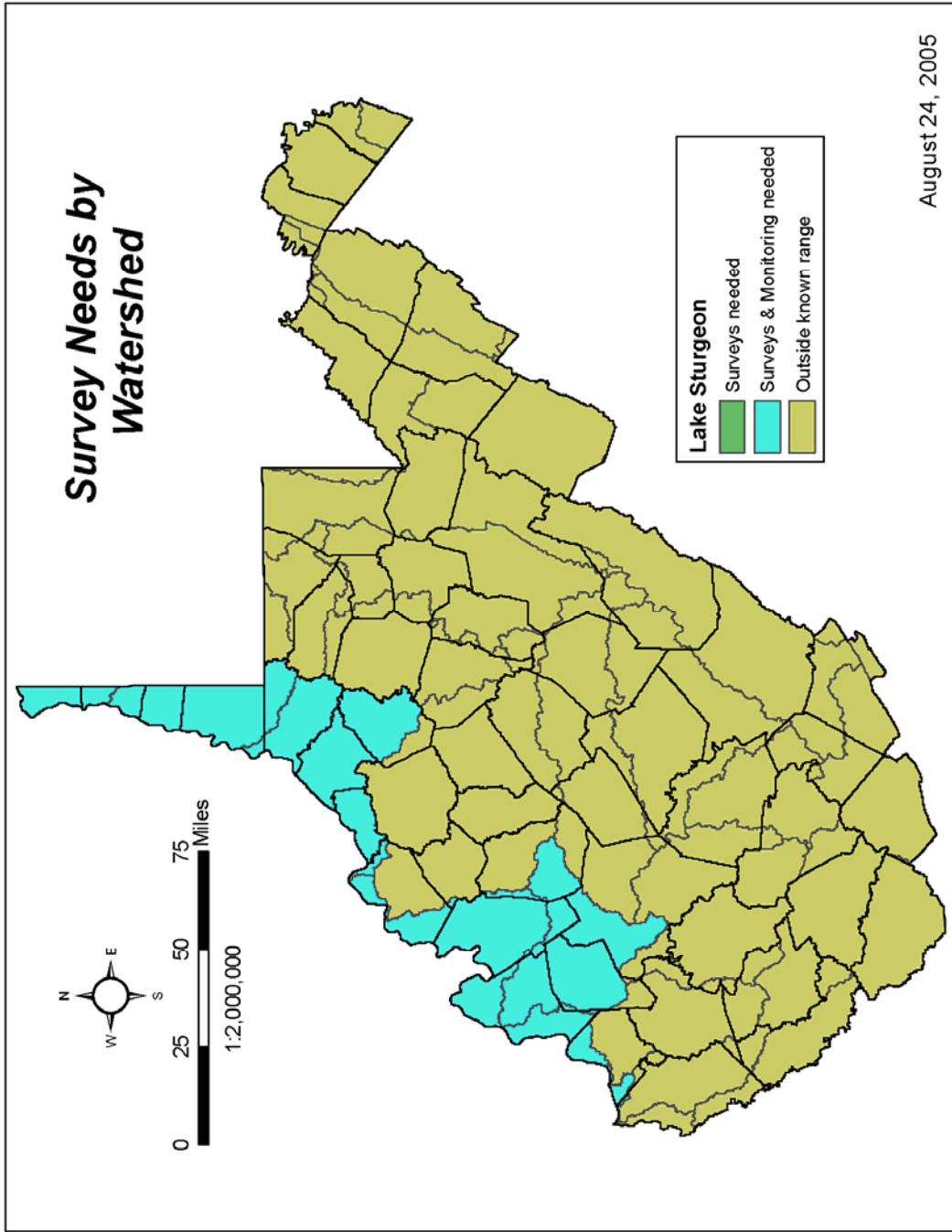
- Maintain Lake Sturgeon as a no creel limit and no possession fish species.

REFERENCES

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O'Bara, Chris. 2005. Lake Sturgeon Restoration Plan. West Virginia Division of Natural Resources, Wildlife Section, Warmwater Fisheries Program.

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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Fishes

Common Name: Crystal Darter

Scientific name: *Crystallaria asprella*

STATUS

The ranks and information in the chart below indicate the status of the Crystal Darter in West Virginia. This species is listed as rare and a species of concern in West Virginia because of the lack of data available for the species. Only ten specimens have been collected during the last twenty-five years. The Elk River specimens comprise the only known Ohio River watershed population and are considered genetically distinct from other populations.

Priority Group	Global Rank	State Rank	AFS	IUCN Rank	Trend
1*	G3G4	S1	SC	VU A1c	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Crystal Darter into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether sites are in public or private ownership.

Habitat: Crystal Darters typically utilize sandy runs with embedded coarser substrate and pools. It is believed that they may utilize pools during the day and feed in the runs and shoals at night. The majority of specimens were collected at dusk or later.

Watershed	Site Name	Record Type	Ownership
Elk River	Clendenin Water Treatment Plant	Recent	Private
	Clendenin #2	Recent	Private
	Mink Shoals	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Crystal Darter. Because there is inadequate information on the distribution and status of the species in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below.

Bolded text indicates primary actions required to identify conservation needs of the Crystal Darter.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled.	Compile existing data and integrate it into the agency database.
	Provide public access to general fish information.	Develop and maintain a WV Fish Atlas.
		Complete an update of the <i>Fishes of West Virginia</i> .
		Provide general fish data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Determine status at historic sites.	Conduct surveys of historic sites in the lower Elk River immediately above the confluence with the Kanawha River.
	Determine the length of stream occupied at each recent occurrence.	Evaluate habitat and determine what may separate populations within the same river system.
	Investigate reaches of the Elk River having the potential to support Crystal Darter populations that have not been previously surveyed.	Identify, prioritize and survey sites in the Elk River.

Category	Need	Action
Monitoring	Develop a long-term monitoring protocol.	Establish long-term monitoring sites.
		Monitor sites to determine status of population and changes to habitat.

Category	Need	Action
Research	Life history information.	Establish priority list of research needs and implement high priority studies.
	Efficient, effective survey methods.	Determine most effective survey method for each habitat type.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Crystal Darter and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition
Forest Health	Coordination, Education
Water Quantity and Quality	Coordination, Education, Legislation/Regulation, Management, Restoration
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	Legislation/Regulation, Education
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE CRYSTAL DARTER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge of the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Compile existing data and integrate it into the agency database.
- Develop a WV Fish Atlas and publish.

Surveys:

- Conduct surveys of a historical site in the lower portion of the Elk River just above the navigation pool of the lower Kanawha River.
- Identify, prioritize and survey sites in the Elk River.

Research:

- Determine most effective survey method for each habitat type.

Coordination:

- Work with forest landowners, watershed groups, state and federal regulators, NGOs and others to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc.) in the Elk River watershed. This includes encouraging the use of Best Management Practices when timbering and conducting other site altering operations.
- Assess effects of possible dam construction on rivers and streams as projects arise.
- Mitigate the impacts of mining and other development activities in the Elk River watershed.

Education:

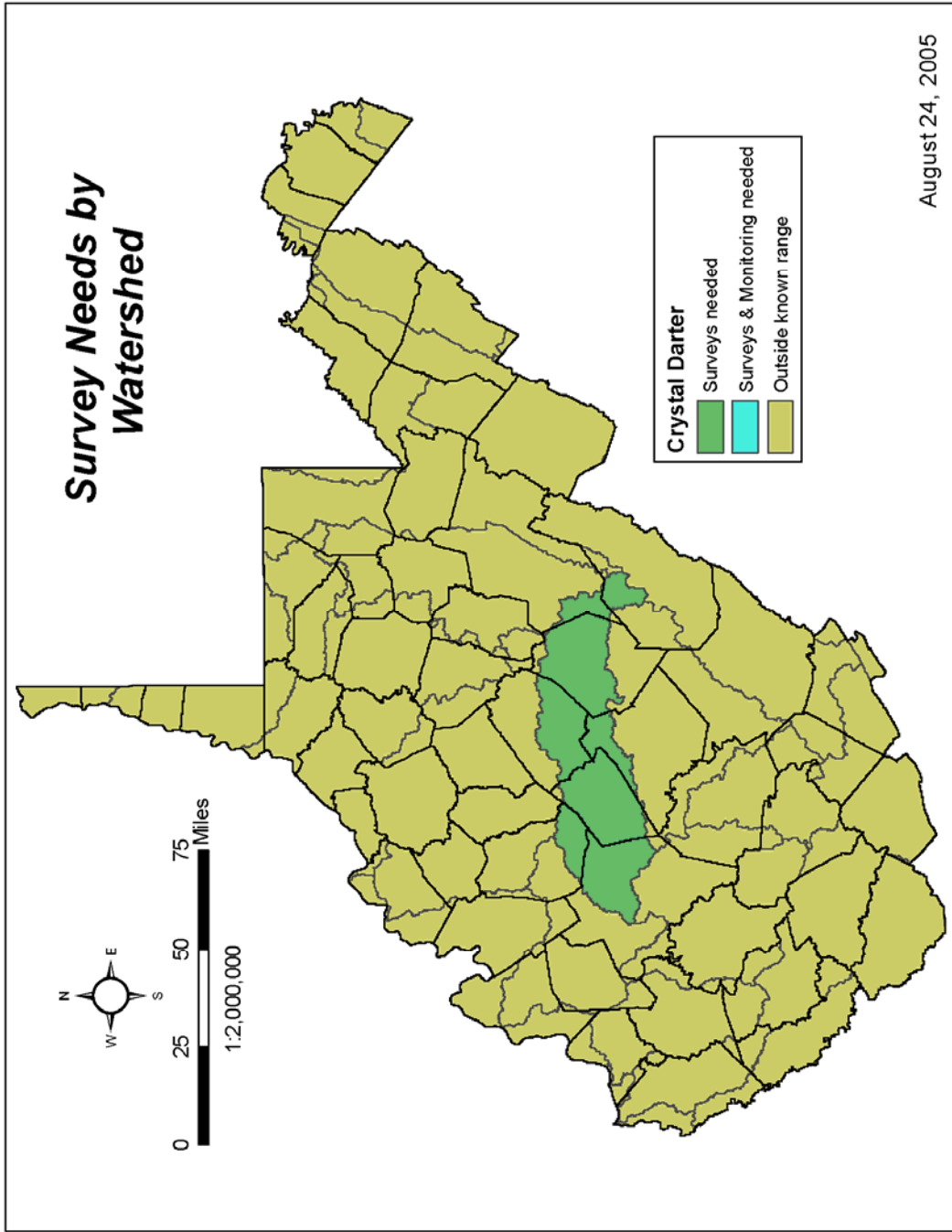
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc.) in the Elk River.
- Educate students, teachers and citizens to the importance of stream fishes through presentations, pamphlets, etc.

Legislation/Regulation:

- Enforce rules regarding the transportation and release of fishes between watersheds.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

- Cincotta, Dan. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.
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- Welsh, Stuart. 2005. Personal Communication. West Virginia University Cooperative Fish and Wildlife Unit, Morgantown, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Fishes

Common Name: Shovelnose Sturgeon

Scientific name: *Scaphirhynchus platyrhynchus*

STATUS

The ranks and information in the chart below indicate the status of the Shovelnose Sturgeon in West Virginia. This species is listed as a species of concern in West Virginia because it was extirpated from the state in the mid-1900s and there is a current effort to reestablish the species. Adult fish have been stocked, however attempts to obtain viable eggs and/or fingerling shovelnose sturgeon for hatchery production and later stockings have been unsuccessful.

Priority Group	Global Rank	State Rank	AFS	Trend
1*	G5	S1	SC	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of the Shovelnose Sturgeon into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether sites are in public or private ownership.

Habitat: The Shovelnose Sturgeon inhabits large rivers. It is usually found over clean sand and gravel substrate where there are large concentrations of mollusks.

Watershed	Record Type
Ohio	Historic
Kanawha	Current?

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Shovelnose Sturgeon. Because there is inadequate information on the distribution and status of the Shovelnose Sturgeon in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Shovelnose Sturgeon.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled.	Compile existing data and integrate it into the agency database.
	Provide public access to general fish information.	Develop and establish a WV Fish Atlas.
		Complete an update of the <i>Fishes of West Virginia</i> .
	Provide general fish data, such as distribution maps, on the internet.	

Category	Need	Action
Surveys	Survey for species to determine if reintroductions are successful.	Shovelnose sturgeon will be surveyed using gill nets in reaches that have received sturgeon introductions.

Category	Need	Action
Monitoring	Develop a long-term monitoring protocol.	Establish long-term monitoring sites.
		Mark stocked fish with passive integrated transponder (PIT) tags.
		Monitor sites (starting three years following the first introductions) to determine status of population and changes to habitat.

Category	Need	Action
Research	Life history information.	Establish priority list of research needs and implement high priority studies.
	Efficient, effective monitoring methods	Research, develop and implement an appropriate monitoring methodology.

Category	Need	Action
Reintroduction	Re-establish species in the Ohio and Kanawha Rivers.	Determine a source for eggs or fingerlings.
		Rear young at Palestine and Apple Grove State Fish Hatcheries.
		Annually introduce approximately 1,000 fish in the Ohio and Kanawha rivers.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Shovelnose Sturgeon and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition
Forest Health	
Water Quantity and Quality	Coordination, Education, Legislation/Regulation, Management, Restoration
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	Legislation/Regulation, Education
Data Protection	

SELECTED ACTIONS FOR THE CONSERVATION OF THE SHOVELNOSE STURGEON AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to reestablish and conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge of the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop standardized survey protocols and associated materials.
- Compile existing data.

Surveys:

- Shovelnose sturgeon will be surveyed using gill nets in reaches that have received sturgeon introductions.

Monitoring:

- Establish long-term monitoring sites.
- Mark stocked fish with passive integrated transponder (PIT) tags.
- Monitor sites to determine status of population and changes to habitat.

Research:

- Research, develop and implement an appropriate monitoring methodology.

Reintroduction:

- Determine a source for eggs or fingerlings.
- Rear young at Palestine and Apple Grove State Fish Hatcheries.
- Annually introduce approximately 1,000 fish in the Ohio and Kanawha rivers.

Coordination:

- Work with management agencies so that all are aware of the reintroduction effort and will work cooperatively to avoid detrimental activities in the Ohio and Lower Kanawha rivers.

Education:

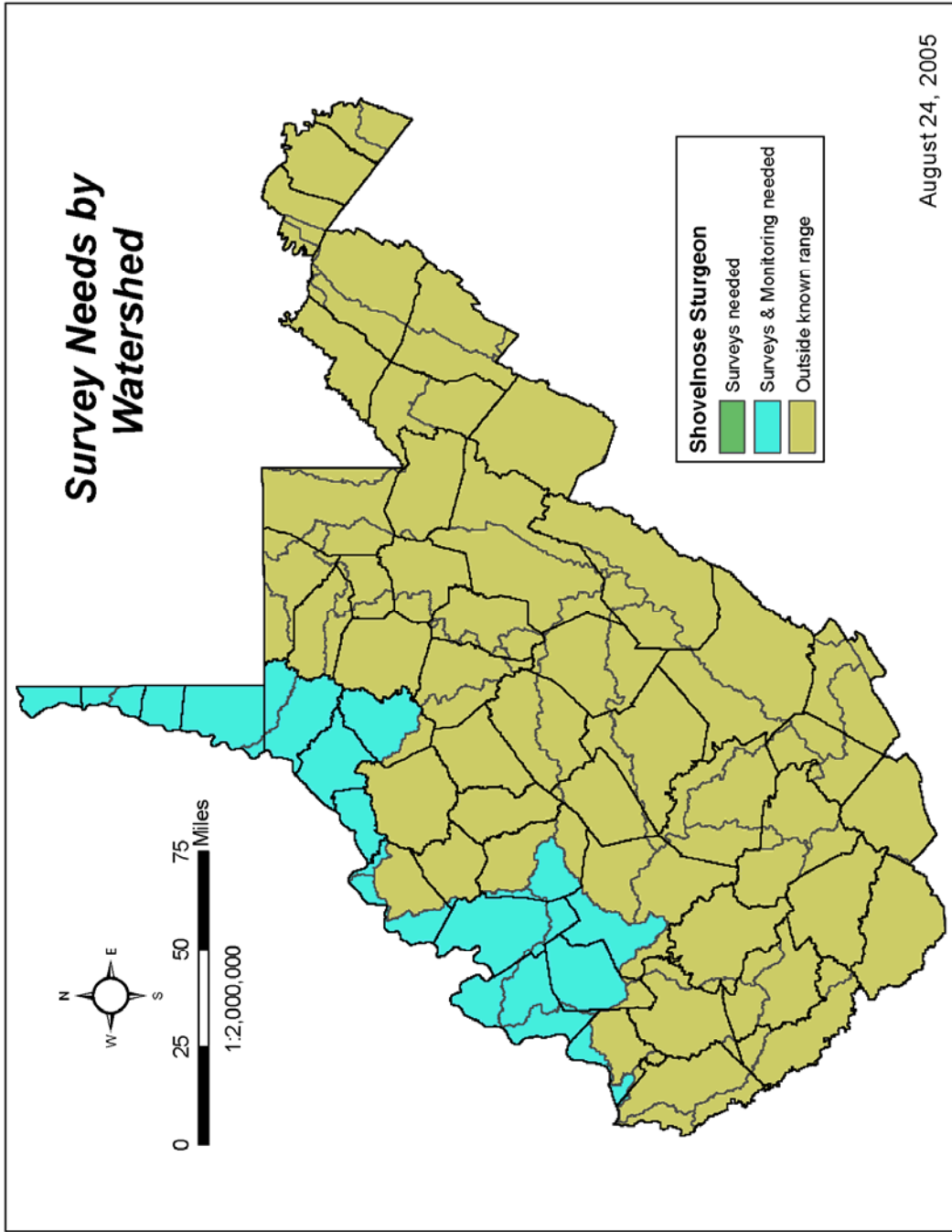
- Conduct presentations and create an educational pamphlet outlining the reintroduction effort.
- Educate anglers about the program so they will immediately return to the water any Shovelnose Sturgeon caught.

Legislation/Regulation:

- Maintain Sturgeon as a no creel limit and no possession fish species.

REFERENCES

- Cincotta, D.A. 1990. *Fishes*. Pages vi-34A in J. Crum, editor. *Vertebrate Species of Concern*. WV Division of Natural Resources, Charleston.
- O'Bara, Chris. 2005. *Shovelnose Sturgeon Restoration Plan*. West Virginia Division of Natural Resources, Wildlife Section, Warmwater Fisheries Program.
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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Fishes

Common Name: Spotted Darter

Scientific name: *Etheostoma maculatum*

STATUS

The ranks and information in the chart below indicate the rarity of the population of Spotted Darter in West Virginia. This species is listed as rare and a species of concern for West Virginia because of the scant data available for the species and its limited range.

Priority Group	Global Rank	State Rank	USFWS	IUCN Rank	NE Tech Comm.	AFS	Trend
1*	G4	S1	SC	LR/nt	X	SC	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Spotted Darter into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether sites are in public or private ownership.

Habitat: Spotted Darters are typically found in mid-to large clean rivers in swift riffles over large rubble and boulders.

Watershed	Site Name	Record Type	Ownership
Elk River	Braxton County	Recent	Private
	Clay County	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Spotted Darter. Because there is inadequate information on the distribution and status of the Spotted Darter in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Spotted Darter.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data compiled into database with coordinates.	Compile existing data and enter it into a database.
	Public access to general fish information.	Provide general fish data, such as distribution maps, on the internet. Complete an update of the <i>Fishes of West Virginia</i> .

Category	Need	Action
Surveys	Determine distribution and status of this species in the state.	Survey the lower Elk River in Clay County and other potential habitat.
	Determine length of stream occupied at each recent occurrence.	Evaluate habitat and determine barriers that would separate populations within the same river system.

Category	Need	Action
Monitoring	Long-term monitoring.	Identify and prioritize potential monitoring sites; implement regular surveys at selected sites.
		Monitor existing sites to determine status of population and any changes to habitat.

Category	Need	Action
Research	Survey methods.	Determine most effective survey method for each habitat type.
	Life history.	Identify and prioritize research needs, develop prospecti; and solicit contractual research studies.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Spotted Darter and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial

development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition,
Forest Health	Coordination, Education, Management, Restoration, Acquisition
Water Quantity and Quality	Coordination, Education, Management, Legislation/Regulation, Restoration
Over Collection	Legislation/Regulation, Education
Management Conflicts	Coordination
Invasive Species	Management, Education, Legislation/Regulation, Coordination, Restoration
Damaging Recreation	Education, Coordination, Acquisition, Legislation/Regulation
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF SPOTTED DARTER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Compile existing data and enter it into a database.
- Complete an update of the *Fishes of West Virginia*.

Surveys:

- Survey the lower Elk River in Clay County and other potential habitat.

Monitoring:

- Identify and prioritize monitoring sites; implement regular surveys of selected sites.

Coordination:

- Work with forest landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in streams with Spotted Darters. This may include limiting ATV use, encouraging use of Best Management Practices when timbering or engaged in impacting activities.
- Assess effects of possible dam construction on rivers and streams as projects may arise.
- Mitigate against impacts of mining and other development activities in the vicinity of Spotted Darter streams.

Education:

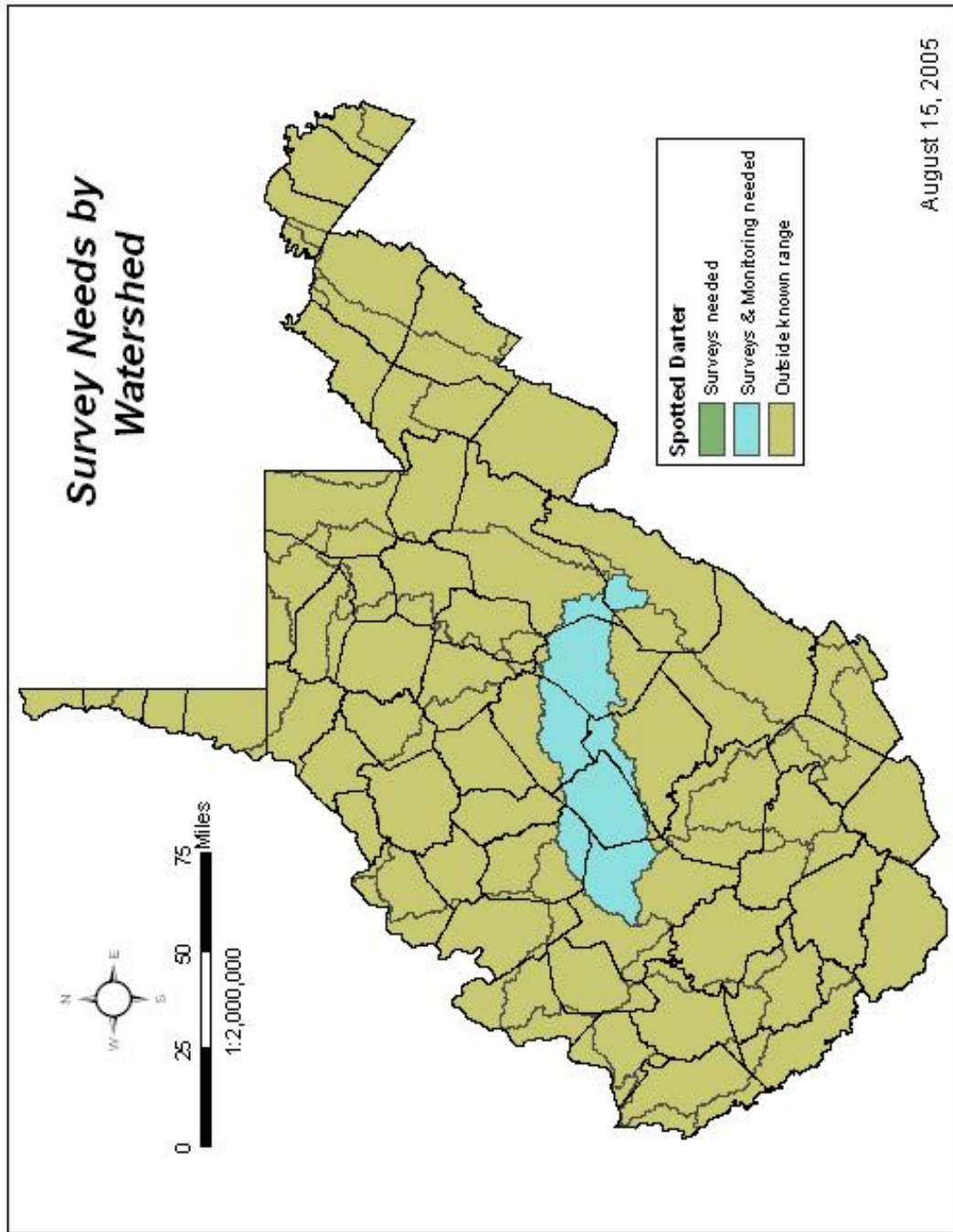
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) on Spotted Darter streams.
- Educate students, teachers and citizens to the importance of stream fishes through presentations, pamphlets, etc.

Legislation:

- Enforce rules regarding the transportation and release of fishes between watersheds.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

- Cincotta, Dan. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.
- Cincotta, D.A.1990. Fishes. Pages vi-34A in J. Crum, editor. *Vertebrate Species of Concern*. WV Division of Natural Resources, Charleston.
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- Welsh, Stuart. 2005. Personal Communication. West Virginia University Cooperative Fish and Wildlife Unit, Morgantown, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Fishes

Common Name: Slenderhead Darter

Scientific name: *Percina phoxacephala*

STATUS

The ranks and information in the chart below indicate the rarity of the West Virginia Slenderhead Darter population. This species is listed as rare and a species of concern for West Virginia because of the scant data available for the species (5 records total). It is known from only Middle Island Creek and the main channel Ohio River and certain tributaries of the Ohio River.

Priority Group	Global Rank	State Rank	Trend
1*	G5	S1	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Slenderhead Darter into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether the sites are in public or private ownership.

Habitat: This species' preferred habitat is somewhat variable. The literature describes it as generally found in the fast currents of clean-swept rocky riffles. However, in West Virginia, it is usually collected from slack water and low-gradient streams and rivers. Apparently, this darter is moderately tolerant of silty and turbid conditions.

Watershed	Site Name	Record Type	Ownership
Ohio River	Ohio River and minor tributaries	Recent	Private
Middle Island Creek	Middle Island Creek	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Slenderhead Darter. Because there is inadequate information on the distribution and status of the Slenderhead Darter in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Slenderhead Darter.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled into a database.	Compile existing data and enter it into a database.
	Public access to general fish information.	Develop and maintain a WV Fish Atlas.
		Complete an update of the <i>Fishes of West Virginia</i> .
	Provide general fish data, such as distribution maps, on the internet.	

Category	Need	Action
Surveys	Determine distribution and status in the state.	Survey historic and potential sites in the Western Allegheny Plateau.
	Determine length of stream occupied at each recent occurrence.	Evaluate habitat and determine what may separate populations within the same river system.

Category	Need	Action
Monitoring	Long-term monitoring.	Identify and prioritize monitoring sites.
		Monitor chosen sites to determine status of population and any changes to habitat.

Category	Need	Action
Research	Life history.	Identify and prioritize research needs, develop prospecti and solicit contractual research studies.
	Survey methods.	Determine most effective survey method for each habitat type.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Slenderhead Darter and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition,
Forest Health	Coordination, Education, Management, Restoration, Acquisition
Water Quantity and Quality	Coordination, Education, Management, Legislation/Regulation, Restoration
Over Collection	Legislation/Regulation, Education
Management Conflicts	Coordination
Invasive Species	Management, Education, Legislation/Regulation, Coordination, Restoration
Damaging Recreation	Education, Coordination, Acquisition, Legislation/Regulation
Data Protection	Legislation/Regulation

Selected Actions for the Conservation of the Slenderhead Darter and Its Habitat

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Compile existing data and enter it into a database.
- Develop and maintain a WV Fish Atlas.

Surveys:

- Survey historic and potential sites in the Western Allegheny Plateau.

Monitoring:

- Identify and prioritize potential monitoring sites.

Research:

- Determine most effective survey method for each habitat type.

Coordination:

- Work with forest landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in streams of the Western Allegheny Plateau. This includes encouraging the use of Best Management Practices when timbering or engaged in impacting activities.
- Assess effects of possible dam construction on rivers and streams as projects may arise.
- Mitigate for impacts of development activities in watersheds supporting Slenderhead Darters.

Education:

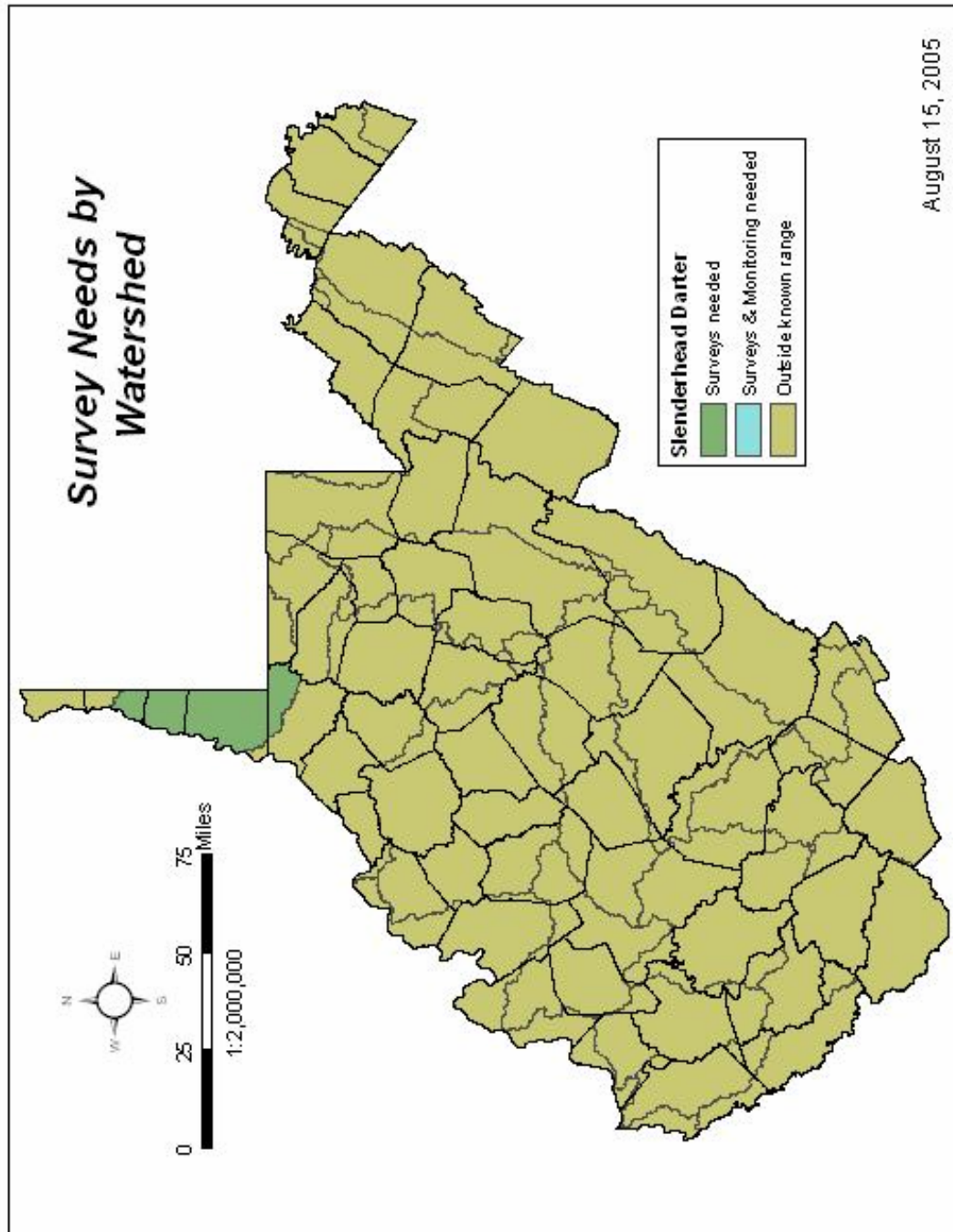
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) in watersheds supporting Slenderhead Darters.
- Educate students, teachers and citizens to the importance of stream fishes through presentations, pamphlets, etc.

Legislation/Regulation:

- Enforce rules regarding the transportation and release of fishes between watersheds.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

- Cincotta, Dan. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.
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- Thompson, B.A. 1980. *Percina phoxocephala* (Nelson), Slenderhead Darter. Page 737 in D.S. Lee et al., editors. *Atlas of North American Freshwater Fishes*. North Carolina State Museum of Natural History, Raleigh.
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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Fishes

Common Name: Northern Brook Lamprey

Scientific name: *Ichthyomyzon fossor*

STATUS

The ranks and information in the chart below indicate the rarity of the West Virginia Northern Brook Lamprey population. This species is listed as rare and a species of concern for West Virginia because of the scant data available for the species (1 historic record). It is known only from the Elk River.

Priority Group	Global Rank	State Rank	NE Tech Comm.	Trend
1*	G4	S1	X	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places the known occurrence of the Northern Brook Lamprey into a watershed, gives the age of the record (recent is within 20 years) and indicates whether the site is under public or private ownership.

Habitat: Ammocoetes live in mud or sandy banks in small creeks. Adults spawn in clean, rocky riffles.

Watershed	Site Name	Record Type	Ownership
Elk River	Elk River	Historic	Public

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Northern Brook Lamprey. Because there is inadequate information on the distribution and status of the Northern Brook Lamprey in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Northern Brook Lamprey.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled into a database.	Compile existing data and enter it into a database.
	Public access to general fish information.	Develop and maintain a WV Fish Atlas.
		Complete an update of the <i>Fishes of West Virginia</i> .
	Provide general fish data, such as distribution maps, on the internet.	

Category	Need	Action
Surveys	Determine distribution and status in the state.	Conduct surveys of historical sites and survey potential habitat elsewhere.
	Determine length of stream occupied at each recent occurrence.	Evaluate habitat and determine what may separate populations within the same river system.

Category	Need	Action
Monitoring	Long-term monitoring.	Identify and prioritize monitoring sites.
		Monitor chosen sites to determine status of population and any changes in habitat.

Category	Need	Action
Research	Life history.	All aspects are needed (little research has been done on this species).
	Survey methods.	Identify most effective survey method for each habitat type.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Northern Brook Lamprey and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition,
Forest Health	Coordination, Education, Management, Restoration, Acquisition
Water Quantity and Quality	Coordination, Education, Management, Legislation/Regulation, Restoration
Over Collection	Legislation/Regulation, Education
Management Conflicts	Coordination
Invasive Species	Management, Education, Legislation/Regulation, Coordination, Restoration
Damaging Recreation	Education, Coordination, Acquisition, Legislation/Regulation
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE NORTHERN BROOK LAMPREY AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Compile existing data and enter it into a database.
- Develop and maintain a WV Fish Atlas.

Surveys:

- Conduct surveys of the historical sites in the Elk River and other potential habitat.

Research:

- Determine most effective survey method for each habitat type.

Coordination:

- Work with forest landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in the Elk River watershed. This includes encouraging the use of Best Management Practices when timbering or conducting other impacting activities.
- Assess effects of possible dam construction on rivers and streams as projects may arise.
- Mitigate for impacts of mining and other development activities in the Elk River watershed.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) in the Elk River.
- Educate students, teachers and citizens to the importance of stream fishes through presentations, pamphlets, etc.

Legislation/Regulation:

- Enforce rules regarding the transportation and release of fishes between watersheds.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

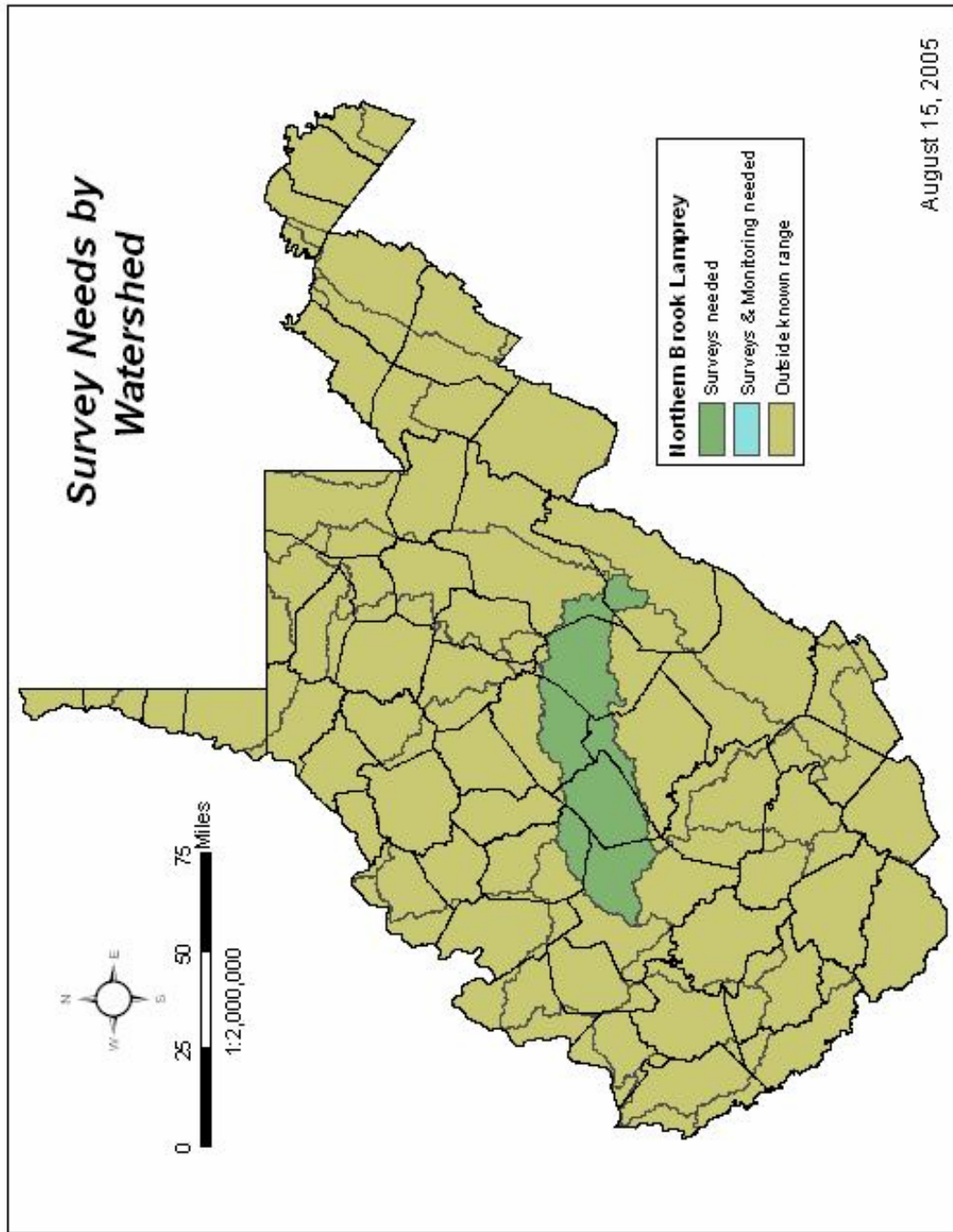
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Welsh, Stuart. 2005. Personal Communication. West Virginia University Cooperative Fish and Wildlife Unit, Morgantown, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Fishes

Common Name: Popeye Shiner

Scientific name: *Notropis ariommus*

STATUS

The ranks and information in the chart below indicate the rarity of the West Virginia Popeye Shiner population. This species is found sporadically in major tributaries of the lower Kanawha River and the main channel of the Cheat River.

Priority Group	Global Rank	State Rank	Jeff Forest	Trend
2*	G3	S2	X	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Popeye Shiner into watersheds, gives the ages of records (recent is within 20 years) and indicates whether sites are in public or private ownership.

Habitat: The Popeye Shiner is usually found in warm streams and mid-size rivers of moderate gradient.

Watershed	Site Name	Record Type	Ownership
Coal River	Coal River	Historic	Private
Elk River	Elk River	Recent	Private
Cheat River	Cheat River	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Popeye Shiner. Because there is inadequate information on the distribution and status of the Popeye Shiner in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Popeye Shiner.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled into a database.	Compile existing data and enter into a database.
	Public access to general fish information	Develop and maintain a WV Fish Atlas and publish.
		Complete an update of the <i>Fishes of West Virginia</i> .
		Provide general fish data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Determine distribution and status in the state.	Conduct surveys of historical sites and other sites with potential habitat.
	Determine length of stream occupied at each recent occurrence.	Evaluate habitat and determine what may separate populations within the same river system.

Category	Need	Action
Monitoring	Long-term monitoring.	Identify and prioritize monitoring sites.
		Monitor chosen sites to determine status of population and any changes to habitat.

Category	Need	Action
Research	Life history.	Identify and prioritize research needs, develop prospecti, and solicit contractual studies.
	Survey methods.	Determine most effective survey method for each habitat type.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Popeye Shiner and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition,
Forest Health	Coordination, Education, Management, Restoration, Acquisition
Water Quantity and Quality	Coordination, Education, Management, Legislation/Regulation, Restoration
Over Collection	Legislation/Regulation, Education
Management Conflicts	Coordination
Invasive Species	Management, Education, Legislation/Regulation, Coordination, Restoration
Damaging Recreation	Education, Coordination, Acquisition, Legislation/Regulation
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE POPEYE SHINER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Compile existing data and enter into a database.
- Develop and maintain to a WV Fish Atlas and publish.

Surveys:

- Conduct surveys of historical sites and other sites with potential habitat.

Monitoring:

- Identify and prioritize monitoring sites.

Research:

- Determine most effective survey method for each habitat type

Coordination:

- Work with forest landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in occupied watersheds. This includes encouraging the use of Best Management Practices when timbering or engaging in other impacting activities.
- Assess effects of possible dam construction on rivers and streams as projects may arise.
- Mitigate for impacts of mining and other development activities in occupied watersheds.

Education:

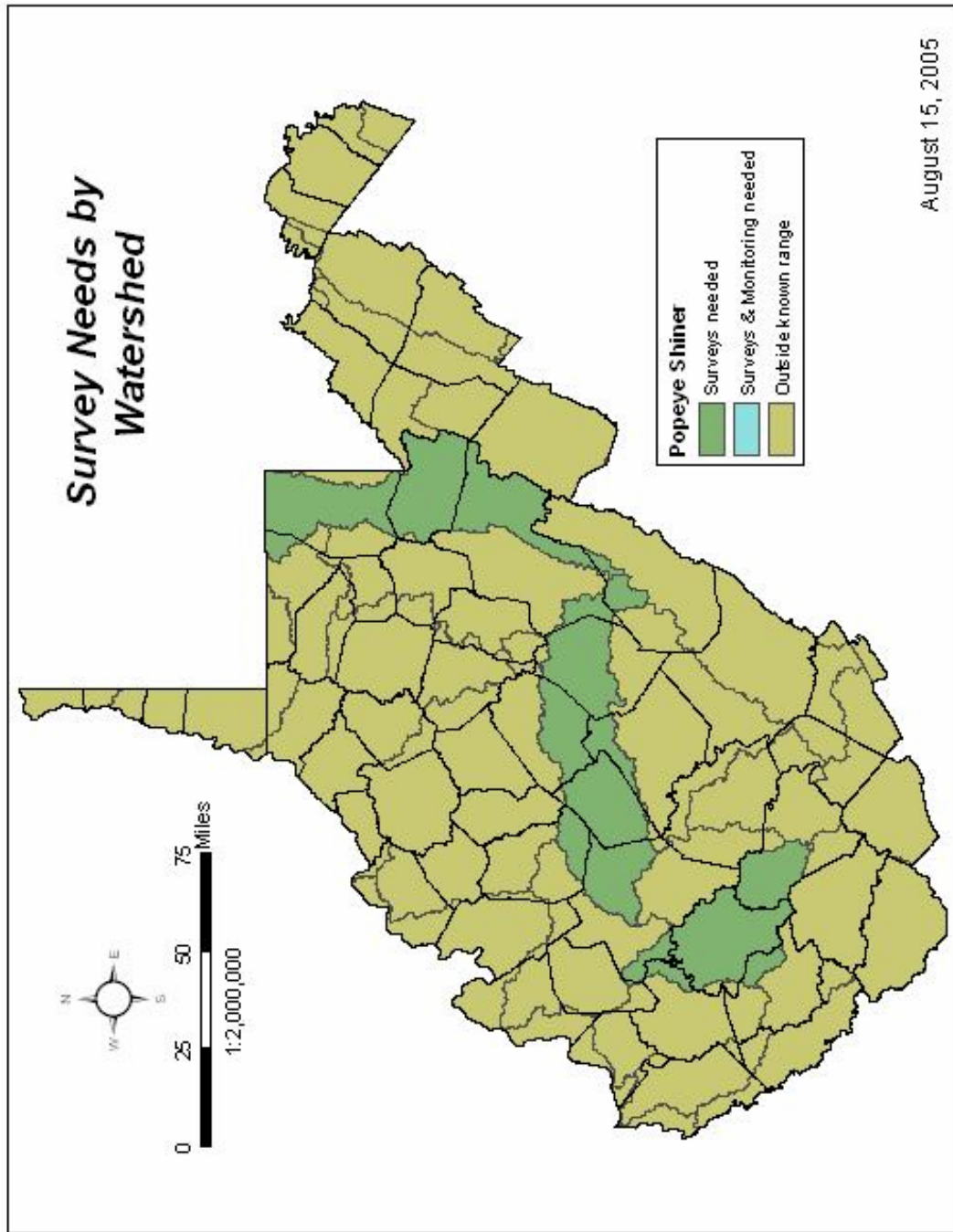
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) in occupied watersheds.
- Educate students, teachers and citizens to the importance of stream fishes through presentations, pamphlets, etc. Include the detrimental effects of competitive invasive species in educational outreach.

Legislation/Regulation:

- Enforce rules regarding the transportation and release of fishes between watersheds.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

- Cincotta, Dan. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.
- Cincotta, D.A.1990. *Fishes*. Pages vi-34A in J. Crum, editor. *Vertebrate Species of Concern*. WV Division of Natural Resources, Charleston.
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- Welsh, Stuart. 2005. Personal Communication. West Virginia University Cooperative Fish and Wildlife Unit, Morgantown, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Fishes

Common Name: Paddlefish

Scientific name: *Polyodon spathula*

STATUS

The ranks and information in the chart below indicate the status of the Paddlefish in West Virginia. Historically, paddlefish were found along the entire portion of the Ohio River within West Virginia, and in the Monongahela, Kanawha, Little Kanawha and Elk rivers. Over the last 100 years, populations have declined in all historically inhabited water bodies due to degraded water quality and habitat, as well as commercial exploitation. In the late 1990s this resulted in only the lower reaches of the Ohio River in West Virginia supporting a reproducing Paddlefish population.

Priority Group	Global Rank	State Rank	AFS	Trend
1*	G5	SX	SC	Extirpated

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of the Paddlefish into watersheds, gives the ages of records (recent is within 20 years) and indicates whether sites are in public or private ownership.

Habitat: The Paddlefish is a big-river species, usually occurring in backwaters, pools and oxbows. Adults remain in low gradient areas until spawning season, then they migrate upstream to gravel bar areas submerged by high spring waters. Since most of the Ohio is dammed, the only remaining spawning habitat is the tailraces of the dams when gravel bars are present.

Watershed	Record Type
Ohio	Historic
Kanawha	Historic
Monongahela	Historic
Little Kanawha	Historic
Elk	Historic

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the reestablishment and consequent conservation of the Paddlefish.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled.	Compile existing data and integrate it into the agency database.
	Provide public access to general fish information.	Develop and establish a WV Fish Atlas.
		Complete an update of the <i>Fishes of West Virginia</i> .
	Provide general fish data, such as distribution maps, on the internet.	

Category	Need	Action
Surveys	Surveys are needed for monitoring of introduced populations.	Paddlefish will be surveyed using gill nets in reaches that have received sturgeon introductions.

Category	Need	Action
Monitoring	Develop a long-term monitoring protocol.	Establish long-term monitoring sites.
		Mark stocked fish with passive integrated transponder (PIT) tags.
		Monitor sites to determine status of population and changes to habitat.

Category	Need	Action
Research	Life history information.	Establish priority list of research needs and implement high priority studies.
	Efficient, effective monitoring methods	Research, develop and implement an appropriate monitoring methodology.

Category	Need	Action
Reintroduction	Reestablish species in the Ohio and Kanawha Rivers	Determine a source for eggs or fingerlings.
		Rear young at Palestine and Apple Grove State Fish Hatcheries.
		Annually introduce approximately 1,000 fish in the Ohio and Kanawha rivers.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Paddlefish and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition
Forest Health	
Water Quantity and Quality	Coordination, Education, Legislation/Regulation, Management, Restoration
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	Legislation/Regulation, Education
Data Protection	

SELECTED ACTIONS FOR THE CONSERVATION OF THE PADDLEFISH AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to reestablish and conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge of the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Compile existing data and integrate it into the agency database.

Surveys:

- Paddlefish will be surveyed using gill nets in reaches that have received sturgeon introductions.

Monitoring:

- Establish long-term monitoring sites.
- Mark stocked fish with passive integrated transponder (PIT) tags.
- Monitor sites to determine status of population and changes to habitat.

Research:

- Research, develop and implement an appropriate monitoring methodology.

Reintroduction:

- Determine a source for eggs or fingerlings.
- Rear young at Palestine and Apple Grove State Fish Hatcheries.
- Annually introduce approximately 1,000 fish in the Ohio and Kanawha rivers.

Coordination:

- Work with management agencies so that all are aware of the reintroduction effort and will work cooperatively to avoid detrimental activities in the Ohio and Lower Kanawha rivers.

Education:

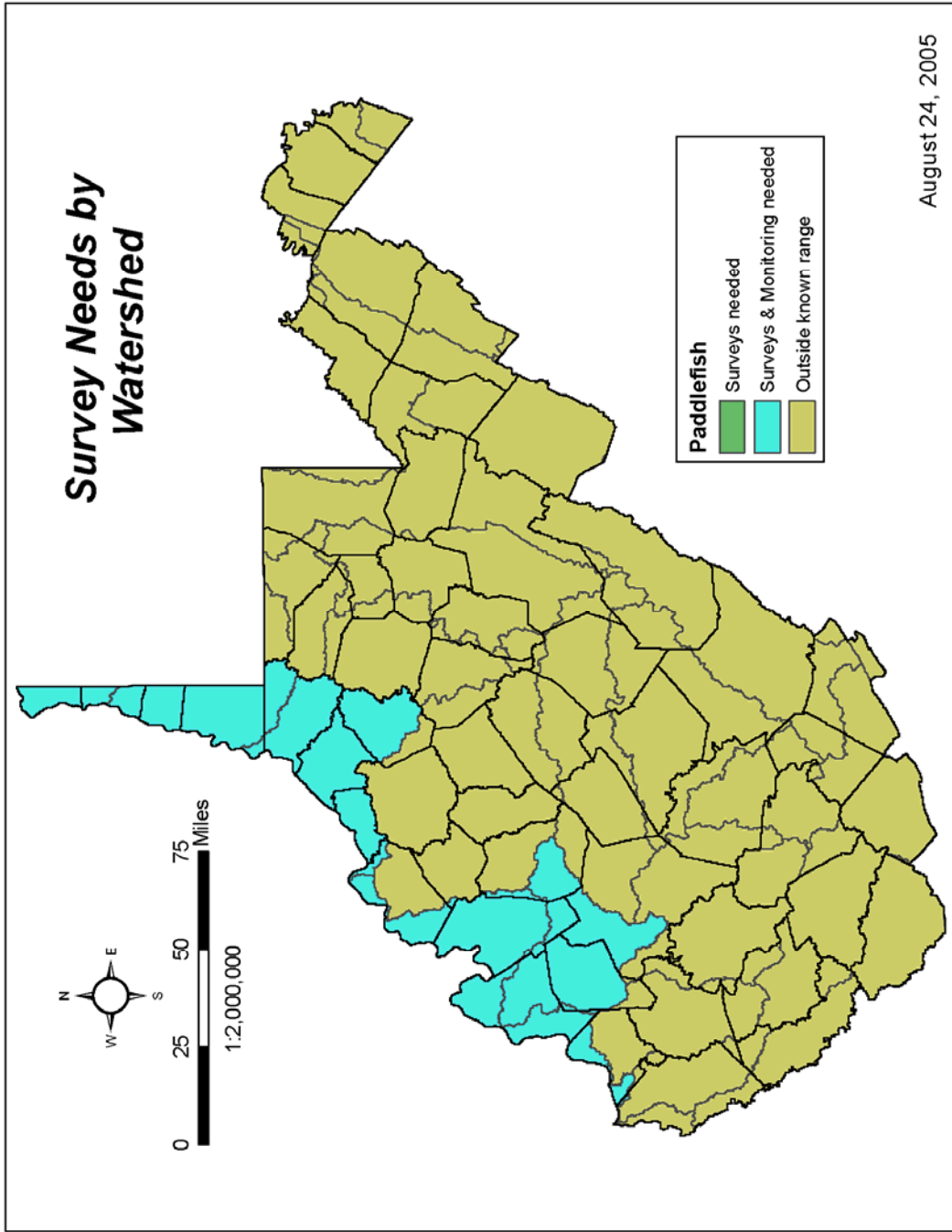
- Conduct presentations and create an educational pamphlet outlining the reintroduction effort.
- Educate anglers about the program so they will immediately return to the water any Paddlefish caught.

Legislation/Regulation:

- Maintain Paddlefish as a no creel limit and no possession fish species.

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- Cincotta, D.A. 1990. *Fishes*. Pages vi-34A in J. Crum, editor. *Vertebrate Species of Concern*. WV Division of Natural Resources, Charleston.
- O'Bara, Chris. 2005. Paddlefish Restoration Plan. West Virginia Division of Natural Resources, Wildlife Section, Warmwater Fisheries Program.
- Stauffer, J. R., Jr., J.M. Boltz, L.R. White. 1995. *The Fishes of West Virginia*. Proceedings of the Academy of Natural Sciences of Philadelphia 146:1-389.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Fishes

Common Name: Stripeback Darter

Scientific name: *Percina notogramma*

STATUS

The ranks and information in the chart below indicate the rarity of the West Virginia Stripeback Darter population. This species is listed as rare and a species of concern for West Virginia because of the inadequate data concerning Stripeback Darter's natural history and distribution across a limited range. The Potts Creek record in the James River (Atlantic slope) is the only known location in West Virginia.

Priority Group	Global Rank	State Rank	Trend
1*	G4	S1	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Stripeback Darter into a watershed, gives the age of the record (recent is within 20 years) and indicates whether the site is in public or private ownership.

Habitat: Stripeback Darters are typically found in warm, clean waters of moderate gradient streams and medium size rivers.

Watershed	Site Name	Record Type	Ownership
James River	Potts Creek	Historic	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Stripeback Darter. Because there is inadequate information on the distribution and status of the Stripeback Darter in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Stripeback Darter.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled into a database.	Compile existing data and enter it into Biotics.
	Public access to general fish information.	Develop and maintain a WV Fish Atlas.
		Complete an update of the <i>Fishes of West Virginia</i> .
	Provide general fish data, such as distribution maps, on the internet.	

Category	Need	Action
Surveys	Determine distribution and status in the state.	Conduct surveys of historical sites and other sites with potential habitat.
	Determine length of stream occupied at each recent occurrence.	Evaluate habitat and determine what may separate populations within the same river system.

Category	Need	Action
Monitoring	Long-term monitoring.	Select monitoring sites and initiate regular surveys.
		Identify and prioritize sites and implement monitoring to determine status of population and any changes to habitat.

Category	Need	Action
Research	Life history	Identify and prioritize by life history research needs, develop prospecti and solicit studies from contractors.
	Survey methods	Determine most effective survey method for each habitat type.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Stripeback Darter and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition,
Forest Health	Coordination, Education, Management, Restoration, Acquisition
Water Quantity and Quality	Coordination, Education, Management, Legislation/Regulation, Restoration
Over Collection	Legislation/Regulation, Education
Management Conflicts	Coordination
Invasive Species	Management, Education, Legislation/Regulation, Coordination, Restoration
Damaging Recreation	Education, Coordination, Acquisition, Legislation/Regulation
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE STRIPEBACK DARTER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Compile existing data and enter into Biotics.
- Develop and maintain a WV Fish Atlas.

Surveys:

- Conduct surveys of historical sites and other sites with potential habitat.

Research:

- Identify and prioritize research needs, develop prospecti and solicit contracts.
- Determine most effective survey method for each habitat type.

Monitoring:

- Select monitoring sites and initiate regular surveys.

Coordination:

- Work with forest landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in watersheds harboring this species. This includes encouraging the use of Best Management Practices when timbering and for agriculture.
- Assess effects of possible dam construction on rivers and streams as projects may arise.
- Mitigate for impacts of development activities in the occupied watersheds.

Education:

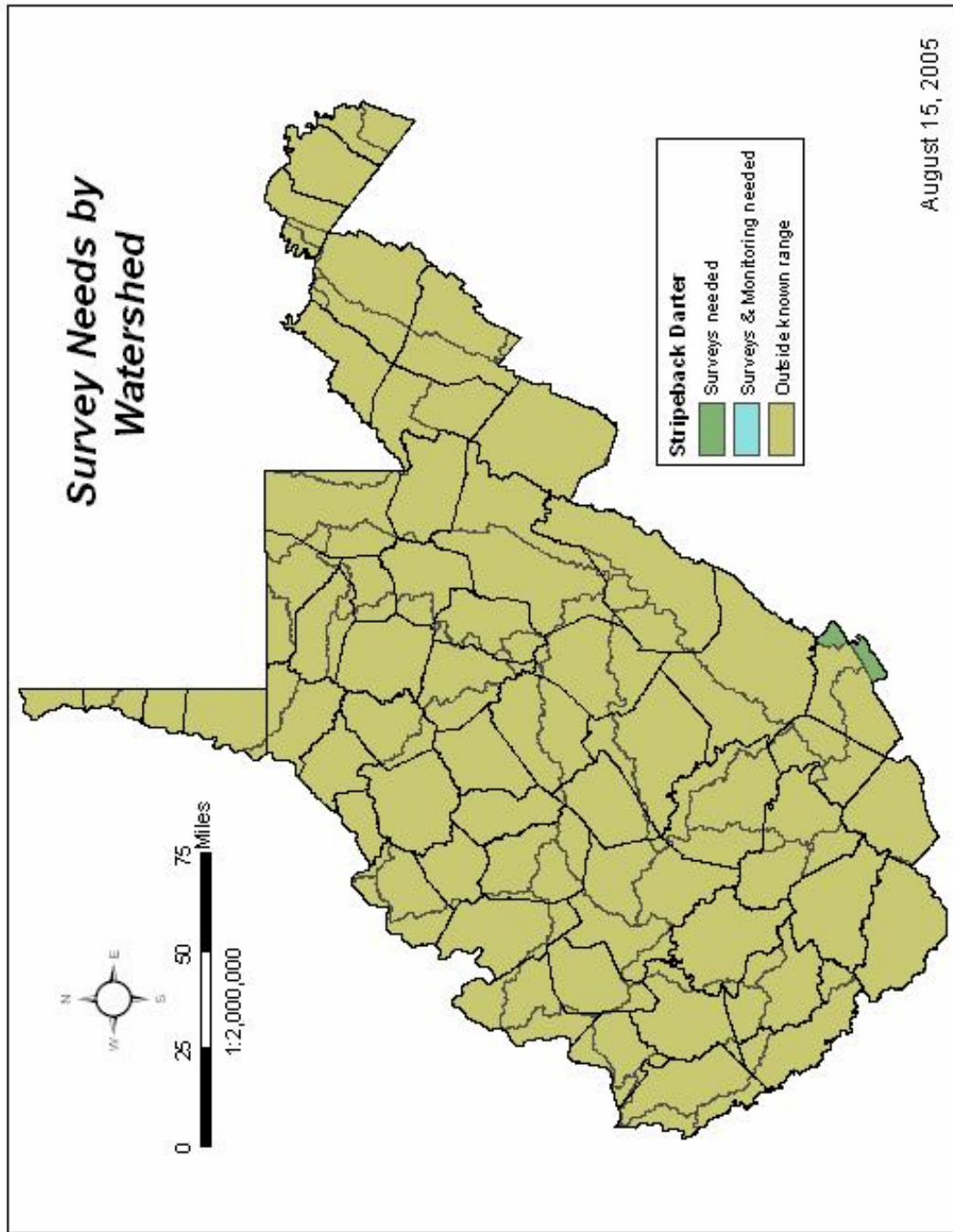
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) in occupied watersheds.
- Educate students, teachers and citizens to the importance of stream fishes through presentations, pamphlets, etc.

Legislation/Regulation:

- Enforce rules regarding the transportation and release of fishes between watersheds.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

- Cincotta, Dan. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.
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- Welsh, Stuart. 2005. Personal Communication. West Virginia University Cooperative Fish and Wildlife Unit, Morgantown, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Fishes

Common Name: Candy Darter

Scientific name: *Etheostoma osburni*

STATUS

The ranks and information in the chart below indicate the rarity of the West Virginia Candy Darter population. This species is endemic to the New River drainage of the upper Kanawha River in Virginia and West Virginia. Populations have been seriously reduced in Virginia and West Virginia. The WVDNR, American Fisheries Society and the US Fish & Wildlife Service all classify the Candy Darter as a species of concern.

Priority Group	Global Rank	State Rank	USFWS	Mon Forest	Jeff Forest	IUCN Rank	NE Tech Comm.	AFS	Trend
1*	G3	S1	SC	X	X	LR/nt	X	SC	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Candy Darter into watersheds and gives the ages of records (recent is within 20 years) and indicates whether sites are under public or private ownership. Approximately 50 historic sites exist in WV streams.

Habitat: The Candy Darter is usually found in the riffles of small streams and medium sized rivers. Males typically inhabit rubble and boulder substrates in the fast riffles while the females prefer substrates with smaller materials in slower portions of the stream.

Watershed	Site Name	Record Type	Ownership
Gauley River	Gauley River Tributaries	Recent	Public/Private
Greenbrier River	Greenbrier River Tributaries	Recent	Public/Private
New River tributaries	Bluestone River and Indian Creek	Historic	Public/Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Candy Darter. Because there is inadequate information on the distribution and status of the Candy Darter in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Candy Darter.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data compiled into a database with coordinates.	Compile existing data and enter it into databases.
	Public access to general fish information.	Provide general fish data, such as distribution maps, on the internet. Develop and maintain a WV Fish Atlas.

Category	Need	Action
Surveys	Determine distribution and status in West Virginia.	Survey streams where it is thought to be extirpated and in other potential habitat.
	Determine length of stream occupied at each recent occurrence.	Evaluate habitat and identify barriers that would separate populations within the same river system.

Category	Need	Action
Monitoring	Long-term monitoring.	Identify and prioritize monitoring sites; implement regular surveys at selected sites.
		Monitor existing sites to determine status of population and changes to habitat.

Category	Need	Action
Research	Survey methods.	Determine most effective survey method for each habitat type.
	Life history.	Identify and prioritize research needs, develop prospecti and solicit contractual research studies.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Candy Darter and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition,
Forest Health	Coordination, Education, Management, Restoration, Acquisition
Water Quantity and Quality	Coordination, Education, Management, Legislation/Regulation, Restoration
Over Collection	Legislation/Regulation, Education
Management Conflicts	Coordination
Invasive Species	Management, Education, Legislation/Regulation, Coordination, Restoration
Damaging Recreation	Education, Coordination, Acquisition, Legislation/Regulation
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE CANDY DARTER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Compile existing data and enter it into a database.
- Develop and maintain a WV Fish Atlas.

Surveys:

- Survey streams where it is thought to be extirpated and in other potential habitat.

Monitoring:

- Identify and prioritize monitoring sites; implement regular surveys at selected sites.

Research:

- Determine most effective survey method for each habitat type.

Coordination:

- Work with forest landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in streams with Candy Darters. This may include limiting ATV use, encouraging use of Best Management Practices when timbering and other site related issues.
- Assess effects of possible dam construction on rivers and streams as projects may arise.
- Mitigate against impacts of mining and other development activities in the vicinity of Candy Darter streams.

Education:

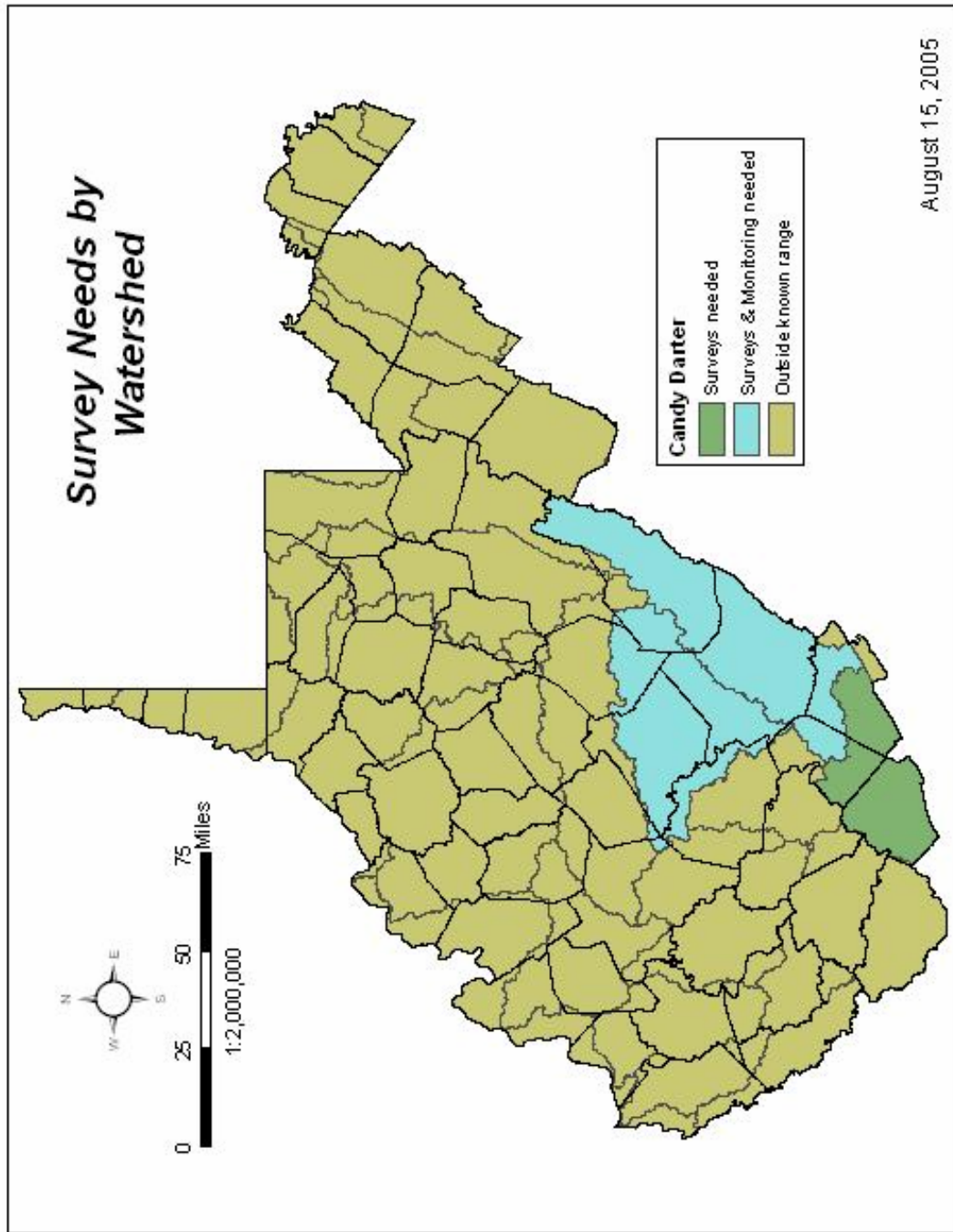
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) in rivers occupied by Candy Darters.
- Educate students, teachers, and citizens to the importance of stream fishes through presentations, pamphlets, etc.

Legislation:

- Enforce rules regarding the transportation and release of fishes between watersheds.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

- Cincotta, Dan. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.
- Cincotta, D.A.1990. *Fishes*. Pages vi-34A in J. Crum, editor. *Vertebrate Species of Concern*. WV Division of Natural Resources, Charleston.
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- Jenkins, R. E. and N. M. Burkhead. 1994. *Freshwater Fishes of Virginia*. American Fisheries Society, Bethesda, MD.1079pp.
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- Welsh, Stuart. 2005. Personal Communication. West Virginia University Cooperative Fish and Wildlife Unit, Morgantown, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Fishes

Common Name: Northern Madtom

Scientific name: *Noturus stigmosus*

STATUS

The ranks and information in the chart below indicate the rarity and trend of the West Virginia Northern Madtom. This species is listed as rare and a species of concern for West Virginia because of the scant data available for the species. Fewer than ten specimens have ever been collected.

Priority Group	Global Rank	State Rank	Trend
1*	G3	S1	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Northern Madtom into watersheds, gives the ages of records (recent is within 20 years) and indicates whether sites are in public or private ownership.

Habitat: The Northern Madtom is usually found in large streams to small rivers of moderate current with a substrate of shifting sand and mud.

Watershed	Site Name	Record Type	Ownership
Elk River	Elk River	Historic	Private
Lower Kanawha	Kanawha River Main Channel	Historic	Private
Tug Fork River	Tug Fork	Historic	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Northern Madtom. Because there is inadequate information on the distribution and status of the Northern Madtom in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements, and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Northern Madtom.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled into database.	Compile existing data and enter into the database.
	Public access to general fish information	Develop and maintain a WV Fish Atlas.
		Complete an update of the <i>Fishes of West Virginia</i> .
	Provide general fish data, such as distribution maps, on the internet.	

Category	Need	Action
Surveys	Determine distribution and status in the state.	Conduct surveys of historical sites and other sites with potential habitat.
	Determine length of stream occupied at each recent occurrence.	Evaluate habitat and determine what may separate populations within the same river system.

Category	Need	Action
Monitoring	Long-term monitoring.	Identify and prioritize monitoring sites.
		Monitor chosen sites to determine status of population and any changes to habitat.

Category	Need	Action
Research	Life history.	Identify and prioritize research needs, develop prospecti; and solicit contractual studies.
	Survey methods.	Determine most effective survey method for each habitat type.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Northern Madtom and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition,
Forest Health	Coordination, Education, Management, Restoration, Acquisition
Water Quantity and Quality	Coordination, Education, Management, Legislation/Regulation, Restoration
Over Collection	Legislation/Regulation, Education
Management Conflicts	Coordination
Invasive Species	Management, Education, Legislation/Regulation, Coordination, Restoration
Damaging Recreation	Education, Coordination, Acquisition, Legislation/Regulation
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE NORTHERN MADTOM AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Compile existing data and enter into the database.
- Develop and maintain a WV Fish Atlas and publish.

Surveys:

- Conduct surveys of historical and other sites with potential habitat.

Monitoring:

- Identify and prioritize monitoring sites.

Research:

- Identify and prioritize research needs, develop prospecti; and solicit contractual studies.
- Determine most effective survey method for each habitat type.

Coordination:

- Work with forest landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in watersheds supporting this species. This includes encouraging the use of Best Management Practices when timbering.
- Assess effects of possible dam construction on rivers and streams as projects may arise.
- Mitigate for impacts of development activities in the occupied watersheds.

Education:

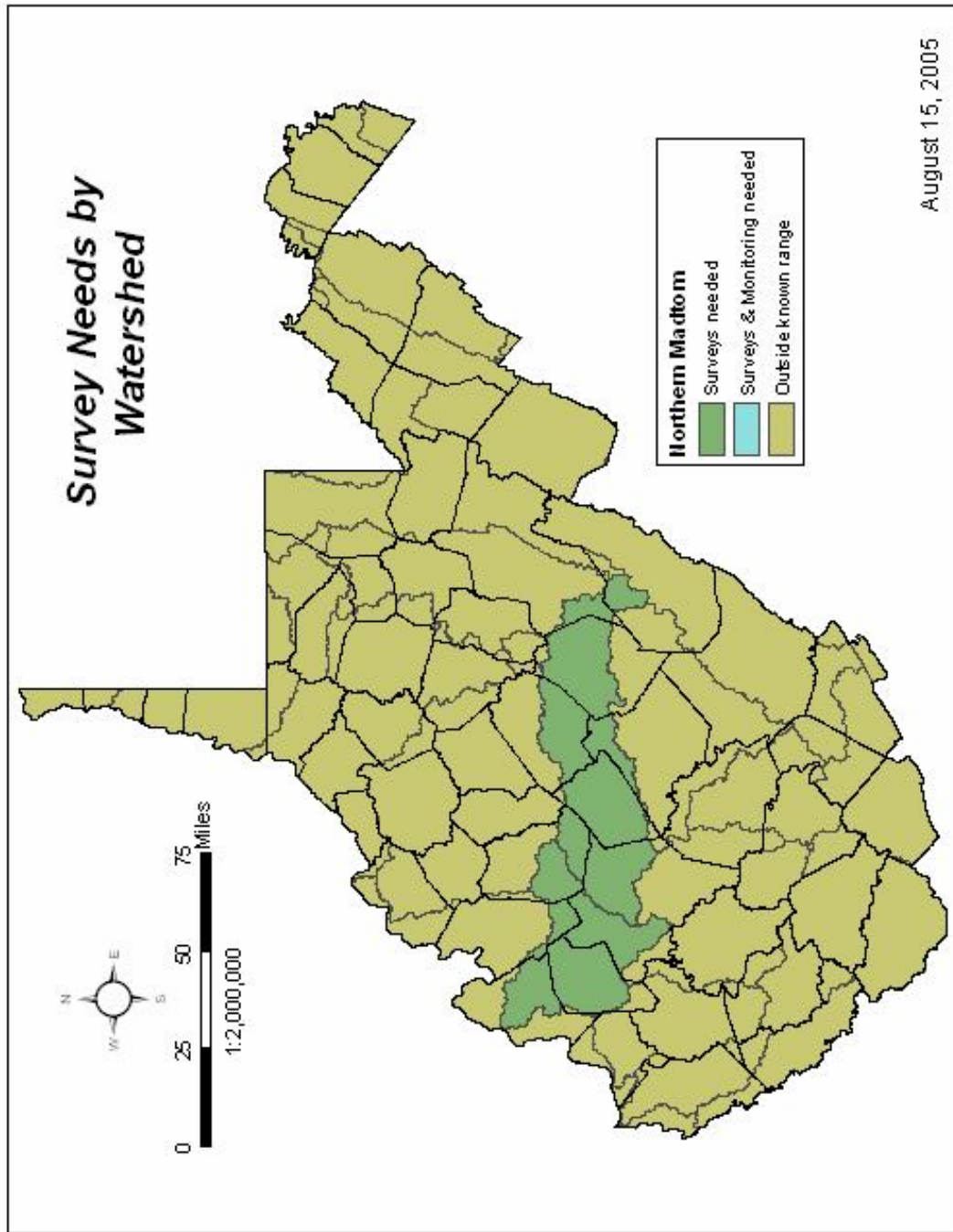
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) in occupied watersheds.
- Educate students, teachers and citizens to the importance of stream fishes through presentations, pamphlets, etc.

Legislation/Regulation:

- Enforce rules regarding the transportation and release of fishes between watersheds.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

- Cincotta, Dan. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.
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- Welsh, Stuart. 2005. Personal Communication. West Virginia University Cooperative Fish and Wildlife Unit, Morgantown, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Fishes

Ten fish groups are addressed in this fact sheet due to the similarity of needed actions for all of these fish species. Most have little distribution data and scant status information. Groups generally represent taxonomic and/or geographic similarity.

Group: Catfishes

STATUS

The ranks and information in the chart below indicate the rarity and status of Catfish Species in Greatest Need of Conservation in West Virginia.

Scientific Name	Common Name	Priority Group	Global Rank	State Rank	Trend
<i>Ameirus melas</i>	Black Bullhead	1*	G5	S1	Declining
<i>Noturus eleutherus</i>	Mountain Madtom	2	G4	S2	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of each Catfish species into watersheds and gives the ages of the records (recent is within 20 years). The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. The table also reflects what type of habitat each species utilizes.

Species	Watershed	Record Type	Habitat
<i>Ameirus melas</i>	Little Kanawha	Recent Historic	Creeks/Rivers
	Lower Ohio Valley		
	Middle Ohio Valley		
	Upper Ohio Valley		
	Twelve Pole		
	Coal		
	Lower Kanawha		
<i>Noturus eleutherus</i>	Ohio River	Recent Historic	Rivers
	Elk		
	Tug Fork		

Group: Sculpins

STATUS

The ranks and information in the chart below indicate the rarity and status of Sculpin Species in Greatest Need of Conservation in West Virginia.

Scientific Name	Common Name	Priority Group	Global Rank	State Rank	Trend
<i>Cottus carolinae kanawhae</i>	Kanawha Sculpin	1*	G5	S1	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of each Sculpin species into watersheds and gives the ages of the records (recent is within 20 years). The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. The table also reflects what type of habitat each species utilizes.

Species	Watershed	Record Type	Habitat
<i>Cottus carolinae kanawhae</i>	Upper New River	Recent Historic	Creeks/Rivers

Group: Lampreys

STATUS

The ranks and information in the chart below indicate the rarity and status of Lamprey Species in Greatest Need of Conservation in West Virginia.

Scientific Name	Common Name	Priority Group	Global Rank	State Rank	Trend
<i>Ichthyomyzon bdellium</i>	Ohio Lamprey	2*	G3G4	S2	Unknown
<i>Ichthyomyzon unicuspis</i>	Silver Lamprey	2	G5	S2	Unknown
<i>Lampetra appendix</i>	American Brook Lamprey	2	G4	S2	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of each Lamprey species into watersheds and gives the ages of the records (recent is within 20 years). The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. The table also reflects what type of habitat each species utilizes.

Species	Watershed	Record Type	Habitat
<i>Ichthyomyzon bdellium</i>	Ohio River	Recent Historic	Rivers
	Kanawha River		
	Little Kanawha River		
	Middle Island Creek		
	Elk River		
<i>Ichthyomyzon unicuspis</i>	Ohio River	Recent Historic	Rivers
	Lower Kanawha		
	Upper Kanawha		
<i>Lampetra appendix</i>	Ohio	Recent Historic	Creeks/Rivers
	Elk		
	Little Kanawha		
	Kanawha River		
	Coal		
	Guyandotte		
	Tug Fork		

Group: Sunfish

STATUS

The ranks and information in the chart below indicate the rarity and status of Sunfish Species in Greatest Need of Conservation in West Virginia.

Scientific Name	Common Name	Priority Group	Global Rank	State Rank	Trend
<i>Lepomis gulosus</i>	Warmouth	2*	G5	S2	Unknown
<i>Lepomis humilis</i>	Orangespotted Sunfish	2	G5	S2	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of each sunfish species into watersheds and gives the ages of the records (recent is within 20 years). The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. The table also reflects what type of habitat each species utilizes.

Species	Watershed	Record Type	Habitat
<i>Lepomis gulosus</i>	Ohio	Recent Historic	Rivers
	Kanawha		
	Monongahela		
	Guyandotte		
	Tug Fork		
<i>Lepomis humilis</i>	Ohio River	Recent Historic	Rivers

Group: Atlantic Slope Minnows

STATUS

The ranks and information in the chart below indicate the rarity and status of Atlantic Slope Minnow Species in Greatest Need of Conservation in West Virginia.

Scientific Name	Common Name	Priority Group	Global Rank	State Rank	Trend
<i>Cyprinella analostana</i>	Satinfin Shiner	1*	G5	S1	Declining
<i>Hybognathus regius</i>	Eastern Silvery Minnow	1	G5	S1	Declining
<i>Notropis amoenus</i>	Comely Shiner	2	G5	S2	Unknown
<i>Notropis procne</i>	Swallowtail Shiner	1	G5	S1	Unknown
<i>Exoglossum laurae</i> **	Tonguetied Minnow	2	G4	S2	Declining
<i>Luxilus cornutus</i> **	Common Shiner	2	G5	S2	Unknown
<i>Lythrurus ardens</i> **	Blueside Shiner	1	G5	S1	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

**Indicates minnows that also occur in Ohio drainages.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of each Atlantic Slope Minnow species into watersheds and gives the ages of the records (recent is within 20 years). The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. The table also reflects what type of habitat each species utilizes.

Species	Watershed	Record Type	Habitat
<i>Cyprinella analostana</i>	Potomac	Historic	Creeks/Rivers
<i>Hybognathus regius</i>	Potomac	Historic	Creeks/Rivers
<i>Notropis amoenus</i>	Potomac	Recent Historic	Creeks/Rivers
<i>Notropis procne</i>	Potomac	Recent Historic	Creeks/Rivers
<i>Exoglossum laurae</i>	Upper New River	Recent Historic	Creeks/Rivers
	Potts Creek		
<i>Luxilus cornutus</i>	Potomac	Recent Historic	Creeks/Rivers
	Potts Creek		
	New River		
<i>Lythrurus ardens</i>	Upper New River	Recent Historic	Creeks/Rivers
	Potts Creek		

Group: Ohio Drainage Minnows

STATUS

The ranks and information in the chart below indicate the rarity and status of Ohio Drainage Minnow Species in Greatest Need of Conservation in West Virginia.

Scientific Name	Common Name	Priority Group	Global Rank	State Rank	Trend
<i>Macrhybopsis hyostoma</i>	Shoal Chub	1*	G5	S1	Unknown
<i>Margariscus margarita</i>	Pearl Dace	1	G5	S1	Declining
<i>Notropis blennioides</i>	River Shiner	1	G5	S1	Unknown
<i>Notropis boops</i>	Bigeye Shiner	1	G5	S1	Unknown

<i>Notropis buchanani</i>	Ghost Shiner	2	G5	S2	Unknown
<i>Notropis scabriceps</i>	New River Shiner	1	G4	S1	Declining
<i>Pararhinichthys bowersi</i>	Cheat Minnow	1	G1G2Q	S1	Unknown
<i>Phoxinus erythrogaster</i>	Southern Redbelly Dace	2	G5	S2	Unknown
<i>Pimephales vigilax</i>	Bullhead Minnow	1	G5	S1	Unknown
<i>Exoglossum laurae</i> **	Tonguetied Minnow	2	G4	S2	Declining
<i>Luxilus cornutus</i> **	Common Shiner	2	G5	S2	Unknown
<i>Lythrurus ardens</i> **	Blueside Shiner	1	G5	S1	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

**Indicates minnows that also occur in Ohio drainages.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of each Ohio Drainage Minnow species into watersheds and gives the ages of the records (recent is within 20 years). The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. The table also reflects what type of habitat each species utilizes.

Species	Watershed	Record Type	Habitat
<i>Macrhybopsis hyostoma</i>	Ohio	Recent Historic	Rivers
	Kanawha		
	Guyandotte		
	Elk		
	Tug		
<i>Margariscus margarita</i>	Cheat	Recent Historic	Creeks/Headwaters
	Potomac		
<i>Notropis blennius</i>	Ohio	Recent Historic	Rivers
	Kanawha		
<i>Notropis boops</i>	Little Kanawha	Recent	Creeks/Rivers
<i>Notropis buchanani</i>	Ohio	Recent Historic	Rivers
	Kanawha		

	Coal		
	Little Kanawha		
	West Fork		
	Guyandotte		
<i>Notropis scabriceps</i>	Upper New River	Recent Historic	Creeks/Rivers
<i>Pararhinichthys bowersi</i>	Monongahela	Recent Historic	Creeks/Rivers
<i>Phoxinus erythrogaster</i>	Ohio	Recent Historic	Creeks/Rivers
	Kanawha		
	Coal		
	Guyandotte		
	Little Kanawha		
<i>Pimephales vigilax</i>	Ohio	Recent Historic	Rivers
	Kanawha		
	Little Kanawha		
<i>Exoglossum laurae</i>	Upper New River	Recent Historic	Creeks/Rivers
	Potts Creek		
<i>Luxilus cornutus</i>	Potomac	Recent Historic	Creeks/Rivers
	Potts		
	New River		
<i>Lythrurus ardens</i>	Upper New River	Recent Historic	Creeks/Rivers
	Potts Creek		

Group: Atlantic Slope Darters

STATUS

The ranks and information in the chart below indicate the rarity and status of Atlantic Slope Darter Species in Greatest Need of Conservation in West Virginia.

Scientific Name	Common Name	Priority Group	Global Rank	State Rank	Trend
<i>Etheostoma longimanum</i>	Longfin Darter	1*	G4	S1	Declining
<i>Etheostoma olmstedii</i>	Tessellated Darter	1	G5	S1	Unknown
<i>Percina peltata</i>	Shield Darter	1	G5	S1	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of each Atlantic Slope Darter species into watersheds and gives the ages of the records (recent is within 20 years). The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. The table also reflects what type of habitat each species utilizes.

Species	Watershed	Record Type	Habitat
<i>Etheostoma longimanum</i>	Potts Creek	Recent Historic	Creeks/Rivers
<i>Etheostoma olmstedii</i>	Potomac	Recent Historic	Creeks/Rivers
<i>Percina peltata</i>	Shenandoah	Historic	Creeks/Rivers

Group: Ohio Drainage Darters

STATUS

The ranks and information in the chart below indicate the rarity and status of Ohio Drainage Darter Species in Greatest Need of Conservation in West Virginia.

Scientific Name	Common Name	Priority Group	Global Rank	State Rank	Trend
<i>Crystallaria asprella</i>	Crystal Darter	1*	G3G4	S1	Unknown
<i>Etheostoma maculatum</i>	Spotted Darter	1	G2	S1	Unknown
<i>Etheostoma osburni</i>	Candy Darter	1	G3	S1	Declining

<i>Etheostoma pellucidum</i>	Eastern Sand Darter	2	G3	S2	Unknown
<i>Etheostoma tippecanoe</i>	Tippecanoe Darter	2	G3G4	S2	Unknown
<i>Percina copelandi</i>	Channel Darter	2	G4	S2	Unknown
<i>Percina evides</i>	Gilt Darter	2	G4	S2	Unknown
<i>Percina gymnocephala</i>	Appalachia Darter	1	G4	S1	Declining
<i>Percina macrocephala</i>	Longhead Darter	2	G3	S2	Unknown
<i>Percina phoxocephala</i>	Slenderhead Darter	1	G5	S1	Unknown
<i>Percina sciera</i>	Dusky Darter	2	G5	S2	Declining
<i>Percina shumardi</i>	River Darter	1	G5	S1	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of each Ohio Drainage Darter species into watersheds and gives the ages of the records (recent is within 20 years). The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. The table also reflects what type of habitat each species utilizes.

Species	Watershed	Record Type	Habitat
<i>Crystallaria asprella</i>	Elk	Recent Historic	Rivers
<i>Etheostoma maculatum</i>	Elk	Recent Historic	Rivers
<i>Etheostoma osburni</i>	Upper New	Recent Historic	Creeks/Rivers
<i>Etheostoma pellucidum</i>	Little Kanawha	Recent Historic	Rivers
	Elk		
	Coal		
	Guyandotte		
	Tug Fork		

<i>Etheostoma tippecanoe</i>	Elk	Recent Historic	Rivers
	Little Kanawha		
<i>Percina copelandi</i>	Ohio	Recent Historic	Rivers
	Little Kanawha		
	Elk		
	Kanawha		
	Guyandotte		
Tug Fork			
<i>Percina evides</i>	Elk	Recent Historic	Rivers
	Tug Fork		
<i>Percina gymnocephala</i>	Greenbrier	Recent Historic	Creeks/Rivers
	Gauley		
<i>Percina macrocephala</i>	Elk	Recent Historic	Rivers
<i>Percina phoxocephala</i>	Little Kanawha	Recent	Rivers
<i>Percina sciera</i>	Ohio	Recent Historic	Rivers
	Kanawha		
	Little Kanawha		
	Elk		
	Coal		
	Guyandotte		
	Tug Fork		
<i>Percina shumardi</i>	Ohio	Recent Historic	Rivers
	Little Kanawha		

Group: Suckers

STATUS

The ranks and information in the chart below indicate the rarity and status of Sucker Species in Greatest Need of Conservation in West Virginia.

Scientific Name	Common Name	Priority Group	Global Rank	State Rank	Trend
<i>Carpionides carpio</i>	River Carpsucker	2*	G5	S2	Increasing
<i>Carpionides velifer</i>	Highfin Carpsucker	1	G4G5	S1	Unknown
<i>Cycleptus elongatus</i>	Blue Sucker	1	G3G4	S1	Declining
<i>Erimyzon oblongus</i>	Creek Chubsucker	1	G5	S1	Unknown

<i>Ictiobus cyprinellus</i>	Bigmouth Buffalo	1	G5	S1	Unknown
<i>Ictiobus niger</i>	Black Buffalo	1	G5	S1	Unknown
<i>Moxostoma carinatum</i>	River Redhorse	2	G4	S2	Unknown
<i>Thoburnia routhoeca</i>	Torrent Sucker	2	G4	S2	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of each Sucker species into watersheds and gives the ages of the records (recent is within 20 years). The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. The table also reflects what type of habitat each species utilizes.

Species	Watershed	Record Type	Habitat
<i>Carpionides carpio</i>	Ohio	Recent Historic	Rivers
	Kanawha		
	Coal		
	Guyandotte		
	Tug		
	West Fork		
<i>Carpionides velifer</i>	Ohio	Recent Historic	Rivers
	Little Kanawha		
	Kanawha		
	Coal		
	Guyandotte		
	Tug Fork		
<i>Cycleptus elongatus</i>	Ohio River	Recent	Rivers
<i>Erimyzon oblongus</i>	Potomac	Recent Historic	Creeks/Rivers
<i>Ictiobus cyprinellus</i>	Ohio River	Recent Historic	Rivers
	Little Kanawha River		

<i>Ictiobus niger</i>	Ohio River	Recent Historic	Rivers
	Kanawha		
	Coal		
<i>Moxostoma carinatum</i>	Ohio	Recent Historic	Rivers
	Little Kanawha		
	Elk		
	Kanawha		
	Coal		
	Guyandotte		
	Tug Fork		
<i>Thoburnia rhothoea</i>	Potomac	Recent Historic	Creeks/Rivers
	Potts		

Group: Fish families with single representatives

STATUS

The ranks and information in the chart below indicate the rarity and status Fish Species in Greatest Need of Conservation in West Virginia.

Scientific Name	Common Name	Priority Group	Global Rank	State Rank	Trend
<i>Anguilla rostrata</i>	American Eel	1*	G5	S1	Declining
<i>Esox americanus vermiculatus</i>	Grass Pickerel	1	G5T5	S1	Unknown
<i>Fundulus diaphanus</i>	Banded Killifish	1	G5	S1	Unknown
<i>Hiodon alosoides</i>	Goldeye	1	G5	S1	Declining
<i>Umbra limi</i>	Central Mudminnow	1	G5	S1	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of single species Fish families into watersheds and gives the ages of the records (recent is within 20 years). The number of records

is not indicated in this table. Each watershed listed may have more than one record for the species. The table also reflects what type of habitat each species utilizes.

Species	Watershed	Record Type	Habitat
<i>Anguilla rostrata</i>	Ohio River	Recent Historic	Creeks/Rivers
	Potomac		
<i>Esox americanus vermiculatus</i>	Ohio	Historic	Creeks/Rivers
<i>Fundulus diaphanus</i>	Ohio River	Recent Historic	Creeks/Rivers
	Potomac		
<i>Hiodon alosoides</i>	Ohio	Recent Historic	Rivers
	Kanawha		
<i>Umbra limi</i>	Ohio River	Recent Historic	Creeks/Rivers

DECISION MAKING PROCESS – NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of fishes in the state. Because there is inadequate information on the distribution and status of these various fishes in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of Fishes in Greatest Need of Conservation.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Synthesize distribution data.	Compile all available data and enter the information into Biotics.
	Collect all future data in a standardized format.	Develop standardized survey site and species forms.
	Synthesize ecological and life history data.	Gather data and incorporate it into a new <i>Fishes of West Virginia</i>.

Category	Need	Action
Surveys	Provide public access to general fish information.	Complete an update on the <i>Fishes of West Virginia</i> .
	Examine population status.	Survey historic and new sites in appropriate habitat for each species.
	Examine habitat availability.	Design and implement studies that outline habitat parameters for each species.

Category	Need	Action
Monitoring	Long-term species monitoring for population trend assessment.	Design and implement standardized monitoring protocols for estimating population size and habitat health.

Category	Need	Action
Research	Fill information gaps on ecology and life history aspects pertaining to WV populations.	Coordinate research projects with researchers.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Fish Species and their habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition
Forest Health	Coordination, Education
Water Quantity and Quality	Coordination, Education, Legislation/Regulation, Management, Restoration
Over Collection	Legislation/Regulation, Education
Management Conflicts	Coordination
Invasive Species	Management, Education, Legislation/Regulation, Coordination, Restoration
Damaging Recreation	Legislation/Regulation, Education
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF FISH SPECIES AND THEIR HABITATS

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve these species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Develop standardized site and species survey forms.
- Compile existing data and enter into Biotics.
- Add data to a WV Fish Atlas and publish.

Surveys:

- Survey historic and new sites in appropriate habitat for each species.

Research:

- Coordinate research projects with researchers.

Coordination:

- Work with forest landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in watersheds harboring these species. This includes encouraging the use of Best Management Practices when timbering.
- Assess effects of possible dam construction on rivers and streams as projects may arise.
- Mitigate against impacts of development activities in the occupied watersheds.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) in occupied watersheds.
- Educate students, teachers and citizens to the importance of stream fishes through presentations, pamphlets, etc.

Legislation/Regulation:

- Enforce rules regarding the transportation and release of Fishes between watersheds.
- Pass legislation to protect species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

Stauffer, J. R., J. M. Boltz, and L. R. White. 1995. *The Fishes of West Virginia*. Academy of Natural Sciences. Philadelphia, Pennsylvania.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.

Invertebrates

Invertebrates, all those animals without backbones, make up by far the greatest number of animal species in West Virginia. An acre of healthy West Virginia forest or field may have a population of over one million invertebrates. All are small, and most are inconspicuous so only a few groups are relatively well known, and these groups are mostly the colorful or economically important insects.

Insects comprise such an abundant group that they account for more than half the numbers of all living organisms on earth. Insects live on and in plants, caves, sun-parched cliffs, snow, soil, decaying vegetation, most mammals (including people), most birds and each other. Their very small size has contributed to their widespread distribution. They range in size from 1/100 of an inch long to over 13 inches long, with nearly half of all species less than a ¼ inch long.

In this state we have a fair knowledge of the butterflies, tiger beetles, damselflies and dragonflies, snails, mussels and a handful of other groups. There has been considerable interest in aquatic invertebrates as indicators of water quality and as important links in the food web that includes game fishes, and they are much better known than their terrestrial cousins.

There has been a lot of discussion about the damage and the good done by insects. They are essential pollinators of our crops and the greatest threats to those crops, they give us honey and silk, they transmit numerous diseases to people and livestock, and they are a very important source of food for wildlife. Lesser known invertebrates may also be important. The Field Museum of Natural History has said of millipedes, "Their ecological importance is immense: the health and survival of every deciduous forest depends on them, since they are one of the prime mechanical decomposers of wood and leaf litter." (Milli-PEET 2005). The 11,000 named species of millipedes (worldwide) are only a fraction of the estimated 50,000 to 80,000 living species. Millipedes, like land snails, have very limited dispersal ability, with the result that there tend to be many endemic species. Only recently have biologists realized that some of these, and many other soil- and litter-dwelling invertebrates, are more abundant in winter, and winter collecting can give a very different picture of forest floor fauna.

Centipedes, harvestmen, sowbugs, pseudoscorpions and earthworms are some other invertebrates whose species are poorly known in West Virginia, as regards to distribution, status, life histories and ecological roles. A start has been made in surveying the state's spiders, but much remains to be done. In such neglected groups, we can safely assume that researchers will eventually find many new species, and determine that many others are rare and /or local. Doubtless some will be identified as reliable indicators of environmental quality and conditions. As their life histories and behaviors are eventually discovered, we will learn what important roles are played by seemingly insignificant species.

Cave invertebrates, mussels, crayfish, land snails, moths, stoneflies, spiders, dragonflies and damselflies and tiger beetles have their own fact sheets because there is at least a rudimentary knowledge about their distribution and status in the state. Little is known about the thousands of other invertebrate species. As information becomes available, other invertebrate groups may be found to be in need of conservation. Right now not enough is known to make such determinations.

A review of the conservation needs for invertebrate groups, as outlined on the following fact sheets, indicates that initial actions for the listed species are centered on survey, inventory and data management. Information on the distribution and status of many invertebrates is lacking and filling these information gaps is a necessary first step for the future conservation assessment of each species. Standardized data acquisition and management both within the WV DNR Wildlife Resources Section and by all other research partners will greatly assist with these conservation assessments. Centralized and shared information is a prerequisite to the formulation of on-the-ground conservation plans for all listed species.

Because the WRS acts as a statewide repository for information, we rely on partners to share information to maximize understanding of our biological resources. Occasionally researchers are reluctant to share information for fear that the information will be requested from state government via the Freedom

of Information Act (FOIA) and used to the detriment of the species involved. For this reason it is believed appropriate to have legislation enacted to protect sensitive rare species information from wide dissemination. This need is expressed across the board on the fact sheets for animal species in greatest need of conservation.

There is an ongoing need to educate all citizens about the value of the diversity of life in the state and especially the role all SGNC play in the intricate web of life. Education is a unifying theme throughout the actions section of the fact sheets for most species. In addition there is a need to coordinate with land management agencies and other landowners/managers on the use of best management practices for the conservation of biological resources in general as well as specific practices when SGNC are present.

Unfortunately because of the dearth of data on the distribution and status of many individual species, few specific on-the-ground conservation actions have been identified. As additional data are collected, one would anticipate an increasing inventory of specific site-related projects that are desirable for the health and/or continued existence of invertebrate SGNC throughout the state.

Reference

Milli-PEET. 2005. Taxonomy, Systematics and Evolution of the Diplopoda. The Field Museum. *Introduction to Millipedes*. www.myriapoda.org/milliPEET/introduction.html. Accessed 7/14/05.

Taxa: Mollusks

Common name: Flat-spired Three-toothed Landsnail

Scientific name: *Triodopsis platysayoides*

STATUS

The ranks and information in the chart below indicate the rarity of the Flat-spired Three-toothed Landsnail in West Virginia. This species is endemic to a small portion of the Cheat River Watershed in West Virginia and is listed as threatened by the U.S. Fish and Wildlife Service.

Priority	Global Rank	State Rank	USFWS	IUCN Rank	NE Tech Comm	Trend
1	G1	S1	LT	DD	X	Stable

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The Flat-spired Three-toothed Landsnail is restricted to the Cheat River Gorge. All records are recent (within 20 years) and sites are in private and public ownership. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. Due to the sensitive nature of this species, site names are not given.

Habitat: The Flat-spired Three-tooth Landsnail is usually associated with outcroppings of Upper Connoquenessing Sandstone. It usually occurs in areas that are wooded and dominated by sandstone cliffs or large sandstone boulders. It is often found in cracks and crevices in the rocks or in small cave-like structures. At one site, the snail is associated with a cave in the limestone layer beneath the sandstone.

Watershed	Record Type	Ownership
Cheat River	Recent	Private
		Public

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Flat-spired Three-toothed Landsnail. Because there is inadequate information on status of the Flat-spired Three-toothed Landsnail, the first step in its conservation is to gain a better understanding of its current status, habitat use and genetic background. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Flat-spired Three-toothed Landsnail.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	GIS layer of Flat-spined Three-toothed Landsnail data.	Create a GIS layer of Flat-spined Three-toothed Landsnail data using existing and newly gathered data.
	Public access to general landsnail information.	Provide general Flat-spined Three-toothed Landsnail data, such as distribution maps, on the internet.
	Habitat detection.	Pursue GIS and remote sensing techniques to identify potential habitat.

Category	Need	Action
Surveys	Survey for new sites.	Survey areas with potential Three-toothed Landsnail habitat to locate new sites.

Category	Need	Action
Monitoring	Monitor existing sites.	Conduct surveys at existing sites to determine status of population and any changes to habitat.
	Microclimate data.	Use data loggers to obtain data on microclimate conditions.

Category	Need	Action
Research	Genetic analysis.	Determine genetic status by extracting DNA from slime samples.
	Survey protocol.	Develop survey protocol for disproving the presence of this species.
	Habitat detection.	Pursue GIS and remote sensing techniques to identify potential habitat.

Category	Need	Action
Propagation	Establish new populations.	Raise snails in captivity and attempt to establish populations in suitable habitats within the known range.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There several conservation issues associated with the Flat-spired Three-toothed Landsnail and its habitat. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management
Forest Health	Coordination, Education, Management, Acquisition
Water Quantity and Quality	Legislation/Regulation
Over Collection	
Management Conflicts	Coordination
Invasive Species	Coordination, Management
Damaging Recreation	Education, Management
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE FLAT-SPIRED THREE-TOOTHED LANDSNAIL AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Create a GIS layer of Flat-spired Three-toothed Landsnail data using existing data and newly gathered data.
- Pursue GIS and remote sensing techniques to identify potential habitat.

Monitoring:

- Conduct surveys at existing sites to determine status of population and any changes to habitat.
- Use data loggers to obtain data on microclimate conditions.

Research:

- Determine genetic status by extracting DNA from slime samples.
- Develop survey protocol for disproving the presence of this species.
- Pursue GIS and remote sensing techniques to identify potential habitat.

Acquisition:

- Acquire easements or fee simple ownership of tracts within the Cheat Gorge with known Flat-spined Three-toothed Landsnail occurrences.

Coordination:

- Work with landowners to protect snail sites on their properties. This may include limiting tree removal, preventing erosion and minimizing road construction.
- Coordinate internally to protect snails on State Forests and Wildlife Management Areas.

Management:

- Control invasive plant species, which may affect microclimate at snail sites.

Propagation:

- Raise snails in captivity and attempt to establish populations in suitable habitats within the known range.

Education:

- Educate the public about the importance of biodiversity and the impacts that various land use activities have on RTE species.

Legislation/Regulation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.
- Support the improvement and enforcement of Clean Air laws to decrease acid precipitation.

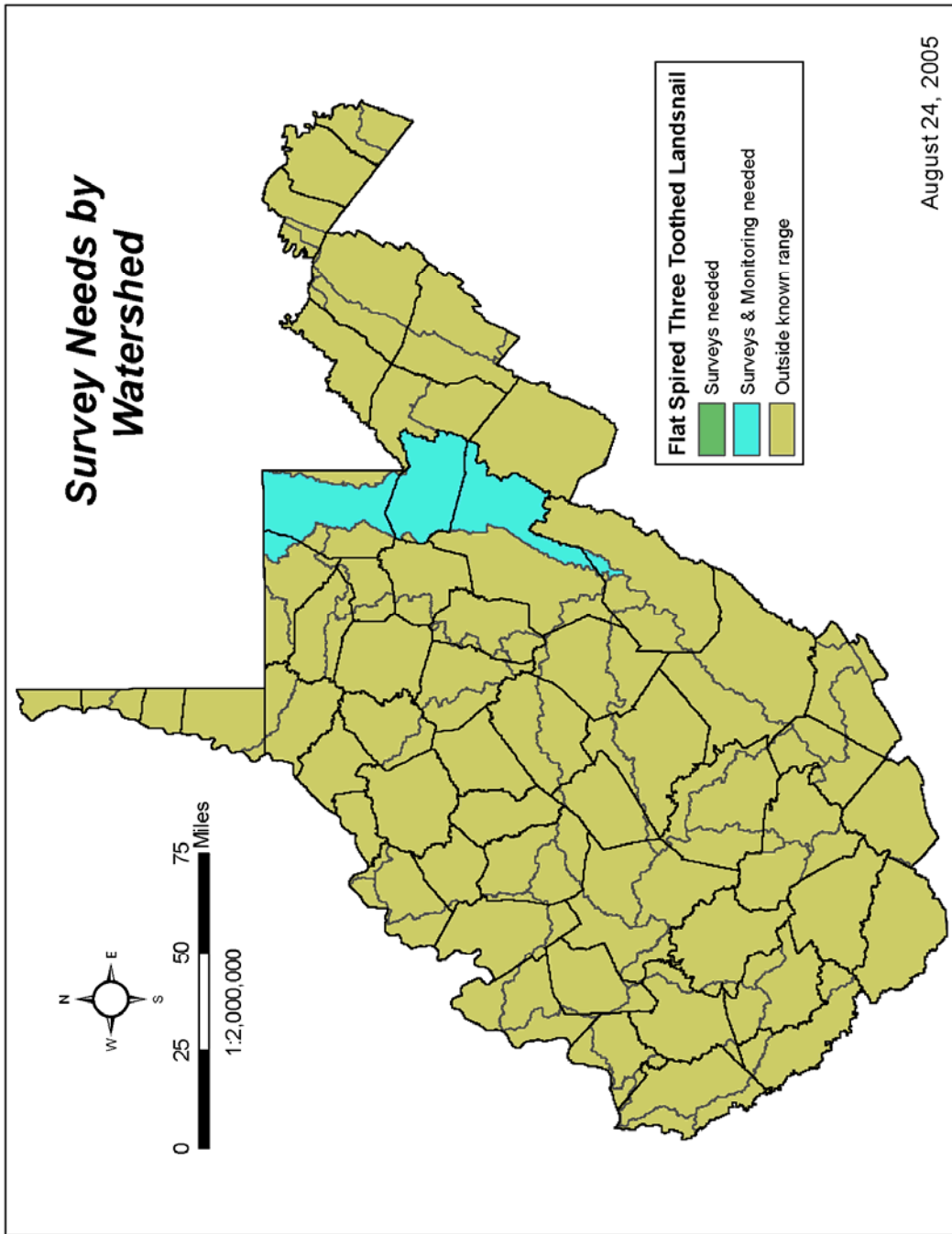
REFERENCES

Stihler, Craig. 2003. *WV Threatened and Endangered Animal Project: Five Year Work Plan for Federal Assistance*. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program. 24pp.

Stihler, Craig. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section. 2004. *Federal Assistance Performance Report: Endangered Species (Animals). Project E-1, Segment 21 (1 October 2003 - 30 September 2004)* Elkins, West Virginia.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Molluska
Group: Landsnails

STATUS

Landsnails are not considered wildlife under the current definition as stated in Chapter 20 of the West Virginia Code and therefore have no legal protection. However, the Natural Heritage Program is charged with the documentation and conservation of rare West Virginia species. Data has been collected on several Landsnail species over the last few years and the following species have been designated as globally rare by NatureServe or state rare by consultation with state Landsnail experts. There are undoubtedly more rare species in the state than what is listed below. With expert collaboration, many rare species will be added to the Species of Greatest Need of Conservation list.

These Landsnail species are included on the Species in Greatest Need of Conservation List, but data on the group as a whole is lacking and surveys cannot be approached on a species basis. Therefore, all of our Landsnail species in Greatest Need of Conservation are considered **Priority 2** species, even though there are globally rare species on the list. The one exception is the Flat-spined Three-toothed Landsnail, a federally listed species, which is addressed in a separate species sheet.

Species Name	Common Name	Priority Group	Global Rank	State Rank	USFWS	Jeff Forest
<i>Carychium clappi</i>	Appalachian Thorn	2	G4G5	SH		
<i>Glyphyalinia raderi</i>	Maryland Glyph Snail	2	G2	S2	SC	X
<i>Helicodiscus triodus</i>	Tallus Coil	2	G2	SH		X
<i>Hendersonia occulta</i>	Cherrystone Drop	2	G4	S1S2		
<i>Leptoxis dilatata</i>	Seep Mudalia	2	G2?	SU		
<i>Paravitrea ceres</i>	Sidelong Supercoil	2	G?	S1		
<i>Paravitrea reesi</i>	Round Supercoil	2	G3	S1		X
<i>Paravitrea seradens</i>	Barred Supercoil	2	G3	SH		
<i>Somatogyrus pennsylvanicus</i>	Shale Pebblesnail	2	G3	SU		
<i>Webbhelix multilineata</i>	Striped Whitelip	2	G?	S1		

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places each species into watersheds and describes the age of each record within that watershed (recent is within 20 years). Not all of our Landsnail species have site data so they are not included in this table. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species.

Habitat: Specific habitats for each species of concern are not discussed here. These Landsnails utilize many different microhabitats, mainly in forested or rocky areas.

Species	Watershed	Record Type
<i>Hendersonia occulta</i>	Greenbrier	Historic
	Upper New	Recent
	Cheat	Recent
	Cacapon	Recent
	Potomac	Recent
	South Branch Potomac	Recent
	Upper New	Recent
<i>Carychium clappi</i>	Lower New	Historic
<i>Helicodiscus triodus</i>	Lower New	Historic
<i>Paravitrea reesei</i>	Upper New	Historic
	Greenbrier	Historic
<i>Paravitrea seradens</i>	Lower New	Historic
<i>Webbhelix multilineata</i>	Youghiogheny	Recent
	Middle Ohio Valley	Recent Historic

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of Landsnails. Because there is inadequate information on the distribution and status of Landsnails in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below.

Bolded text indicates primary actions required to identify conservation needs of Landsnails.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Capture all records of WV snails from the literature and museums to create an accurate state list with Heritage Ranks.	Create state snail list with snail expert collaboration. Identify rare species and assign ranks.
	Future data will be collected using standardized procedures.	All surveys will have site and species forms and coordinates will be obtained using GPS.
	Identify WV DEP Aquatic snail specimens.	Contract snail experts to identify snail specimens.
	Public access to general Landsnail information.	Provide general WV Landsnail data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Determine status at historic sites.	Conduct surveys with priority given to threatened sites.
	Survey new sites.	Survey snails in unique habitats such as caves, high elevation wetlands, old growth timber sites and riverine areas

Category	Need	Action
Monitoring	Long-term species monitoring.	Monitor sites with high diversity, significant threat or with unique features as new snail information becomes available.

Category	Need	Action
Research	Life history.	Identify research needs as more surveys are conducted.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with Landsnails and their habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation,

utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management
Forest Health	Coordination, Education, Management
Water Quantity and Quality	
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF LANDSNAILS AND THEIR HABITATS

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Collaborate with experts to create and rank a list of state species.
- Contract experts to identify snail specimens.

Surveys:

- Survey snails in unique habitats such as caves, high elevation wetlands, old growth timber sites and riverine areas

Coordination:

- Work with forest landowners to reduce or eliminate activities that may be detrimental to Landsnail sites. This includes encouraging use of Best Management Practices when timbering, mining, or engaged in other impacting activities.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Landsnail sites. General information on the importance of invertebrate groups and general biodiversity should be included.

Legislation:

- Develop and submit legislation to include Landsnails and other Terrestrial Invertebrates in the definition of wildlife.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: April 13, 2005).

Taylor, Ralph. 2005. Personal Communication. Marshall University, Huntington, WV.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.

Taxa: Lepidoptera
Group: Moths

STATUS

Moths are not considered wildlife under the current definition as stated in Chapter 20 of the West Virginia Code and therefore have no legal protection. However, the Natural Heritage Program is charged with the documentation and conservation of rare West Virginia species. Data have recently been collected on several moth species and the following species have been designated as rare by consultation with state moth experts. These moth species are included on the Species of Greatest Need of Conservation list, but data on the group as a whole are lacking and surveys cannot be approached on a species basis. Therefore, all moth species of concern are considered **Priority 2** species even though there are globally rare species on the list.

Species	Priority Group	Global Rank	State Rank	USFWS	Jeff Forest	Trend
<i>Aplectoides condita</i>	2*	G4	S1			Unknown
<i>Brachionycha borealis</i>	2	G4	S1			Unknown
<i>Catocala dulciola</i>	2	G3	SU			Unknown
<i>Catocala herodias gerhardi</i>	2	G3T3	SU		X	Unknown
<i>Chaetagnaea cerata</i>	2	G3G4	S1			Unknown
<i>Eilema bicolor</i>	2	G5	S1			Unknown
<i>Euchlaena effecta</i>	2	G5	S1			Unknown
<i>Euchlaena milnei</i>	2	G2G4	S2	SC	X	Unknown
<i>Hadena ectypa</i>	2	G3G4	S1			Unknown
<i>Lithophane oriunda</i>	2	G4	S1			Unknown
<i>Lophocampa maculata</i>	2	G5	S1			Unknown
<i>Melanchra assimilis</i>	2	G5	S1			Unknown
<i>Merolonche dollii</i>	2	G3G4	SH			Unknown
<i>Metalepsis salicarum</i>	2	G5	S1			Unknown
<i>Syngrapha rectangula</i>	2	G5	S1			Unknown
<i>Xestia tenuicula</i>	2	G4	S1			Unknown
<i>Zale calycanthata</i>	2	G4	SU			Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

Moth species of concern occur throughout the state with the heaviest concentrations in the mountainous counties. Most surveys have been conducted in this area and these localities might be a product of survey intensity rather than actual distribution. The number of records is not indicated in this table. Recent records are within 20 years. Each watershed listed may have more than one record for the species.

Habitat: Almost all West Virginia Moth surveys have been conducted in forested areas. This says little about the actual habitat required for these species and Moths should be present in most habitat types. Therefore, there is no species specific habitat information presented here.

Species	Watershed	Record type
<i>Euchlaena effecta</i>	Youghiogheny	Historic
<i>Euchlaena milnei</i>	South Branch Potomac	Recent Historic
	Potomac	
	Greenbrier	
<i>Eilema bicolor</i>	Gauley	Historic
<i>Lophocampa maculata</i>	Cheat	Historic
<i>Zale calycanthata</i>	South Branch Potomac	Recent
	North Branch Potomac	
<i>Catocala herodias gerhardi</i>	South Branch Potomac	Recent Historic
	Potomac	
<i>Catocala dulciola</i>	Greenbrier	Historic
<i>Syngrapha rectangula</i>	Cheat	Recent Historic
	Upper Guyandotte	
	South Branch Potomac	
<i>Merolonche dolli</i>	Cacapon	Recent
<i>Lithophane oriunda</i>	Gauley	Historic
<i>Chaetagnaea cerata</i>	Monongahela	Historic
<i>Brachionychna borealis</i>	South Branch Potomac	Recent Historic
<i>Melanchra assimilis</i>	Youghiogheny	Recent Historic
	Gauley	
	Cheat	
<i>Hadena ectypa</i>	Greenbrier	Recent Historic
	Monongahela	
<i>Metalepsis salicarum</i>	Youghiogheny	Historic

<i>Aplectoides condita</i>	Youghiogheny	Historic
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DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of Moths. Because there is inadequate information on the distribution and status of Moths in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of Moths.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Capture legacy data.	Continue contracts to capture existing Moth data; contact other researchers who have collected in WV and solicit their information.
	Coordinates.	Determine coordinates whenever possible.
	Public access to general Moth information.	Provide general Moth data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Survey areas of past Gypsy Moth spraying to determine presence of other Moth species.	Surveys need to be conducted with priority given to sites with potential habitat and most likely to support the most species.
	Survey new sites.	Analyze potential habitat statewide to identify new survey areas.

Category	Need	Action
Monitoring	Long-term species monitoring.	Continue to monitor areas where WVU Moth researchers have conducted long-term surveys and identify new sites as new data becomes available. Examine all current sites to determine if an area or areas of high diversity exist to establish monitoring stations. Establish sites statewide to represent a diversity of habitat types and regions.

Category	Need	Action
Research	All life history aspects pertaining to WV populations, especially habitat requirements.	Coordinate projects with researchers, write prospecti for needed projects and actively seek contractors.
	Environmental factors.	Determine the impacts of invasive plants on host and nectar species

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with Moths and their habitats. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Coordination , Education, Management
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF MOTHS AND THEIR HABITATS

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve these species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of these species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of these species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Continue to capture existing moth data; contact other researchers who have collected in WV and solicit their information.
- Determine coordinates whenever possible.

Surveys:

- Conduct surveys at priority sites with potential habitat most likely to support the most species.
- Analyze potential habitat statewide to identify new survey areas for all Moth species.

Coordination:

- Work with forest landowners to reduce or eliminate activities that may be detrimental to moth sites. This includes maintaining host and nectar species while encouraging use of Best Management Practices when timbering, mining, or engaging in other impacting activities.
- Coordinate with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc.) in streams and wetlands where Moths occur.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Moth sites. General information on the importance of invertebrate groups and general biodiversity should be included.

Legislation/Regulation:

- Develop and introduce legislation to include Moths and other Terrestrial Insects in the definition of wildlife.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

Butler, Linda. 2000 and 2005. Personal Communication. West Virginia University, Morgantown, WV.

NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: April 13, 2005).

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.

Taxa: Arachnida
Group: Spiders

STATUS

Spiders are not considered wildlife under the current definition of wildlife as stated in Chapter 20 of the West Virginia Code and therefore have no legal protection. However, the Natural Heritage Program is charged with the documentation and conservation of rare West Virginia species. Currently there are 401 West Virginia species vouchered in collections with 642 anticipated species among an estimated 800 in the Eastern North American fauna. Currently there is one person interested and capable of working on West Virginia Spider identification and collection who has been cooperating with the WVDNR. A few species have been identified as state rare and are listed below. Nature Serve does not have adequate information for global ranks.

Spider records are being continually acquired and the first step is to reassess the rare species list and assign accurate rankings. These 642 species are represented by 3,765 site records from 36 of the 55 counties in West Virginia, with additional records awaiting identification and processing. All Spider species included on this list are considered **Priority 2**.

Scientific Name	Common Name	Global Rank	State Rank
<i>Agelenopsis emertoni</i>	Emerton's Grass Spider	G?	S1
<i>Arctosa rubicunda</i>	Reddish Arctosa	G?	S1
<i>Calymmaria sp. 21</i>	West Virginia Calymmaria	G1	S1
<i>Castianeira variata</i>	Diverse Ant Mimic	G?	S1
<i>Chrosiothes jenningsi</i>	Jenning's Comb-foot	G1	S1
<i>Hogna aspersa</i>	Fierce Wolf Spider	G?	S1
<i>Hogna carolinensis</i>	Carolina Wolf Spider	G?	S1
<i>Hogna frondicola</i>	Vegetable Leaf Wolf Spider	G?	S1
<i>Neriene clathrata</i>	Barred Neriene	G?	S1
<i>Ozyptila modesta</i>	Shy Toad Spider	G?	S1
<i>Pardosa distincta</i>	Adorned Leopard-Wolf Spider	G?	S1
<i>Pirata insularis</i>	Island Pirate Spider	G?	S1
<i>Pirata sedentarius</i>	Sedentary Pirate	G?	S1
<i>Pirata seminolus</i>	Seminole Swamp Pirate	G?	S1
<i>Pirata zelotes</i>	Eager Swamp Pirate	G?	S1
<i>Schizocosa retrorsa</i>	Backward Schizocosa	G?	S1

<i>Tapinocyba hortensis</i>	Garden Rug Merchant	G?	S1
<i>Zelotes hentzi</i>	Hentz's Zelotes	G?	S1

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION AND HABITAT

Spiders have been collected from 36 counties. A high elevation study conducted in 1999-2001 accounts for many of the records. High elevation and other sites are represented by collections from Sugar Grove Naval Base in Pendleton County, Green Bottom WMA, Beech Fork State Park, Blackwater Falls State Park, Adolph, Spruce Knob, Bickle's Knob, Allegheny Mountain, Dolly Sods, Panther State Forest, North Fork Mountain, Second Creek, North Bend State Park, Sleepy Creek WMA and other sites in southern West Virginia and the eastern mountains.

Habitat: Specific habitats for each species of concern are not discussed here. Many habitats are represented by these records which include high elevation mountaintops, shale barrens, old fields, wetlands and others.

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of Spiders. Because there is inadequate information on the distribution and status of Spiders in West Virginia, as in most states, the first step in their conservation is to understand their distribution, habitat requirements and status. Needs and actions for each category are outlined below.

Bolded text indicates primary actions required to identify conservation needs of Spiders.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Capture legacy data.	Compile WV Spider data from experts, museums and the literature. Create a printed checklist of West Virginia spiders.
	Identify backlog of specimens.	Contract Spider expert to identify an estimated 4 to 6 K specimens.
	Rank each species using Heritage ranking system.	Collaborate with state Spider expert to determine ranks.
	Public access to general Spider information.	Provide general WV Spider data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Verify species records at sites represented by species new to science or juveniles.	Contract Spider experts to collect specimens at these sites.
	Survey new sites.	Target unique habitats such as caves, high elevation wetlands, old growth timber and riverine areas such as those found at the headwaters of the Greenbrier River and along the Elk River at Gauley Mountain.

Category	Need	Action
Monitoring	Long-term species monitoring.	As new Spider information becomes available, monitor sites with high diversity, areas under threat and unique areas suggested by experts. Monitor sites for threats.

Category	Need	Action
Research	Life history.	Identify research needs with experts as more surveys are conducted.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with Spiders and their habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Coordination , Education, Management
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE SPIDERS AND THEIR HABITATS

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve these species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of these species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of these species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Contract experts to identify an estimated 4 to 6 K specimens.
- Collaborate with experts to determine ranks.

Surveys:

- Contract experts to collect specimens at priority sites.
- Target unique habitats such as caves, high elevation wetlands, old growth timber and riverine areas such as those found at the headwaters of the Greenbrier River and along the Elk River at Gauley Mountain.

Coordination:

- Work with forest landowners to reduce or eliminate activities that may be detrimental to Spider sites. Encourage use of Best Management Practices when timbering, mining, or engaged in other impacting activities.
- Coordinate with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in streams and wetlands where Spiders occur.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Spider sites. General information on the importance of invertebrate groups and general biodiversity should be included.

Legislation:

- Develop and introduce legislation to include Spiders and Terrestrial Insects in the definition of wildlife.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

Arnold, Jim. 2005. Personal Communication. Marshall University, Huntington, WV.

Arnold, James. 2004. *Further Studies of West Virginia Spiders: A Continuation of Arachnid Identification and Distribution Studies- West Virginia Arachnid Survey*. Report to WVDNR Wildlife Diversity Cooperative and Research Program, Elkins, WV.

NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: April 13, 2005).

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.

Taxa: Plecoptera
Group: Stoneflies

STATUS

Data and information have been collected recently on several Stonefly species and the following species have been designated as globally rare by NatureServe or state rare by consultation with state Stonefly experts. These Stonefly species are included on the Species of Greatest Need of Conservation list, but data on the group as a whole are lacking and surveys can not be approached on a species basis. Therefore, all Stonefly species of concern are considered **Priority 2** species even though globally rare species are included on the list.

Scientific Name	Common Name	Global Rank	State Rank
<i>Allocapnia frumi</i>	Monongahela Snowfly	G2	S2
<i>Alloperla aracoma</i>	Aracoma Sallfly	G3	S1
<i>Alloperla biserrata</i>	Dusky Sallfly	G3	S1
<i>Diploperla kanawholensis</i>	Little Kanawha Perlodid Stonefly	G3	S1
<i>Hansonoperla appalachia</i>	Hanson's Appalachian Stonefly	G3	S2
<i>Hansonoperla hokolesqua</i>	Splendid Stonefly	G2	S1
<i>Megaleuctra flinti</i>	Shenandoah Stonefly	G2	S1
<i>Ostrocerca complexa</i>	Notched Forestfly	G4	S1
<i>Ostrocerca prolongata</i>	Bent Forestfly	G3	S1
<i>Pteronarcys comstocki</i>	Spiny Salmonfly	G3	S2
<i>Sweltsa pocahontas</i>	Pocahontas Sallfly	G2	S2
<i>Utaperla gaspesiana</i>	Gaspe Sallfly	G3	S1

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix 1 for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The records obtained for these species of stoneflies come from the Monongahela National Forest near Cranberry Glades and the city of Richwood in Nicholas County. These sites are in the Gauley River watershed. A few records for three species came from the Elk, Upper Guyandotte and Little Kanawha drainages. The record age ranges from 1975 to 2000 with the majority coming from the mid 1980s through the early 1990s. The records are all from larval specimens.

Habitat: Most species occur in small creeks, streams and seeps in forested areas.

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of Stoneflies. Because there is inadequate information on the distribution and status of Stoneflies in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below.

Bolded text indicates primary actions required to identify conservation needs of Stoneflies.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Compile all records of WV Stonefly specimens and observations from literature and experts to create an accurate state list with Heritage ranks.	Collaborate with state Stonefly experts to create a list and rank species. Publish <i>Stoneflies of West Virginia</i> in 2006.
	Public access to general stonefly information.	Provide general WV stonefly data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Survey new sites.	Survey stoneflies in unique habitats and in geographical data gaps that will be delineated in the <i>Stoneflies of West Virginia</i>.

Category	Need	Action
Monitoring	Long-term species monitoring sites.	As new Stonefly information becomes available, monitor unique areas, sites with high diversity or significant threats.

Category	Need	Action
Research	Life history.	Identify research needs with state Stonefly experts as more surveys are conducted.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with Stoneflies and their habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Coordination , Education, Management
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF STONEFLIES AND THEIR HABITATS

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve these species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of these species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of these species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Collaborate with state Stonefly experts to create a list and rank of species. Publish *Stoneflies of West Virginia* in 2006.

Surveys:

- Survey stoneflies in unique habitats and in geographical data gaps that will be delineated in the *Stoneflies of West Virginia*.

Coordination:

- Work with forest landowners to reduce or eliminate activities that may be detrimental to Stonefly sites. This includes encouraging use of Best Management Practices when timbering, mining, or engaged in other impacting activities.

- Coordinate with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in streams and wetlands where rare stoneflies occur.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Stonefly sites.
- General information on the importance of invertebrate groups and general biodiversity should be included.

Legislation:

- Develop and introduce legislation to include adult Stoneflies and other Terrestrial Insects in the definition of wildlife.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

Kirchner, Ralph. 2000. *Report of Stonefly localities*. Word document submitted to WVDNR Wildlife Diversity Program, Elkins, WV.

NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: April 13, 2005).

Tarter, Donald. 2000. Personal Communication. Retired, Marshall University, Huntington, WV.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.

Mammals

West Virginia is currently home to 72 mammals with an additional four species that have been extirpated from the state. Extirpated species include Bison, Elk, Grey Wolf and Eastern Cougar. The last recorded Bison in West Virginia was killed near Valley Head, Randolph County, in 1825. Elk were reported near the headwaters of the Tygart and Greenbrier rivers as late as 1875 and were gone by 1890. Bounties were paid on wolves in West Virginia through the late 1800s, with the last recorded wolf killed in 1900. The last report of indigenous Eastern Cougars was from tracks in the 1930s. Although sightings continue, the animals may have been brought into the state and released, such as the two cougars taken in 1976. The Beaver, Fisher and River Otter were also eradicated, but were reintroduced in the 1930s, 1969 and 1985, respectively.

Seven of the existing species are exotic, having either been brought intentionally into the state or have come in on their own. These are the House Mouse, Norway Rat, Black Rat, feral dog, Wild Boar, feral cat and feral goat. The Black Rat (Roof Rat), Norway Rat and House Mouse all came to North America with settlers and traders. Dogs, cats and goats that have wandered off or were abandoned have established feral populations in portions of the state. Wild Boars were introduced into the state in 1972. Today a population of Wild Boars exists in Boone, Logan, Raleigh and Wyoming counties.

Two species, the Porcupine and the Coyote, are adventive, meaning that they are native to North America but have come into the state on their own and were not historically part of West Virginia's fauna. Porcupines have been reported sporadically in the Eastern Panhandle and are not likely established in the state while Coyotes have not only entered the state but have been so successful that they are now breeding statewide.

Just as human activities have resulted in the decline and extinction of some mammals, these activities also have resulted in increased abundance and range expansion of others. The Opossum is more abundant and more widely distributed due to human activities, as are mammals that prefer farm and early successional habitats. Bear have increased across the state over the last 30 years; the harvest going from only about 100 per year in the early 1970s to a high of over 1,700 animals in 2003. White-tailed Deer have increased dramatically after having been harvested relentlessly in the early twentieth century. In 1945 fewer than 1,000 deer were harvested and current annual average harvest for the five year period of 1998-2003 was about 220,000.

Twenty-two of the state's mammals have been listed as Species in Greatest Need of Conservation. Five of these species, Virginia Big-eared Bat, Indiana Bat, Gray Myotis (bat), West Virginia Northern Flying Squirrel and the extirpated Eastern Cougar, are federally listed as endangered.

Scientific Name	Common Name
<i>Corynorhinus rafinesquii</i>	Rafinesque's Big-eared Bat
<i>Corynorhinus townsendii virginianus</i>	Virginia Big-eared Bat
<i>Lasionycteris noctivagans</i>	Silver-haired Bat
<i>Lasiurus borealis</i>	Eastern Red Bat
<i>Lasiurus cinereus</i>	Hoary Bat
<i>Myotis leibii</i>	Eastern Small-footed Myotis
<i>Myotis sodalis</i>	Indiana Myotis
<i>Nycticeius humeralis</i>	Evening Bat
<i>Microtus chrotorrhinus carolinensis</i>	Rock Vole
<i>Microtus ochrogaster</i>	Prairie Vole
<i>Synaptomys cooperi</i>	Southern Bog Lemming
<i>Zapus hudsonius</i>	Meadow Jumping Mouse
<i>Ochrotomys nuttalli</i>	Golden Mouse
<i>Reithrodontomys humulis</i>	Eastern Harvest Mouse
<i>Sorex dispar</i>	Long-tailed Shrew
<i>Sorex hoyi winnemana</i>	Pygmy Shrew
<i>Sorex palustris punctulatus</i>	Water Shrew
<i>Cryptotis parva</i>	Least Shrew
<i>Neotoma magister</i>	Allegheny Wood Rat
<i>Sylvilagus obscurus</i>	Appalachian Cottontail
<i>Spilogale putorius</i>	Spotted Skunk
<i>Glaucomys sabrinus fuscus</i>	WV Northern Flying Squirrel

A review of the conservation needs for Mammals, as outlined on the following fact sheets, indicates that initial actions for the listed species are centered on survey, inventory and data management. Information on the distribution and status of many small mammals is lacking and filling these information gaps is a necessary first step for the future conservation assessment of each species. Standardized data acquisition and management both within the WV DNR Wildlife Resources Section and by all other research partners will greatly assist with these conservation assessments. Centralized and shared information is a prerequisite to the formulation of on-the-ground conservation plans for all listed species.

Bats as a group have received considerable attention over the last two decades and information is more current for this group than for many other mammals. Many specific cave conservation activities have been taken to help conserve bats and suggestions for other land conservation activities are outlined for several species.

Several species are trapped and information on their distribution can be garnered from fur tag data. This information needs to be gathered into a centralized system so accurate assessments of status and range change can be made.

Because the WRS acts as a statewide repository for information, we rely on partners to share information to maximize understanding of our biological resources. Occasionally researchers are reluctant to share information for fear that the information will be requested from state government via the Freedom of Information Act (FOIA) and used to the detriment of the species involved. For this reason it is believed appropriate to have legislation enacted to protect sensitive rare species information from wide dissemination. This need is expressed across the board on the fact sheets for animal Species in Greatest Need of Conservation.

Taxa: Mammals

Common name: Virginia big-eared Bat

Scientific name: *Corynorhinus townsendii virginianus*

STATUS

The ranks and information in the chart below indicate the rarity of the Virginia Big-eared Bat in West Virginia. This species is listed as endangered by the U.S. Fish and Wildlife Service.

Priority	Global Rank	State Rank	USFWS	Mon Forest	Jeff Forest	IUCN Rank	Trend
1*	G4T2	S2	LE	X	X	VU A2c	Stable

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of the Virginia Big-eared Bat into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether the sites are under public or private ownership. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. Sites listed are hibernacula or maternity colonies.

Habitat: The Virginia Big-eared Bat uses caves in both the summer and winter. During the winter, these bats hibernate in caves that are cold, but remain above freezing. Maternity colonies are usually formed in warm caves. These bats will travel up to six miles from their summer roosts to forage. Virginia Big-eared Bats forage in a variety of habitats including old fields, hay fields and forested areas.

Watershed	Record Type	Ownership
Cacapon	Recent Historic	Private
Cheat	Recent Historic	Private
		Public
Lower New	Recent	Public
South Branch Potomac	Recent Historic	Private
		Public
Tygart Valley	Recent	Private
		Public
Youghiogheny	Historic	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Virginia Big-eared Bat. Because there is inadequate information on the distribution and habits of the Virginia Big-eared Bat in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, migration patterns, and habitat use. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to further conservation goals for the Virginia Big-eared Bat.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Public access to general bat information.	Publish <i>Bats of West Virginia</i>. Provide general bat data, such as distribution maps, on the internet.
	GIS layer of bat data.	Create a GIS layer of bat data using existing data and newly gathered data.

Category	Need	Action
Surveys	Additional hibernacula, maternity sites and "transition" caves need to be surveyed.	Caves to be surveyed will be selected based on structure, proximity to existing known hibernacula or maternity sites, and reports from cavers. Mist netting and trapping will also be utilized.
	The status of Virginia Big-eared Bat in the New River Gorge area needs to be determined.	Utilize mist netting and trapping at mine entrances, and mist netting throughout the gorge to determine the distribution of the Virginia Big-eared Bat within the New River Gorge.

Category	Need	Action
Monitoring	Monitor existing sites.	Monitor hibernating populations biennially and summer populations annually to document changes in populations or habitat, and to monitor potential threats.
	Microclimate data at hibernacula and maternity sites need to be collected.	Place data loggers at Virginia Big-eared Bat hibernacula and maternity sites.

Category	Need	Action
Research	Foraging habits, habitat use and movements of the Virginia Big-eared Bat need to be determined.	Continue using radio-telemetry to track bat movements, especially in late summer and autumn; then combine with existing data to determine habits and distribution.
	Habitat use in areas near maternity roosts needs to be determined.	Complete analysis of radio-telemetry data collected during previous field seasons.
	Virginia Big-eared Bat's use of habitat in the New River Gorge needs to be determined.	Utilize radio-telemetry to determine foraging areas and travel patterns.
	Population structure and management implications need to be determined.	In coordination with other states in the Virginia Big-eared Bat's range, continue collecting tissue samples to determine if WV's populations of Virginia Big-eared Bats are genetically different from others.
	Potential impacts of streblid flies and potential management strategies need to be evaluated.	Monitor bat populations which are affected by streblid flies. Monitoring will include bat numbers, and possibly recording the weights of bats over time. Techniques for removing the flies will be evaluated.
	Impacts of wind turbines and other large structures on all bat species needs to be determined.	Monitor wind turbine and cell tower sites routinely to recover bat carcasses to provide information on whether high mortality is affected by seasonal changes, weather patterns, etc.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There several conservation issues associated with the Virginia Big-eared Bat and its habitat. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	Acquisition , Coordination, management
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE VIRGINIA BIG-EARED BAT AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge of the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Publish *Bats of West Virginia*.
- Create a GIS layer of bat data using existing and newly gathered data.

Surveys:

- Caves to be surveyed will be selected based on structure, proximity to existing known hibernacula or maternity sites and reports from cavers. Mist netting and trapping will also be utilized.
- Utilize mist netting and trapping at mine entrances, and mist netting throughout the New River Gorge to determine the distribution of the Virginia Big-eared Bat within the Gorge.

Research:

- Continue using radio-telemetry to track bat movement, especially in late summer and autumn; and combine with existing data to determine habits and distribution.
- Complete analysis of radio-telemetry data collected during previous field seasons.
- Utilize radio-telemetry to determine foraging areas and travel patterns.
- In coordination with other states in the Virginia Big-eared Bat's range, continue collecting tissue samples to determine if WV's populations of Virginia Big-eared Bats are genetically different from others.
- Monitor wind turbine and cell tower sites routinely to recover bat carcasses to provide information on whether high mortality is affected by seasonal changes, weather patterns, etc.

Acquisition:

- Acquire easements or ownership of caves or cave entrances to protect important hibernacula or maternity sites.

Coordination:

- Work with landowners to protect important hibernacula and maternity sites by placing gates or fences at cave entrances for permanent or seasonal cave closures.
- Work with the U.S. Fish and Wildlife Service and the WV Department of Environmental Protection to require bat surveys prior to closing mine entrances.
- Work with the U.S. Forest Service and the National Park Service regarding Virginia Big-eared Bat sites on or near their lands; prepare management plans for hibernacula and summer roosts.
- Coordinate with the U.S. Fish and Wildlife Service and biologists from other states within the Virginia Big-eared Bat's range to revise the recovery plan due to a better understanding of the various issues effecting the bat (forest health, quarrying, abandoned mine lands projects, development, etc.)
- Coordinate with project developers and landowners to address impacts of quarrying, road construction and development in the vicinity of Virginia Big-eared Bat hibernacula, maternity sites and foraging areas.
- Work with landowners to maintain sufficient foraging habitat within seven miles of known Virginia Big-eared Bat caves.
- Work with WV Department of Agriculture to insure that the gypsy moth control program does not significantly impact the food base around bat caves.
- Work with U.S. Fish and Wildlife Service to revise recovery plan.

Education:

- Educate the public relative to bats and their habits, outlining the effects of various land use practices that may impact hibernacula, maternity sites and foraging areas (such as caving, forestland management and conversion of agricultural fields).
- Place signage at closed cave entrances to explain the reason for the closure.

Legislation/Regulation:

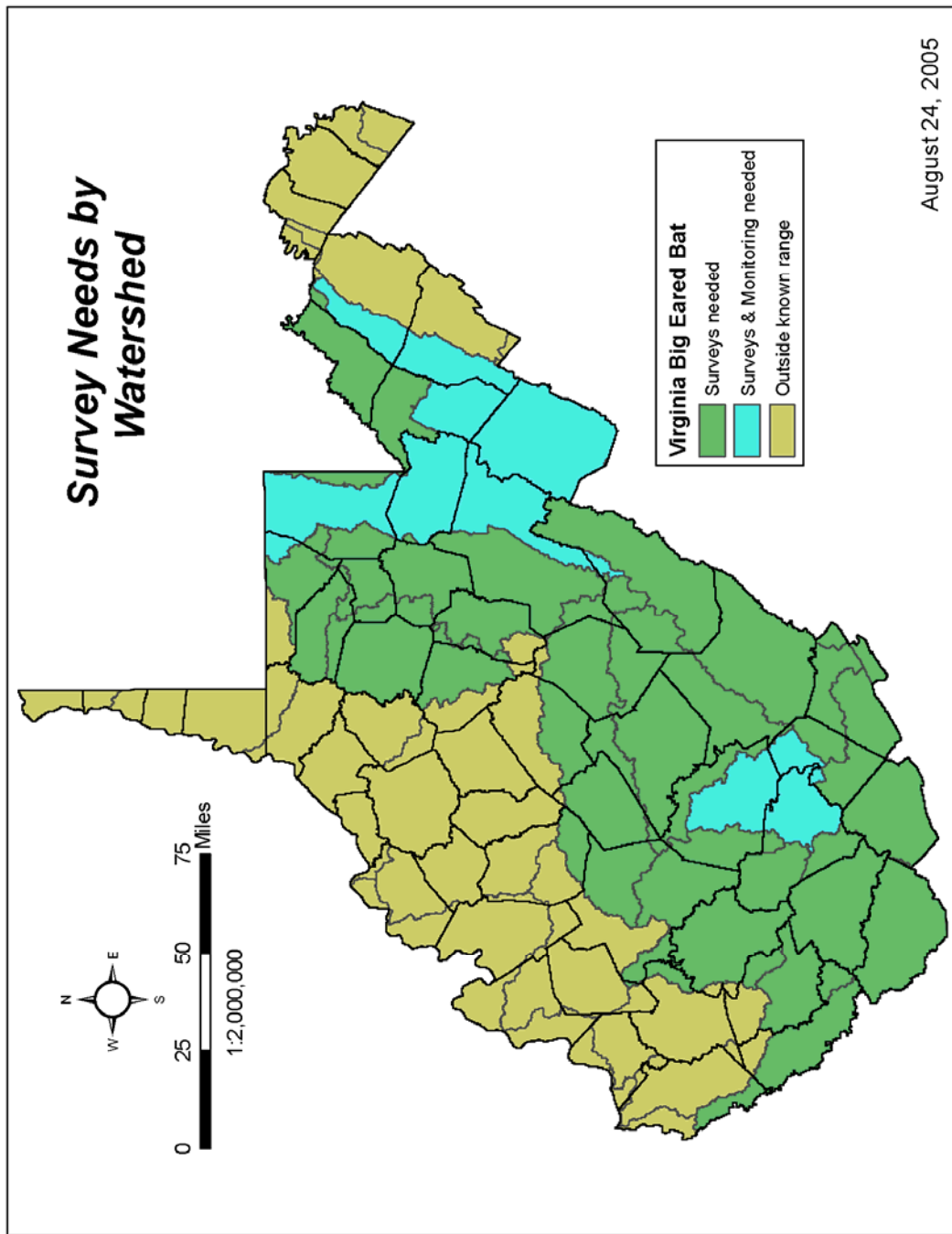
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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Stihler, Craig. 2003. *WV Threatened and Endangered Animal Project: Five Year Work Plan for Federal Assistance*. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program. 24pp.

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West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mammals

Common name: WV Northern Flying Squirrel

Scientific name: *Glaucomys sabrinus fuscus*

STATUS

The ranks and information in the chart below indicate the rarity of the WV Northern Flying Squirrel in West Virginia. This species is listed as endangered by the U.S. Fish and Wildlife Service.

Priority	Global Rank	State Rank	USFWS	Mon Forest	Jeff Forest	IUCN Rank	NE Tech Comm	Trend
1*	G5T2	S2	LE	X	X	LC (Not subsp.)	X	Stable

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION AND SITE STATUS

The following table places known occurrences of the WV Northern Flying Squirrel into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether the sites are in public or private ownership. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. Due to the sensitive nature of this species, site names are not given.

Habitat: The WV Northern Flying Squirrel is usually found in spruce/fir/hemlock and northern hardwood forests. It is often associated with red spruce and northern hardwoods such as sugar maple, American beech, black cherry, and black and yellow birch. The Northern Flying Squirrel is typically found at elevations over 3000 feet, although it has been recorded as low as 2320 feet. At most of the known occurrences the forests are moist with some mature trees, standing snags and downed logs; lichens and mosses are often abundant.

Watershed	Record Type	Ownership
Cheat	Recent	Private
	Historic	Public
Elk	Recent	Private
		Public
Gauley	Recent Historic	Public
Greenbrier	Recent	Private
		Public
North Branch Potomac	Recent	Private
South Branch Potomac	Recent	Private
		Public
Tygart Valley	Recent	Private
		Public

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the WV Northern Flying Squirrel. Because there is inadequate information on the distribution and status of the WV Northern Flying Squirrel in West Virginia, the first step in its conservation is to gain a better understanding of its status and habitat use. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the WV Northern Flying Squirrel.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	GIS layer of Northern Flying Squirrel data.	Continue creating a GIS layer of Northern Flying Squirrel data using existing data and newly gathered data; and use GIS to map potential habitat.
	Public access to general mammal information.	Provide general Northern Flying Squirrel data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Additional sites need to be surveyed	Survey areas with potential Northern Flying Squirrel habitat for new populations by placing either nest boxes or live traps.

Category	Need	Action
Monitoring	Continue monitoring existing sites.	Conduct nest box surveys at long-term monitoring sites during the spring and fall to determine status of population and any changes to habitat. Captured Northern Flying Squirrels will be PIT-tagged or ear-tagged.

Category	Need	Action
Research	Food habit study.	Fecal samples will be collected from squirrels captured during nest box surveys and examined to determine food habits.
	Habitat use, seasonal movements and den tree characteristics need to be described.	Captured flying squirrels will be fitted with transmitters and tracked using radio telemetry.
	Habitat studies.	Computer models and remote sensing techniques will be used to map potential Northern Flying Squirrel habitat.
	Genetic analysis.	Blood or tissue samples will be taken from squirrels to determine the genetic status of the Northern Flying Squirrel populations in WV.
	Silvicultural methods study.	Determine if silvicultural practices can be used to promote and enhance Northern Flying Squirrel habitat in currently marginal habitats or disturbed habitats in need of reclamation.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are several conservation issues associated with the WV Northern Flying Squirrel and its habitat. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management
Forest Health	Coordination, Education, Management, Acquisition, Restoration
Water Quantity and Quality	Legislation/Regulation
Over Collection	
Management Conflicts	Coordination
Invasive Species	Coordination
Damaging Recreation	Coordination, Management
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE WV NORTHERN FLYING SQUIRREL AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge of the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Create a GIS layer of WV Northern Flying Squirrel data using existing data and newly gathered data; and use GIS to map potential habitat.

Surveys:

- Survey areas with potential Northern Flying Squirrel habitat for new populations by placing either nest boxes or live traps.

Research:

- Collect and examine fecal samples from squirrels captured during nest box surveys to determine food habits.
- Fit captured flying squirrels with transmitters and track their movements and habitat use using radio telemetry.
- Use computer models and remote sensing techniques to map potential WV Northern Flying Squirrel habitat.
- Collect blood or tissue samples from squirrels to determine the genetic status of the WV Northern Flying Squirrel populations in WV.
- Determine if silvicultural practices can be used to promote and enhance WV Northern Flying Squirrel habitat in current marginal habitats or disturbed habitats in need of reclamation.

Acquisition:

- Acquire easements or ownership of tracts of lands (with buffer zones) with known WV Northern Flying Squirrel occurrences.

Coordination:

- Coordinate with U.S. Forest Service and other interested parties to help control invasive species such as the Hemlock Woolly Adelgid.
- Continue present cooperation with the U.S. Forest Service to maintain nest box monitoring methodologies and forest plan strategies.
- Coordinate with project developers and landowners to address impacts of second-home development, timbering, road construction or other projects that require tree removal and fragmentation in WV Northern Flying Squirrel habitat.

Education:

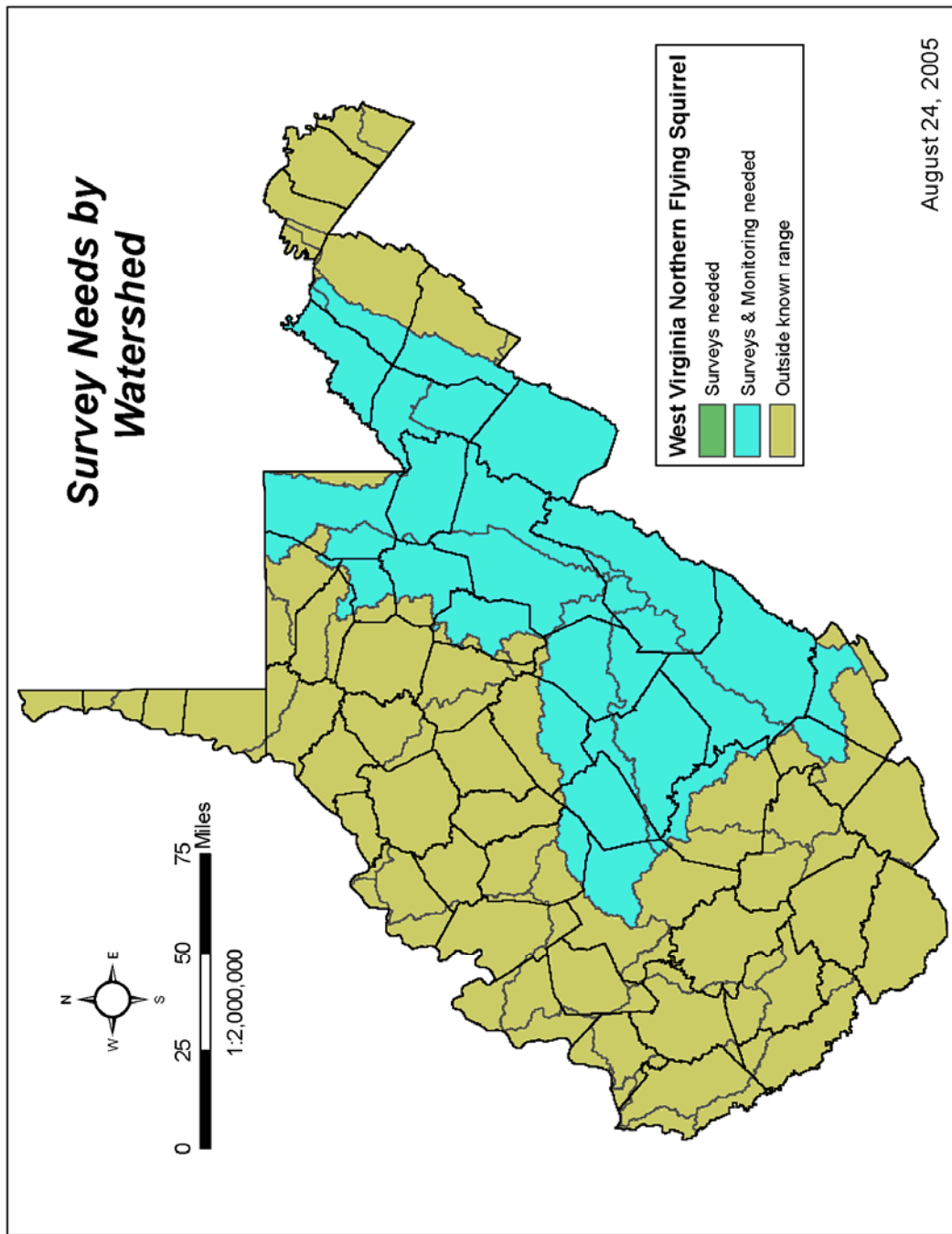
- Educate the public about the differences between Northern and Southern flying squirrels and what they can do to protect WV Northern Flying Squirrel habitat.

Legislation/Regulation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.
- Support the improvement and enforcement of Clean Air laws to decrease acid precipitation and the presence of heavy metals.

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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mammals

Common name: Eastern Small-footed Bat

Scientific name: *Myotis leibii*

STATUS

The ranks and information in the chart below indicate the rarity of the Eastern Small-footed Bat in West Virginia. This species is recognized as Species of Concern by the U.S. Fish and Wildlife Service. It is listed as rare and in need of conservation and its status is monitored by many groups. It is considered a species of concern in every state in which it occurs.

Priority	Global Rank	State Rank	USFWS	Mon Forest	Jeff Forest	IUCN Rank	NE Tech Comm	Trend
1	G3	S1	SC	X	X	LR/lc	X	Stable

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of the Eastern Small-footed Bat into watersheds and gives the ages of the records (recent is within 20 years), and indicates whether the sites are under public or private ownership. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. Sites listed are hibernacula, roost sites, or mistnet captures.

Habitat: The Eastern Small-footed Bat hibernates in caves and mines during the winter. Temperatures at the hibernation sites are cold and stable, but remain above freezing. Little is known about the summer habitat of this bat, although it is usually found in mountainous regions. These bats are observed in cracks in rock outcrops and talus piles. Maternity colonies most likely occur in these rock outcrops and talus areas (boulder fields and rock debris at the base of cliffs).

Watershed	Record Type	Ownership
Cacapon	Recent	Private
	Historic	Private
Cheat	Recent	Public
	Historic	Public
Coal	Recent	Private
Gauley	Recent	Public
Greenbrier	Recent	Private
	Historic	Public
Lower Guyandotte	Recent	Private
Lower New	Recent	Public

North Branch Potomac	Recent	Private
South Branch Potomac	Recent Historic	Private
		Public
Tug Fork	Recent	Private
Tygart Valley	Recent	Private
Upper Guyandotte	Recent	Private
Upper Kanawha	Recent	Private
Upper New	Recent	Private
		Public
Youghiogheny	Historic	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Eastern Small-footed Bat. Because there is inadequate information on the distribution and status of the Eastern Small-footed Bat in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, migration patterns, and habitat use. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Eastern Small-footed Bat.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Public access to general bat information.	Publish <i>Bats of West Virginia</i>. Provide general bat data, such as distribution maps, on the internet.
	GIS layer of bat data.	Create a GIS layer of bat data using existing and newly gathered data.

Category	Need	Action
Surveys	Additional winter roost sites need to be surveyed.	Investigate caves and mines for additional populations. Talus and cliffs should also be investigated when feasible.
	Additional summer roost sites need to be surveyed.	Investigate bridge expansion joints, conduct mist net surveys and use acoustic monitoring to find new sites. Visual surveys of talus areas will also be conducted.
	Historic sites need to be revisited.	Historic hibernacula will be visited to determine if bats are still present at the sites and to note any habitat changes.

Category	Need	Action
Monitoring	Monitor existing sites.	Monitor hibernating populations and summer roost sites to document changes in the populations or habitat, and to monitor any potential threats.

Category	Need	Action
Research	Life history and habitat use data needs to be obtained.	Use radio-telemetry to track bats as they forage and return to their roost sites.
	Population structure needs to be determined.	Work with wildlife agencies in states throughout the Eastern Small-footed Bat's range to collect tissue and hair samples for genetic analyses.
	Impacts of wind turbines and other large structures on all bat species needs to be determined.	Monitor wind turbine and cell tower sites routinely to recover bat carcasses to provide information on mortality rates and whether high mortality is affected by seasonal changes, weather patterns, etc.
	Foraging habitat needs to be determined.	Analyze guano samples to determine food habitats and possible foraging sites.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There several conservation issues associated with the Eastern Small-footed Bat and its habitat. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	
Over Collection	
Management Conflicts	Coordination , Management
Invasive Species	
Damaging Recreation	Acquisition , Coordination
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE EASTERN SMALL-FOOTED BAT AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Publish *Bats of West Virginia*.
- Create a GIS layer of bat data using existing and newly gathered data.

Surveys:

- Investigate caves and mines for additional populations. Talus and cliffs should also be investigated when feasible.
- Investigate bridge expansion joints, conduct mist net surveys and use acoustic monitoring to find new sites. Visual surveys of talus areas will also be conducted.

Research:

- Use radio-telemetry to track bats as they forage and return to their roost sites.
- Work with wildlife agencies in states throughout the Eastern Small-footed Bat's range to collect tissue and hair samples for genetic analyses.
- Monitor wind turbine and cell tower sites routinely to recover bat carcasses to provide information on mortality rates and whether high mortality is affected by seasonal changes, weather patterns, etc.
- Analyze guano samples to determine food habitats and possible foraging sites.

Acquisition:

- Acquire easements or ownership of caves, cave entrances and mine portals to protect winter and summer roost sites.

Coordination:

- Work with landowners to maintain foraging habitat (forests near roosts) and protect roost sites (caves, mine, rock outcrops).
- Work with the U.S. Forest Service, the National Park Service and the Division of Highways regarding Eastern Small-footed Bat sites on their lands, especially potential rock climbing areas and bridges.
- Mitigate against impacts of quarrying, road construction and development in the vicinity of Eastern Small-footed Bat roost sites and foraging areas.
- Work with U.S. Fish and Wildlife Service and the WV Department of Environmental Protection to require bat surveys prior to closing mine entrances.

Education:

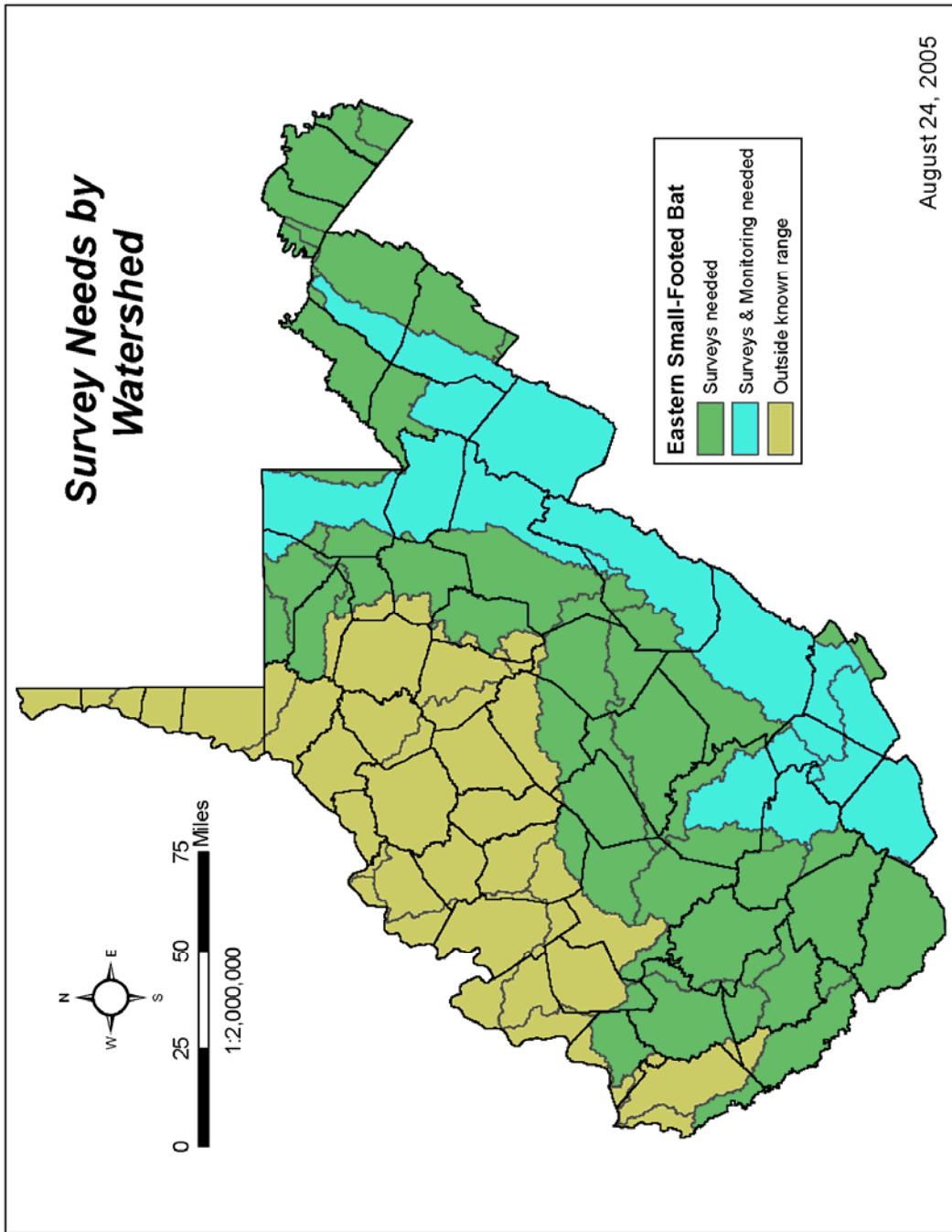
- Educate the public about bats and their habits, outlining the effects of various land use practices that may impact hibernacula, maternity sites and foraging areas (such as caving, rock climbing and forestland management).
- Place signage at protected roosts sites to inform the public.

Legislation/Regulation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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- West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mammals
Common name: Evening Bat
Scientific name: *Nycticeius humeralis*

STATUS

The ranks and information in the chart below indicate the rarity of the Evening Bat in West Virginia. It is listed as rare and in need of conservation and its status is monitored by many groups.

Priority	Global Rank	State Rank	IUCN Rank	Trend
2*	G5	S1	LR/lc	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of the Evening Bat into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether the sites are under public or private ownership. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. Sites listed are from a museum specimen and mistnet captures.

Habitat: During the summer, Evening Bats roost in buildings, tree cavities and behind loose tree bark. These sites may also be utilized as maternity colonies. Little is known about the Evening Bat's hibernation habitat, although these bats rarely enter caves.

Watershed	Record Type	Ownership
Middle Ohio River Valley	Recent	Public
Potomac	Historic	Private
Coal	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Evening Bat. Because there is inadequate information on the distribution and status of the Evening Bat in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, migration patterns, and habitat use. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Evening Bat.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Public access to general bat information.	Publish <i>Bats of West Virginia</i>.
		Provide general bat data, such as distribution maps, on the internet.
GIS layer of bat data.	Create a GIS layer of bat data using existing and newly gathered data.	

Category	Need	Action
Surveys	Summer roost sites need to be surveyed.	Investigate abandoned buildings, snags and trees with loose bark in areas where the bat has been captured to search for summer roost and maternity sites.

Category	Need	Action
Monitoring	Known occurrences need to be monitored.	Mist net at known capture sites to determine presence/absence. This will also allow for the placement of radio transmitters.
	Maternity sites need to be monitored.	Monitor maternity sites once they have been located.

Category	Need	Action
Research	Life history and habitat use data needs to be obtained.	Use radio-telemetry to track bats as they forage and return to their roost sites.
	Impacts of wind turbines and other large structures on migrating bat species need to be determined.	Monitor wind turbine and cell tower sites routinely to recover bat carcasses to provide information on whether high mortality is affected by seasonal changes, weather patterns, etc.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There several conservation issues associated with the Evening Bat and its habitat. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE EVENING BAT AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge of the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Publish *Bats of West Virginia*.
- Create a GIS layer of bat data using existing and newly gathered data.

Surveys:

- Investigate abandoned buildings, snags and trees with loose bark in areas where the bat has been captured to search for summer roost and maternity sites.

Research:

- Use radio-telemetry to track bats as they forage and return to their roost sites.
- Monitor wind turbine and cell tower sites routinely to recover bat carcasses to provide information on whether high mortality is affected by seasonal changes, weather patterns, etc.

Coordination:

- Work with landowners to protect important roosting sites.
- Coordinate with WVDNR wildlife managers regarding occurrences of the Evening Bat on Wildlife Management Areas.
- Mitigate against impacts of mining, development, timbering, or other projects that require tree removal in the vicinity of existing or potential Evening Bat sites.

Education:

- Educate the public about bats and their habits, outlining the effects of various land use practices that may impact roosting sites and foraging areas (such as forestland management, land development and removal of abandoned buildings).

Legislation/Regulation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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Taxa: Mammals
Common name: River Otter
Scientific name: *Lutra canadensis*

STATUS

The River Otter began a precipitous decline in West Virginia in the early 1900s and the last few otters were spotted in Grant and Pendleton counties in the 1950s. As water quality improved, the WVDNR reintroduced 245 otters in 14 West Virginia rivers between 1984 and 1997. Populations are increasing on many of these rivers.

Priority Group	Global Rank	State Rank	Trend
2*	G5	S1	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the River Otter into watersheds, gives the ages of the records (recent is within 20 years), and indicates whether sites are in public or private ownership.

Habitat: The River Otter requires areas with considerable open water and aquatic vegetation. It inhabits many of the medium and larger sized rivers and creeks of West Virginia.

Watershed	Site Name	Record Type
Elk	Elk River	Recent
Greenbrier	Greenbrier River	Recent
	Meadow River	Recent
Little Kanawha	Little Kanawha River	Recent
	Steer Creek	Recent
	North Fork Hughes River	Recent
Lower New	New River	Recent
Middle Ohio River Valley	Sandy Creek	Recent
South Branch Potomac	South Branch Potomac River	Recent
Cacapon	North River	Recent

DECISION MAKING PROCESS- NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the River Otter. Because there is inadequate information on the life history of the River Otter in West Virginia, the first step in its conservation is to gain a better understanding of its status and life history. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the River Otter.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Obtain coordinates.	Increase GPS use, protocol development and training.
	Public access to general River Otter information.	Provide general River Otter data information, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Distribution and status of otter populations in WV rivers need to be determined.	Continue to conduct bridge surveys.
	Additional surveys.	Add additional bridge sites for bridge surveys; monitor bridges, sites on the Potomac, Monongahela, Ohio, Kanawha and Big Sandy rivers.

Category	Need	Action
Monitoring	Long-term monitoring sites and status of species.	Continue monitoring bridge sites every 3-5 years.
		Monitor non-seasonal mortalities.

Category	Need	Action
Research	Life history studies.	Identify, prioritize and implement for conservation of the species.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the River Otter and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	
Forest Health	Coordination , Management
Water Quantity and Quality	Education, Coordination , Management
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	
Data Protection	

SELECTED ACTIONS FOR THE CONSERVATION OF THE RIVER OTTER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge of the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.

Surveys:

- Continue to conduct bridge surveys.
- Add additional bridge sites for bridge surveys; monitor bridges, sites on the Potomac, Monongahela, Ohio, Kanawha and Big Sandy rivers.

Research:

- Identify, prioritize and implement life history studies for conservation of the species.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc.) in streams supporting or having the potential to support the River Otter. This may include limiting ATV use, encouraging use of Best Management Practices when timbering and other site related issues.
- Assess effects of possible dam construction on rivers and streams as projects arise.
- Work with the U.S. Forest Service to consider the River Otter in management practices.
- Coordinate with the DEP to limit the amount of acid mine drainage entering streams.

Education:

- Educate the public as to the importance of wildlife and the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc.) through presentations, pamphlets, etc.

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Taxa: Mammals
Group: Small Mammals

STATUS

The ranks and information in the chart below indicate the rarity and status of small mammals which are in Greatest Need of Conservation in West Virginia. The Southern Water Shrew, Southern Rock Vole and the Allegheny Woodrat are addressed as separate species and are not included here. Small mammals are difficult to survey. The process is time intensive and surveys may be conducted for years before a rare target species is actually captured. Small mammal data are generally lacking and surveys are needed for all species.

Scientific Name	Common Name	Priority Group	Global Rank	State Rank	NE Tech Comm	Trend
<i>Cryptotis parva</i>	Least Shrew	2*	G5	S2	X	Unknown
<i>Ochrotomys nuttalli</i>	Golden Mouse	2	G5	S2		Unknown
<i>Sorex dispar</i>	Long-tailed Shrew	2	G4	S2S3		Unknown
<i>Sorex hoyi winnemana</i>	Southern Pygmy Shrew	2	G5T4	S2S3		Unknown
<i>Synaptomys cooperi</i>	Southern Bog Lemming	2	G5	S2		Unknown
<i>Microtus ochrogaster</i>	Prairie Vole	2	G5	S3		Unknown
<i>Zapus hudsonius</i>	Meadow Jumping Mouse	2	G5	S3		Unknown
<i>Condylura cristata</i>	Star-nosed Mole	2	G5	S2		Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places each species of Small Mammals into watersheds and describes the habitat. The number of recent (within 20 years) versus historic records are provided. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species.

Species	Watershed	Record Type	Habitat
Least Shrew	Gauley	Recent Historic	Old Fields
	Potomac		
Prairie Vole	Lower Guyandotte	Recent Historic	Drier, Sandier Meadows and Old Fields
	Lower Ohio Valley		
	Middle Ohio Valley		
	Twelve Pole		

Golden Mouse	Lower Guyandotte	Recent Historic	Fields and Thickets
	Upper Guyandotte		
	Lower New		
	Upper New		
	Lower Ohio Valley		
Long-tailed Shrew	Cheat	Recent Historic	Wooded Talus Slopes and Colluvial Boulder- Fields, Medium to High Elevation
	Elk		
	Gauley		
	Lower New		
	Upper New		
	Tygart Valley		
	Upper Guyandotte		
Southern Pygmy Shrew	Cheat	Recent	Moist to Xeric Woodlands with Abundant Leaf Litter
	Lower New		
	Upper New		
	Potomac		
	South Branch Potomac		
	Tygart Valley		
Southern Bog Lemming	Cheat River	Recent Historic	Wet Meadows, Ponds, Fields Near Creeks and Streams
	Elk		
	Greenbrier		
	Middle Ohio		
	Upper Ohio		
	Monongahela		
	South Branch Potomac		
	Tug Fork		
	Twelve Pole		
	Upper Guyandotte		
	Youghiogheny		

Meadow Jumping Mouse	Cheat	Recent Historic	Wet Meadows, Ponds, Fields Near Creeks and Streams
	Elk		
	Gauley		
	Greenbrier		
	Lower Kanawha		
	Middle Ohio Valley		
	Upper Ohio Valley		
	Monongahela		
	North Branch Potomac		
	South Branch Potomac		
	Tygart Valley		
	Upper New		
Star-nosed Mole	Cheat	Recent Historic	Swamps, Bogs, Wet Meadows and Damp Leaf Litter in Forests.
	Greenbrier		
	Tygart Valley		
	South Branch Potomac		

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Small Mammals. Since much of the information on the distribution and status of Small Mammals in West Virginia is sparse, the first step in their conservation is to gain a better understanding of their distribution and habitat requirements. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Small Mammals.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Coordinates of capture and survey site.	Estimate coordinates of historic sites or revisit sites to capture GPS coordinates. All new data use GPS.
	Public access to data.	Complete <i>Mammals of West Virginia</i> .
		General Website information on small mammals.

Category	Need	Action
Surveys	Determine status at historic sites.	A very high percentage of sites are historic, surveys need to be conducted with priority given to sites with habitat most likely to support the species.
	Determine extent of potential habitat for recent occurrences.	Conduct detailed habitat documentation with site visits and possible surveys.
	Additional sites need to be surveyed.	Analyze potential habitat statewide to determine potential survey areas.

Category	Need	Action
Monitoring	Long-term species monitoring sites.	Evaluate all current small mammal sites to determine if an area of high diversity exists, and establish monitoring stations. Re-evaluate sites as new Small Mammal data becomes available.
	Monitor habitat.	Quantitatively evaluate sites to determine habitat changes; if impacts occur, survey for species.

Category	Need	Action
Research	All life history aspects pertaining to WV populations, especially habitat requirements.	Coordinate research projects with researchers. Write prospecti for needed projects and actively seek contractors.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There several conservation issues associated with Small Mammals and their habitat. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Coordination, Education
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF SMALL MAMMALS AND THEIR HABITATS

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve these species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.

Surveys:

- A very high percentage of sites are historic; surveys need to be conducted with priority given to sites with habitat most likely to support the species.
- Conduct detailed habitat documentation with site visits and possible surveys.
- Analyze potential habitat statewide to identify potential new survey areas.

Research:

- Coordinate research projects with researchers. Write proposals for needed prospecti for needed projects and actively seek contractors.

Coordination:

- Work with landowners to consider the effects of land use practices on their properties. This may include maintaining open fields or thickets, encouraging use of Best Management Practices when timbering or during road construction, maintaining water quality and other site related issues.
- Encourage private landowners to allow surveys for small mammals.
- Mitigate for impacts of projects which may convert habitat.

Education:

- Educate the public about the importance of biodiversity and what they can do to maintain or create small mammal habitat.

Legislation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.
- Develop appropriate regulations and collection limits on all Small Mammal species.

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Taxa: Mammals

Common name: Indiana Bat

Scientific name: *Myotis sodalis*

STATUS

The ranks and information in the chart below reflect the rarity of the Indiana Bat in West Virginia. This species is listed as endangered by the U.S. Fish and Wildlife Service.

Priority	Global Rank	State Rank	USFWS	Mon Forest	Jeff Forest	IUCN Rank	NE Tech Comm	Trend
1*	G2	S1	LE	X	X	EN A1c	X	Increasing

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of the Indiana Bat into watersheds, gives the ages of the records (recent is within 20 years), and indicates whether the sites are under public or private ownership. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. Sites listed are hibernacula and maternity colonies.

Habitat: Indiana Bats hibernate in caves which provide suitable hibernaculum conditions. These caves usually have fairly stable winter temperatures ranging from 2.8 to 6.1 °C (37 to 43 °F) and a high relative humidity (66 percent to 95 percent). During the summer, females form small maternity colonies under the loose bark of trees. Males also utilize trees, forming small colonies in hollow trees or under loose bark. Feeding areas for the Indiana Bat consist of wooded habitats, both along river corridors and in upland forests.

Watershed	Record Type	Ownership
Cacapon	Historic	Private
Cheat	Recent	Private
		Public
Coal	Recent	Private
Elk	Recent	Private
		Public
Greenbrier	Recent Historic	Private
Lower New	Recent	Public
South Branch Potomac	Recent Historic	Private
		Public
Tygart Valley	Recent	Private
Upper New	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Indiana Bat. Because there is inadequate information on the distribution and status of the Indiana Bat in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, migration patterns and habitat use. Needs and actions for each category are outlined below.

Bolded text indicates primary actions required to identify conservation needs of the Indiana Bat.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Public access to general bat information.	Publish <i>Bats of West Virginia</i>.
		Provide general bat data, such as distribution maps, on the internet.
GIS layer of bat data.	Create a GIS layer of bat data using existing and newly gathered data.	

Category	Need	Action
Surveys	Additional potential hibernacula sites need to be surveyed.	Select caves based on structure, proximity to existing known hibernacula and reports from cavers.
	Additional maternity sites need to be surveyed.	Conduct mist net surveys at water sources and in travel corridors in areas suitable for Indiana Bat maternity colonies. Band Indiana Bats to determine where bats of specific maternity colonies hibernate.
	Historic sites need to be revisited.	Historic hibernacula will be visited to determine if bats are still present at the sites and to note any habitat changes.

Category	Need	Action
Monitoring	Existing sites need to be monitored.	Monitor to document changes in the populations or habitat, and to monitor any potential threats. Significant hibernacula will be monitored biennially, while minor hibernacula will be monitored on a less frequent basis. Maternity sites will also be monitored.
	Microclimate data at hibernacula needs to be collected.	Place temperature loggers at Indiana Bat hibernacula.

Category	Need	Action
Research	Information on Indiana Bat movements, activities outside of the hibernacula and roosts need to be obtained to analyze habitat use.	Utilize acoustic monitoring and/or radio-telemetry to track and locate roost trees, foraging areas and summer habitat.
	Impacts of wind turbines and other large structures on all bat species needs to be determined.	Monitor wind turbine and cell tower sites routinely to recover bat carcasses to provide information on mortality rates and whether high mortality is affected by seasonal changes, weather patterns, etc.
	Hair isotope studies.	Collect and analyze hair samples from female Indiana Bats in hibernacula to determine approximate summer locations and migration distances.
	Genetics of WV Indiana Bat populations need to be examined to determine how they relate to other populations in the East.	Coordinate with the U.S. Fish and Wildlife Service, state agencies, U.S. Forest Service and other surveyors to collect tissue samples from Indiana Bats for genetic information.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There several conservation issues associated with the Indiana Bat and its habitat. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Education , Coordination, Management
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	Acquisition , Coordination
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE INDIANA BAT AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Publish *Bats of West Virginia*.
- Create a GIS layer of bat data using existing and newly gathered data.

Surveys:

- Select caves based on structure, proximity to existing known hibernacula and reports from cavers.
- Conduct mist net surveys at water sources and in travel corridors in areas suitable for Indiana Bat maternity colonies. Band Indiana Bats to determine where bats of specific maternity colonies hibernate.

Research:

- Utilize acoustic monitoring and/or radio-telemetry to track bats and locate roost trees, foraging areas and summer habitat.
- Monitor wind turbine and cell tower sites routinely to recover bat carcasses to provide information on mortality rates and whether high mortality is affected by seasonal changes, weather patterns, etc.
- Collect and analyze hair samples from female Indiana Bats in hibernacula to determine approximate summer locations and migration distances.
- Coordinate with the U.S. Fish and Wildlife Service, state agencies and U.S. Forest Service and other surveyors to collect tissue samples from Indiana Bats for genetic information.

Acquisition:

- Acquire easements or ownership of caves or cave entrances to protect important hibernacula.

Coordination:

- Work with landowners to protect important hibernacula by placing gates or fences at cave entrances for permanent or seasonal cave closures.
- Work with the U.S. Forest Service, the National Park Service and the Division of Forestry to protect Indiana Bat sites on or near their lands.
- Coordinate with project developers and landowners to address impacts of mining, development, timbering, or other projects that require large-scale tree removal in the vicinity of Indiana Bat hibernacula, maternity sites or possible migration corridors.
- Work with the U.S. Fish and Wildlife Service and the WV Department of Environmental Protection to require bat surveys prior to closing mine entrances.

Education:

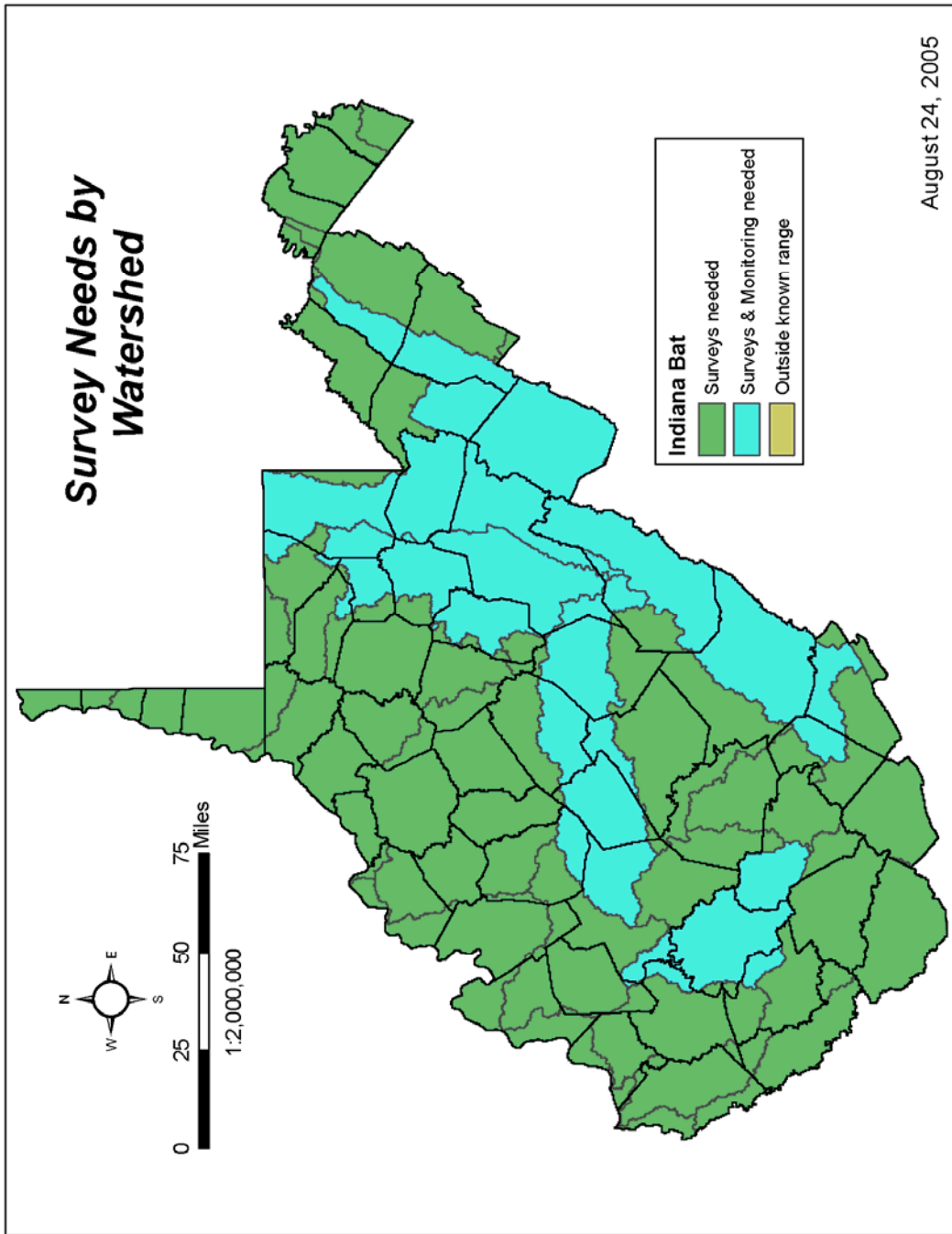
- Educate the public in regards to bats and their habits, outlining the effects of various land use practices that may impact hibernacula, maternity sites and foraging areas (such as caving, small-scale forestland management and stream channel modification).
- Place signage at closed cave entrances to explain the reason for the closure.

Legislation/Regulation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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- Stihler, Craig. 2003. *WV Threatened and Endangered Animal Project: Five Year Work Plan for Federal Assistance*. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program. 24pp.
- Stihler, Craig. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.
- West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mammals
Group: Tree Bats

STATUS

The ranks and information in the chart below indicate the rarity and status of the Tree Bats in West Virginia. Only those species which are considered to be in Greatest Need of Conservation are addressed.

Species Name	Common Name	Priority Group	Global Rank	State Rank	IUCN Rank	NE Tech Comm	Trend
<i>Lasionycteris noctivagans</i>	Silver-haired Bat	2	G5	S2	LR/lc	X	Stable
<i>Lasiurus borealis</i>	Eastern Red Bat	2	G5	S4	LR/lc	X	Stable
<i>Lasiurus cinereus</i>	Hoary Bat	2	G5	S3	LR/lc	X	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places each species of Tree Bat into watersheds and describes their habitat. The number of recent (within 20 years) versus historic records is also given. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. Most sites are the result of mistnetting captures.

Species	Watershed	Record Type	Habitat
Silver-haired Bat	Cheat	Recent Historic	Roost and maternity sites include foliage of trees, tree cavities, under loose bark and sometimes in open buildings. Foraging takes place over streams or lakes in wooded areas.
	Coal		
	Gauley		
	Greenbrier		
	Lower Guyandotte		
	Lower Kanawha		
	Lower New		
	South Branch Potomac		
	Tug Fork		
	Twelve Pole		
Tygart			

Species	Watershed	Record Type	Habitat
Eastern Red Bat	Cacapon	Recent	Forested areas where it roosts in the foliage of trees. Foraging takes place near the canopy or above treetops, at water sources or at lights.
	Cheat		
	Coal		
	Elk		
	Gauley		
	Greenbrier		
	Little Kanawha		
	Lower Guyandotte		
	Lower Kanawha		
	Upper Guyandotte		
	Upper New		
	Lower New		
	Lower Ohio		
	Middle Ohio Valley		
	North Branch Potomac		
	Potomac		
	Shenandoah		
	South Branch Potomac		
	Tug Fork		
	Twelvepole		
Tygart Valley			
Upper Ohio Valley			
Hoary Bat	Coal	Recent	Deciduous and coniferous forests and woodlands where it roosts in the tree foliage. The Hoary Bat will sometimes roost in rock crevices. Forages near water sources or around lights.
	Cheat		
	Elk		
	Gauley		
	Greenbrier		
	Lower Kanawha		
	Middle Ohio Valley		
	South Branch Potomac		
	Tug Fork		
	Tygart Valley		
	Upper Kanawha		

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Tree Bats. Since much of the information on the distribution and status of the tree bats in West Virginia is inadequate, the first step in their conservation is to gain a better understanding of their distribution, migration patterns, and habitat use. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Tree Bats.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Public access to general bat information.	Publish <i>Bats of West Virginia</i>. Provide general bat data, such as distribution maps, on the internet.
	GIS layer of bat data.	Create a GIS layer of bat data using existing data and newly gathered data.

Category	Need	Action
Surveys	Statewide distribution needs to be documented.	Mist net in forested areas to determine the presence or absence of tree bats. Investigate open sheds or garages and trees with loose bark for summer roost and maternity sites. Utilize acoustical monitoring to determine which species of bats are in a certain area.

Category	Need	Action
Monitoring	Obtain an index of population density.	Track populations over time using standardized mist netting methods and standardized acoustic monitoring surveys.

Category	Need	Action
Research	Determine impacts of wind turbines and other large structures on all bat species, especially those that migrate along ridgetops.	Monitor wind turbine and cell tower sites routinely to recover bat carcasses to provide information on mortality rates and whether high mortality is affected by seasonal changes, weather patterns, etc.
	Determine migration routes/corridors through state.	Utilize radar and acoustic monitoring to determine migration routes, time periods and peaks.
	Determine habitat use.	Utilize radio-telemetry to track bat movements to determine habitat use, roost sites and foraging areas.
	Hair isotope studies.	Conduct hair isotope studies to determine migration distances.
	Genetic analysis.	Take wing punch samples to determine genetic structure of east coast populations.
	Monitoring protocol.	Develop a protocol for long-term monitoring of Tree Bat populations.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There several conservation issues associated with Tree Bats and their habitat. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	
Over Collection	
Management Conflicts	Coordination
Invasive Species	
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE TREE BATS AND THEIR HABITATS

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve these species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on their distribution, status and conservation needs. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Publish *Bats of West Virginia*.
- Create a GIS layer of bat data using existing data and newly gathered data.

Surveys:

- Mist net in forested areas to determine the presence or absence of tree bats. Investigate open sheds or garages and trees with loose bark for summer roost and maternity sites. Utilize acoustical monitoring to determine which species of bats are in a certain area.

Research:

- Monitor wind turbine and cell tower sites routinely to recover bat carcasses to provide information on mortality rates and whether high mortality is affected by seasonal changes, weather patterns, etc.
- Utilize radar and acoustic monitoring to determine migration routes, time periods and peaks.
- Utilize radio-telemetry to track bat movements to determine habitat use, roost sites and foraging areas.

Coordination:

- Work with landowners and land managers to protect important roosting sites.
- Mitigate impacts of mining, development, timbering, or other projects that require tree removal in the vicinity of existing or potential sites which may provide roosting or foraging areas for Tree Bats; or at sites where migration corridors may be impacted.

Education:

- Educate the public about bats and their habits, outlining the effects of various land use practices that may impact roosting sites and foraging areas (such a forestland management and land development).

Legislation/Regulation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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Taxa: Mammals

Common name: Fisher

Scientific name: *Martes pennanti*

STATUS

Fishers were believed to be very rare in West Virginia at the turn of the century and sightings were restricted to the higher elevations. Twenty-three Fishers were released by the WVDNR in 1969 at Canaan Mountain in Tucker County and Cranberry Glades in Pocahontas County. Mandatory checking of harvested Fisher began in 1975. While reports are scarce for most counties, they are high in Tucker, Preston, Grant and Mineral Counties.

Priority Group	Global Rank	State Rank	Trend
2*	G5	S3	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION AND HABITAT

The locations for the Fisher are by county. The number of recent (within 20 years) versus historic records is listed by county instead of watershed. The number of records is not indicated in this table. Each county listed may have more than one record for the species.

Habitat: The Fisher is a dweller of continuous forest; a common resident of the coniferous and mixed conifer/hardwood forests of past years. It now inhabits areas with extensive second-growth hardwood forests.

County	Record Type
Barbour	Recent Historic
Grant	Recent Historic
Hampshire	Recent
Harrison	Recent
Lewis	Recent
Marion	Recent
Mineral	Recent Historic
Monongalia	Recent
Pocahontas	Recent
Preston	Recent Historic
Randolph	Recent Historic

Taylor	Recent
Tucker	Recent Historic
Upshur	Recent
Wetzel	Recent

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Fisher. Because there is inadequate information on the distribution and status of the Fisher in West Virginia, the first step in its conservation is to gain a better understanding of their status and habitat use. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Fisher.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	UTM coordinates for existing and future tag locations.	Plot harvest sites on maps to obtain coordinates and integrate into the agency data base.
	Public access to general Fisher information.	Provide general Fisher data, such as distribution maps, on the internet.
	Obtain locality data from trappers.	Develop and implement a short survey on trap locations taken from field tags.

Category	Need	Action
Surveys	Rely on harvest checking program to obtain distribution information.	Obtain tag information each year.

Category	Need	Action
Monitoring	Monitor status of species.	Continue collection of trapping data.

Category	Need	Action
Research	Life history studies.	Identify research projects needed for conservation of the species.
	Assess range changes over time.	Analyze trapper data to determine if range is changing over time.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There several conservation issues associated with the Fisher and its habitat. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	
Forest Health	Coordination, Education, Management
Water Quantity and Quality	
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	Legislation/Regulation
Data Protection	

SELECTED ACTIONS FOR THE CONSERVATION OF THE FISHER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge of the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Plot harvest sites on map to obtain coordinates and integrate into the agency database.
- Develop and implement a survey on trap locations taken from field tags.

Surveys:

- Obtain tag information each year.

Research:

- Identify research projects needed for conservation of the species.
- Analyze trapper data to determine if range is changing over time.

Coordination:

- Coordinate with private landowners to maintain forestland on their properties.
- Work with the U.S. Forest Service to consider the Fisher in management practices.

Education:

- Educate students, teachers and citizens to the importance of wildlife through presentations, pamphlets, etc.

Legislation/Regulation:

- Enforce trapping regulations and use the mandatory tagging rule to supply critical distribution information.

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Taxa: Mammals

Common name: Eastern Harvest Mouse

Scientific name: *Reithrodontomys humulis*

STATUS

The ranks and information in the chart below indicate the rarity of the Eastern Harvest Mouse in West Virginia. It is listed as rare and in need of conservation due to the historic nature of the occurrences in the state. West Virginia is at the northern part of its range and it may be naturally rare.

Priority Group	Global Rank	State Rank	Trend
1*	G5	SH	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Eastern Harvest Mouse into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether sites are in public or private ownership.

Habitat: Eastern Harvest Mice utilize old fields of matted grass and broom sedge, tangled patches of blackberry and greenbrier, roadside ditches, wet bottomlands and grassy flat woods.

Watershed	Site Name	Record Type	Ownership
Greenbrier River	Camp Summers	Historic	Private
	White Sulphur Springs	Historic	Private
	Camp Pocahontas	Historic	Private
Lower Guyandotte River	Cox Landing	Historic	Private
	Barboursville	Historic	Private
Lower Ohio River Valley	Cox Landing-South	Historic	Private
	Ceredo	Historic	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Eastern Harvest Mouse. Because there is inadequate information on the distribution and status of the Eastern Harvest Mouse in West Virginia, the first step in its conservation is to gain a better understanding of distribution and life history. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Eastern Harvest Mouse.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data needs to be compiled into the database with coordinates.	Most mammal data is entered into the database, although coordinate data is needed.
	Public access to general mammal information.	Complete <i>Mammals of West Virginia</i> . Provide general Eastern Harvest Mouse data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Status at historic sites needs to be determined.	Under the WV Landowner Incentive Program, sites will be surveyed in 2005 or 2006; if species is not found, but suitable habitat is present, plans will be made to survey again in the next 2-3 years.
	New sites need to be surveyed.	As historic sites are visited, areas with appropriate habitat will also be surveyed or noted for future survey.

Category	Need	Action
Monitoring	Long-term monitoring.	If species is found, monitor existing sites to determine status of population and any changes to habitat.

Category	Need	Action
Research	All life history aspects pertaining to WV populations, especially habitat requirements.	Coordinate research projects with researchers. Write proposals for needed projects and actively seek contractors.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There several conservation issues associated with the Eastern Harvest Mouse and its habitat. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Some of these practices may increase Harvest Mouse habitat. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management
Forest Health	
Water Quantity and Quality	Legislation/Regulation
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE EASTERN HARVEST MOUSE AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.

Surveys:

- Under the WV Landowner Incentive Program, sites will be surveyed in 2005 or 2006. If the species is not found, but suitable habitat is present, plans will be made to survey again in the next 2-3 years.
- As historic sites are visited, areas with appropriate habitat will also be surveyed or noted for future survey.

Research:

- Coordinate research projects with researchers. Write proposals for needed projects and actively seek contractors.

Coordination:

- Coordinate with private landowners to maintain Eastern Harvest Mouse habitat, such as old fields, wet meadows or open areas and to allow surveys on their properties.

Education:

- Educate the public about the importance of small mammals and what the public can do to create or maintain habitat for the Eastern Harvest Mouse through presentations, pamphlets, etc.

Legislation/Regulation:

- Support the improvement and enforcement of Clean Air laws to decrease acid precipitation.
- Develop stricter regulations and collection limits on all small mammals.
- Pass legislation to protect Species in Need of Greatest Conservation sites from FOIA requests.

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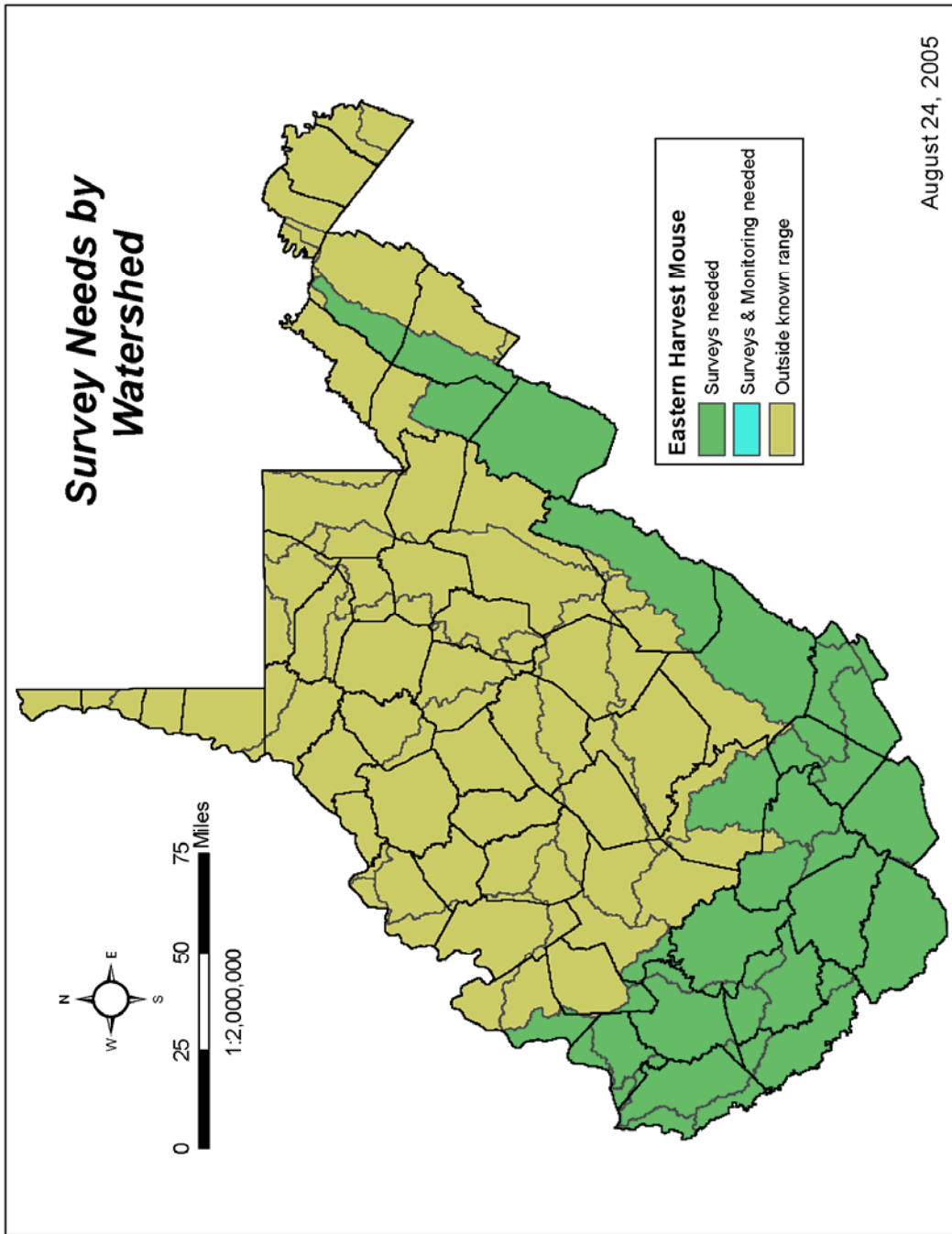
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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mammals

Common name: Allegheny Woodrat

Scientific name: *Neotoma magister*

STATUS

The ranks and information in the chart below indicate the rarity of the Allegheny Woodrat in West Virginia. This species is in need of conservation throughout its range and is recognized as a Species of Concern by the US Fish and Wildlife Service. West Virginia may be this species' stronghold.

Priority	Global Rank	State Rank	USFWS	Mon Forest	IUCN Rank	NE Tech Comm	Trend
1*	G3G4	S3	SC	X	LR/nt	X	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Allegheny Woodrat into watersheds and gives the ages of the records (recent is within 20 years), and indicates whether sites are under public or private ownership.

Habitat: Allegheny Woodrats are found almost exclusively in rocky areas such as caves, deep crevices and large boulder fields. These areas are located in or around hardwood forests that have an abundance of oaks and other mast-bearing trees. The Allegheny Woodrat is also known to occur in northern hardwood (beech, birch, maple), oak-pine forests and red spruce/northern hardwood forests.

Watershed	Site Name	Record Type	Ownership
Cacapon	Baker Cave	Recent	Private
	Cove Mountain - 2 Sites	Recent	Public
	Cheek Rocks	Recent	Public
	Hoy	Historic	Private
	Nathaniel Mountain WMA	Recent	Public
	South Branch Mountain	Recent	Private
	Short Mountain WMA	Recent	Public

Cheat	Coopers Rock State Forest	Recent	Public
	Snake Hill WMA	Recent	Public
	Upper Beaverhole Cave	Recent	Private
	Cornwell Cave	Recent	Private
	Camp Dawson - Pringle Tract	Recent	Public
	University Forest Road	Recent	Public
	Sand Spring Lookout Tower	Recent	Public
	Bowden Quarry	Recent	Private
	Yahoo Cave 1	Recent	Private
	Bowden Cave	Recent	Public/Private
	Laurel Run Cave/Bennett Rock Trail	Recent	Public
	Arbogast/Cave Hollow Cave	Recent	Public/Private
	Elklick Cave	Recent	Public
	Lindy Run	Recent	Private
	Canaan Valley State Park Quarry	Recent	Public
	North Fork Blackwater River	Recent	Private
	Bear Heaven	Recent	Public
	Mill Run Cave	Recent	Private
	Two Lick Run Cave	Recent	Public
	Bickle Hollow	Recent	Public
Coal	Horse Creek Junction	Recent	Private
Elk	Webster Springs	Historic	Private
	Dreen Cave	Recent	Public
	Just Cave	Recent	Private

Gauley	Koontz Bend	Recent	Public
	Summersville Dam	Recent	Public
	Meadow River - Route 19 Bridge	Recent	Public
	Carnifex Tunnel Ridge	Recent	Public
	Anjean Road Cliffs	Recent	Private
	Coal Siding Run	Recent	Public
	Sugar Knob - South	Recent	Private
	Camp Woodbine	Historic	Public
	Kennison Mountain	Recent	Public
Greenbrier	Raywood	Recent	Public
	Bone Cave	Recent	Private
	Bob Gee Cave	Recent	Private
	Lobelia Saltpeter Cave	Recent	Private
	Droop Mountain	Recent	Private
	Marthas Cave	Recent	Private
	Kates Mountain	Recent	Public
	Snedegars Cave	Recent	Private
	Tub Cave	Recent	Private
Lower Kanawha	Polly Hollow	Recent	Public
	Hoffman Hollow	Recent	Public
	Wall Fork	Recent	Public
Lower New	Endless Wall	Recent	Public
	Kaymoor Mine	Recent	Public
	Elverton	Recent	Public
	Cotton Hill	Recent	Private
	Babcock State Park	Recent	Public
	Fall Branch	Recent	Public

Monongahela	Dellslow-East	Historic	Private
	South Hills	Historic	Private
North Branch Potomac	Allegheny Ballistic Lab	Recent	Public
	Keyser Quarry	Recent	Private
	Gerstell	Historic	Private
	New Creek Quarry	Recent	Private
	Pinnacle Lookout Tower	Recent	Public
	Greenland Gap	Recent	Private
	Greenland Gap Cave	Recent	Private
Potomac	Shockeys Knob	Recent	Private
	Third Hill Mountain	Recent	Public
	Devils Nose	Historic	Public
	Locks-Of-The-Mountain	Recent	Public
South Branch Potomac	Fairview Cave	Recent	Private
	Cave Mountain Cave	Recent	Public
	Hinkle Mountain Road	Recent	Private
	Franklin Quarry	Recent	Private
	Petersburg Gap	Recent	Private
	Stump Knob	Recent	Private
	Stump Run	Recent	Private
	Cliff Cave	Recent	Private
	Smokehole Cave	Recent	Private
	Green Hollow Cave	Recent	Private
	Kenny Simmons Cave	Recent	Private
	Peacock Cave	Recent	Public
	Trout Cave	Recent	Private
	Gale Warner Cave	Recent	Private
Mill Run	Recent	Public	

South Branch Potomac (con't)	Nathaniel Mountain Cabin	Recent	Public
	Nathaniel Mountain WMA	Recent	Public
	Kline Gap Cave	Recent	Private
	Bear Rocks	Recent	Public
	Smoke Cliffs	Recent	Public
	Dolly Sods	Recent	Public
	Reeds Cliff	Recent	Private
	Schoolhouse Cave	Recent	Private
	Spruce Knob	Recent	Public
	Smokehole Road	Recent	Public
	Reeds Creek - 2 Sites	Recent	Public
	Mill Run Cave	Recent	Private
	Keys Cave	Recent	Public
	Bill Hendricks Cave	Recent	Private
	Dickson Mountain	Recent	Private
	Goshen Ridge	Recent	Private
	Flute Cave	Recent	Public
	Hoffman School Cave	Recent	Public
	Vandevander Cave	Recent	Private
	Hoffman Cliff Cave	Recent	Public
Minor Rexroad Cave	Recent	Private	
Sinnitt Cave	Recent	Private	
Tug Fork	Jennie Creek	Recent	Private
	Panther State Forest	Recent	Public
Twelve Pole	Camp Road	Historic	Private
Tygart Valley	Laurel Mountain Quarry	Recent	Private
	Brushy Fork Church Quarry	Recent	Private
	Harper Trail Cave	Recent	Public
	Izaak Walton Cave	Recent	Private

Tygart Valley (con't)	Valley Bend Quarry	Recent	Private
	Cheat Mountain Quarry	Recent	Private
	Limekiln Run Cave	Recent	Public
	Fort Lick Cave	Recent	Private
	Stewart Run Cave	Recent	Private
	Spruce Rocks	Recent	Private
	Laurel Run	Recent	Private
	Rich Mountain-Panther Run	Recent	Private
	Pleasant Run	Recent	Private
	Rich Mountain	Recent	Private
	Birch Run	Recent	Private
	Rich Mountain-Blue Rock	Recent	Private
Upper Guyandotte	Baileysville	Recent	Private
	Pinnacle Ridge	Recent	Private
Upper Kanawha	Fourmile Fork	Recent	Private
Upper New	Eads Mill Quarry	Recent	Private
	Kelly's Tank Cave	Recent	Private
	Honacker Cave	Recent	Private
	Caldwell Cave	Recent	Public
	East River Mountain-Radio Tower	Recent	Private
	Peters Mountain	Recent	Private
	Brush Creek	Recent	Private
	Beacon Cave	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Allegheny Woodrat. Because there is inadequate information on the distribution and status of Allegheny Woodrat in West Virginia, the first step in their conservation is to gain a better understanding of its status and habitat use. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Allegheny Woodrat.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	GIS layer of Allegheny Woodrat data.	Create a GIS layer of Allegheny Woodrat data using existing and newly gathered data.
	Public access to general mammal information.	Provide general Woodrat data, such as distribution maps, on the internet.
	Compile data.	Compile existing data on Woodrat sites and individual animals and enter into a standardized database.

Category	Need	Action
Surveys	Additional sites need to be identified and surveyed.	Survey areas with potential Allegheny Woodrat habitat to locate new sites, and collect data while conducting other surveys (bat surveys in caves, etc.).
	Extent of populations needs to be determined.	Conduct surveys at current Woodrat sites to determine the extent of populations.
	Historical sites need to be revisited.	Visit historical sites to determine if appropriate habitat still exists; if so, set traps for Woodrats to determine if a population is still present at the site.

Category	Need	Action
Monitoring	Existing sites need to be monitored.	Continue to monitor existing long-term sites to determine status of population and any changes to habitat.
	Additional long-term monitoring sites.	Establish additional long-term monitoring sites to obtain population trend information over a wider area.
	Cave data.	Continue to note Woodrat sign when monitoring bat caves.

Category	Need	Action
Research	Genetic analysis.	Determine genetic structure of population by extracting DNA from blood samples.
	Determine population dynamics.	Conduct long-term studies to determine dispersal, meta-population dynamics, and the role of mast and food on populations.
	Determine cause of species' decline.	Investigate areas where Woodrat populations are declining to determine the reasons for the decline, ie. mast production, habitat fragmentation, etc.
	Determine presence of raccoon roundworm.	Collect blood samples and conduct genetic analyses to examine relationships among Woodrat populations in WV and surrounding states.
	Potential habitat.	Investigate using remote sensing and GIS to map potential habitat.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There several conservation issues associated with the Allegheny Woodrat and its habitat. This section outlines the issues and the appropriate actions required to address the issues.

Bolded actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management
Forest Health	Coordination, Education, Management, Acquisition
Water Quantity and Quality	
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE ALLEGHENY WOODRAT AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge of the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Create a GIS layer of Allegheny Woodrat data using existing and newly gathered data.
- Compile existing data on Woodrat sites and individual animals and enter into a standardized database.

Surveys:

- Visit historical sites to determine if appropriate habitat still exists; if so, set traps for Woodrats to determine if a population is still present at the site.

Monitoring:

- Continue to monitor existing long-term sites to determine status of population and any changes to habitat.
- Establish additional long-term monitoring sites to obtain population trend information over a wider area.
- Continue to note Woodrat sign when monitoring bat caves.

Research:

- Conduct long-term studies to determine dispersal, meta-population dynamics and the role of mast and food on populations.
- Investigate areas where Woodrat populations are declining to determine the reasons for the decline, ie. mast production, habitat fragmentation, etc.
- Collect blood samples and conduct genetic analyses to examine relationships among Woodrat populations in WV and surrounding states.
- Investigate using remote sensing and GIS to map potential habitat.

Acquisition:

- Acquire conservation easements from landowners that will protect the Allegheny Woodrat and its habitat.

Coordination:

- Continue present cooperation with the U.S. Forest Service, National Park Service and other public landowners to ensure that the Woodrat is considered in management plans.
- Mitigate against impacts of second-home development, timbering, road construction, quarrying or other projects that will alter Woodrat habitat.

Education:

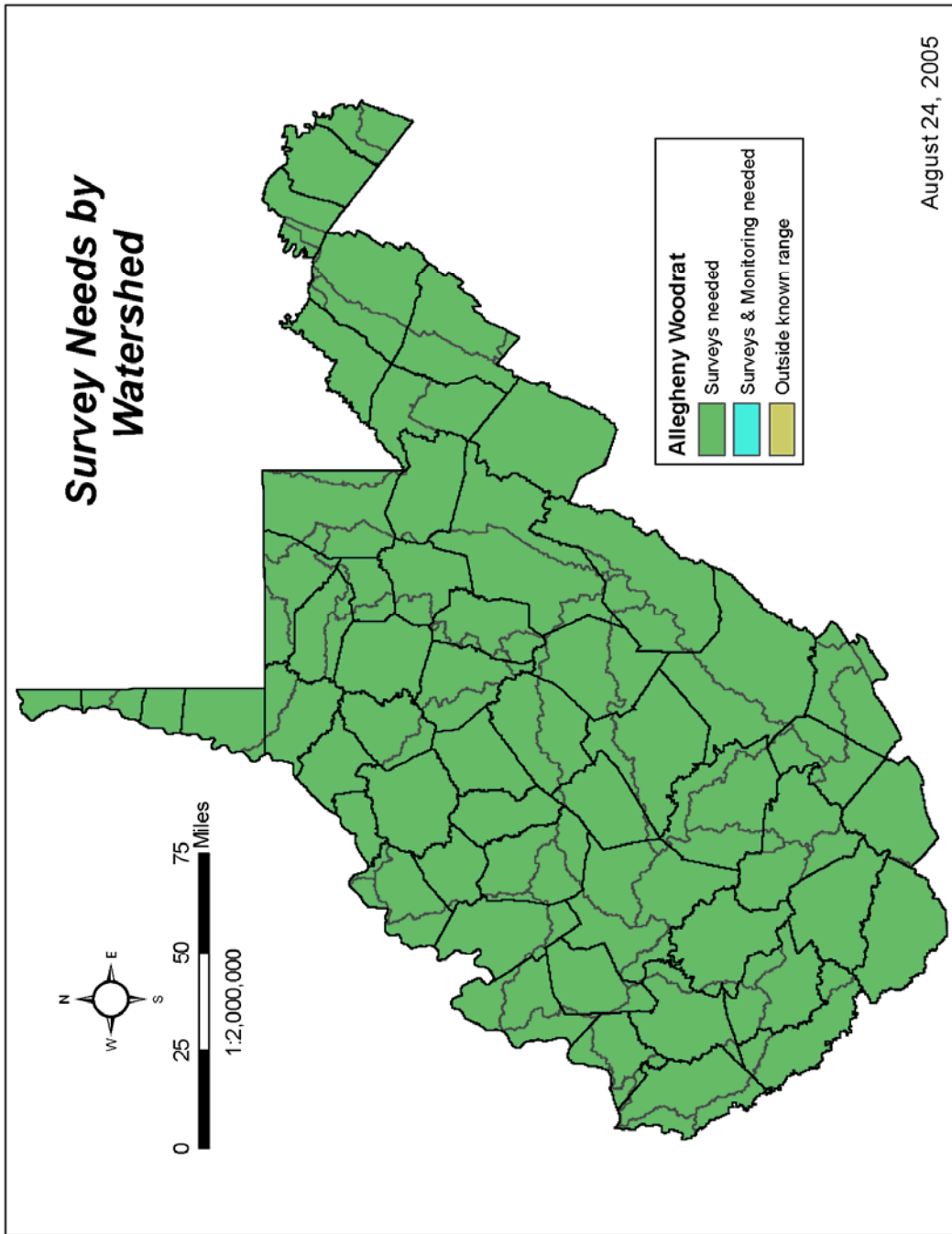
- Educate the public in the identification of the Allegheny Woodrat (as opposed to non-native rat species) and in the protection of their habitat.
- Educate consulting foresters and surveyors to identify Woodrats and their sign to report occurrences.

Legislation/Regulation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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- Stihler, Craig. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.
- West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mammals

Common name: Eastern Big-eared Bat

Scientific name: *Corynorhinus rafinesquii*

STATUS

The ranks and information in the chart below indicate the rarity of the Eastern Big-eared Bat in West Virginia. It is listed as rare and in need of conservation and its status is monitored by many groups. It is considered a species of concern in every state in which it occurs.

Priority	Global Rank	State Rank	IUCN Rank	NE Tech Comm	Trend
1*	G3G4	S1	VU A2c	X	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places known occurrences of the Eastern Big-eared Bat into watersheds and gives the ages of the records (recent is within 20 years), and indicates whether the sites are under public or private ownership. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. Sites listed are roost locations.

Habitat: The Eastern Big-eared Bat inhabits forested regions, usually hibernating just within the entrance of small caves; however the winter habitat is poorly known. They have also been documented using shallow caves or rock shelters in sandstone as summer roosts, but will also utilize abandoned buildings in or near wooded areas. The foraging habitat is primarily mature forests.

Watershed	Record Type	Ownership
Gauley	Historic	Private
Lower New	Recent	Public
Twelve Pole	Recent	Public

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Eastern Big-eared Bat. Because there is inadequate information on the distribution and status of the Eastern Big-eared Bat in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, migration patterns and habitat use. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Eastern Big-eared Bat.

Category	Need	Actions
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Public access to general bat information	Publish <i>Bats of West Virginia</i>. Provide general bat data, such as distribution maps, on the internet.
	GIS layer of bat data	Create a GIS layer of bat data using existing and newly gathered data.

Category	Need	Actions
Surveys	Winter roost sites need to be surveyed	Investigate caves and mines during the winter, and net/trap during the spring and fall in southwestern WV and the New River Gorge for additional populations.
	Possible new summer roost sites need to be surveyed	Investigate abandoned buildings, hollow trees and snags, rock shelters and caves for summer roosts and maternity sites.

Category	Need	Actions
Monitoring	Existing sites need to be monitored	Monitor existing sites to document changes in populations or habitat, and to monitor any potential threats.

Category	Need	Actions
Research	Life history and habitat use data need to be obtained	Use radio-telemetry to track bats to identify foraging habitat.
	Determine population structure.	Work with wildlife agencies in the states throughout the Eastern Big-eared Bat's range to collect tissue and hair samples for genetic analyses.
	Impacts of wind turbines and other large structures on all bat species need to be determined.	Monitor wind turbine and cell tower sites to recover bat carcasses to provide information on mortality levels and whether mortality rate is affected by seasonal changes, weather patterns, etc.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There several conservation issues associated with the Eastern Big-eared Bat and its habitat. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forestland Management	Coordination , Education, Management
Water Quantity and Quality	
Harvest	
Management Conflicts	
Invasive Species	
Recreation	Acquisition
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE EASTERN BIG-EARED BAT AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Publish *Bats of West Virginia*.
- Create a GIS layer of bat data using existing data and newly gathered data.

Surveys:

- Investigate caves and mines during the winter, and net/trap during the spring and fall, in southwestern WV and the New River Gorge to identify any additional populations.
- Investigate abandoned buildings, hollow trees and snags, rock shelters and caves for summer roost and maternity sites.

Research:

- Use radio-telemetry to track bats and identify foraging habitat.
- Work with wildlife agencies in states throughout the Eastern Big-eared Bat's range to collect tissue and hair samples for genetic analyses.
- Monitor wind turbine and cell tower sites to recover bat carcasses to determine mortality levels and whether mortality rate is affected by seasonal changes, weather patterns, etc.

Acquisition:

- Acquire easements or ownership of caves, cave entrances and mine portals to protect important roost sites.

Coordination:

- Work with landowners to protect important hibernacula by placing gates or fences at cave entrances for permanent or seasonal cave closures.
- Work with the National Park Service and the Division of Forestry regarding Eastern Big-Bat sites on their lands.
- Mitigate for impacts of mining, development, timbering or other projects that require tree removal in the vicinity of existing or potential Eastern Big-eared bat sites.

Education:

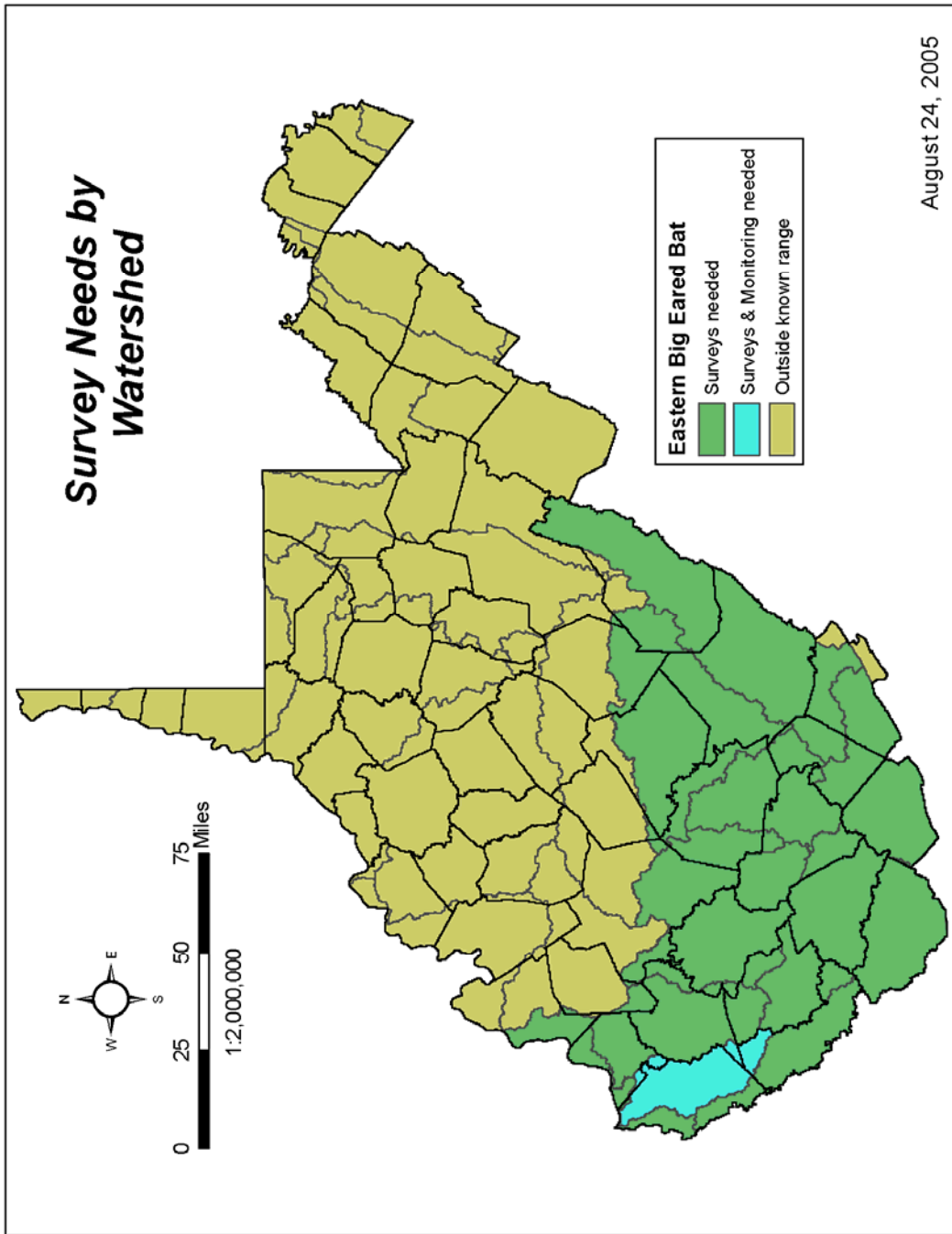
- Educate the public regarding bats and their habits, outlining the effects of various land use practices that may impact roosting sites and foraging areas (such as caving, forestland management and land development).
- Place signage at closed roosts sites to explain the reason for the closure.

Legislation/Regulation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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- NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: June 2, 2005).
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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mammals

Common name: Southern Rock Vole

Scientific name: *Microtus chrotorrhinus carolinensis*

STATUS

The ranks and information in the chart below indicate the rarity of the Southern Rock Vole in West Virginia. It is listed as rare and in need of conservation and its status is monitored by many groups. The subspecies is monitored and is considered rare in all five states in which it occurs.

Priority Group	Global Rank	State Rank	USFWS	Mon Forest	Jeff Forest	NE Tech Comm	Trend
1	G4T3	S2	SC	X	X	X	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Southern Rock Vole into watersheds and gives the ages of the records (recent is within 20 years), and indicates whether sites are under public or private ownership.

Habitat: Rock voles typically occur in moist talus or among mossy rocks and logs in spruce and northern hardwood forests. Other habitats include unvegetated talus, grass balds, recent clearcuts and roadfills, all with dense vegetation nearby. There is usually a stream or other surface water in the immediate vicinity.

Watershed	Site Name	Record type	Ownership
Cheat	Stuart Knob	Recent	Public
	Fernow Experimental Forest	Recent	Public
	Dolly Sods-North	Recent	Public
	Cheat Bridge	Historic	Public
	Porterwood	Historic	Private
	Bickle-Stuart Knob	Historic	Public
	Spruce-Old Spruce	Recent	Public
	Parsons - South	Historic	Public
	Mt. Porte Crayon	Recent	Private
	Fish Hatchery Run	Recent	Public
	Black Run	Recent	Public

Watershed	Site Name	Record Type	Ownership
Cheat (con't)	Backbone Mountain	Historic	Public
	Olsen Tower	Historic	Public
Gauley	Richwood	Historic	Public
	Cranberry Glades	Historic	Public
	Kennison Mountain	Recent	Public
	Millpoint	Historic	Private
	North Fork Headwaters	Recent	Private
	Gaudineer Knob	Recent	Public
South Branch Potomac	Spruce Knob	Recent	Public
Tygart Valley	Snyder Knob	Historic	Public

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Southern Rock Vole. Because there is inadequate information on the distribution and status of the Southern Rock Vole in West Virginia, the first step in its conservation is to gain a better understanding of its distribution and habitat requirements. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Southern Rock Vole.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data will be compiled into the database with coordinates.	Most mammal data is entered into the database, although coordinate data is needed.
	Public access to general mammal information.	Complete <i>Mammals of West Virginia</i> . Provide general Southern Rock Vole data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Determine status at historic sites.	Visit sites to determine if habitat still exists; survey majority of sites to determine presence of species.
	Survey new sites.	Determine distribution gaps within the species range.

Category	Need	Action
Monitoring	Monitor habitat.	The majority of sites occur on Forest Service land where minimal impact occurs. There should be periodic site visits to determine habitat changes. If impacts occur, survey for species.

Category	Need	Action
Research	All life history aspects pertaining to WV populations, especially habitat requirements.	Coordinate research projects with researchers. Write a proposal for needed projects and actively seek contractors.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There several conservation issues associated with the Southern Rock Vole and its habitat. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management
Forest Health	Coordination, Education, Management
Water Quantity and Quality	Legislation/Regulation
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE SOUTHERN ROCK VOLE AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Most mammal data is entered into the database, although coordinate data is needed.

Surveys:

- Visit sites to determine if habitat still exists; survey majority of sites to determine presence of species.
- Determine distribution gaps within the species range.

Research:

- Coordinate research projects with researchers. Write a proposal for needed projects and actively seek contractors.

Coordination:

- Work with the U.S. Forest Service to ensure that the Southern Rock Vole is considered in management practices.
- Work with private landowners regarding protecting the Southern Rock Vole on their lands and allowing surveying/monitoring for the species.
- Mitigate against impacts of timbering, road construction or other projects that may alter the Southern Rock Vole's habitat.

Education:

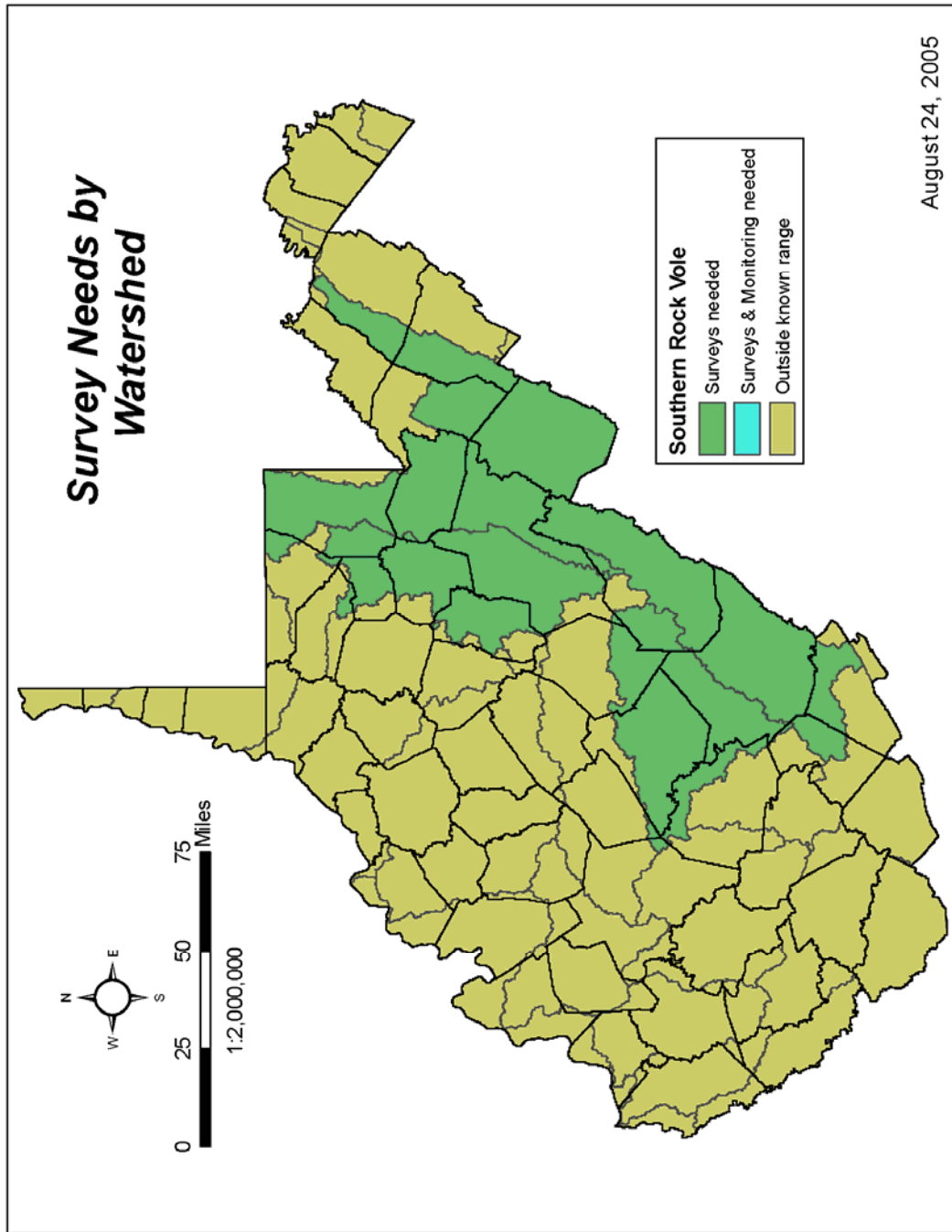
- Educate the public about the importance of biodiversity and what they can do to maintain, create or protect Southern Rock Vole habitat.

Legislation/Regulation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.
- Develop appropriate regulations and collection limits on all small mammal species.
- Support the improvement and enforcement of Clean Air laws to decrease acid precipitation.

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



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mammals

Common name: Appalachian Cottontail

Scientific name: *Sylvilagus obscurus*

STATUS

The ranks and information in the chart below indicate the rarity of the Appalachian Cottontail in West Virginia. This species is in need of conservation throughout its range, and is recognized as a Species of Concern by the US Fish and Wildlife Service.

Priority	Global Rank	State Rank	USFWS	IUCN Rank	NE Tech Comm	Trend
2	G4	S3	SC	LR/lc	X	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Appalachian Cottontail into watersheds and gives the ages of the records (recent is within 20 years) and indicates whether sites are in public or private ownership.

Habitat: The Appalachian Cottontail is restricted to areas with dense cover (woods, shrubby/brushy areas). It is most often found at higher elevations, and is often associated with conifers and heaths, such as mountain laurel and *Vaccinium* species.

Watershed	Site Name	Record Type	Ownership
Cacapon	Long Mountain	Recent	Public
Cheat	Snake Hill WMA	Recent	Public
	Fernow Experimental Forest	Historic	Public
	Mount Storm	Historic	Private
	Canaan Valley	Historic	Public
	Beaver Creek	Historic	Private
	Red Creek Campground	Recent	Public
	Cheat Bridge	Historic	Public
	Barton Knob	Recent	Public
Gauley	Bolair	Recent	Public

Greenbrier	Seneca State Forest	Historic	Public
	White Sulphur Springs	Historic	Private
	Ronceverte	Historic	Private
	Travellers Repose	Historic	Private
	Thornwood	Historic	Public
	Gaudineer Knob	Historic	Public
Potomac	Cacapon Mountain	Historic	Public
South Branch Potomac	Shot Cherry Cabin	Recent	Public
	Spruce Knob	Recent	Public
Tygart Valley	Conley Run	Recent	Private
Upper New	Peters Mountain	Recent	Public/Private

DECISION MAKING PROCESS NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Appalachian Cottontail. Because there is inadequate information on the status of the Appalachian Cottontail in West Virginia, the first step in its conservation is to gain a better understanding of its distribution and genetic background. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Appalachian Cottontail.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	GIS layer of Appalachian Cottontail locations.	Create a GIS layer of Appalachian Cottontail distributional data using existing data and newly gathered data.
	Provide public access to general mammal information.	Provide general Appalachian Cottontail data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Additional new sites need to be surveyed.	Survey areas with potential Appalachian Cottontail habitat to locate new sites. Work with hunters to retrieve skulls from rabbits taken in potential Appalachian Cottontail habitat.
	Extent of populations needs to be determined.	Set trap lines at known Appalachian Cottontail sites to determine the extent of populations.
	Historical sites need to be revisited.	Visit historical sites to determine if appropriate habitat still exists. If so, set traps for Appalachian Cottontails to determine if a population is still present at the site.

Category	Need	Action
Monitoring	Existing sites need to be monitored.	Monitor existing sites to determine if the Appalachian Cottontail is still present and document any changes to habitat. Continue monitoring Dolly Sods site.

Category	Need	Action
Research	Genetic analysis.	Continue genetic analyses to determine if <i>S. obscurus</i> and <i>S. transitionalis</i> are separate species; determine if hybridization is occurring with <i>S. floridanus</i> ; examine relationships between populations within WV.
	Dispersal and habitat use study.	Continue research on the Appalachian Cottontail's movements, dispersal and use of habitat by establishing long-term monitoring sites and conduct radio-telemetry studies.
	Habitat use.	Examine habitat use to describe habitat needed to support Appalachian Cottontail populations and develop guidelines to manage or enhance habitat.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There several conservation issues associated with the Appalachian Cottontail and its habitat. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management
Forest Health	Coordination, Education, Management
Water Quantity and Quality	
Over Collection	Education
Management Conflicts	
Invasive Species	
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE APPALACHIAN COTTONTAIL AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.

Surveys:

- Surveys areas with potential Appalachian Cottontail habitat to locate new sites. Work with hunters to retrieve skulls from rabbits taken in potential Appalachian Cottontail habitat.
- Operate trap lines at known Appalachian Cottontail sites to determine the extent of populations.
- Visit historical sites to determine if appropriate habitat still exists. If so, set traps for Appalachian Cottontails to determine if a population is still present at the site.

Research:

- Continue genetic analyses to determine if *S. obscurus* and *S. transitionalis* are separate species; determine if hybridization is occurring with *S. floridanus*; examine relationships between populations within WV.
- Continue research on the Appalachian Cottontail's movements, dispersal and use of habitat by establishing long-term monitoring sites and conducting radio-telemetry studies.
- Examine habitat use to describe habitat needed to support Appalachian Cottontail populations and develop guidelines to manage or enhance habitat.

Coordination:

- Continue coordination with the U.S. Forest Service to ensure that the Appalachian Cottontail is considered in management plans.
- Mitigate against impacts of timbering, road construction, utility corridors or other projects that may alter Appalachian Cottontail habitat.

Education:

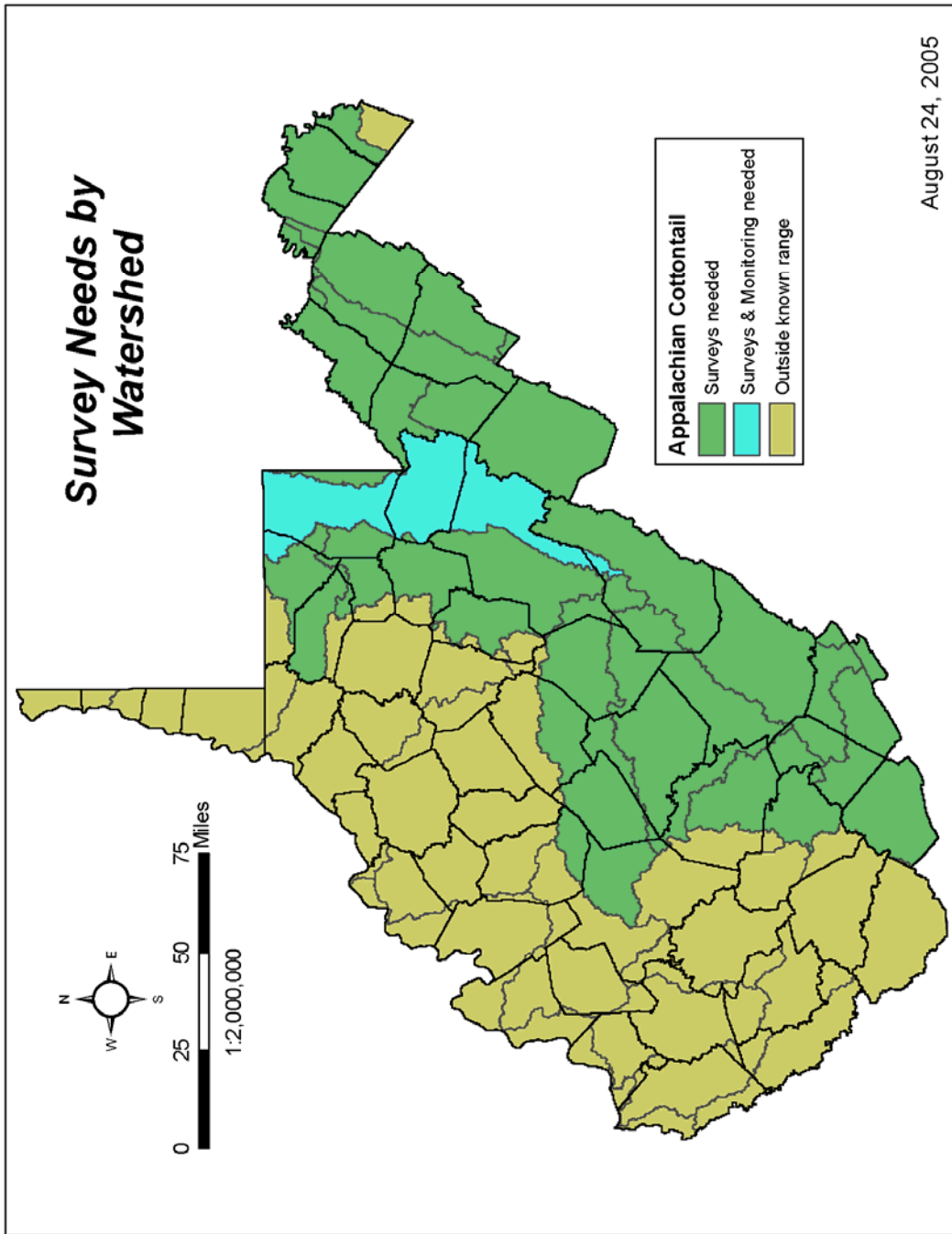
- Educate the public about the importance of biodiversity and the impacts of land use activities on rare species.

Legislation/Regulation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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- Stihler, Craig. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.
- West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mammals
Common name: Spotted Skunk
Scientific name: *Spilogale putorius*

STATUS

According to the data collected from furbearer harvest records, Spotted Skunk numbers were much higher in the 1980s than they were in the 1990s through today. Sightings are rare and this animal may be in decline in West Virginia.

Priority Group	Global Rank	State Rank	Trend
1*	G5	S1	Declining

*The letters and/or numbers in the chart refer to each group’s designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION AND HABITAT

The locations for the Spotted Skunk are by county. The number of recent (within 20 years) versus historic records is listed by county instead of watershed. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species.

Habitat: The habitat varies somewhat for the Spotted Skunk. In the south, it inhabits weedy cultivated fields and woodlots. It is common in the vicinity of farms and seems to avoid heavy woods and wetlands. In West Virginia, Spotted Skunks have been seen mainly in rocky areas, fields and in some forests.

County	Record Type
Barbour	Historic
Boone	Recent
Braxton	Recent
Calhoun	Historic
Clay	Historic
Gilmer	Recent
Harrison	Recent
Jackson	Recent
Kanawha	Historic
Lincoln	Historic
Lewis	Recent

Logan	Historic
Marion	Historic
Mason	Recent
Monroe	Historic
Nicholas	Historic
Pendleton	Recent
Pocahontas	Historic
Summers	Recent
Upshur	Recent
Webster	Recent
Wetzel	Historic
Wirt	Recent

DECISION MAKING PROCESS- NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Spotted Skunk. Because there is inadequate information on the status of the Spotted Skunk in West Virginia, the first step in its conservation is to gain a better understanding of its distribution and habitat requirements. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Spotted Skunk.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Site information on skunks trapped in the last 5 years need to be obtained.	Contact trappers who have reported skunks in the last 5 years and attempt to obtain specific localities.
	Specific locality data from trappers needs to be obtained.	Have trappers fill out a short form on trap location in the future.
	Coordinates need to be obtained and entered in database.	Get coordinates from topographic maps and enter data.
	Public access to general skunk information.	Provide general spotted skunk data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Survey additional sites.	When feasible, trap appropriate habitat or areas in which skunks have been reported.

Category	Need	Action
Monitoring	Monitor status of species.	Continue collection of trapping data.

Category	Need	Action
Research	Life history studies.	Identify research projects needed for conservation of the species.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There several conservation issues associated with the Spotted Skunk and its habitat. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management
Forest Health	Coordination, Education, Management
Water Quantity and Quality	
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	
Data Protection	

SELECTED ACTIONS FOR THE CONSERVATION OF THE SPOTTED SKUNK AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Contact trappers who have reported skunks in the last 5 years and attempt to obtain specific localities.
- Have trappers fill out a short form on trap location in the future.

Surveys:

- When feasible, trap appropriate habitat or areas in which Spotted Skunks have been reported.

Research:

- Identify research projects needed for conservation of the species.

Coordination:

- Encourage private landowners to maintain Spotted Skunk habitat and allow surveys/monitoring on their properties.
- Work with the U.S. Forest Service to consider the Spotted Skunk in management practices.

Education:

- Educate students, teachers and citizens to the importance of wildlife through presentations, pamphlets, etc.

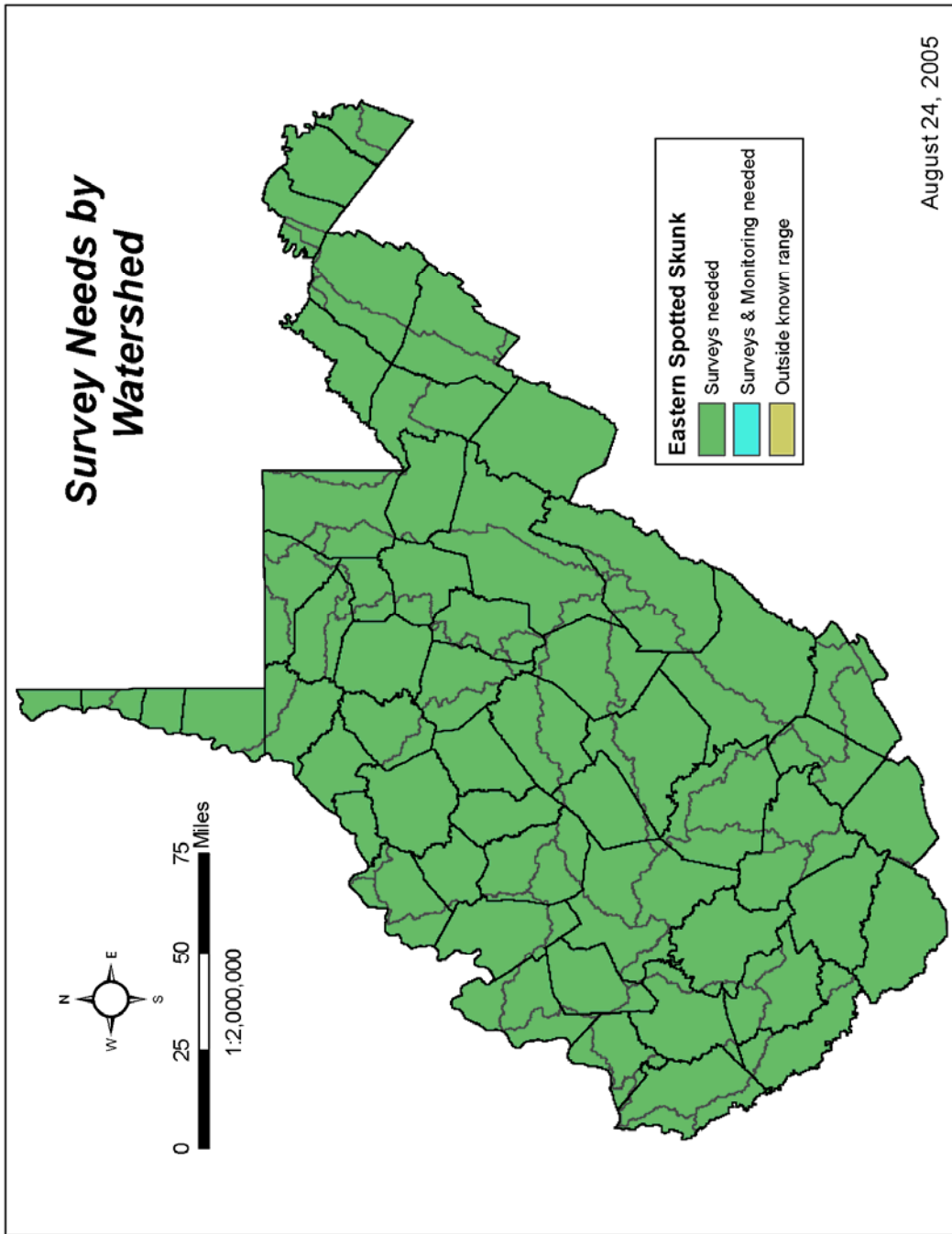
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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mammals

Common name: Southern Water Shrew

Scientific name: *Sorex palustris punctulatus*

STATUS

The ranks and information in the chart below indicate the rarity of the Southern Water Shrew in West Virginia. This species is listed as rare and in need of conservation and its status is monitored by many groups. It is considered a species of concern in every state in which it occurs.

Priority Group	Global Rank	State Rank	USFWS	Mon Forest	Jeff Forest	IUCN Rank	NE Tech Comm	Trend
1*	G5T3	S1	SC	X	X	LR/lc	X	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Southern Water Shrew into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether sites are in public or private ownership.

Habitat: Water Shrews are usually found near water. They often occupy the shoreline of rocky mountain streams. They can also live in sphagnum swamps bordering beaver meadows, marshes, etc.

Watershed	Site Name	Record Type	Ownership
Cheat	Elk Lick Run	Historic	Public
	Engine Run	Historic	Public
	Davis	Historic	Private
	Blister Run	Historic	Public
	Cheat Bridge Site	Historic	Public
	Spruce	Historic	Public
	Bickle Run	Recent	Public
	Glade Run Swamp	Historic	Public
	Black Run	Recent	Public

Gauley	Williams River Headwaters	Historic	Public
Greenbrier	Gaudineer Knob	Historic	Public
	First Fork	Recent	Public
South Branch Potomac	Spruce Knob	Historic	Public
Tygart Valley	Westvaco Research Forest	Recent	Private
Youghiogheny	Cranesville Swamp	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Southern Water Shrew. Because there is inadequate information on the distribution and status of the Southern Water Shrew in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and life history. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Southern Water Shrew.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled into the database with coordinates.	Most mammal data is entered into the database although coordinate data is needed.
	Public access to general mammal information.	Provide general Southern Water Shrew data, such as distribution maps, on the internet. Complete <i>Mammals of West Virginia</i> .

Category	Need	Action
Surveys	Status at historic sites needs to be determined.	Surveys should be conducted with priority given to sites in which the habitat could have been altered since the species was documented.
	Additional sites need to be surveyed.	Analyze potential habitat within mountainous areas to determine new survey areas. Identify potential streams when conducting other types of fieldwork.

Category	Need	Action
Monitoring	Long-term monitoring.	Monitor existing sites to determine status of population and any changes to habitat.

Category	Need	Action
Research	All life history aspects pertaining to WV populations, especially habitat requirements.	Conduct a natural history study at a site within the Monongahela National Forest.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Southern Water Shrew and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Education , Coordination, Management
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE SOUTHERN WATER SHREW AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Most mammal data is entered into the database although coordinate data is needed.

Surveys:

- Surveys should be conducted with priority given to sites in which the habitat could have been altered since the species was last documented.
- Analyze potential habitat within mountainous areas to determine new survey areas. Identify potential streams when conducting other types of fieldwork.

Research:

- Conduct a basic natural history study at a site within the Monongahela National Forest.

Coordination:

- Work with public and private landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in streams which provide habitat for the Southern Water Shrew. This may include encouraging use of Best Management Practices when timbering or during road construction, avoiding stream alterations and other site related issues.
- Work with private landowners regarding protecting the Southern Water Shrew on their lands and allowing surveying/monitoring for the species.
- Coordinate with the U.S. Forest Service to continue protecting Southern Water Shrew sites on the forest.
- Assess effects of possible dam construction on rivers and streams as projects arise.
- Mitigate for impacts of mining and other development activities in the vicinity of Southern Water Shrew streams.

Education:

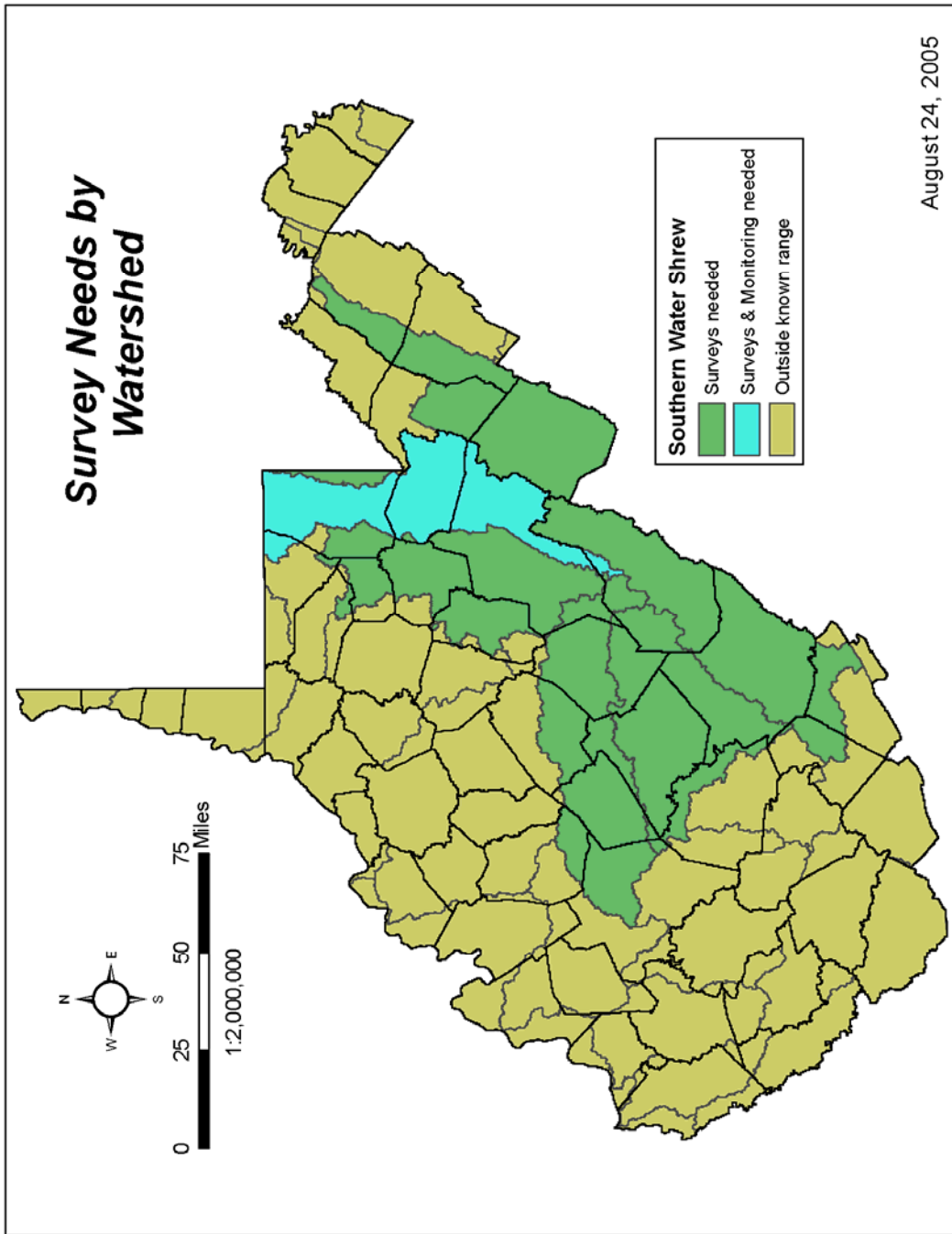
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) on Southern Water Shrew streams.

Legislation:

- Develop appropriate regulations and collection limits on all small mammal species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Freshwater Mussels

North America has the richest freshwater Mussel fauna in the world. Two hundred and twenty-five species have been reported in North America, with 130 reported from the Ohio River System alone. Today, in many large unpolluted streams in WV, the trained observer can usually spot 20 to 30 species of freshwater Mussels. There are 69 species of Mussels known from the state's waters.

Mussels live in a variety of aquatic habitats, but all require areas where the running water has high oxygen content and supplies a rich food source of organic particles and micro-organisms (single-celled animals, bacteria and diatoms). The constant flow of water also removes waste materials that would be toxic to the mussels. The best substrate for fresh-water Mussels is a combination of silt, sand, gravel or cobble with little sedimentation. Some bi-valves exist in the stiller waters of natural lakes and ponds; however, they are almost never found in impoundments. This is due to sedimentation, recirculation of waste toxic to Mussels, and the high concentrations of carbon dioxide and carbonic acid which dissolves their calcareous shells.

The life cycle of the freshwater Mussel is a complex and fascinating phenomenon. Four distinct stages occur: 1) the fertilized egg, 2) the young or glochidium in the brood sac of the female Mussel, 3) the glochidium in the parasitic stage on a fish or salamander and 4) the adult, free-living stage with a shell.

The late 1800's witnessed the birth of the button industry which produced buttons from Mussel shells. The soft bodies of the millions of Mussels harvested for this purpose also provided food for livestock. However, the development and refinement of plastics after World War II spelled doom for this industry.

Freshwater Mussels are an important food source for muskrat and other furbearers, waterfowl and fish (especially the freshwater drum). Bivalves can also be used as fish bait. Besides their aesthetic appeal, Mussels are very important indicators of water quality. Because freshwater Mussels are filter feeders, often dependent on one species of fish for reproduction, and are basically sedentary and quite long lived, they are adversely affected by long-range water quality problems (pollution), physical barriers such as dams and locks, and changes in the abundance of fish, algae and other microorganisms.

Populations of all freshwater Mussels have been drastically reduced in our streams and waterways, many to the point of extinction. West Virginia has six federally endangered Mussels, the Pink Mucket Pearly Mussel (*Lampsilis orbiculata*), Tubercled-blossom Pearly Mussel (*Epioblasma torulosa torulosa*), James Spiny mussel (*Canthyria collina*), Fanshell (*Cyprogenia stegaria*), Northern Riffleshell (*Epioblasma torulosa rangiana*) and Clubshell (*Pleurobema clava*). The reasons for their decline are many, and all are related directly to man's activities. Impoundments, dams, or other activities associated with these facilities create: excess sedimentation, which covers their siphons and suffocates them; physical barriers that isolate populations and separate them from host fishes; increased metals and other pollutants; and fluctuations in water flow that decreases nutrient and oxygen availability and prohibits toxic waste removal. Perhaps even more damaging because entire beds are destroyed are the activities of commercial sand and gravel dredging, navigation maintenance dredging, and barge handling associated with permanent loading and unloading facilities and toxic chemical spills. Because of this degradation, 42 out of the 69 species in the state (60 percent) are listed as Species in Greatest Need of Conservation.

Common Name	Scientific Name
Elktoe	<i>Alasmidonta marginata</i>
Triangle Floater	<i>Alasmidonta undulata</i>
Brook Floater	<i>Alasmidonta varicosa</i>
Spectaclecase	<i>Cumberlandia monodonta</i>
Purple Wartyback	<i>Cyclonaias tuberculata</i>
Fanshell	<i>Cyprogenia stegaria</i>
Elephant-ear	<i>Elliptio crassidens</i>
Northern Riffleshell	<i>Epioblasma torulosa rangiana</i>
Snuffbox	<i>Epioblasma triquetra</i>
Long-solid	<i>Fusconaia subrotunda</i>
Pink Mucket	<i>Lampsilis abrupta</i>
Yellow Lampmussel	<i>Lampsilis cariosa</i>
Yellow Sandshell	<i>Lampsilis teres teres</i>
Green Floater	<i>Lasmigona subviridis</i>
Black Sandshell	<i>Ligumia recta</i>
Washboard	<i>Megalonaias nervosa</i>
Sheepnose	<i>Plethobasus cyphus</i>
Clubshell	<i>Pleurobema clava</i>
James Spiny mussel	<i>Pleurobema collina</i>
Ohio Pigtoe	<i>Pleurobema cordatum</i>
Salamander Mussel	<i>Simpsonaias ambigua</i>
Rayed bean	<i>Villosa fabalis</i>
Cylindrical Papershell	<i>Anodontooides ferussacianus</i>
Butterfly	<i>Ellipsaria lineolata</i>
Northern Lance	<i>Elliptio fisheriana</i>
Ebonyshell	<i>Fusconaia ebena</i>
Wavy-rayed Lampmussel	<i>Lampsilis fasciola</i>
Pocketbook	<i>Lampsilis ovata</i>
White Heelsplitter	<i>Lasmigona complanata</i>
Creek Heelsplitter	<i>Lasmigona compressa</i>
Fragile Papershell	<i>Leptodea fragilis</i>
Threehorn Wartyback	<i>Obliquaria reflexa</i>
Rough Pigtoe	<i>Pleurobema sintoxia</i>
Monkeyface	<i>Quadrula metanevra</i>
Mapleleaf	<i>Quadrula quadrula</i>
Lilliput	<i>Toxolasma parvus</i>
Pistolgrip	<i>Tritogonia verrucosa</i>
Fawnsfoot	<i>Truncilla donaciformis</i>
Deertoe	<i>Truncilla truncata</i>
Pondhorn	<i>Uniomerus tetralasmus</i>
Rainbow	<i>Villosa iris</i>
Little Spectaclecase	<i>Villosa lienosa</i>

Because of their importance in the ecosystem and extent of their decline, freshwater Mussels warrant further study as to distribution, relative abundance, species diversity and population stability. This will ensure better protection of these rapidly dwindling, valuable and fascinating creatures.

The exotic Zebra Mussel (*Dreissena polymorpha*) threatens our native bivalves because of its rapid reproduction, growth and ability to colonize new areas. Zebra Mussels are now found in the Ohio and Kanawha Rivers. Their rapid growth and ability to attach to hard surfaces allows them to encrust over our native Mussels, thereby cutting off much of the food and oxygen supply.

A review of the conservation needs for Mussels, as outlined on the following fact sheets, indicates that initial actions for the listed species are centered on survey, inventory and data management. Information on the distribution and status of many Mussels is lacking and filling these information gaps is a necessary first step for the future conservation assessment of each species. While more survey work needs to be done, many Mussel beds are known and require monitoring to assess their health over time. Standardized data acquisition and management both within the WV DNR Wildlife Resources Section and by all other research partners will greatly assist with conservation assessments of Mussel populations. Centralized and shared information is a prerequisite to the formulation of on-the-ground conservation plans for all listed species.

Because the WRS acts as a statewide repository for information, we rely on partners to share information to maximize understanding of our biological resources. Occasionally researchers are reluctant to share information for fear that the information will be requested from state government via the Freedom of Information Act (FOIA) and used to the detriment of the species involved. For this reason it is believed appropriate to have legislation enacted to protect sensitive rare species information from wide dissemination. This need is expressed across the board on the fact sheets for animal Species in Greatest Need of Conservation.

There is an ongoing need to educate all citizens about the value of the diversity of life in the state and especially the role all SGNC play in the intricate web of life. Education is a unifying theme throughout the actions section of the fact sheets for most species. In addition there is a need to coordinate with land management agencies and other landowners/managers on the use of Best Management Practices for the conservation of biological resources in general as well as specific practices when SGNC are present.

Unfortunately because of the dearth of data on the distribution and status of many individual species, few specific on-the-ground (or aquatic sites, as would be partially the case for Mussels) conservation actions have been identified. As additional data are collected, one would anticipate an increasing inventory of specific site-related projects that are desirable for the health and/or continued existence of Mussel populations throughout the state.

Taxa: Mussels

Common name: Elktoe

Scientific name: *Alasmidonta marginata*

STATUS

The ranks and information in the chart below indicate the rarity of the Elktoe in West Virginia. It is listed as rare and in need of conservation and its status is monitored by many groups. The Elktoe is considered a species of concern in almost every state in which it occurs. Although this species has a global rank of G4, it is a Federal Species of Concern. There are very few locations nationwide and the relative abundance is very low throughout its distribution.

Priority Group	Global Rank	State Rank	Mon Forest	IUCN Rank	NE Tech Comm	AFS	Trend
1*	G4	S2	X	DD	X	SC	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of Elktoes into watersheds and gives the site names and ages of the records (recent is within 20 years).

Habitat: The Elktoe prefers areas of good flow in clean cobble / gravel substrates in small to medium sized rivers.

Watershed	Site Name	Record Type
West Fork	West Fork River	Historic?
Cheat	Cheat River	Historic
	West Fork of Glady Fork River	Recent
Tygart Valley	Glady Fork	Recent
Greenbrier	Greenbrier River	Recent
	West Fork of Greenbrier River	Recent
Upper New	Bluestone River	Recent
Lower New	New River	Recent
Elk	Elk River	Recent
Little Kanawha	North Fork of Hughes River	Historic
Middle Ohio River Valley	Middle Island Creek	Recent

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Elktoe. Because there is inadequate information on the distribution and status of the Elktoe in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Elktoe.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Legacy data.	Capture museum records for all WV specimens.
	Coordinates.	Determine coordinates for current data.
	Public access to data.	Publish <i>Mussels of WV</i>. Provide general mussel data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Length of stream occupied at each recent occurrence needs to be determined.	Conduct surveys and analyze habitat.
	New and historic sites need to be surveyed.	Revisit historic sites and conduct new surveys on sites along known river systems and their tributaries. Priority will be given to the Greenbrier and New River watersheds.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Establish long-term monitoring sites to be resurveyed at least every 5 years.
	Monitor habitats.	Visit sites to determine habitat changes and level of habitat impact through use of scour chains and measuring other stream stability parameters; if impacts occur, survey for species.

Category	Need	Action
Research	Life history.	Conduct research on all life history aspects and conduct other research as impacts occur.
	Effects of mining, highways, etc.	

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Elktoe and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Education , Coordination, Management
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE ELKTOE AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Check and capture museum records and enter data from 2000 to current in a database.
- Determine coordinates for current data.
- Publish *Mussels of WV*.

Surveys:

- Conduct surveys and analyze habitat.
- Revisit historic sites and conduct new survey sites along known river systems and their tributaries. Priority will be given to the Greenbrier and New watersheds.

Monitoring:

- Establish long-term monitoring sites to be resurveyed at least every 5 years.

Coordination:

- Coordinate with WVDEP and U.S. Forest Service to manage riparian zones and reduce sediment loading.
- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (erosion/sedimentation, chemical pollution, acid mine drainage, etc.) in streams with Elktoes.

Education:

- Educate and work with landowners on streambed and stream bank stability issues and the importance of riparian buffers to limit erosion, nutrient and solid waste loading, and chemical pollution to streams.
- Educate students, teachers and citizens to the importance of mussels through presentations, pamphlets, etc.

Legislation/Regulation:

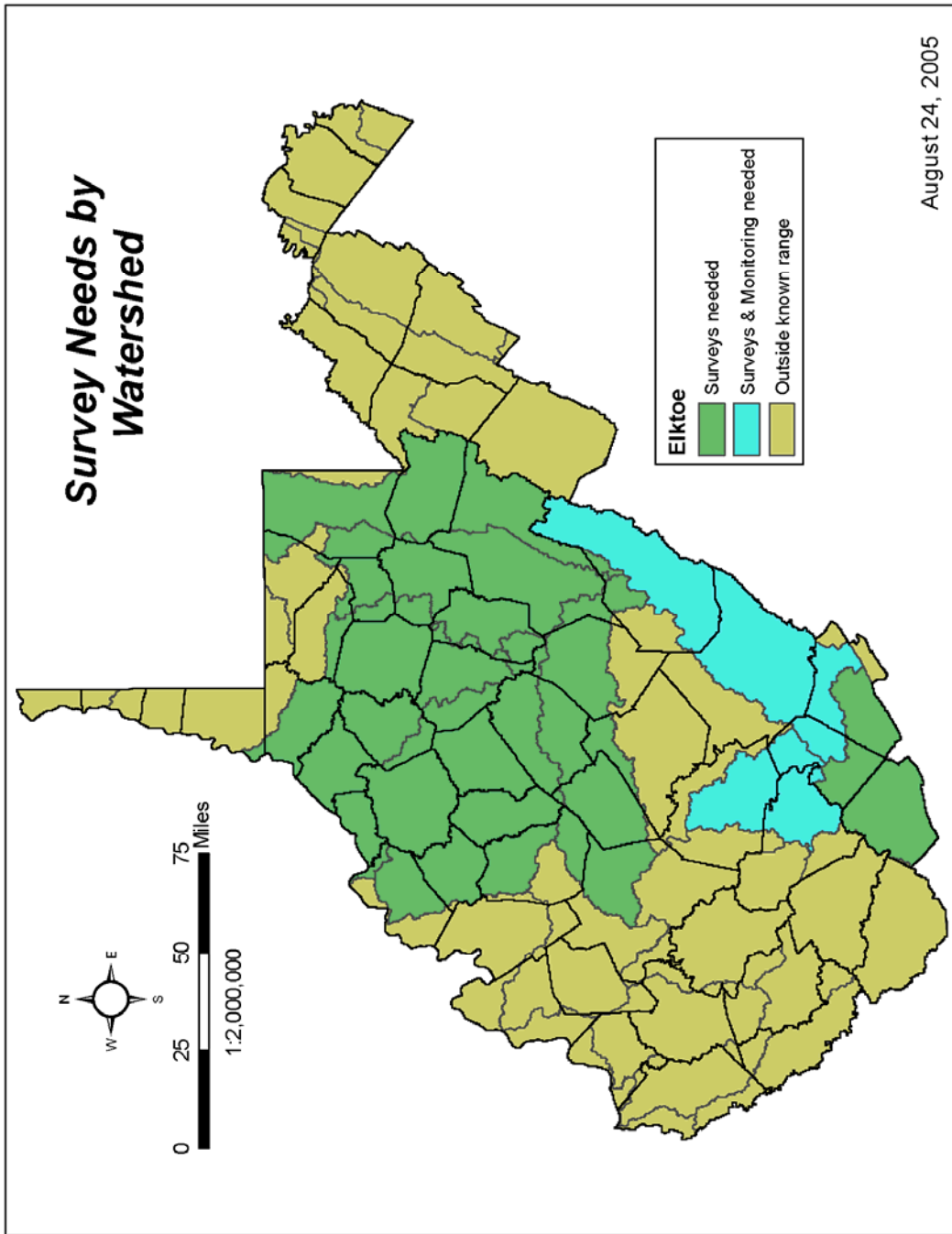
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mussels

Common name: Triangle Floater

Scientific name: *Alasmidonta undulata*

STATUS

The ranks and information in the chart below indicate the rarity of the Triangle Floater in West Virginia. It is listed as rare and in need of conservation and its status is monitored by many groups. The Triangle Floater is considered a species of concern in almost every state in which it occurs.

Priority Group	Global Rank	State Rank	AFS	Trend
1*	G4	S1	SC	declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Triangle Floater into watersheds and gives the site names and ages of the records (recent is within 20 years).

Habitat: This species inhabits medium sized creeks to medium sized rivers.

Watershed	Site Name	Record Type
Cacapon	Cacapon River	Recent
North Branch Potomac	Patterson Creek	Recent
South Branch Potomac	South Branch Potomac	Recent

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Triangle Floater. Because there is inadequate information on the distribution and status of the Triangle Floater in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Triangle Floater.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Legacy data.	Capture museum records for all WV specimens.
	Coordinates.	Determine coordinates for current data.
	Public access to data.	Publish <i>Mussels of WV</i>.
		Provide general mussel data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Length of stream occupied at each recent occurrence needs to be determined.	Conduct surveys and analyze habitat.
	Determine status at historic sites.	A very high percentage of sites are historic. Surveys need to be conducted with priority given to sites with potential habitat and most likely to harbor the species.
	Survey new sites.	Analyze potential habitat statewide to determine new survey areas/sites.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Establish long-term monitoring sites to be resurveyed at least every 5 years
	Monitor habitat.	Visit site to determine habitat changes and level of habitat impact through use of scour chains. Measure other stream stability parameters. If impacts occur, survey for species.

Category	Need	Action
Research	Life history.	Conduct research on all life history aspects and conduct other research as impacts occur.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Triangle Floater and its habitat. This section outlines the issues and the appropriate actions to address the issues. Bolded actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Education , Coordination, Management
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE TRIANGLE FLOATER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Capture museum records for all WV specimens.
- Determine coordinates for current data.
- Publish *Mussels of WV*.

Surveys:

- Conduct surveys and analyze habitat.
- A very high percentage of sites are historic. Surveys need to be conducted with priority given to sites with potential habitat and most likely to harbor the species.
- Analyze potential habitat statewide to determine new survey areas/sites.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (stream channel modification, erosion/sedimentation, nutrient loading, chemical pollution, etc) in streams with Triangle Floaters.
- Mitigate for impacts of development activities in the vicinity of Triangle Floater sites.

Education:

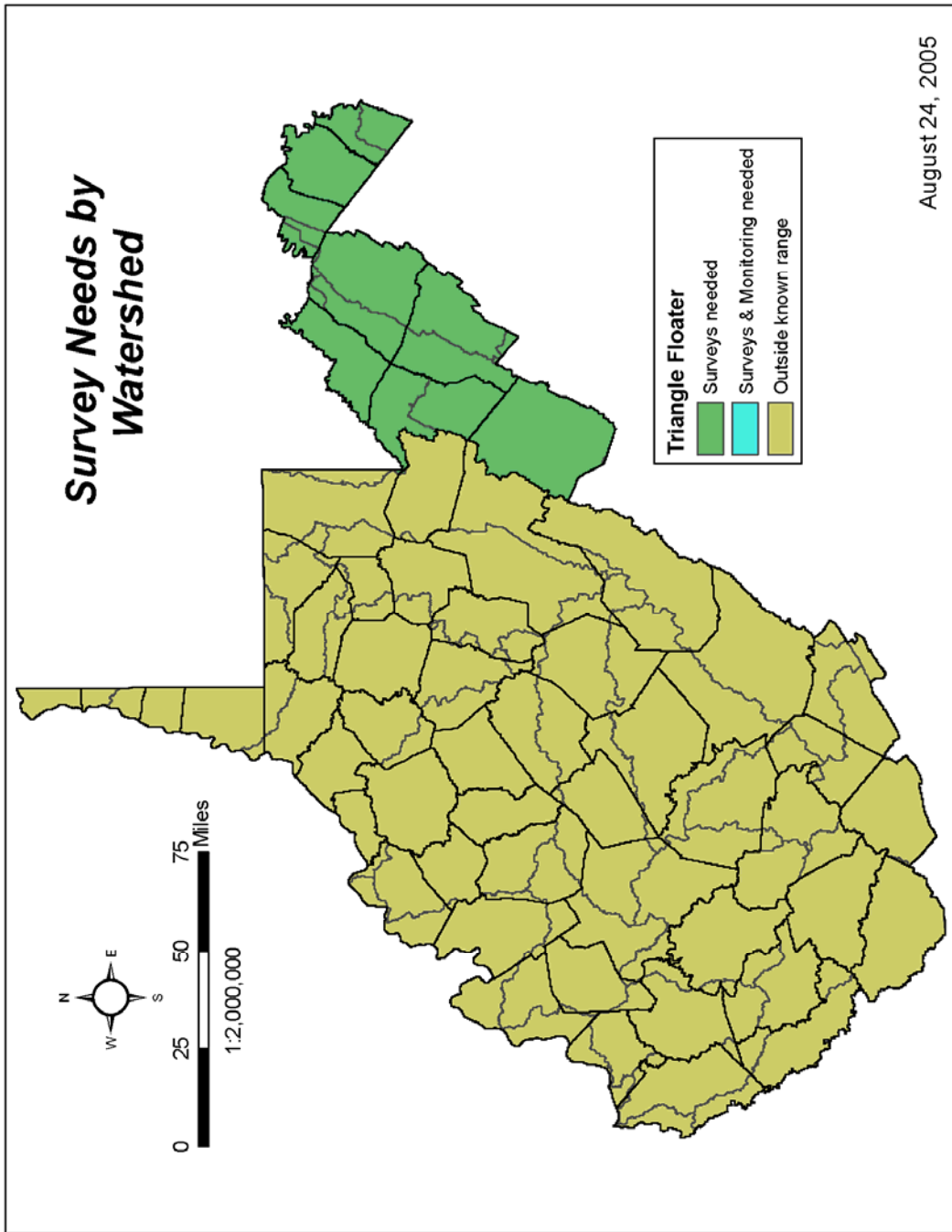
- Educate and work with landowners on streambed and stream bank stability issues and the importance of riparian buffers to limit erosion, nutrient and solid waste loading, and chemical pollution to streams.
- Educate students, teachers and citizens to the importance of Mussels through presentations, pamphlets, etc.

Legislation/Regulation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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- NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: June 27, 2005).
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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mussels

Common name: Brook Floater

Scientific name: *Alasmidonta varicosa*

STATUS

The ranks and information in the chart below indicate the rarity of the Brook Floater in West Virginia. It is listed as rare and in need of conservation and its status is monitored by many groups. The Brook Floater is considered a species of concern in every state in which it occurs.

Priority Group	Global Rank	State Rank	USFWS	Jeff Forest	IUCN Rank	NE Tech Comm	AFS	Trend
1*	G3	S1	SC	X	DD	X	T	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Brook Floater into watersheds and gives the site names and ages of the records (recent is within 20 years).

Habitat: The Brook Floater inhabits medium-sized creeks to medium-sized rivers in areas with moderate current.

Watershed	Site Name	Record Type
Potomac	Potomac River	Recent Historic
Cacapon	Cacapon River	Recent Historic
	North River	Historic
North Branch Potomac	Patterson Creek	Recent
South Branch Potomac	South Branch Potomac	Recent Historic

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Brook Floater. Because there is inadequate information on the distribution and status of the Brook Floater in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Brook Floater.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Legacy data.	Capture museum records for all WV specimens.
	Coordinates.	Determine coordinates for all current data.
	Public access to data.	Publish <i>Mussels of WV</i>.
		Provide general mussel data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Length of stream occupied at each recent occurrence needs to be determined.	Conduct surveys and analyze habitats.
	New and historic sites need to be surveyed.	Revisit historic sites and conduct new surveys on sites along known river systems and their tributaries.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Establish long-term monitoring sites to be resurveyed at least every 5 years.
	Monitor habitat.	Visit sites to determine habitat changes and level of habitat impact through use of scour chains. Measure other stream stability parameters. If impacts occur, survey for species.

Category	Need	Action
Research	Life history.	Conduct research on all life history aspects and conduct other research as impacts occur.
	Effects of mining, highways, etc.	

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Brook Floater and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Education , Coordination, Management
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE BROOK FLOATER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Capture museum records for all WV specimens.
- Determine coordinates for current data.
- Publish *Mussels of WV*.

Surveys:

- Conduct surveys and analyze habitats.

Monitoring:

- Establish long-term monitoring sites to be resurveyed at least every 5 years.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (erosion/sedimentation, nutrient loading, chemical pollution, stream channelization, etc) in streams with Brook Floaters.

Education:

- Educate and work with landowners on streambed and stream bank stability issues and the importance of riparian buffers to limit erosion, nutrient and solid waste loading, and chemical pollution to streams.
- Educate students, teachers and citizens to the importance of mussels through presentations, pamphlets, etc.

Legislation/Regulation:

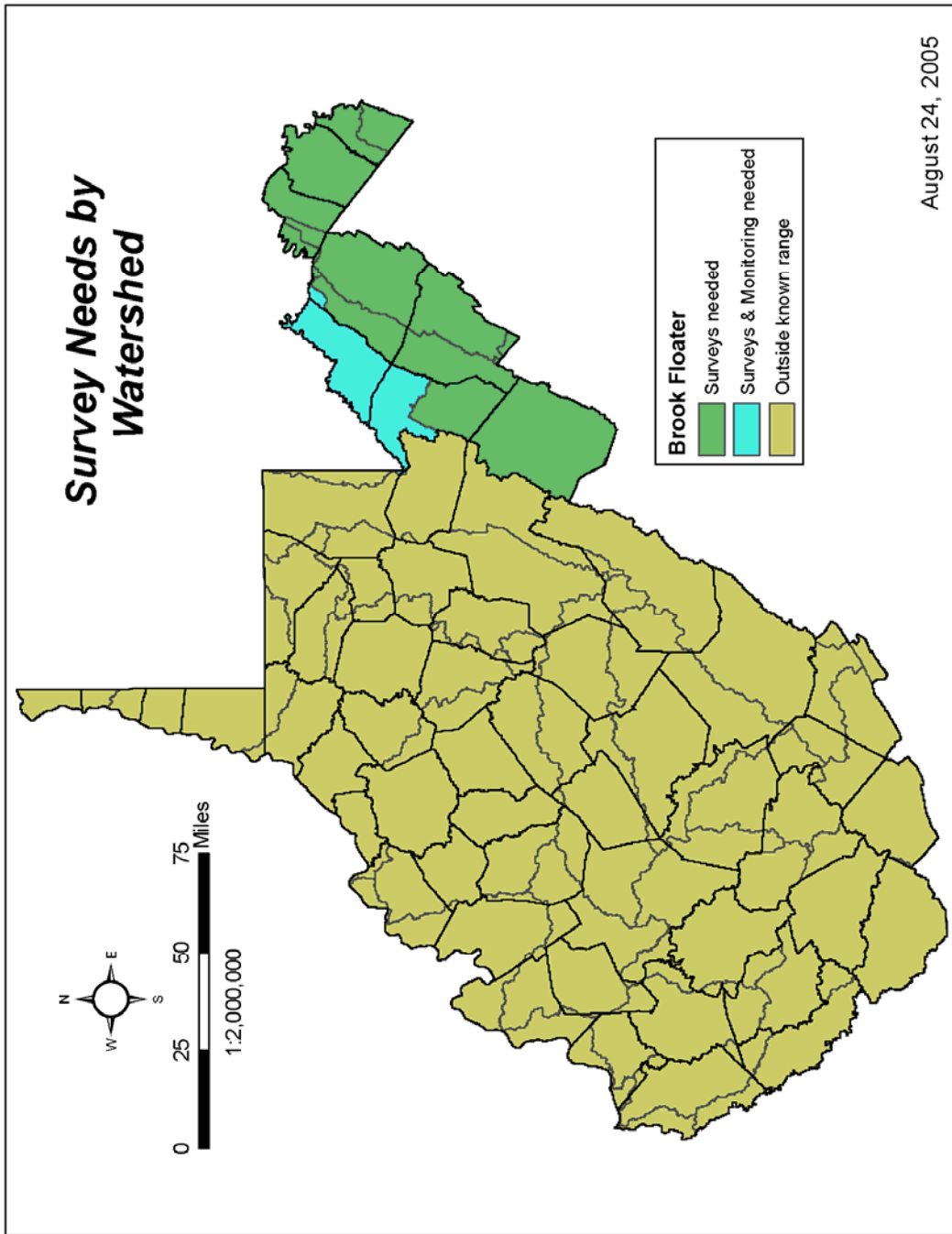
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: June 27, 2005).

Clayton, Janet. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mussels

Common name: Spectaclecase

Scientific name: *Cumberlandia monodonta*

STATUS

The ranks and information in the chart below indicate the rarity of the Spectaclecase in West Virginia. It is listed as rare and in need of conservation and its status is monitored by many groups. The Spectaclecase is considered a species of concern in almost every state in which it occurs. It was discovered in West Virginia only a couple of years ago and only two sites and two specimens have been found in the Upper Kanawha drainage.

Priority Group	Global Rank	USFWS	State Rank	Jeff Forest	IUCN Rank	Trend
1*	G2G3	Cat1	S1	X	LR/lc	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places each occurrence of the Spectaclecase into watersheds and gives the site names and ages of the records (recent is within 20 years).

Habitat: The Spectaclecase prefers areas of good flow in clean cobble/gravel substrates in small to medium sized rivers.

Watershed	Site Name	Record Type
Upper Kanawha	Kanawha River	Recent

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Spectaclecase. Because there is inadequate information on the distribution and status of the Spectaclecase in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Spectaclecase.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Acquire legacy data and database information.	Check museum records and enter data from 2000 to current in a database.
	Coordinates.	Check past data for coordinates and add coordinates to current data.
	Public access to data.	Publish <i>Mussels of WV</i>. Provide general mussel data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Length of stream occupied at each recent occurrence needs to be determined.	Conduct surveys and analyze habitat.
	New sites need to be surveyed.	Conduct surveys throughout the Kanawha River with emphasis on the Upper Kanawha.

Category	Need	Action
Monitoring	Monitor habitats.	Visit sites to determine habitat changes and level of habitat impact through use of scour chains and measuring other stream stability parameters; if impacts occur, survey for species.

Category	Need	Action
Research	Life history.	Conduct research on all life history aspects and conduct other research as impacts occur.
	Effects of mining, highways, etc.	

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Spectaclecase and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Education , Coordination, Management
Over Collection	
Management Conflicts	
Invasive Species	Education , Management
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE SPECTACLECASE AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Check museum records and enter data from 2000 to current in a database.
- Check past data for coordinates and add coordinates to current data.
- Publish *Mussels of WV*.

Surveys:

- Conduct surveys and analyze habitat.
- Conduct surveys throughout the Kanawha River with emphasis on the Upper Kanawha.

Coordination:

- Coordinate with WVDEP and U.S. Forest Service to manage riparian zones and reduce sediment loading.
- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (erosion/sedimentation, chemical pollution, acid mine drainage, etc) in streams with Spectaclecase.

Education:

- Educate and work with landowners on streambed and stream bank stability issues and the importance of riparian buffers to limit erosion, nutrient and solid waste loading, and chemical pollution to streams.
- Educate students, teachers and citizens to the importance of mussels through presentations, pamphlets, etc.
- Educate boaters and other river users as to appropriate recommended actions to prevent transfer of invasive zebra mussels.

Legislation/Regulation:

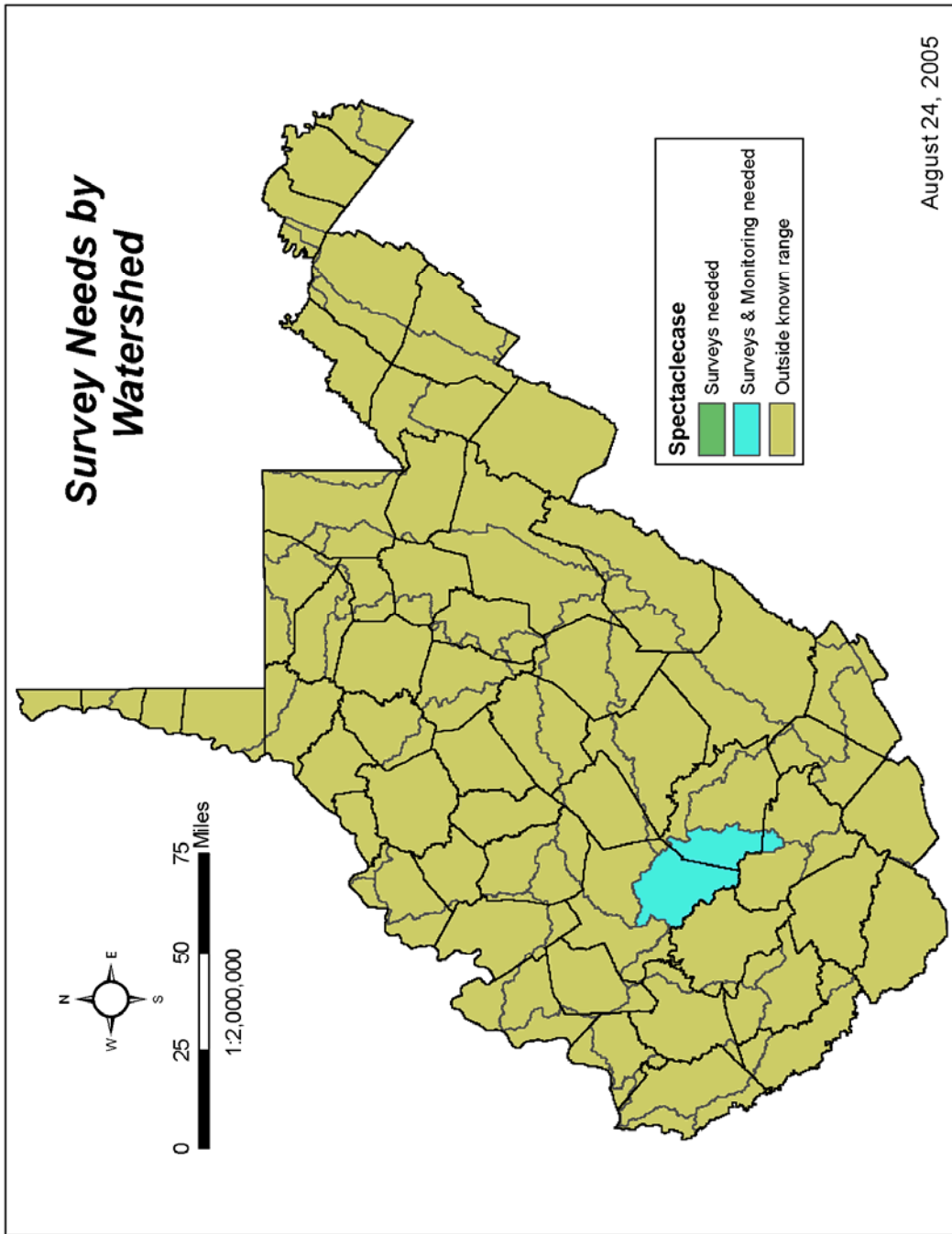
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: June 27, 2005).

Clayton, Janet. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mussels
Common name: Fanshell
Scientific name: *Cyprogenia stegaria*

STATUS

The ranks and information in the chart below indicate the rarity of the Fanshell in West Virginia. It is listed as rare and in need of conservation and its status is monitored by many groups. The Fanshell is listed as endangered with the US Fish and Wildlife Service.

Priority Group	Global Rank	State Rank	USFWS	Jeff Forest	IUCN Rank	NE Tech Comm	AFS	Trend
1*	G1	S1	LE	X	CR A1ce	X	E	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of Fanshells in watersheds and gives the site names and ages of the records (recent is within 20 years).

Habitat: This species prefers large rivers and is typically found in areas of good current.

Watershed	Site Name	Record Type
Middle Ohio River Valley	Ohio River	Recent Historic
Upper Kanawha	Kanawha River	Recent

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Fanshell. Because there is inadequate information on the distribution and status of the Fanshell in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Fanshell.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Legacy data.	Capture museum records for all WV specimens.
	Coordinates.	Determine coordinates for current data.
	Public access to data.	Publish <i>Mussels of WV</i>.
		Provide general mussel data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Length of stream occupied at each recent occurrence needs to be determined.	Conduct surveys and analyze habitat.
	New and historic sites need to be surveyed.	Revisit historic sites and conduct new surveys on sites along known river systems and their tributaries.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Establish long-term monitoring sites to be resurveyed at least every 5 years.
	Monitor habitat.	Visit site to determine habitat changes and level of habitat impact through use of scour chains. Measure other stream stability parameters. If impacts occur, survey for species.

Category	Need	Action
Research	Life history.	Conduct research on all life history aspects and conduct other research as impacts occur.
	Effects of mining, highways, etc.	

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Fanshell and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Propagation, Coordination, Education, Management
Forest Health	
Water Quantity and Quality	Education, Coordination, Management
Over Collection	
Management Conflicts	
Invasive Species	Education, Management
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE FANSHELL AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Capture museum records for all WV specimens.
- Determine coordinates for current data.
- Publish *Mussels of WV*.

Surveys:

- Conduct surveys and analyze habitat.
- Revisit historic sites and conduct new surveys on sites along known river systems and their tributaries.

Monitoring:

- Establish long-term monitoring sites to be resurveyed at least every 5 years.

Propagation:

- Develop a propagation program to restore populations in the Ohio and Kanawha rivers.

Coordination:

- Work with landowners and industry to reduce or eliminate activities that may be detrimental to water quality (sedimentation, erosion, chemical pollution, nutrient loading, etc) in streams with Fanshells.
- Mitigate for impacts of streambed dredging, mining and other development activities in the vicinity of Fanshell streams.

Education:

- Educate and work with landowners and industry on streambed and stream bank stability issues and the importance of riparian buffers to limit erosion, nutrient and solid waste loading, and chemical pollution to streams.
- Educate students, teachers and citizens to the importance of Mussels through presentations, pamphlets, etc.
- Educate boaters and other river users as to appropriate recommended actions to prevent transfer of invasive Zebra Mussels.

Legislation/Regulation:

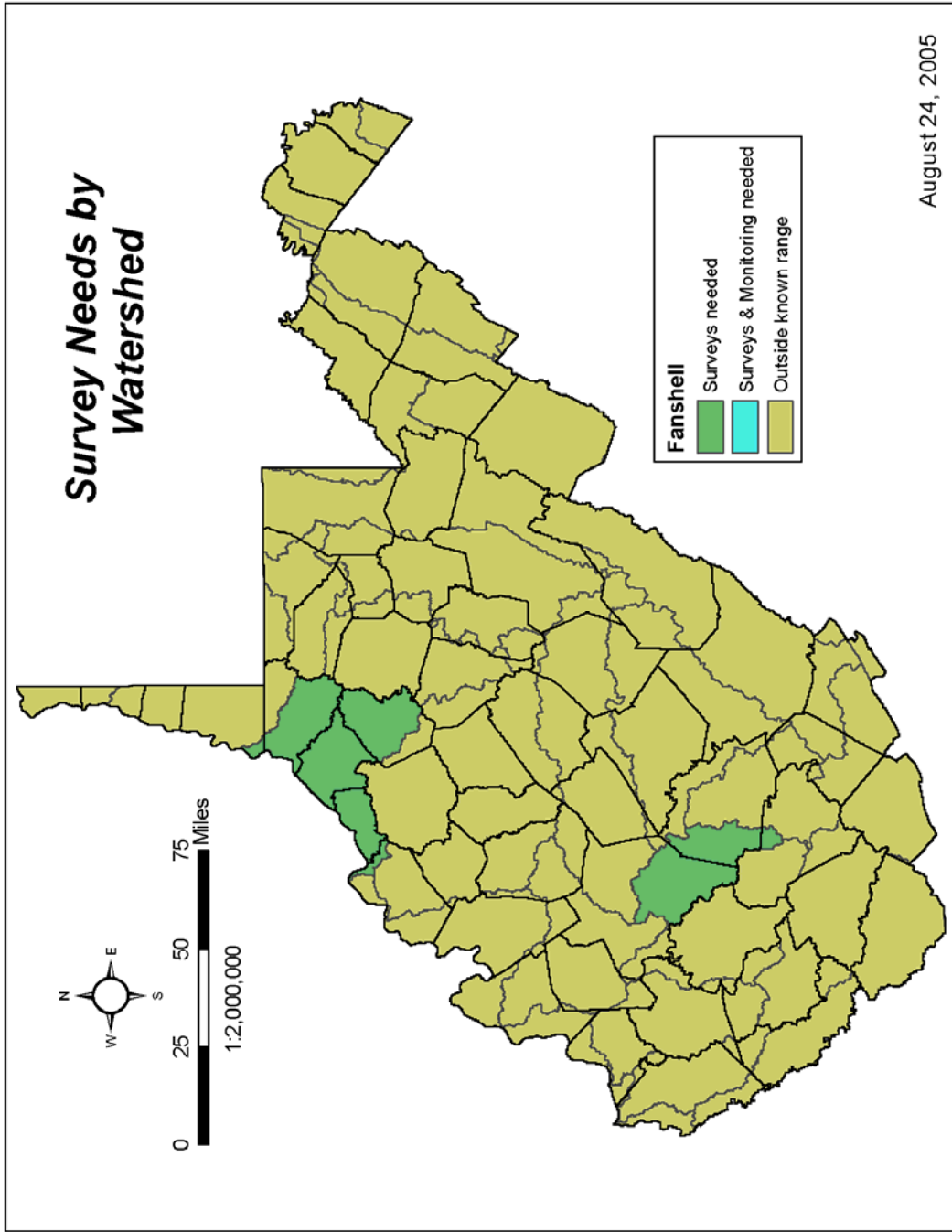
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: June 27, 2005).

Clayton, Janet. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mussels

Common name: Purple Wartyback

Scientific name: *Cyclonaias tuberculata*

STATUS

The ranks and information in the chart below indicate the rarity of the Purple Wartyback in West Virginia. It is listed as rare and in need of conservation and its status is monitored by many groups. The Purple Wartyback is considered a species of concern in many states in which it occurs.

Priority Group	Global Rank	State Rank	IUCN Rank	AFS	Trend
1*	G5	S1	LR/nt	SC	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Purple Wartyback into watersheds and gives the site names and ages of the records (recent is within 20 years).

Habitat: The Purple Wartyback inhabits medium to large rivers with clean gravel to cobble substrate and located within or near riffles.

Watershed	Site Name	Record Type
West Fork	West Fork River	Historic?
Ohio River Valley	Ohio River	Historic?
Little Kanawha	Little Kanawha River	Recent Historic
Upper Kanawha	Kanawha River	Recent
Elk	Elk River	Recent Historic
Lower New	New River	Recent Historic
Upper New	Bluestone River	Recent
	Indian Creek	Recent
Greenbrier	Greenbrier River	Recent Historic

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Purple Wartyback. Because there is inadequate information on the distribution and status of the Purple Wartyback in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Purple Wartyback.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Legacy data.	Capture museum records for all WV specimens.
	Coordinates.	Determine coordinates for current data.
	Public access to data.	Publish <i>Mussels of WV</i>.
Provide general mussel data, such as distribution maps, on the internet.		

Category	Need	Action
Surveys	Length of stream occupied at each recent occurrence needs to be determined.	Conduct surveys and analyze habitat.
	New and historic sites need to be surveyed.	Revisit historic sites and conduct new surveys on sites along known river systems and their tributaries. Priority will be given to the Greenbrier and Little Kanawha Rivers.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Establish long-term monitoring sites to be resurveyed at least every 5 years
	Monitor habitat.	Visit sites to determine habitat changes and level of habitat impact through use of scour chains. Measure other stream stability parameters. If impacts occur, survey for species.

Category	Need	Action
Research	Life history.	Conduct research on all life history aspects and conduct other research as impacts occur.
	Effects of mining, highways, etc.	

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Purple Wartyback and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Propagation, Coordination, Education, Management
Forest Health	
Water Quantity and Quality	Education, Coordination, Management
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE PURPLE WARTYBACK AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Capture museum records for all WV specimens.
- Determine coordinates for current data.
- Publish *Mussels of WV*.

Surveys:

- Conduct surveys and analyze habitat.
- Revisit historic sites and conduct new surveys on sites along known river systems and their tributaries. Priority will be given to the Greenbrier and Little Kanawha Rivers.

Coordination:

- Coordinate with the U.S. Forest Service to manage riparian zones and reduce sediment loading.
- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (erosion/sedimentation, nutrient loading, chemical pollution, acid mine drainage, etc) in streams with Purple Wartybacks.
- Mitigate for impacts of mining and other development activities in the vicinity of Purple Wartyback streams.

Propagation:

- Develop a propagation program to restore populations in the Elk and Little Kanawha rivers.

Education:

- Educate and work with landowners on streambed and stream bank stability issues and the importance of riparian buffers to limit erosion, nutrient and solid waste loading, and chemical pollution to streams.
- Educate students, teachers and citizens to the importance of Mussels through presentations, pamphlets, etc.

Legislation/Regulation:

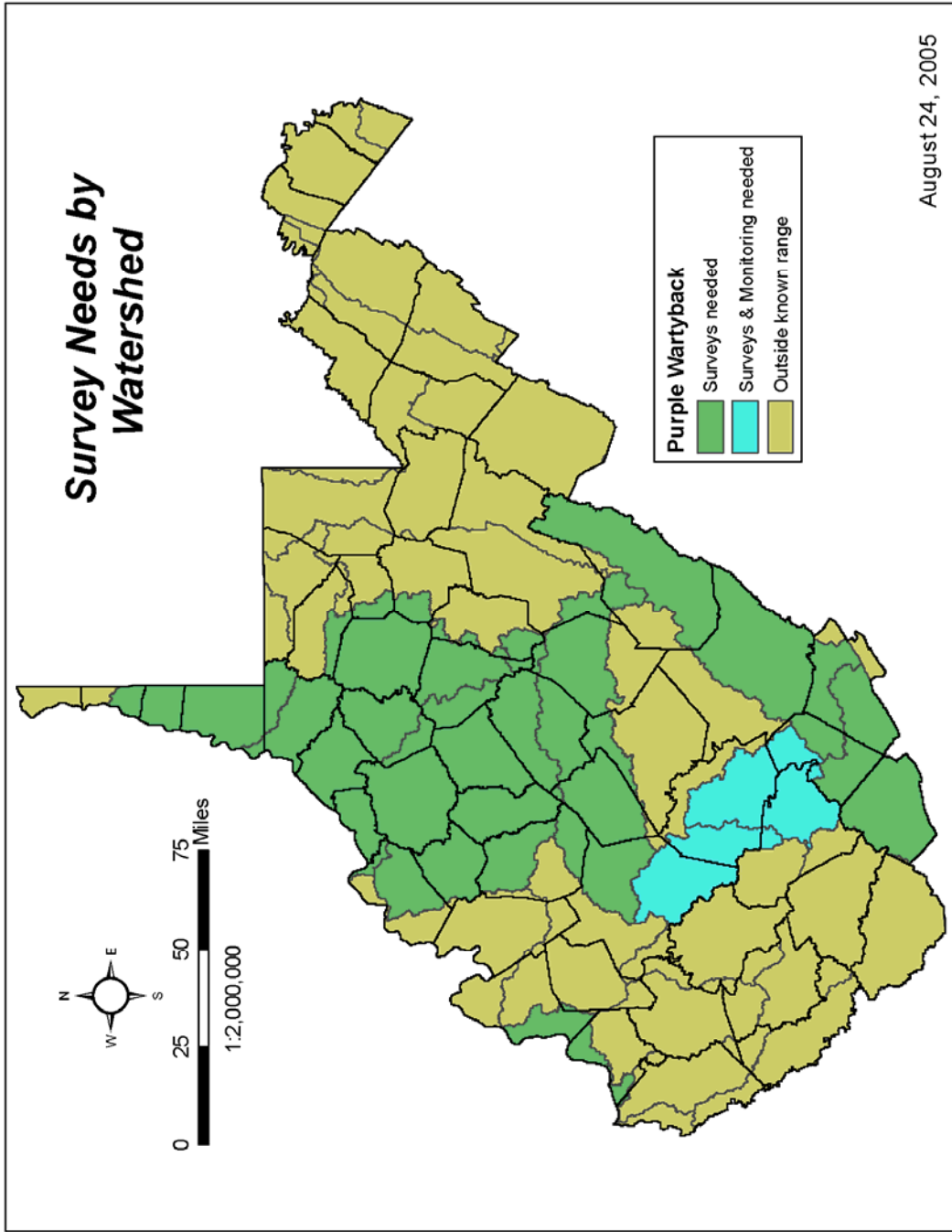
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: June 27, 2005).

Clayton, Janet. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mussels

Common name: Elephant-ear

Scientific name: *Elliptio crassidens*

STATUS

The ranks and information in the chart below indicate the rarity of the Elephant-ear in West Virginia. It is listed as rare and in need of conservation and its status is monitored by many groups. The Elephant-ear is considered a species of concern in many states in which it occurs.

Priority Group	Global Rank	State Rank	Trend
1*	G5	S2	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Elephant-ear into watersheds and gives the site names and ages of the records (recent is within 20 years).

Habitat: The Elephant Ear inhabits medium to large rivers in areas of good current and exists as a remnant population in the impounded Ohio River.

Watershed	Site Name	Record Type
Monongahela River	Monongahela River	Historic
Lower Ohio River Valley	Ohio River	Recent Historic
Middle Ohio River Valley	Middle Island Creek	Historic?
Upper Kanawha	Kanawha River	Recent Historic
Elk	Elk River	Recent Historic
Tug Fork	Tug Fork River	Recent

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Elephant-ear. Because there is inadequate information on the distribution and status of the Elephant-ear in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below.

Bolded text indicates primary actions required to identify conservation needs of the Elephant-ear.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Legacy data.	Determine coordinates for current database. Capture museum records for all WV specimens.
	Coordinates.	Check data for coordinates and apply coordinates to current data.
	Public access to data.	Publish <i>Mussels of WV</i>.
		Provide general mussel data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Length of stream occupied at each recent occurrence needs to be determined.	Conduct surveys and analyze habitat.
	New and historic sites need to be surveyed.	Revisit historic sites and conduct new surveys on sites along known river systems and their tributaries. Priority will be given to the Lower Kanawha River.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Establish long-term monitoring sites to be resurveyed at least every 5 years
	Monitor habitat.	Visit sites to determine habitat changes and level of habitat impact through use of scour chains. Measure other stream stability parameters. If impacts occur, survey for species.

Category	Need	Action
Research	Taxonomy.	Conduct genetic studies to determine if WV populations are different from more southern populations.
	Life history.	Life history is important due to significant declines of the species. Fish hosts need to be determined before a propagation project can begin. Conduct other research as impacts occur.
	Effects of mining, highways, etc.	

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Elephant-ear and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Education , Coordination, Management
Over Collection	
Management Conflicts	
Invasive Species	Education , Management
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE ELEPHANT-EAR AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Determine legacy coordinates for current database. Capture museum records for all WV specimens.
- Check data for coordinates and apply coordinates to current data.
- Publish *Mussels of WV*.

Surveys:

- Conduct surveys and analyze habitat.

Research:

- Conduct genetic studies to determine if WV populations are different from more southern populations.

Coordination:

- Coordinate with the U.S. Fish and Wildlife Service to pursue listing species as Threatened or Endangered.
- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (erosion/sedimentation, chemical pollution, acid mine drainage, etc) in streams with Elephant-ears.
- Mitigate for impacts of mining and other development activities in the vicinity of Elephant-ear streams.

Education:

- Educate and work with landowners on streambed and stream bank stability issues and the importance of riparian buffers to limit erosion, nutrient and solid waste loading, and chemical pollution to streams.
- Educate students, teachers and citizens to the importance of Mussels through presentations, pamphlets, etc.
- Educate boaters and other river users as to appropriate recommended actions to prevent transfer of invasive zebra mussels.

Legislation/Regulation:

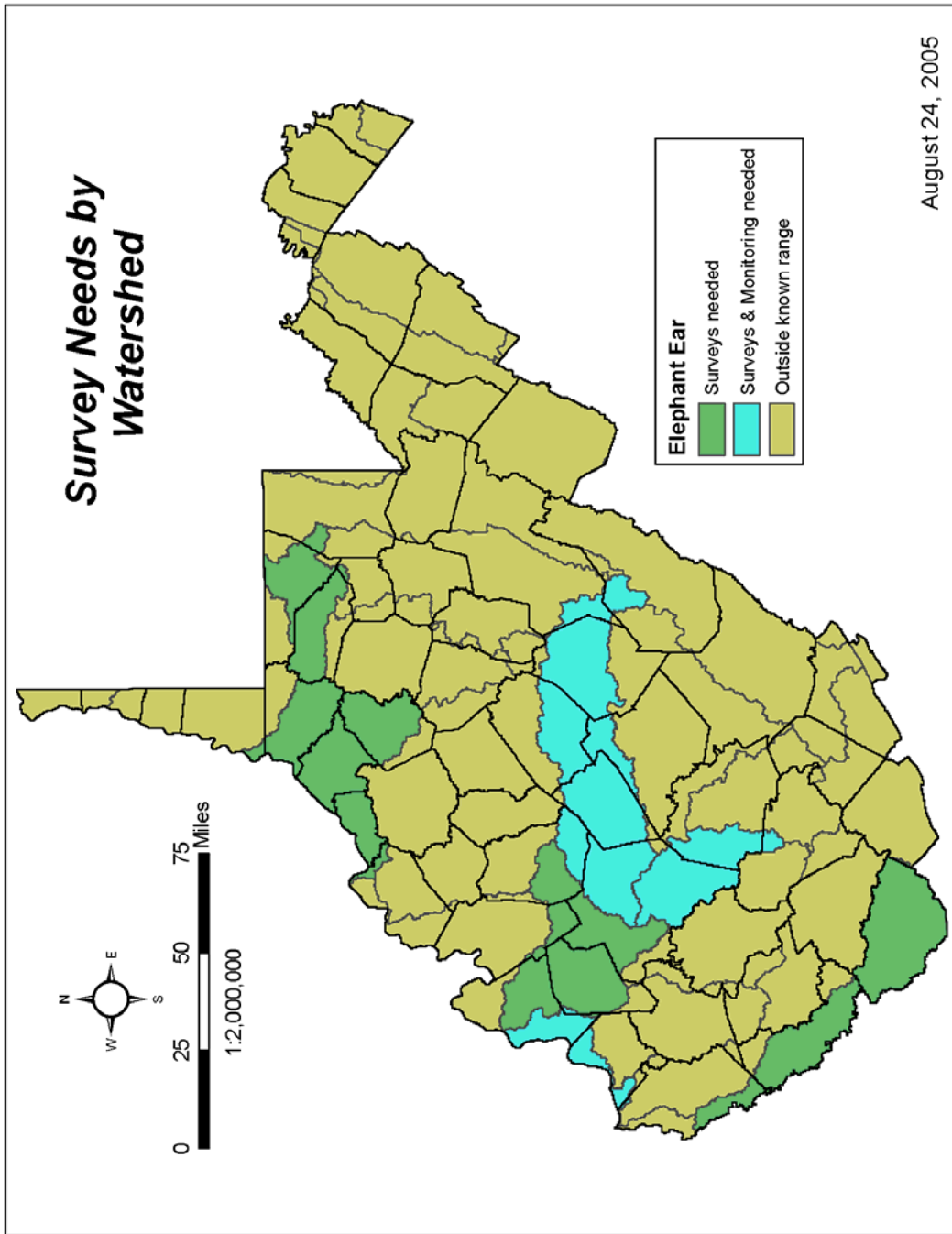
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: June 27, 2005).

Clayton, Janet. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mussels

Common name: Northern Riffleshell

Scientific name: *Epioblasma torulosa rangiana*

STATUS

The ranks and information in the chart below indicate the rarity of the Northern Riffleshell in West Virginia. It is listed as rare and in need of conservation and its status is monitored by many groups. The Northern Riffleshell is listed as endangered by the US Fish and Wildlife Service.

Priority Group	Global Rank	State Rank	USFWS	CITES	NE Tech Comm	AFS	Trend
1*	G2T2	S1	LE	App II	X	E	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Northern Riffleshell into watersheds and gives the site names and ages of the records (recent is within 20 years).

Habitat: The Northern Riffleshell prefers riffles in medium to large rivers.

Watershed	Site Name	Record Type
West Fork	West Fork River	Historic
Upper Kanawha	Kanwaha River	Historic
Elk	Elk River	Recent

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Northern Riffleshell. Because there is inadequate information on the distribution and status of the Northern Riffleshell in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Northern Riffleshell.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Legacy data.	Capture museum records for all WV specimens.
	Coordinates.	Determine coordinates for current data.
	Public access to data.	Publish <i>Mussels of WV</i>.
		Provide general mussel data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Status at historic sites needs to be determined.	Conduct surveys in the Upper Kanawha River.
	Length of stream occupied at each recent occurrence needs to be determined.	Conduct surveys and analyze habitat.
	New and historic sites need to be surveyed.	Revisit historic sites and conduct new surveys on sites along known river systems and their tributaries. Priority will be given to Upper Kanawha River.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Only two individuals have been found in recent years, if a new population is found, set-up long term monitoring site.

Category	Need	Action
Research	Life history.	Conduct research on all life history aspects and conduct other research as impacts occur.
	Effects of mining, highways, etc.	

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Northern Riffleshell and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Propagation, Coordination, Education, Management
Forest Health	
Water Quantity and Quality	Education, Coordination, Management
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE NORTHERN RIFFLESHELL AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Capture museum records for all WV Specimens.
- Determine coordinates for current data.
- Publish *Mussels of WV*.

Surveys:

- Conduct surveys in the Upper Kanawha River.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc.) in streams with Northern Riffleshells.
- Mitigate for impacts of mining and other development activities in the vicinity of Northern Riffleshell streams.

Propagation:

- Establish a propagation program to restore populations since only two individuals have been found in recent years.

Education:

- Educate and work with landowners on streambed and stream bank stability issues and the importance of riparian buffers to limit erosion, nutrient and solid waste loading, and chemical pollution to streams.
- Educate students, teachers and citizens to the importance of Mussels through presentations, pamphlets, etc.

Legislation/Regulation:

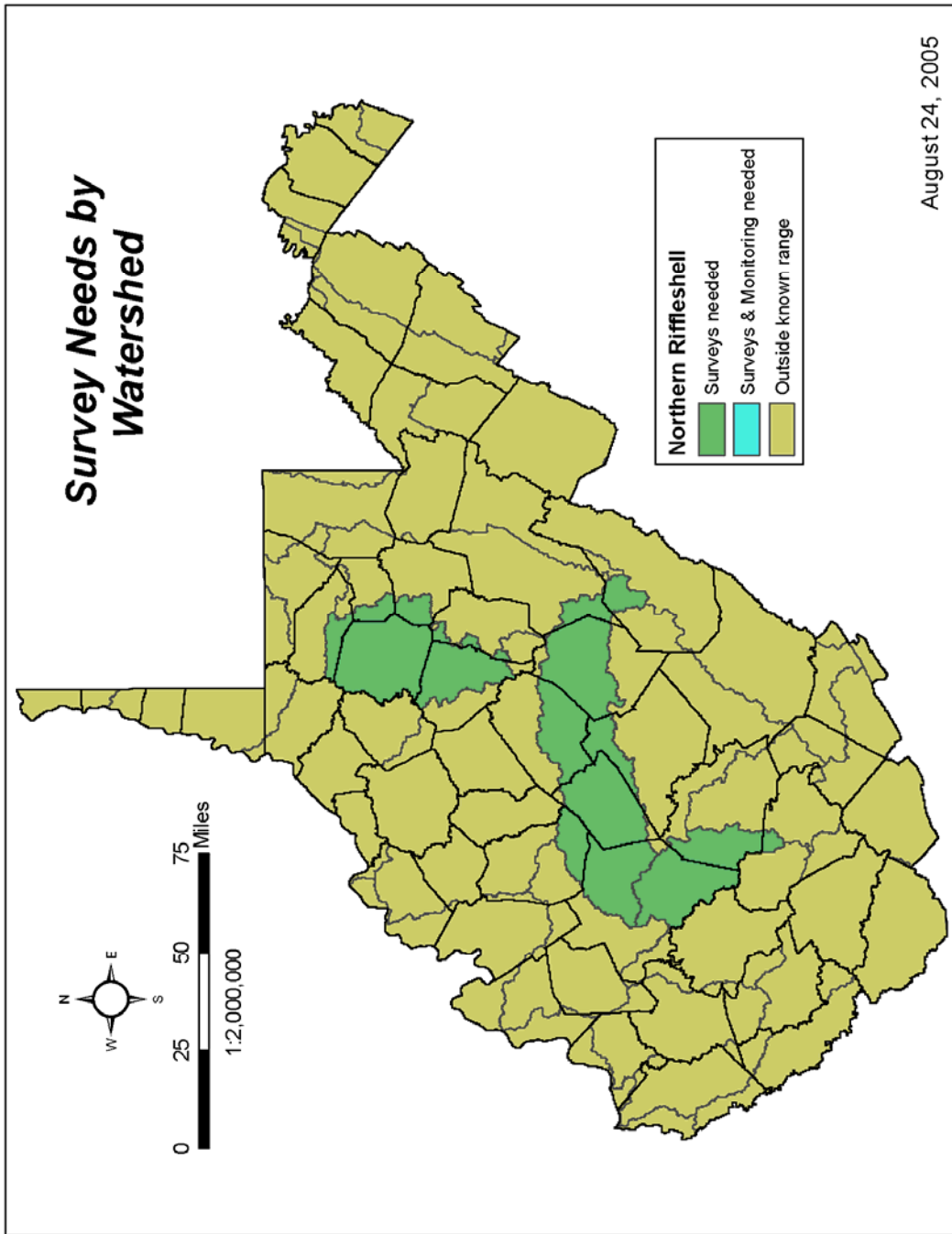
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: June 27, 2005).

Clayton, Janet. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mussels

Common name: Long-solid

Scientific name: *Fusconaia subrotunda*

STATUS

The ranks and information in the chart below indicate the rarity of the Long-solid in West Virginia. It is listed as rare and in need of conservation and its status is monitored by many groups. The Long-solid is considered a species of concern in every state in which it occurs.

Priority Group	Global Rank	State Rank	USFWS	IUCN Rank	AFS	Trend
1*	G3	S2	SC	LR/nt	SC	Stable

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Long-solid into watersheds and gives the site names and ages of the records (recent is within 20 years).

Habitat: The Long-solid inhabits large creeks to large rivers in areas with moderate current.

Watershed	Site Name	Record Type
Monongahela	Monongahela River	Historic
West Fork	West Fork River	Historic
	Hacker's Creek	Recent
Lower Ohio River Valley	Ohio River	Recent Historic
Middle Ohio River Valley	Middle Island Creek	Recent
	Meathouse Creek	Recent
Upper Ohio River Valley	Ohio River	Historic
Little Kanawha	Little Kanawha River	Recent Historic
	North Fork Hughes River	Recent
	South Fork Hughes River	Recent
Upper Kanawha	Kanawha River	Recent Historic
Elk	Elk River	Recent Historic
Tug Fork	Tug Fork River	Recent

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Long-solid. Because there is inadequate information on the distribution and status of the Long-solid in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below.

Bolded text indicates primary actions required to identify conservation needs of the Long-solid.

Category	Need	Activity
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Legacy data.	Capture museum records for all WV specimens.
	Coordinates.	Determine coordinates data for current data.
	Public access to data.	Publish <i>Mussels of WV</i>.
Provide general mussel data, such as distribution maps, on the internet.		

Category	Need	Activity
Surveys	Length of stream occupied at each recent occurrence needs to be determined.	Conduct surveys and analyze habitat.
	New and historic sites need to be surveyed.	Revisit historic sites and conduct new surveys on sites along known river systems and their tributaries.

Category	Need	Activity
Monitoring	Long-term monitoring sites.	Establish long-term monitoring sites to be resurveyed at least every 5 years.
	Monitor habitat.	Visit sites to determine habitat changes and level of habitat impact through use of scour chains. Measure other stream stability parameters. If impacts occur, survey for species.

Category	Need	Activity
Research	Life history.	Conduct research on all life history aspects
	Effects of mining, highways, etc.	Conduct other research as impacts occur.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Long-solid and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Education , Coordination, Management
Over Collection	
Management Conflicts	
Invasive Species	Education , Management
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE LONG-SOLID AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Capture museum records for all WV specimens.
- Determine coordinates for current data.
- Publish *Mussels of WV*.

Surveys:

- Conduct surveys and analyze habitat.
- Revisit historic sites and conduct new surveys on sites along known river systems and their tributaries.

Monitoring:

- Establish long-term monitoring sites to be resurveyed at least every 5 years.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (erosion/sedimentation, chemical pollution, etc) in streams with Long-solids.
- Mitigate against impacts of mining and other development activities in the vicinity of Long-solid streams.

Education:

- Educate and work with landowners on streambed and stream bank stability issues and the importance of riparian buffers to limit erosion, nutrient and solid waste loading, and chemical pollution to streams.
- Educate students, teachers and citizens to the importance of mussels through presentations, pamphlets, etc.
- Educate boaters and other river users as to appropriate recommended actions to prevent transfer of invasive zebra mussels.

Legislation/Regulation:

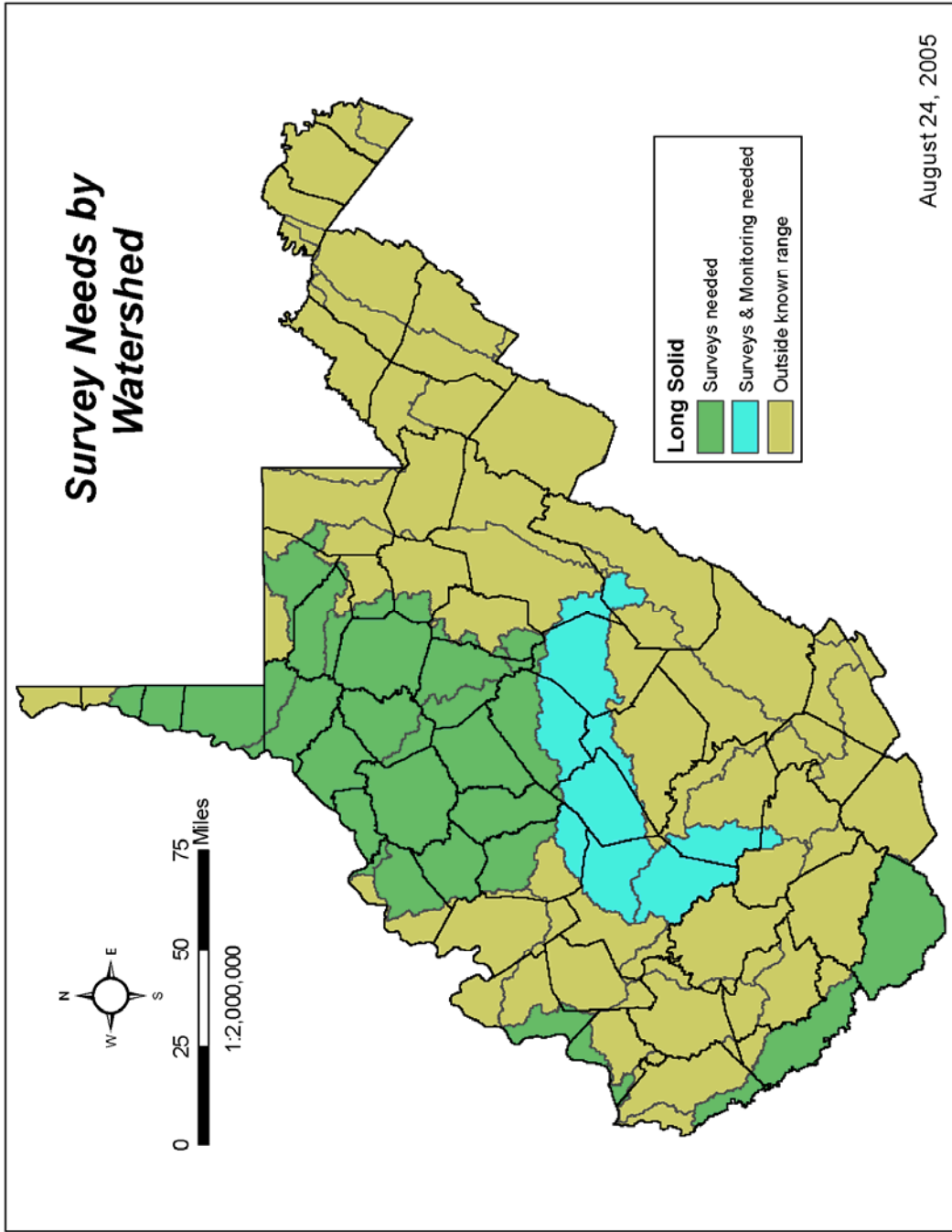
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: June 27, 2005).

Clayton, Janet. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mussels

Common name: Green Floater

Scientific name: *Lasmigona subviridis*

STATUS

The ranks and information in the chart below indicate the rarity of the Green Floater in West Virginia. It is listed as rare and in need of conservation and its status is monitored by many groups. The Green Floater is considered a species of concern in every state in which it occurs.

Priority Group	Global Rank	State Rank	USFWS	Jeff Forest	Mon Forest	IUCN Rank	NE Tech Comm	AFS	Trend
1*	G3	S2	SC	X	X	LR/nt	X	T	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places each occurrence of the Green Floater into watersheds and gives the site names and ages of the records (recent is within 20 years).

Habitat: The Green Floater inhabits medium-sized creeks to large rivers in areas with current breaks (back water eddies). It can be found in a wide variety of substrates.

Watershed	Site Name	Record Type
Potomac	Potomac River	Recent Historic
	Opequon Creek	Recent
Cacapon	Cacapon River	Recent
	North River	Recent
North Branch Potomac	Patterson Creek	Recent
South Branch Potomac	South Branch Potomac River	Recent Historic
	Hamilton Run	Recent
Upper Kanawha	Kanawha River	Recent Historic
Lower New	New River	Recent Historic
Greenbrier	Greenbrier River	Recent Historic
	West Fork Greenbrier River	Recent Historic

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Green Floater. Because there is inadequate information on the distribution and status of the Green Floater in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Green Floater.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Legacy data and database information need to be acquired.	Capture museum records for all WV specimens.
	Coordinates.	Determine coordinates for current data.
	Public access to data.	Publish <i>Mussels of WV</i>. Provide general mussel data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Length of stream occupied at each recent occurrence needs to be determined.	Conduct surveys and analyze habitat.
	New and historic sites need to be surveyed.	Revisit historic sites and conduct new surveys on sites along known river systems and their tributaries. Priority will be given to the Greenbrier River.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Establish long-term monitoring sites to be resurveyed at least every 5 years.
	Monitor habitat.	Visit sites to determine habitat changes and level of habitat impact through use of scour chains. Measure other stream stability parameters. If impacts occur, survey for species.

Category	Need	Action
Research	Life history.	Conduct research on all life history aspects.
	Effects of mining, highways, etc.	Conduct other research as impacts occur.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Green Floater and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Propagation, Coordination, Education, Management
Forest Health	Coordination, Education
Water Quantity and Quality	Education, Coordination, Management
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE GREEN FLOATER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Capture museum records for all WV specimens.
- Determine coordinates for current data.
- Publish *Mussels of WV*.

Surveys:

- Conduct surveys and analyze habitat.
- Revisit historic sites and conduct new surveys on sites along known river systems and their tributaries. Priority will be given to the Greenbrier River.

Monitoring:

- Establish long-term monitoring sites to be resurveyed at least every 5 years.
- Visit sites to determine habitat changes and level of habitat impact through use of scour chains. Measure other stream stability parameters. If impacts occur, survey for species.

Coordination:

- Coordinate with the U.S. Fish and Wildlife Service to pursue listing species as Threatened or Endangered.
- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (erosion/sedimentation, nutrient loading, chemical pollution, acid precipitation, stream channelization etc) in streams with Green Floaters.

Propagation:

- Establish a propagation program to restore and enhance populations in the Greenbrier Rivers.

Education:

- Educate and work with landowners on streambed and stream bank stability issues and the importance of riparian buffers to limit erosion, nutrient and solid waste loading, and chemical pollution to streams.
- Educate students, teachers and citizens to the importance of Mussels through presentations, pamphlets, etc.

Legislation/Regulation:

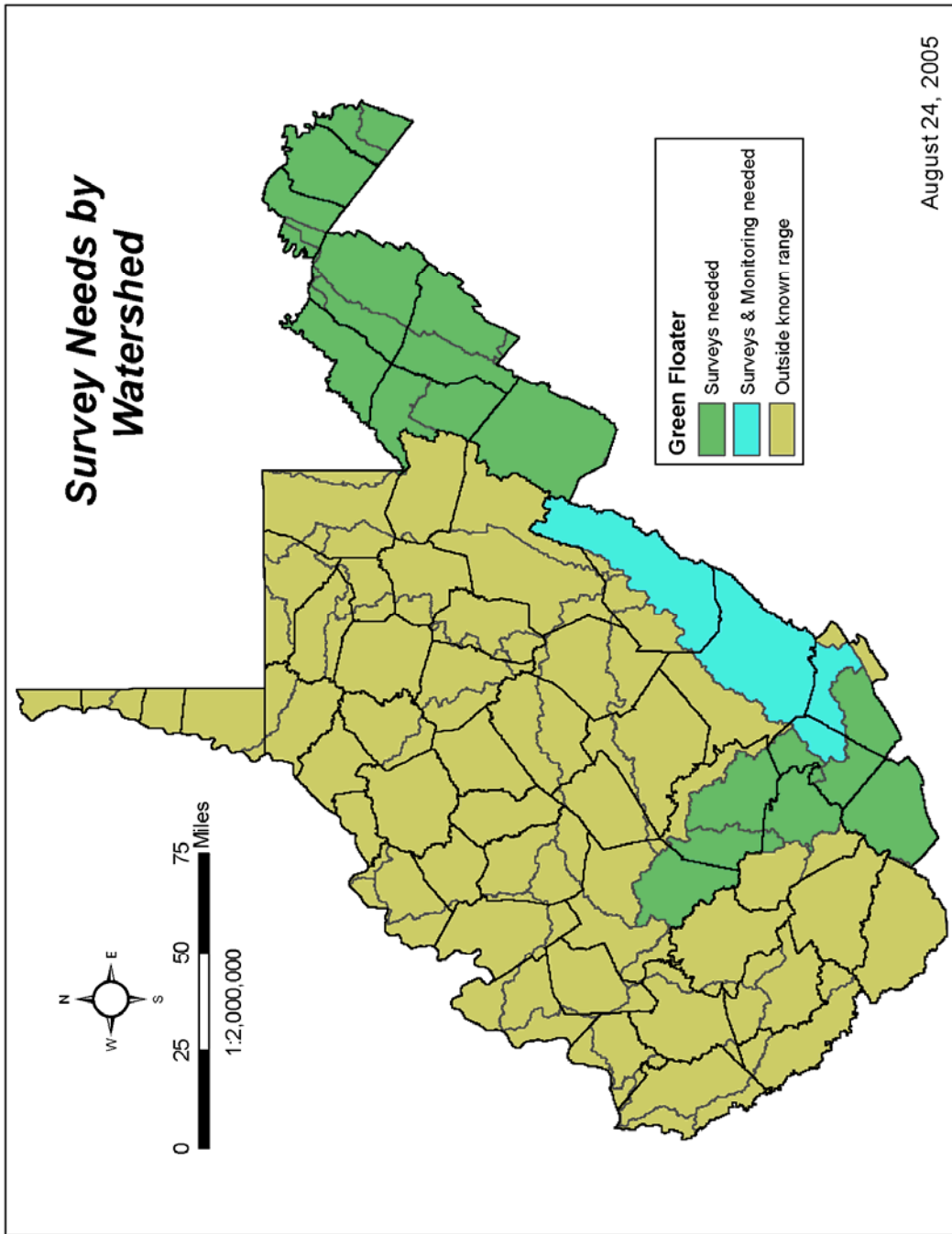
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.
- Pursue federal listing of this species.

REFERENCES

NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: June 27, 2005).

Clayton, Janet. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mussels

Common name: Washboard

Scientific name: *Megalonaias nervosa*

STATUS

The ranks and information in the chart below indicate the rarity of the Washboard in West Virginia. It is listed as rare and in need of conservation and its status is monitored by many groups. The Washboard is considered a species of concern in many states in which it occurs.

Priority Group	Global Rank	State Rank	Trend
1*	G5	S1	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Washboard into watersheds and gives the site names and ages of the records (recent is within 20 years).

Habitat: This species prefers large rivers in areas with low to moderate current.

Watershed	Site Name	Record Type
Middle Ohio River Valley	Ohio River	Recent
Lower Ohio River Valley	Ohio River	Recent
Upper Kanawha	Kanawha River	Recent

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Washboard. Because there is inadequate information on the distribution and status of the Washboard in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Washboard.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Legacy data.	Capture museum records for all WV specimens.
	Coordinates.	Determine coordinates for current data.
	Public access to data.	Publish <i>Mussels of WV</i>.
		Provide general mussel data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Length of stream occupied at each recent occurrence needs to be determined.	Conduct surveys and analyze habitat.
	Survey additional new and historic sites.	Analyze potential habitat in the Ohio and Kanawha rivers to identify new survey areas/sites.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Establish long-term monitoring sites to be re-surveyed at least every 5 years.
	Monitor habitat.	Visit sites to determine habitat changes and level of habitat impact through use of scour chains. Measure other stream stability parameters. If impacts occur, survey for species.

Category	Need	Action
Research	Life history.	Conduct research on all life history aspects and conduct other research as impacts occur.
	Effects of mining, highways, etc.	

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Washboard and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Education , Coordination, Management
Over Collection	
Management Conflicts	
Invasive Species	Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE WASHBOARD AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Capture museum records for all WV specimens.
- Determine coordinates for current data.
- Publish *Mussels of WV*.

Surveys:

- Conduct surveys and analyze habitat.
- Analyze potential habitat in the Ohio and Kanawha rivers to identify new survey areas/sites.

Monitoring:

- Establish long-term monitoring sites to be re-surveyed at least every 5 years.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in streams with Washboards.
- Mitigate for impacts of mining, road building and other development activities in the vicinity of Washboard streams.

Education:

- Educate and work with landowners on streambed and stream bank stability issues and the importance of riparian buffers to limit erosion, nutrient and solid waste loading, and chemical pollution to streams.
- Educate students, teachers and citizens to the importance of mussels through presentations, pamphlets, etc.
- Educate boaters as to appropriate recommended actions to prevent transfer of invasive zebra mussels.

Legislation/Regulation:

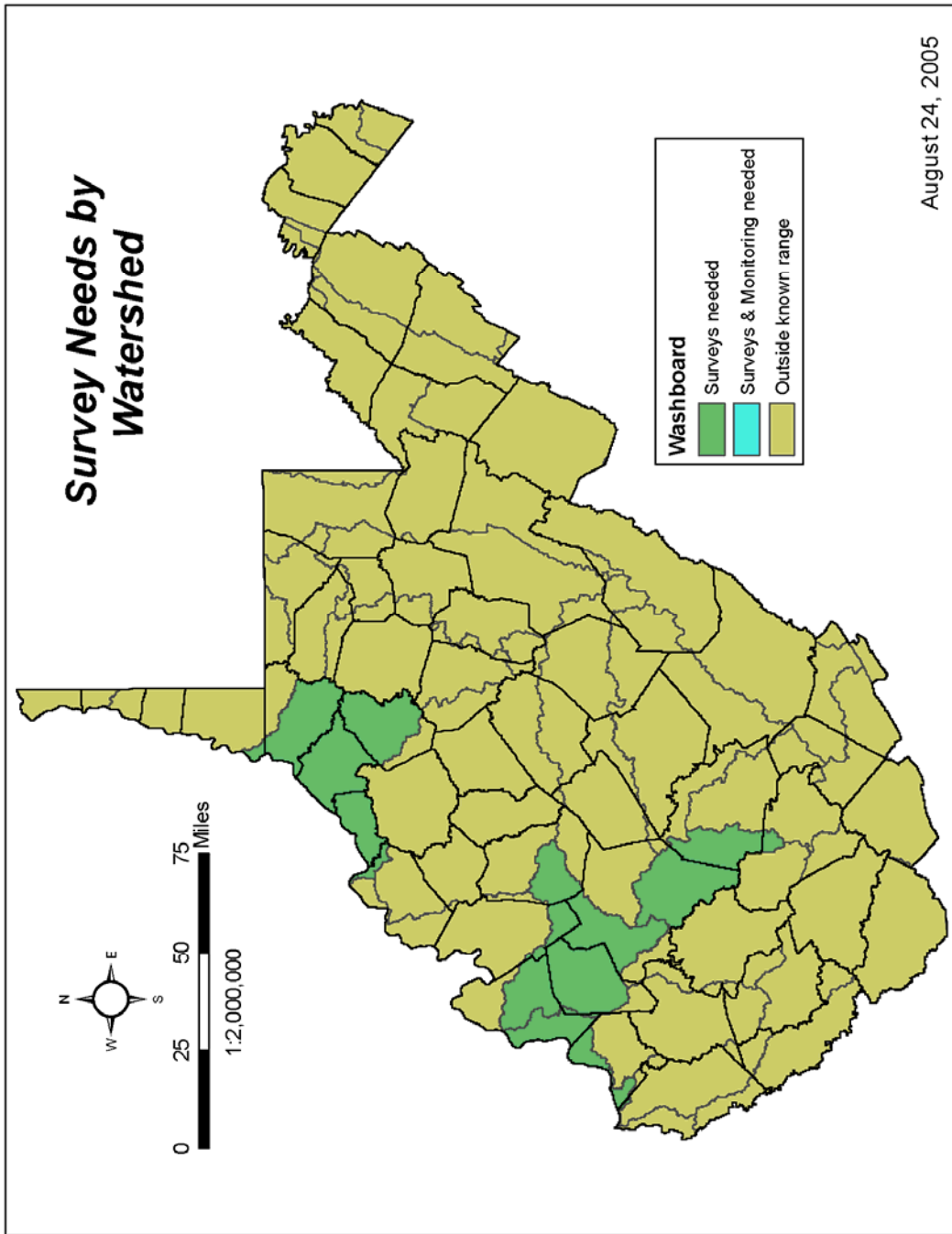
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: June 27, 2005).

Clayton, Janet. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mussels

Common name: James Spiny mussel

Scientific name: *Pleurobema collina*

STATUS

The ranks and information in the chart below indicate the rarity of the James Spiny mussel in West Virginia. It is listed as rare and in need of conservation and its status is monitored by many groups. The James Spiny mussel is listed as an endangered species by the U.S. Fish and Wildlife Service.

Priority Group	Global Rank	State Rank	USFWS	Jeff Forest	IUCN Rank	NE Tech Comm	AFS	Trend
1*	G1	S1	LE	X	CR A1ce	X	E	Stable

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the James Spiny mussel into watersheds and gives the site names and ages of the records (recent is within 20 years).

Habitat: This species occurs only in medium sized streams of the James River drainage.

Watershed	Site Name	Record Type
James	Potts Creek	Recent
	South Fork Potts Creek	Recent

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the James Spiny mussel. Because there is inadequate information on the distribution and status of the James Spiny mussel in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the James Spiny mussel.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Legacy data.	Capture museum records for all WV specimens.
	Coordinates.	Determine coordinates for current data.
	Public access to data.	Publish <i>Mussels of WV</i>.
Provide general mussel data, such as distribution maps, on the internet.		

Category	Need	Action
Surveys	Length of stream occupied at each recent occurrence needs to be determined.	Conduct surveys and analyze habitat.
	New sites need to be surveyed.	Survey any areas along Potts Creek that have not been previously surveyed.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Establish long-term monitoring sites to be re-surveyed at least every 5 years.
	Monitor habitat.	Visit sites to determine habitat changes and level of habitat impact through use of scour chains. Measure other stream stability parameters. If impacts occur, survey for species.

Category	Need	Action
Research	Life history.	Conduct research on all life history aspects and conduct other research as impacts occur.
	Effects of mining, highways, etc.	

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the James Spiny mussel and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Education , Coordination, Management
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE JAMES SPINY MUSSEL AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Capture museum records for all WV specimens.
- Determine coordinates for current data.
- Publish *Mussels of WV*.

Monitoring:

- Establish long-term monitoring sites to be re-surveyed at least every 5 years.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (erosion/sedimentation, nutrient loading, pollution, stream channelization, etc.) in streams with James Spiny mussels.

Education:

- Educate and work with landowners on streambed and stream bank stability issues and the importance of riparian buffers to limit erosion, nutrient and solid waste loading, and chemical pollution to streams.
- Educate students, teachers and citizens to the importance of mussels through presentations, pamphlets, etc.

Legislation/Regulation:

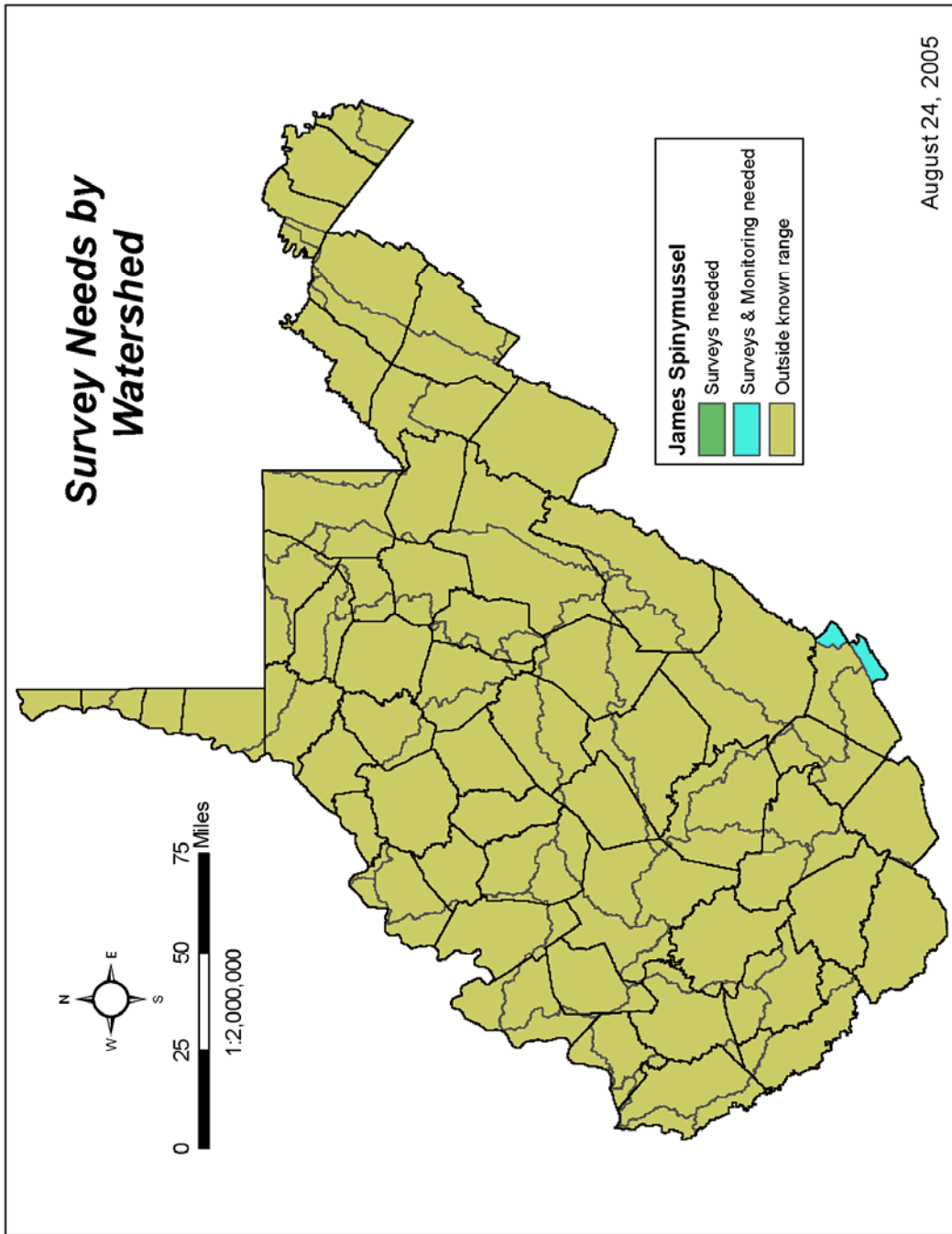
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: June 27, 2005).

Clayton, Janet. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mussels

Common name: Round Pigtoe

Scientific name: *Pleurobema sintoxia*

STATUS

The ranks and information in the chart below indicate the rarity of the Round Pigtoe in West Virginia. It is listed as rare and in need of conservation and its status is monitored by many groups. The Round Pigtoe is considered a species of concern in many states in which it occurs.

Priority Group	Global Rank	State Rank	Trend
2*	G4	S2	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Round Pigtoe into watersheds and gives the site names and the ages of the records (recent is within 20 years).

Habitat: The Round Pigtoe prefers large creeks to large rivers in areas of moderate flow with clean gravel/cobble substrates.

Watershed	Site Name	Record Type
Dunkard Creek	Dunkard Creek	Recent
West Fork	West Fork River	Historic
	Hacker's Creek	Recent
Middle Ohio River Valley	Middle Island Creek	Recent Historic
	Meathouse Fork	Recent
	Buckeye Creek	Recent
Little Kanawha	Little Kanawha River	Recent Historic
	Steer Creek	Recent
	North Fork Hughes River	Recent
	West Fork Little Kanawha River	Recent
Upper Kanawha	Kanawha River	Recent
Elk	Elk River	Recent Historic
Twelve Pole Creek	Beech Fork	Recent

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Round Pigtoe. Because there is inadequate information on the distribution and status of the Round Pigtoe in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Round Pigtoe.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Legacy data.	Capture museum records for all WV specimens.
	Coordinates.	Determine coordinates for current data.
	Public access to data.	Publish <i>Mussels of WV</i>.
		Provide general mussel data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Length of stream occupied at each recent occurrence needs to be determined.	Conduct surveys and analyze habitat.
	Determine status at historic sites.	A very high percentage of sites are historic. Surveys need to be conducted with priority given to sites with potential habitat and most likely to harbor the species such as in the Little Kanawha and Middle Island Creek drainages.
	Survey additional and historic sites.	Analyze potential habitat in the Ohio and Kanawha rivers to determine new survey areas/sites.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Establish long-term monitoring sites to be re-surveyed at least every 5 years.
	Monitor habitat.	Visit sites to determine habitat changes and level of habitat impact through use of scour chains. Measure other stream stability parameters. If impacts occur, survey for species.

Category	Need	Action
Research	Life history.	Conduct research on all life history aspects and conduct other research as impacts occur.
	Effects of mining, highways, etc.	

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Round Pigtoe and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Education , Coordination, Management
Over Collection	
Management Conflicts	
Invasive Species	Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE ROUND PIGTOE AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Capture museum records for all WV specimens.
- Determine coordinates for current data.
- Publish *Mussels of WV*.

Surveys:

- Conduct surveys and analyze habitat.
- A very high percentage of sites are historic. Surveys need to be conducted with priority given to sites with potential habitat and most likely to support the species, especially in the Little Kanawha and Middle Island Creek drainages.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, erosion, nutrient loading, pollution, etc) in streams with Round Pigtoes.
- Mitigate for impacts of oil and gas drilling and other development activities in the vicinity of Round Pigtoe streams.

Education:

- Educate and work with landowners on streambed and stream bank stability issues and the importance of riparian buffers to limit erosion, nutrient and solid waste loading, and chemical pollution of streams.
- Educate students, teachers and citizens to the importance of Mussels through presentations, pamphlets, etc.
- Educate boaters and other river users as to appropriate recommended actions to prevent transfer of invasive zebra mussels.

Legislation/Regulation:

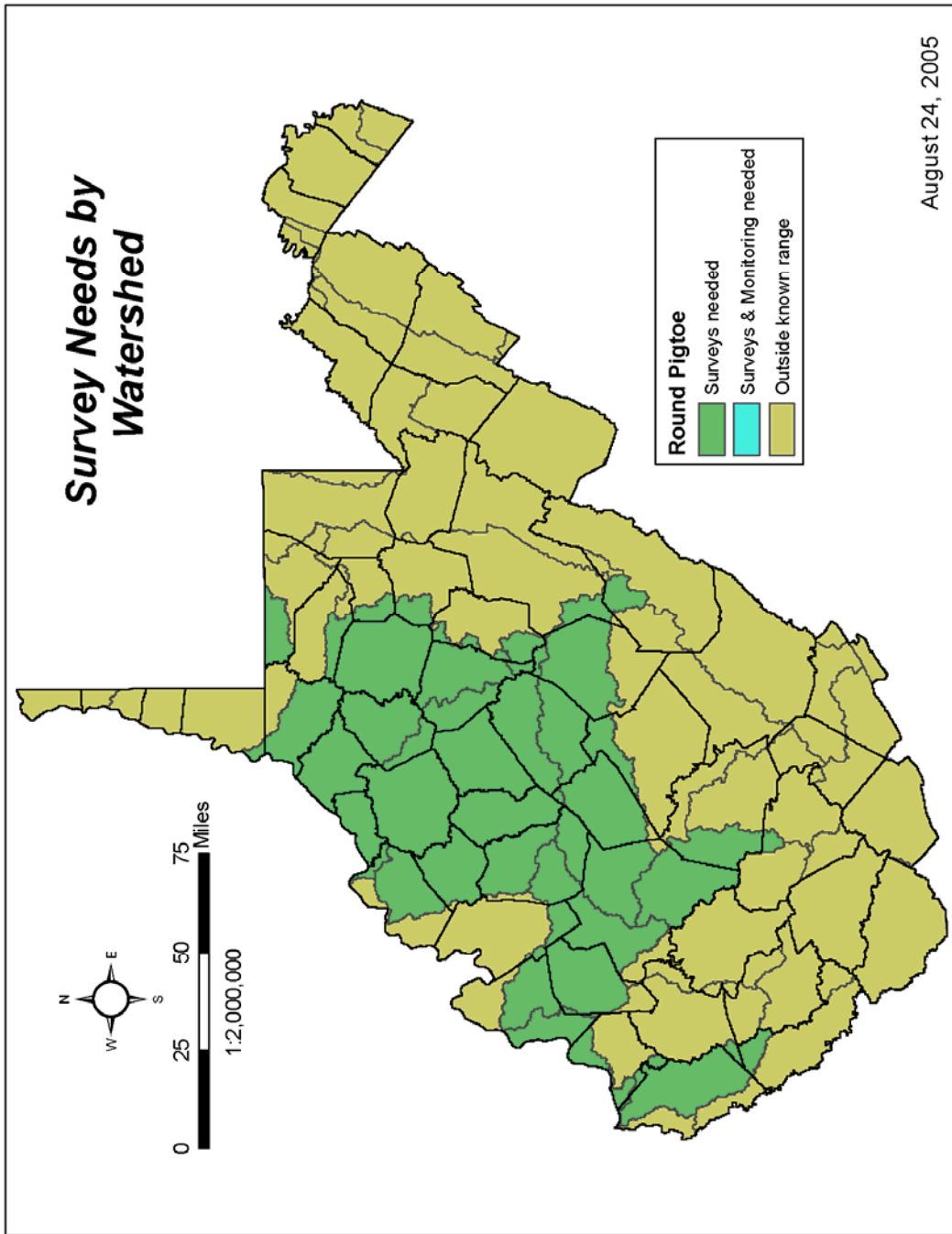
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: June 27, 2005).

Clayton, Janet. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mussels

Common name: Clubshell

Scientific name: *Pleurobema clava*

STATUS

The ranks and information in the chart below indicate the rarity of the Clubshell in West Virginia. It is listed as rare and in need of conservation and its status is monitored by many groups. The Clubshell is listed as an endangered species by the US Fish and Wildlife Service.

Priority Group	Global Rank	State Rank	USFWS	IUCN Rank	CITES	NE Tech Comm	AFS	Trend
1*	G2	S1	LE	CR A1ce	App II	X	E	

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Clubshell into watersheds and gives site names and the ages of the records (recent is within 20 years).

Habitat: Medium sized creeks to large flowing rivers. They are typically associated with areas of moderate flow and gravel substrates.

Watershed	Site Name	Record Type
West Fork	West Fork River	Historic
	Hackers Creek	Recent
Elk	Elk River	Recent Historic
Little Kanawha	Little Kanawha	Recent Historic
	South Fork Hughes	Recent
	North Fork Hughes	Historic
Middle Ohio River Valley	Middle Island Creek	Recent
	Meathouse Fork	Recent
	Ohio River	Historic

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Clubshell. Because there is inadequate information on the distribution and status of the Clubshell in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below.

Bolded text indicates primary actions required to identify conservation needs of the Clubshell.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Legacy data from WV specimens.	Capture museum records from WV specimens.
	Coordinates.	Determine coordinates for all current data.
	Public access to data.	Publish <i>Mussels of WV</i>.
		Provide general mussel data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Determine status at historic sites.	A very high percentage of sites are historic. Surveys need to be conducted with priority given to sites with potential habitat and most likely to support the species, as in the Little Kanawha drainage.
	Determine length of stream occupied at each recent occurrence.	Conduct surveys and analyze habitat.
	Survey additional sites.	Analyze potential habitat statewide to determine new survey areas/sites.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Establish long-term monitoring sites to be re-surveyed at least every 5 years.
	Monitor habitat.	Survey to determine habitat changes and level of habitat impact through use of scour chains and measuring other stream stability parameters; if impacts occur, survey for species.

Category	Need	Action
Research	Life history	Conduct research on all life history aspects and conduct other research as impacts occur.
	Effects of mining, highways, etc.	

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Clubshell and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Education , Coordination, Management
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE CLUBSHELL AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Capture museum records from all WV specimens.
- Determine coordinates for all current data.
- Publish *Mussels of WV*

Surveys:

- A very high percentage of the sites are historic. Surveys need to be conducted with priority given to sites with potential habitat and most likely to support the species, such as the Little Kanawha drainage.
- Conduct surveys and analyze habitat.
- Analyze potential habitat statewide to identify new survey areas/sites.

Monitoring:

- Establish long-term monitoring sites to be re-surveyed at least every 5 years.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (erosion/sedimentation, nutrient loading, chemical pollution, stream channelization, etc.) in streams with Clubshells.

Education:

- Educate and work with landowners on streambed and stream bank stability issues and the importance of riparian buffers to limit erosion, nutrient and solid waste loading, and chemical pollution to streams.
- Educate students, teachers and citizens to the importance of Mussels through presentations, pamphlets, etc.

Legislation/Regulation:

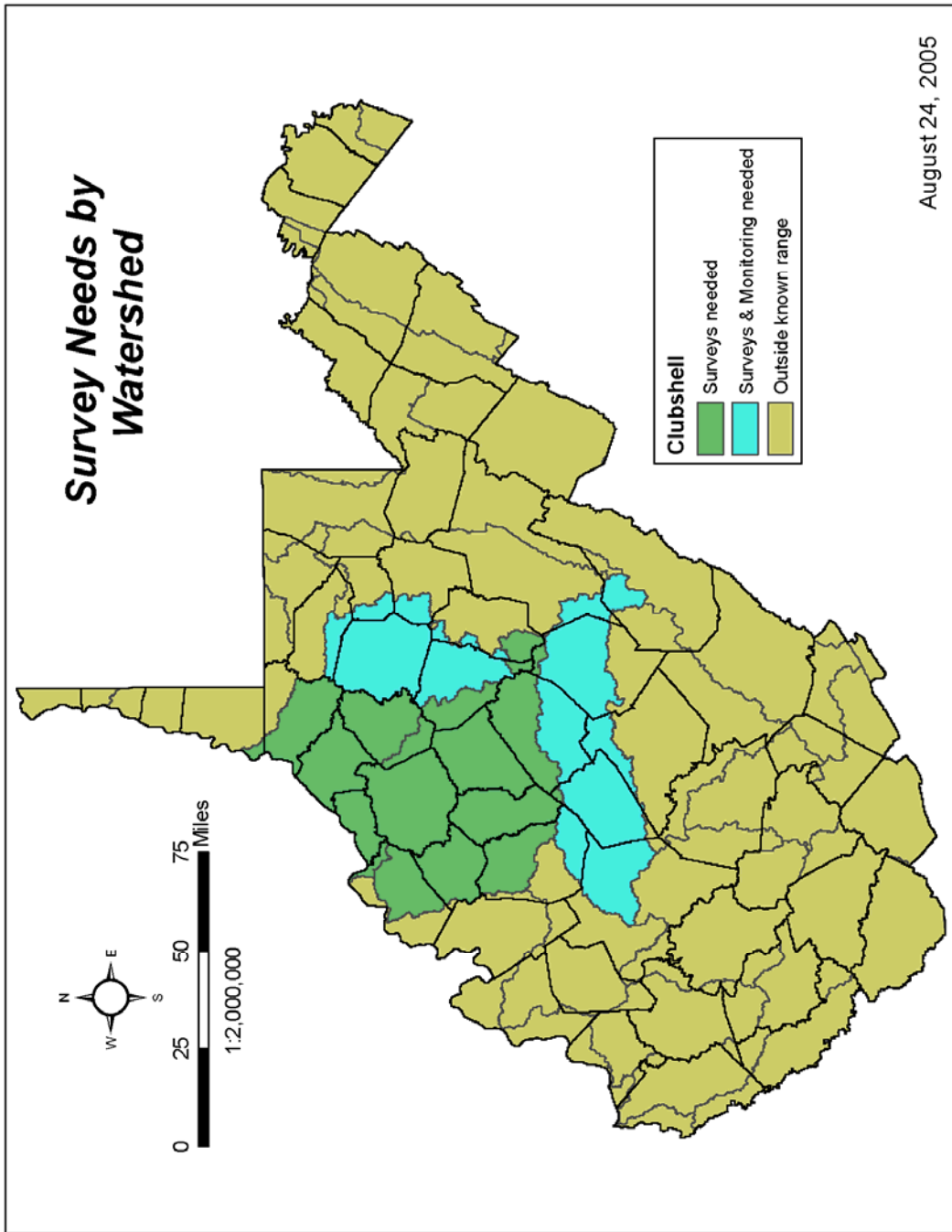
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: June 27, 2005).

Clayton, Janet. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mussels
Common name: Sheepnose
Scientific name: *Plethobasus cyphus*

STATUS

The ranks and information in the chart below indicate the rarity of the Sheepnose in West Virginia. It is listed as rare and in need of conservation and its status is monitored by many groups. The Sheepnose is listed as a Candidate species by the US Fish and Wildlife Service.

Priority Group	Global Rank	State Rank	USFWS	Jeff Forest	AFS	Trend
1*	G3	S1	Cat 1	X	T	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of Sheepnose into watersheds and gives the site names and ages of the record (recent is within 20 years).

Habitat: The Sheepnose prefers coarse sand to gravel in relatively fast current. It is found in large rivers but not in large river impoundments.

Watershed	Site Name	Record Type
Lower Ohio River Valley	Ohio River	Historic
Middle Ohio River Valley	Ohio River	Recent Historic
Lower Ohio River Valley	Ohio River	Recent Historic
Upper Kanawha River	Kanawha River	Recent

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Sheepnose. Because there is inadequate information on the distribution and status of the Sheepnose in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Sheepnose.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Legacy data for WV species.	Capture museum records for all WV specimens.
	Coordinates.	Check data coordinates and apply coordinates to current data.
	Public access to data.	Publish <i>Mussels of WV</i>.
Provide general mussel data, such as distribution maps, on the internet.		

Category	Need	Action
Surveys	Status at historic sites needs to be determined.	A very high percentage of sites are historic. Surveys need to be conducted with priority given to sites with potential habitat and most likely to support the species. Priority will be given to the Kanawha River since this river lacks the most recent surveys and the upper 5 miles are still being impacted by impoundments.
	Length of stream occupied at each recent occurrence needs to be determined.	Conduct surveys and analyze habitat.
	Survey additional sites.	Analyze potential habitat statewide to identify new survey areas/sites

Category	Need	Action
Monitoring	Long-term monitoring sites.	Establish long-term monitoring sites to be re-surveyed at least every 5 years
	Monitor habitat.	Survey to determine habitat changes and level of habitat impact through use of scour chains. Measure other stream stability parameters. If impacts occur, survey for species.

Category	Need	Action
Research	Life history.	Conduct research on all life history aspects and conduct other research as impacts occur.
	Effects of mining, highways, etc.	

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Sheepnose and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Propagation, Coordination, Education, Management
Forest Health	
Water Quantity and Quality	Education, Coordination, Management
Over Collection	
Management Conflicts	
Invasive Species	Education, Management,
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE SHEEPNOSE AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Check museum records and enter data from 2000 to current in a database.
- Check data coordinates and apply coordinates to current data.
- Publish Mussels of WV.

Surveys:

- A very high percentage of sites are historic. Surveys need to be conducted with priority given to sites with potential habitat and most likely to support the species. Priority will be given to the Kanawha River since this river lacks the most recent surveys and the upper 5 miles are still being impacted by impoundments.

Coordination:

- Work with landowners and industry to reduce or eliminate activities that may be detrimental to water quality (chemical pollution, etc.) in streams with Sheepnose.

Propagation:

- Develop a propagation program to restore populations in the Ohio and Kanawha rivers.

Education:

- Educate and work with landowners on streambed and stream bank stability issues and the importance of riparian buffers to limit erosion, nutrient and solid waste loading, and chemical pollution to streams.
- Educate students, teachers and citizens to the importance of Mussels through presentations, pamphlets, etc.
- Educate boaters and other river users as to appropriate recommended actions to prevent transfer of invasive zebra mussels.

Legislation/Regulation:

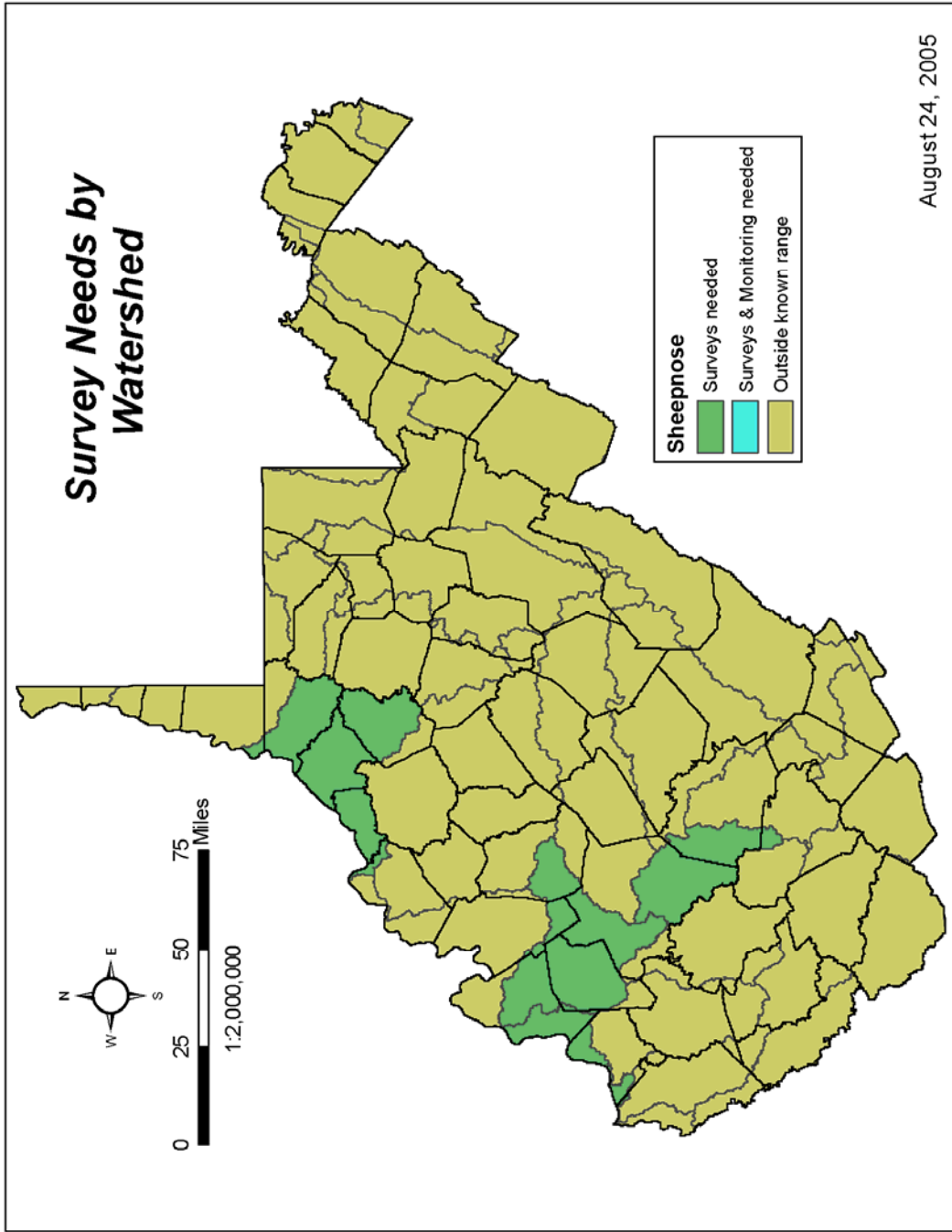
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: June 27, 2005).

Clayton, Janet. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mussels

Common name: Salamander Mussel

Scientific name: *Simpsonaias ambigua*

STATUS

The ranks and information in the chart below indicate the rarity of the Salamander Mussel in West Virginia. It is listed as rare and in need of conservation and its status is monitored by many groups. The Salamander Mussel is considered a species of concern in every state in which it occurs.

Priority Group	Global Rank	State Rank	USFWS	IUCN Rank	NE Tech Comm	AFS	Trend
1*	G3	S1	SC	LR/cd	X	SC	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of Salamander Mussels into watersheds and gives the site names and ages of the records (recent is within 20 years).

Habitat: This species is typically found under big slab rocks where the host for its larval form, the mudpuppy, frequents.

Watershed	Site Name	Record Type
Dunkard Creek	Dunkard Creek	Recent
West Fork	West Fork River	Historic
Middle Ohio River Valley	Middle Island Creek	Recent
Little Kanawha	West Fork Little Kanawha River	Recent
	North Fork Hughes River	Historic
	Spring Creek	Recent
Lower Kanawha	Pocatalico River	Historic
	Hurricane Creek	Recent
Upper Kanawha	Kanawha River	Historic
Twelve Pole Creek	Twelve Pole Creek	Recent

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Salamander Mussel. Because there is inadequate information on the distribution and status of the Salamander Mussel in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Salamander Mussel.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Legacy data.	Capture museum records for all WV specimens.
	Coordinates.	Determine coordinates for all current data.
	Public access to data.	Publish <i>Mussels of WV</i>.
Provide general mussel data, such as distribution maps, on the internet.		

Category	Need	Action
Surveys	Length of stream occupied at each recent occurrence needs to be determined.	Conduct surveys and analyze habitat.
	Determine status at historic and recent sites.	Status needs to be determined at all known locations, historic and recent.
	Additional sites need to be surveyed.	Analyze potential habitat statewide to identify new survey areas/sites.
	Federal listing.	Conduct surveys to verify need for legislative action relative to federal listing.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Establish long-term monitoring sites to be resurveyed at least every 5 years
	Monitor habitat.	Visit sites to determine habitat changes and level of habitat impact through use of scour chains. Measure other stream stability parameters. If impacts occur, survey for species.

Category	Need	Action
Research	Life history and effects of mining, highways, etc.	Conduct research on all life history aspects and conduct other research as impacts occur.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Salamander Mussel and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Education , Coordination, Management
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE SALAMANDER MUSSEL AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Check museum records and enter data from 2000 to current in a database.
- Check coordinates for data and apply coordinates to current data.
- Publish Mussels of WV.

Surveys:

- Conduct surveys and analyze habitat.
- Status needs to be determined at all known locations, historic and recent.
- Analyze potential habitat statewide to identify new survey areas/sites.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (stream channelization/modification, acid mine drainage, erosion/sedimentation, chemical, pollution, etc) in streams with Salamander Mussels.
- Mitigate for impacts of mining, oil/gas drilling and other development activities in the vicinity of Salamander Mussel streams.

Education:

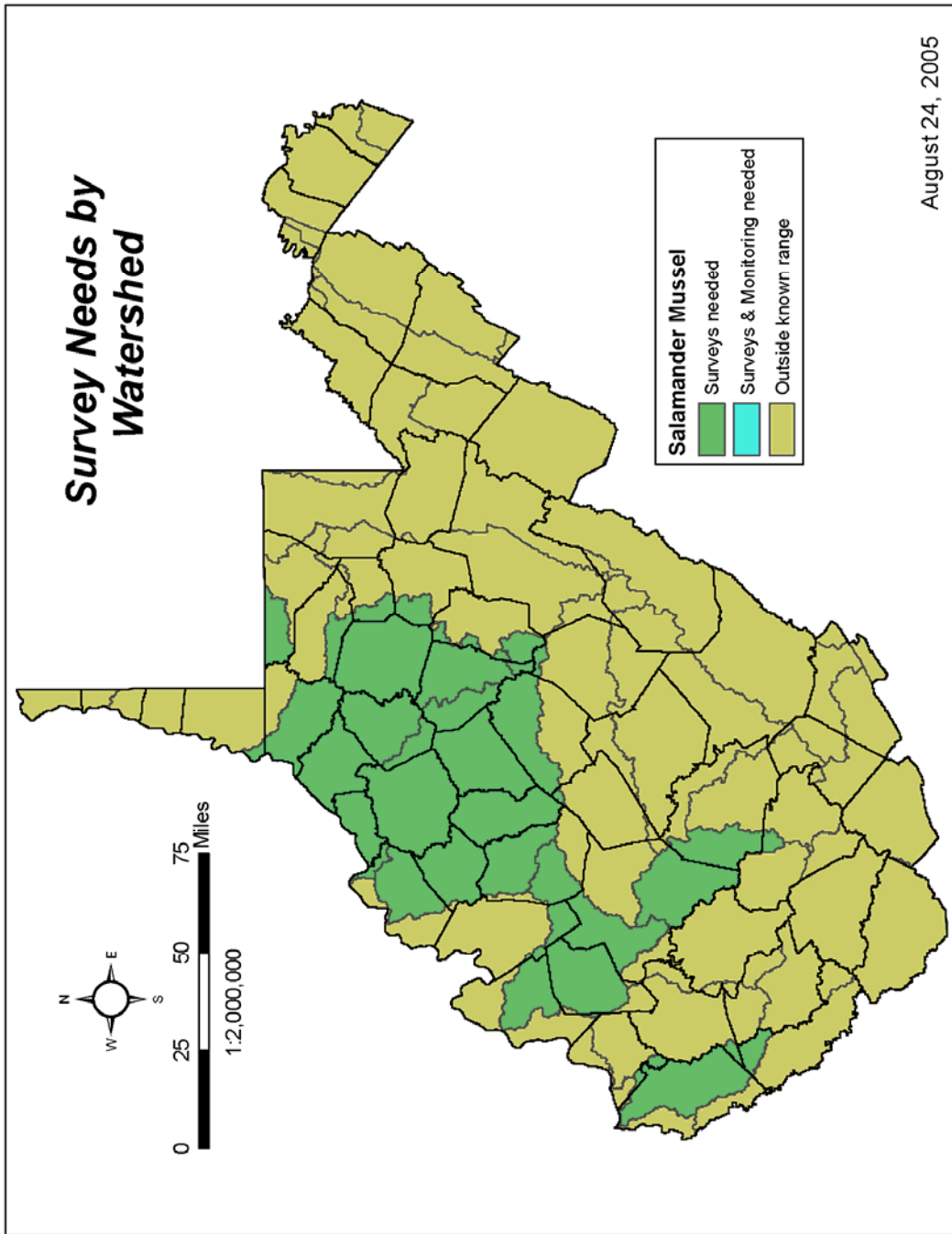
- Educate and work with landowners on streambed and stream bank stability issues and the importance of riparian buffers to limit erosion, nutrient and solid waste loading, and chemical pollution to streams.
- Educate students, teachers and citizens to the importance of Mussels through presentations, pamphlets, etc.

Legislation/Regulation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.
- Conduct surveys to verify need for legislative action relative to federal listing.

REFERENCES

- NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: June 27, 2005).
- Clayton, Janet. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.
- West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mussels
Common name: Pistolgrip
Scientific name: *Tritogonia verrucosa*

STATUS

The ranks and information in the chart below indicate the rarity of the Pistolgrip in West Virginia. It is listed as rare and in need of conservation and its status is monitored by many groups. The Pistolgrip is considered a species of concern in every state in which it occurs.

Priority Group	Global Rank	State Rank	Trend
2*	G4	S2	Declining

*The letters and/or numbers in the chart refer to each group’s designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of Pistolgrip into watersheds, gives the site names and ages of the records (recent is within 20 years).

Habitat: This species can be found in varying substrate and flow types in medium-sized creeks to large rivers.

Watershed	Site Name	Record Type
Dunkard Creek	Dunkard Creek	Recent
West Fork	West Fork River	Historic
	Hacker’s Creek	Recent
Middle Ohio River Valley	Middle Island Creek	Recent Historic
	Mill Creek	Recent
Little Kanawha	Little Kanawha River	Recent Historic
	North Fork Hughes River	Recent
	South Fork Hughes River	Recent
	Henry’s Fork	Recent
	Leading Creek	Recent
	Meathouse Fork	Recent
	Reedy Creek	Recent

Watershed	Site Name	Record Type
Lower Kanawha	Pocatalico River	Recent Historic
Upper Kanawha	Kanawha River	Recent Historic
Lower New	New River	Recent Historic
Upper New	Bluestone River	Recent
	Indian Creek	Recent
Greenbrier	Greenbrier River	Recent Historic
Lower Guyandotte	Guyandotte River	Historic
	Mud River	Recent
Tug Fork	Tug Fork River	Recent
Twelve Pole Creek	Twelve Pole Creek	Recent

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Pistolgrip. Because there is inadequate information on the distribution and status of the Pistolgrip in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below.

Bolded text indicates primary actions required to identify conservation needs of the Pistolgrip.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Legacy data.	Capture museum records for all WV specimens.
	Coordinates.	Determine coordinates for all current data.
	Public access to data.	Publish <i>Mussels of WV</i>.
Provide general mussel data, such as distribution maps, on the internet.		

Category	Need	Action
Surveys	Status at historic sites needs to be determined.	A very high percentage of sites are historic. Surveys need to be conducted with priority given to sites with potential habitat and most likely to support the species, as in the New River watershed.
	Length of stream occupied at each recent occurrence needs to be determined.	Conduct surveys and analyze habitat.
	New sites need to be surveyed.	This species can be found on the surface of the substrate at particular times of the year. Identify sites and conduct surveys in these areas.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Establish long-term monitoring sites to be resurveyed at least every 5 years.
	Monitor habitat.	Visit sites to determine habitat changes and level of habitat impact through use of scour chains. Measure other stream stability parameters. If impacts occur, survey for species.

Category	Need	Action
Research	Life history.	Conduct research on all life history aspects and conduct other research as impacts occur.
	Effects of mining, highways, etc.	

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Pistolgrip and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Propagation, Coordination, Education, Management
Forest Health	
Water Quantity and Quality	Education, Coordination, Management
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE PISTOLGRIP AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Capture museum records for all WV specimens.
- Determine coordinates for current data.
- Publish *Mussels of WV*.

Surveys:

- A very high percentage of sites are historic. Surveys need to be conducted with priority given to sites with potential habitat and most likely to support the species, as the New River watershed.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (erosion/sedimentation, chemical pollution, stream channelization, acid mine drainage, etc) in streams with Pistolgrips.
- Mitigate for impacts of mining, oil/gas drilling and other development activities in the vicinity of Pistolgrip streams.

Propagation:

- Develop a propagation program to facilitate repopulation of the Pistolgrip for the section of the Tug Fork River that was destroyed by a coal slurry spill in 2000.

Education:

- Educate and work with landowners on streambed and stream bank stability issues and the importance of riparian buffers to limit erosion, nutrient and solid waste loading, and chemical pollution to streams.
- Educate students, teachers and citizens to the importance of Mussels through presentations, pamphlets, etc.

Legislation/Regulation:

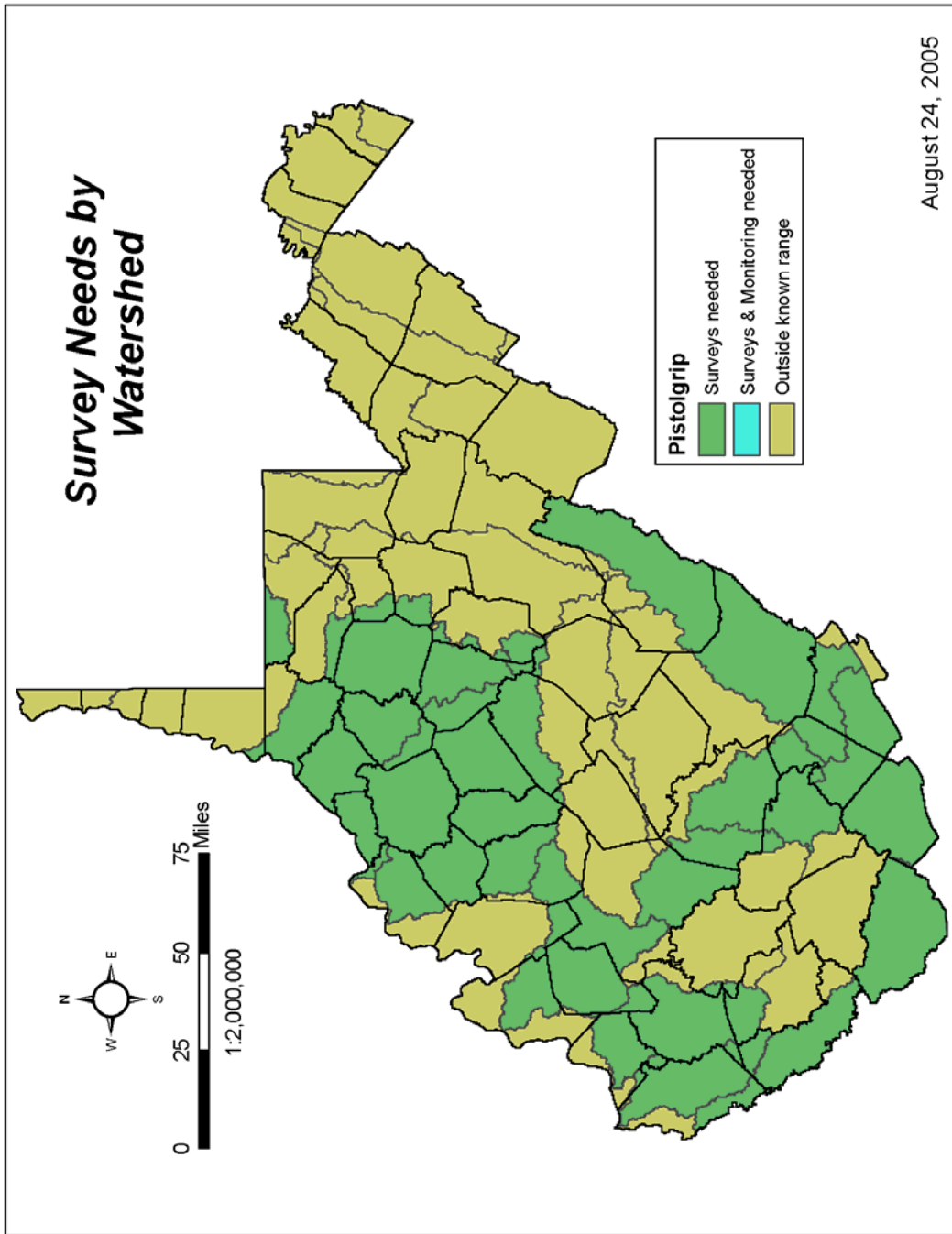
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: June 27, 2005).

Clayton, Janet. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mussels

Common name: Snuffbox

Scientific name: *Epioblasma triquetra*

STATUS

The ranks and information in the chart below indicate the rarity of the Snuffbox in West Virginia. It is listed as rare and in need of conservation and its status is monitored by many groups. The Snuffbox is considered a species of concern in every state in which it occurs.

Priority Group	Global Rank	State Rank	USFWS	Jeff Forest	NE Tech Comm.	AFS	Trend
1*	G3	S2	SC	X	X	T	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Snuffbox into watersheds and gives the site names and ages of the records (recent is within 20 years).

Habitat: This species inhabits large creeks to medium-sized rivers in areas with moderate current (riffles).

Watershed	Site Name	Record Type
Dunkard Creek	Dunkard Creek	Recent
West Fork	West Fork River	Recent Historic
Middle Ohio River Valley	Middle Island Creek	Recent Historic
	Meathouse Fork	Recent
Little Kanawha	Little Kanawha	Recent Historic
	Cedar Creek	Recent
	Leading Creek	Recent
	North Fork Hughes River	Recent Historic
	South Fork Hughes River	Recent
	Henry's Fork	Recent
	Hughes River	Recent
	West Fork Little Kanawha	Recent
Elk	Elk River	Recent

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Snuffbox. Because there is inadequate information on the distribution and status of the Snuffbox in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below.

Bolded text indicates primary actions required to identify conservation needs of the Snuffbox.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Legacy data.	Capture museum records for all WV specimens.
	Coordinates.	Determine coordinates for current data.
	Public access to data.	Publish <i>Mussels of WV</i>.
		Provide general mussel data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Length of stream occupied at each recent occurrence needs to be determined.	Conduct surveys and analyze habitat.
	New and historic sites need to be surveyed.	Revisit historic sites and conduct new surveys at sites with potential habitat.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Establish long-term monitoring sites to be re-surveyed at least every 5 years.
	Monitor habitat.	Visit sites to determine habitat changes and level of habitat impact through use of scour chains. Measure other stream stability parameters. If impacts occur, survey for species.

Category	Need	Action
Research	Life history.	Conduct research on all life history aspects and conduct other research as impacts occur.
	Effects of mining, highways, etc.	

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Snuffbox and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Education , Coordination, Management
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE SNUFFBOX AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Capture museum records for all WV specimens.
- Determine coordinates for current data.
- Publish *Mussels of WV*.

Surveys:

- Conduct surveys and analyze habitat.
- Revisit historic sites and conduct new surveys at sites with potential habitat.

Monitoring:

- Establish long-term monitoring sites to be re-surveyed at least every 5 years.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (erosion/sedimentation, chemical pollution, acid mine drainage).
- Assess effects of possible dam construction on rivers and streams as projects arise.
- Mitigate against impacts of mining and other development activities in the vicinity of Snuffbox streams.

Education:

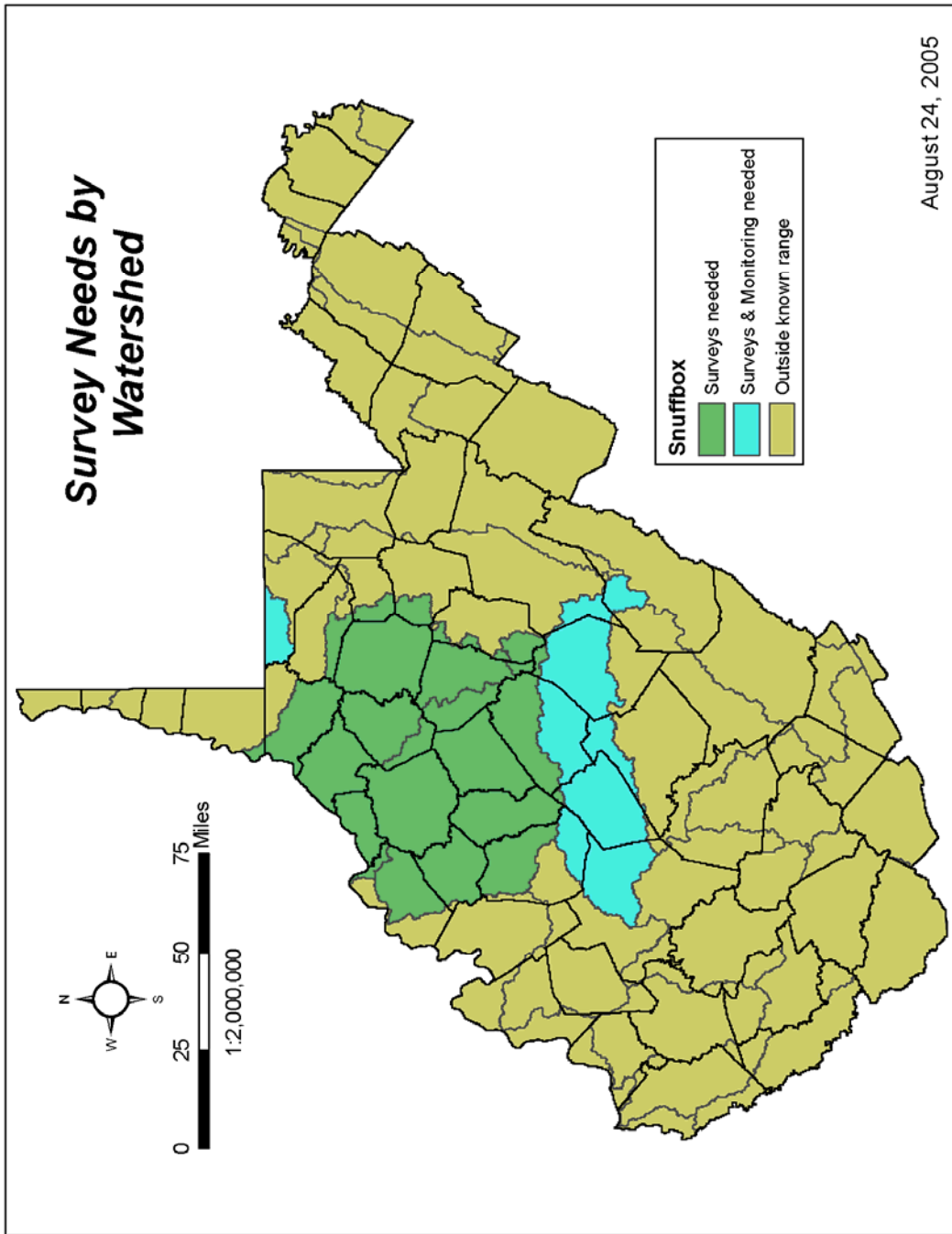
- Educate and work with landowners on streambed and stream bank stability issues and the importance of riparian buffers to limit erosion, nutrient and solid waste loading and chemical pollution to streams.
- Educate students, teachers and citizens to the importance of mussels through presentations, pamphlets, etc.

Legislation/Regulation:

- Coordinate with the Fish and Wildlife Service to pursue listing species as Threatened or Endangered.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

- NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia
<http://www.natureserve.org/explorer>. (Accessed: June 27, 2005).
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- West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mussels

Common name: Pink Mucket

Scientific name: *Lampsilis abrupta*

STATUS

The ranks and information in the chart below indicate the rarity of the Pink Mucket in West Virginia. It is listed as rare and in need of conservation and its status is monitored by many groups. The Pink Mucket is listed as an endangered species with the US Fish and Wildlife Service.

Priority Group	Global Rank	State Rank	USFWS	Jeff Forest	IUCN Rank	NE Tech Comm.	AFS	Trend
1*	G2	S1	LE	X	EN A1ce	X	E	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Pink Mucket into watersheds and gives the site names and ages of the record (recent is within 20 years).

Habitat: This species prefers large rivers in areas of good current with gravel / cobble substrates.

Watershed	Site Name	Record Type
Middle Ohio River Valley	Ohio River	Recent
Lower Ohio River Valley	Ohio River	Recent
Upper Kanawha River	Kanawha River	Recent Historic
Elk River	Elk River	Recent Historic

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Pink Mucket. Because there is inadequate information on the distribution and status of the Pink Mucket in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Pink Mucket.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Legacy data needs to be acquired.	Capture museum records from WV specimens.
	Coordinates.	Determine coordinates for all data records.
	Public access to data.	Publish <i>Mussels of WV</i>.
		Provide general mussel data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Length of stream occupied at each recent occurrence needs to be determined.	Conduct surveys and analyze habitat.
	Survey new and historic sites.	Revisit historic sites and conduct new surveys on sites along known river systems and their tributaries. Priority will be given to the Lower Kanawha River.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Establish long-term monitoring sites to be resurveyed at least every 5 years.
	Monitor habitat.	Visit sites to determine habitat changes and level of habitat impact through use of scour chains. Measure other stream stability parameters. If impacts occur, survey for species.

Category	Need	Action
Research	Life history.	Conduct research on all life history aspects and conduct other research as impacts occur.
	Effects of mining, highways, etc.	

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Pink Mucket and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, stream dredging, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Propagation, Coordination, Education, Management
Forest Health	
Water Quantity and Quality	Education, Coordination, Management
Over Collection	
Management Conflicts	
Invasive Species	Education, Management
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE PINK MUCKET AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Capture museum records from WV specimens.
- Determine coordinates for all current data.
- Publish *Mussels of WV*.

Surveys:

- Conduct surveys and analyze habitat.
- Revisit historic sites and conduct new surveys in potential habitat. Priority will be given to the Lower Kanawha River.

Monitoring:

- Establish long-term monitoring sites to be resurveyed at least every 5 years.

Coordination:

- Work with landowners, government and industry to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc.) in streams with Pink Muckets.
- Mitigate for impacts of stream dredging, mining, road building and other development activities in the vicinity of Pink Mucket streams.

Propagation:

- Develop a propagation program to restore populations in the Ohio and Kanawha rivers.

Education:

- Educate and work with landowners on streambed and stream bank stability issues and the importance of riparian buffers to limit erosion, nutrient and solid waste loading, and chemical pollution to streams.
- Educate students, teachers and citizens to the importance of Mussels through presentations, pamphlets, etc.
- Educate boaters and other users as to appropriate recommended actions to prevent transfer of invasive zebra mussels.

Legislation/Regulation:

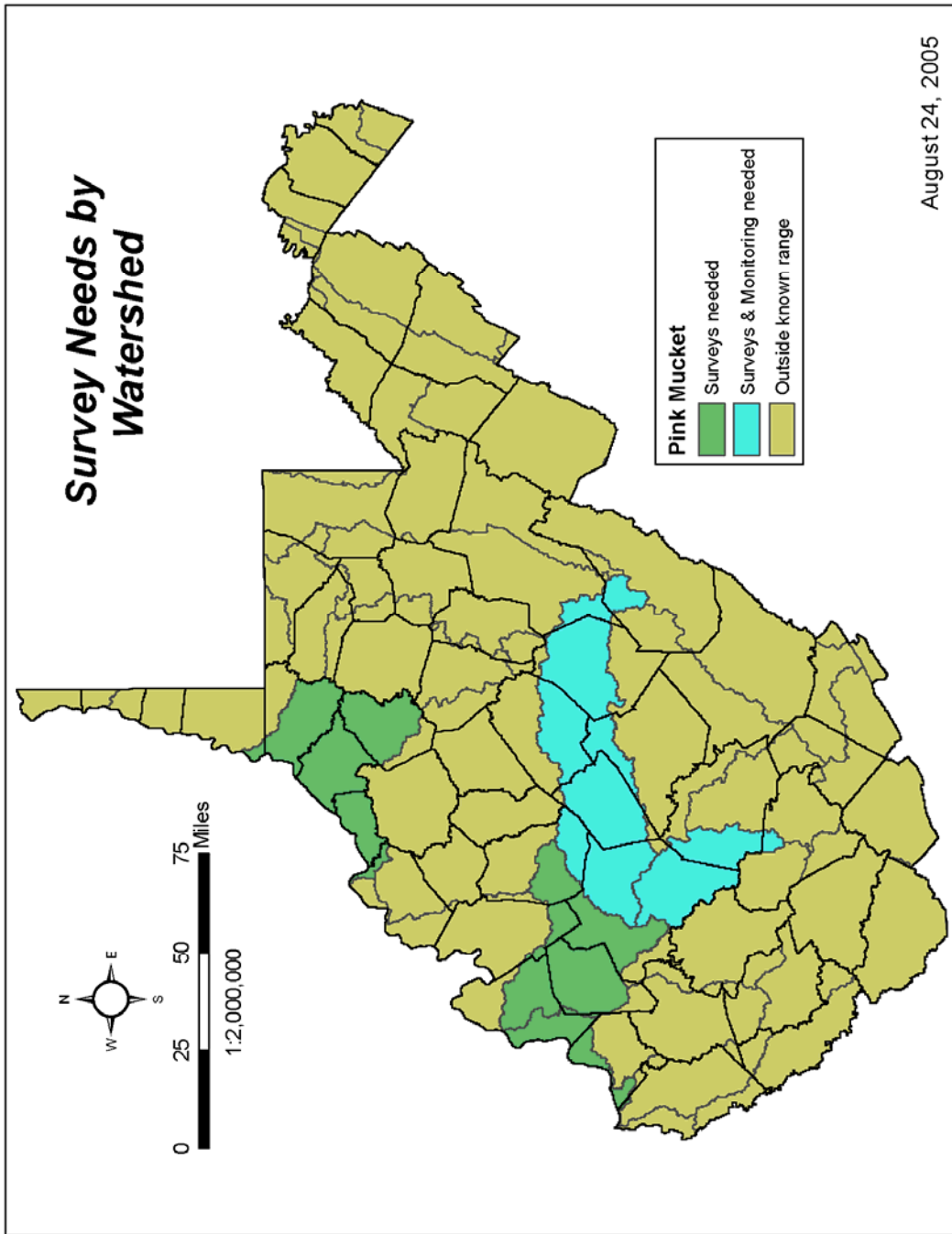
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: June 27, 2005).

Clayton, Janet. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Mussels

Common name: Black Sandshell

Scientific name: *Ligumia recta*

STATUS

The ranks and information in the chart below indicate the rarity of the Black Sandshell in West Virginia. It is listed as rare and in need of conservation and its status is monitored by many groups. The Black Sandshell is considered a species of concern in every state in which it occurs.

Priority Group	Global Rank	State Rank	IUCN Rank	NE Tech Comm	AFS	Trend
1*	G5	S2	LR/nt	X	SC	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of Black Sandshells into watersheds and gives the site names and ages of the records (recent is within 20 years).

Habitat: The Black Sandshell inhabits medium to large rivers in areas of good flow with gravel / cobble substrates.

Watershed	Site Name	Record Type
Cheat	Cheat River	Historic
Lower Ohio River Valley	Ohio River	Recent Historic
Middle Ohio River Valley	Ohio River	Recent
Little Kanawha	Little Kanawha River	Historic
Upper Kanawha	Kanawha River	Recent
Elk	Elk River	Recent Historic

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Black Sandshell. Because there is inadequate information on the distribution and status of the Black Sandshell in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Black Sandshell.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Legacy data.	Capture museum records for all WV specimens.
	Coordinates.	Determine coordinates for current data.
	Public access to data.	Publish <i>Mussels of WV</i>.
		Provide general mussel data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Length of stream occupied at each recent occurrence needs to be determined.	Conduct surveys and analyze habitat.
	New and historic sites need to be surveyed.	Revisit historic sites and conduct new surveys on sites along known river systems and their tributaries.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Establish long-term monitoring sites to be resurveyed at least every 5 years.
	Monitor habitat.	Visit sites to determine habitat changes and level of habitat impact through use of scour chains. Measure other stream stability parameters. If impacts occur, survey for species.

Category	Need	Action
Research	Life history.	Conduct research on all life history aspects and conduct other research as impacts occur.
	Effects of mining, highways, etc.	Conduct other research as impacts occur.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Black Sandshell and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Propagation, Coordination, Education, Management
Forest Health	
Water Quantity and Quality	Education, Coordination, Management
Over Collection	
Management Conflicts	
Invasive Species	Education, Management
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE BLACK SANDSHELL AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Capture museum records for all WV specimens.
- Determine coordinates for current data.
- Publish *Mussels of WV*.

Surveys:

- Conduct surveys and analyze habitat.
- Revisit historic sites and conduct new surveys on sites along known river systems and their tributaries.

Monitoring:

- Establish long-term monitoring sites to be resurveyed at least every 5 years.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (erosion/sedimentation, nutrient loading, chemical pollution, acid mine drainage, etc) in streams with Black Sandshells.
- Mitigate for impacts of mining and other development activities in the vicinity of Black Sandshell streams.

Propagation:

- Develop a propagation program to restore populations in the Cheat River.

Education:

- Educate and work with landowners on streambed and stream bank stability issues and the importance of riparian buffers to limit erosion, nutrient and solid waste loading, and chemical pollution to streams.
- Educate students, teachers and citizens to the importance of mussels through presentations, pamphlets, etc.
- Educate boaters and other river users as to appropriate recommended actions to prevent transfer of invasive zebra mussels.

Legislation/Regulation:

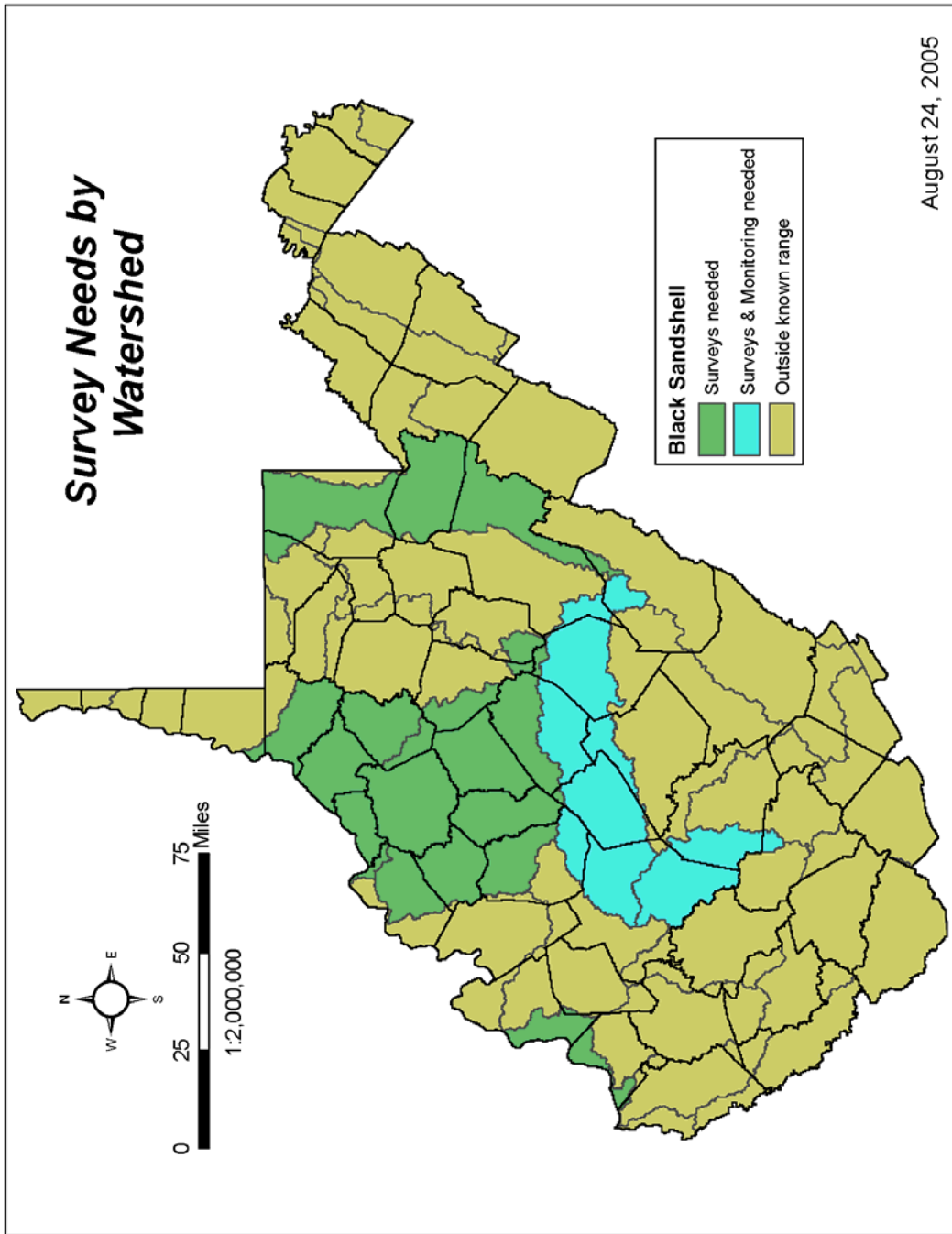
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: June 27, 2005).

Clayton, Janet. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Unionoida
Group: Mussels

STATUS

The ranks and information in the chart below indicate the rarity and status of Mussel Species in Greatest Need of Conservation in West Virginia. Nineteen other SGNC species are covered in individual species fact sheets.

Species Name	Common Name	Priority Group	Global Rank	State Rank	USFWS	Jeff Forest	IUCN Rank	NE Tech Comm	AFS	Trend
<i>Lampsilis cariosa</i>	Yellow Lampmussel	1	G3G4	S1	SC	X	EN A1c	X		Declining
<i>Lampsilis teres teres</i>	Yellow Sandshell	1	G5T1Q	S1						Unknown
<i>Pleurobema cordatum</i>	Ohio Pigtoe	1	G3	S2		X	LR/nt		SC	Declining
<i>Villosa fabalis</i>	Rayed Bean	1	G1G2	SH	Cat 1			X	SC	Extirpated
<i>Ellipsaria lineolata</i>	Butterfly	1	G4	S1			LR/nt		SC	Declining
<i>Anodontoides ferussacianus</i>	Cylindrical Papershell	2	G5	S2						Unknown
<i>Elliptio fisheriana</i>	Northern Lance	2	G4	S1					SC	Unknown
<i>Fusconaia ebena</i>	Ebonysshell	2	G4G5	S1						Declining
<i>Lampsilis fasciola</i>	Wavy-Rayed Lampmussel	2	G4	S2						Unknown
<i>Lampsilis ovata</i>	Pocketbook	2	G5	S1			LR/nt		SC	Unknown
<i>Lasmigona complanata</i>	White Heelsplitter	2	G5	S2						Unknown
<i>Lasmigona compressa</i>	Creek Heelsplitter	2	G5	S1						Unknown
<i>Leptodea fragilis</i>	Fragile Papershell	2	G5	S2						Unknown
<i>Obliquaria reflexa</i>	Threehorn Wartyback	2	G5	S2						Stable
<i>Quadrula metanevra</i>	Monkeyface	2	G4	S1						Unknown
<i>Quadrula quadrula</i>	Mapleleaf	2	G5	S2			LR/lc			Declining
<i>Toxolasma parvus</i>	Lilliput	2	G5	S2						Unknown
<i>Truncilla donaciformis</i>	Fawnsfoot	2	G5	S1						Unknown
<i>Truncilla truncata</i>	Deertoe	2	G5	S1						Unknown
<i>Unio merus tetralasmus</i>	Pondhorn	2	G4	S1						Unknown

<i>Villosa iris</i>	Rainbow	2	G5	S2						Unknown
<i>Villosa lienosa</i>	Little Spectaclecase	2	G5	S1						Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix 1 for an explanation of various designations or ranks used by the groups.

LOCATION AND RECORD STATUS

The following table places known occurrences of each Mussel into watersheds and gives the ages of the records (recent is within 20 years). The number of records is not indicated in this table. Each watershed listed may have more than one record for the species.

Species	Watershed	Record Type
<i>Cumberlandia monodonta</i>	Upper Kanawha	Recent
<i>Lampsilis cariosa</i>	North Branch Potomac	Recent
	Cacapon	
<i>Lampsilis teres teres</i>	Ohio	Recent
<i>Pleurobema cordatum</i>	Ohio River	Recent
	Upper Kanawha	
	Elk	
<i>Villosa fabalis</i>	Twelve Pole Creek	Recent Historic
	Middle Ohio	
	Elk	
	West Fork	
<i>Ellipsaria lineolata</i>	Ohio	Recent
<i>Anodontooides ferussacianus</i>	Twelve Pole	Recent
	Lower Ohio	
	Little Kanawha	
	Lower Kanawha	
	Lower Guyandotte	
<i>Elliptio fisheriana</i>	Potomac	Recent
	Cacapon	

	North Fork Potomac	
<i>Fusconaia ebena</i>	Ohio	Recent
<i>Lampsilis fasciola</i>	West Fork	Recent/Historic Recent Historic
	Middle Ohio	
	Little Kanawha	
	Upper Kanawha	
	Elk	
	Lower New	
	Greenbrier	
	Upper New	
	Coal	
	Cheat	
	Monongahela	
<i>Lampsilis ovata</i>	Ohio	Recent
	Upper Kanawha	
	Elk	
<i>Lasmigona complanata</i>	Middle Ohio	Recent Historic
	Lower Kanawha	
	Tug Fork	
	Lower Guyandotte	
<i>Lasmigona compressa</i>	Little Kanawha	Recent

Species	Watershed	Record Type
<i>Leptodea fragilis</i>	Monongahela	Recent
	Middle Ohio	
	Twelve Pole	
	Little Kanawha	
	Lower Kanawha	
	Upper Kanawha	
	Elk	
	Lower Guyandotte	
	Big Sandy	
	Tug Fork	
<i>Obliquaria reflexa</i>	Ohio	Recent Historic
	Little Kanawha	
	Upper Kanawha	
	Lower Kanawha	
<i>Quadrula metanevra</i>	Ohio River	Recent Historic
	Little Kanawha	
	West Fork	
	Coal	
<i>Quadrula quadrula</i>	Middle Ohio	Recent
	Lower Ohio	
	Little Kanawha	
	Lower Kanawha	
	Tug Fork	
<i>Toxolasma parvus</i>	Lower Ohio	Recent
	Lower Kanawha	
	Lower Guyandotte	
<i>Truncilla donaciformis</i>	Ohio	Recent

Species	Watershed	Record Type
<i>Truncilla truncata</i>	Ohio	Recent
	Little Kanawha	
	Upper Kanawha	
	Elk	
<i>Unio merus tetralasmus</i>	Ohio	Recent
<i>Villosa iris</i>	Dunkard	Recent
	West Fork	
	Middle Ohio	
	Little Kanawha	
	Upper Kanawha	
	Elk	
	Upper New	
<i>Villosa lienosa</i>	Twelve Pole	Recent
	Little Kanawha	
	Lower Kanawha	
	Coal	

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of Mussels. Because there is inadequate information on the distribution and status of Mussels in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of Mussels.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Legacy data.	Capture museum records for all WV species.
	Coordinates.	Determine coordinates for current data.
	Public access to data.	Publish <i>Mussels of WV</i>.
		Provide general mussel data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Status at historic sites needs to be determined.	A very high percentage of sites are historic. Surveys need to be conducted with priority given to sites with potential habitat and most likely to support the species. Priority will be given to: Little Kanawha, Potomac and Monongahela watersheds.
	Length of stream occupied at each recent occurrence needs to be determined.	Conduct surveys and analyze habitat.
	Additional sites need to be surveyed.	Analyze potential habitat statewide to determine new survey areas/sites.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Establish long-term monitoring sites: Examine all current Mussel sites to determine if an area of high diversity exists and establish monitoring stations. Identify additional possible sites as new Mussel data becomes available.
	Monitor habitat.	Visit sites to assess habitat changes. If impacts occur, survey for species.

Category	Need	Action
Research	Life history.	Coordinate projects with researchers. Write prospecti for needed projects and actively seek contractors.
	Effects of mining, highways, etc.	
	Taxonomy.	

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with Mussels and their habitats. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Education , Coordination, Management
Over Collection	Legislation/Regulation , Education
Management Conflicts	Coordination
Invasive Species	Education , Management
Damaging Recreation	Education
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF MUSSELS AND THEIR HABITATS

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve these species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of these species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of these species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Capture museum records for all WV specimens.
- Determine coordinates for current data.
- Publish *Mussels of WV*.

Surveys:

- A very high percentage of sites are historic. Surveys need to be conducted with priority given to sites with potential habitat and most likely to support the species. Priority will be given to: Little Kanawha, Potomac and Monongahela watersheds.
- Conduct surveys and analyze habitat.
- Analyze potential habitat statewide to identify new survey areas/sites.

Coordination:

- Coordinate with WVDEP and U.S. Forest Service to manage riparian zones. Work with landowners and industry to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in streams with Mussels. This may include limiting ATV use, encouraging use of Best Management Practices when timbering or engaging in other impacting activities.
- Assess effects of possible dam construction on rivers and streams as projects arise.
- Mitigate for impacts of mining and other development activities in the vicinity of Mussel streams.

Education:

- Educate landowners to best stream practices to limit erosion, nutrient and solid waste loading, and chemical pollution to Mussel streams.
- Educate students, teachers and citizens to the importance of Mussels through presentations, pamphlets, etc.
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) in Mussel streams. Provide information to encourage anglers to release Mussels and report Mussel locations.
- Educate boaters and other river users as to appropriate recommended actions to prevent transfer of invasive Zebra Mussels.

Legislation/Regulation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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Amphibians and Reptiles

There are 14 toad and frog species, 34 salamanders, 13 species of turtles, six lizards and skinks, and 20 species of snakes. Thirty-nine of these 87 known species are listed as Species in Greatest Need of Conservation.

Common Name	Species Name
Amphibians	
Streamside Salamander	<i>Ambystoma barbouri</i>
Smallmouth Salamander	<i>Ambystoma texanum</i>
Green Salamander	<i>Aneides aeneus</i>
Eastern Hellbender	<i>Cryptobranchus alleganiensis</i>
West Virginia Spring Salamander	<i>Gyrinophilus subterraneus</i>
Cheat Mountain Salamander	<i>Plethodon nettingi</i>
Cow Knob Salamander	<i>Plethodon punctatus</i>
Shenandoah Mountain Salamander	<i>Plethodon virginia</i>
Upland Chorus Frog	<i>Pseudacris triseriata feriarum</i>
Midland Mud Salamander	<i>Pseudotriton montanus diastictus</i>
Eastern Spadefoot	<i>Scaphiopus holbrookii</i>
Blanchard's Cricket Frog	<i>Acris crepitans blanchardi</i>
Eastern Cricket Frog	<i>Acris crepitans crepitans</i>
Jefferson Salamander	<i>Ambystoma jeffersonianum</i>
Black-bellied Salamander	<i>Desmognathus quadramaculatus</i>
Black Mountain Salamander	<i>Desmognathus welteri</i>
Cave Salamander	<i>Eurycea lucifuga</i>
Northern Red Salamander	<i>Pseudotriton ruber</i>
Northern Leopard Frog	<i>Rana pipiens</i>
Reptiles	
Midland Smooth Softshell	<i>Apalone mutica mutica</i>
Spotted Turtle	<i>Clemmys guttata</i>
Wood Turtle	<i>Clemmys insculpta</i>
Eastern Six-lined Racerunner	<i>Cnemidophorus sexlineatus</i>
Timber Rattlesnake	<i>Crotalus horridus</i>

Cornsnake	<i>Elaphe guttata guttata</i>
False Map Turtle	<i>Graptemys pseudogeographica</i>
Mountain Earthsnake	<i>Virginia valeriae pulchra</i>
Wormsnake	<i>Carphophis amoenus</i>
Northern Coal Skink	<i>Eumeces anthracinus anthracinus</i>
Broad-headed Skink	<i>Eumeces laticeps</i>
Northern Map Turtle	<i>Graptemys geographica</i>
Eastern Hog-nosed Snake	<i>Heterodon platirhinos</i>
Eastern Kingsnake	<i>Lampropeltis getula getula</i>
Rough Greensnake	<i>Opheodrys aestivus</i>
River Cooter	<i>Pseudemys concinna</i>
Northern Red-bellied Cooter	<i>Pseudemys rubriventris</i>
Ground Skink	<i>Scincella lateralis</i>
Eastern Ribbonsnake	<i>Thamnophis sauritus</i>
Eastern Earthsnake	<i>Virginia valeriae valeriae</i>

Amphibians:

Toads and frogs have about the same general body shape, but the warty skin of toads distinguishes them from the smooth skinned frogs. Toads and frogs are vocal, with each species having a distinct call. All toads and frogs mate and deposit eggs in water, such as sluggish streams, permanent ponds, temporary ponds, roadside ditches and puddles. The tadpole stage may last from a few days to two years. They generally eat aquatic plant material, but some will eat animals. As adults, toads and frogs consume vast quantities of insects, and as a result make up an important part of aquatic and terrestrial ecosystems (Pauley 2001).

The 35 salamander species range in length from four inches to two feet. Due to their delicate, scaleless bodies, salamanders are restricted to aquatic and semi-aquatic habitats such as rivers, creeks, and springs, and moist forested hillsides. Amphibians have a larval stage and for most species, the larval stage occurs in streams or ponds. For forest species, the larval stage occurs within the egg. Amphibians have permeable skin, gelatinous eggs and gilled larvae, which unfortunately allow for the absorption of pollutants from the water and soil. Thus, salamanders (and frogs and toads) serve as bioindicators to potential dangers in the environment. Salamanders consume large quantities of insects and other invertebrates in both aquatic and terrestrial environments. They also serve as food items for a variety of animals such as fish, birds and mammals (Pauley 2004).

Reptiles:

Turtles are one of three groups of reptiles that occur in the state, the others being lizards and snakes. Turtles are among the oldest land vertebrates and fossil turtles from over 200 million years ago have been discovered. Most turtles are active from April or May through October. Mating generally occurs in the spring and eggs are laid in nests in June and July. Most aquatic

species live to 30 to 35 years, but terrestrial species may reach 100 years or more. Most of the states turtles are aquatic, occurring in rivers, streams, swamps, marshes, ponds and lakes. The Box Turtle is the only completely terrestrial turtle. Scientists have been concerned about the recent declines in populations of turtles. They are particularly vulnerable because turtles take many years to mature and have low reproductive rates. The declines have been attributed to illegal collecting for the pet trade, loss of habitat and automobile/railroad kills. The latter occurs mainly during the spring when turtles cross roads and train tracks searching for nesting sites.

Lizards are reptiles and are often confused with salamanders which are amphibians. Lizards have scaly skin and toes with claws. There are three families of lizards in the state, the fence lizards, skinks and racerunners. The families are separated by the types of scales they possess. Scales of the fence lizards are rough with keels or ridges, while skinks and racerunners have smooth scales. All lizards reproduce through the laying of eggs rather than live births. Lizards can be found in a variety of terrestrial habitats such as gardens, old fields, disturbed areas and forests. They are important in the ecosystem because they eat insects and other invertebrates (Pauley and Seidel, 2000).

Snakes are perhaps the most misunderstood and maligned animals in West Virginia. Fear of being bitten causes senseless killing of almost all snake species. Of the 20 species of snakes found in West Virginia, only two are venomous, the Northern Copperhead and Timber Rattlesnake. No person has died from copperhead bites in over 30 years, and only four from Timber Rattlesnakes between 1969 and 1992. Snakes provide an essential pest control service due to their feeding habits. Snakes in the state range in size from about 10 inches to six feet in length. Snakes are complex and highly adapted creatures that can be found in a variety of habitats (Pauley 2002).

General Background Information:

There are many reasons why a species may be considered in need of conservation in West Virginia. Some species such as the White-spotted Salamander are rare because they have an extremely narrow range. This particular species only occurs in a small area on the West Virginia/ Virginia border. Other species are considered rare because of recent declines due to habitat destruction, decreased water quality, or other human interferences. For example, many people are unaware that the Timber Rattlesnake is a species in decline. Senseless killing and habitat loss are the chief reasons for the decreased numbers of this species.

For other species, West Virginia is at the edge of their ranges or little suitable habitat exists in the state. Populations may be plentiful elsewhere but they are rare in West Virginia. These species are of special concern because if population declines are occurring, they are usually noted at the species periphery. The Six-lined Racerunner, a lizard, has only been found in one location in West Virginia. It is a common species to the south and west of West Virginia.

Many past and current amphibian and reptile projects have been funded by the WVDNR. Most studies have been conducted by Dr. Thomas K. Pauley and his graduate students of Marshall University. His 30-plus years of research has provided the WV DNR with most of what we know about reptiles and amphibians in West Virginia.

A review of the conservation needs for amphibians and reptiles, as outlined on the following fact sheets, indicates that initial actions for the listed species are centered on survey, inventory and data management. Information on the distribution and status of a number of amphibians and reptiles is lacking despite decades of field research, and filling these information gaps is a necessary first step for the future conservation assessment of each species. Standardized data acquisition and management both within the WV DNR Wildlife Resources Section and by all other research partners will greatly assist with these conservation

assessments. Centralized and shared information is a prerequisite to the formulation of on-the-ground conservation plans for all listed species.

Because the WRS acts as a statewide repository for information, we rely on partners to share information to maximize understanding of our biological resources. Occasionally researchers are reluctant to share information for fear that the information will be requested from state government, via the Freedom of Information Act (FOIA), and used to the detriment of the species involved. For this reason it is believed appropriate to have legislation enacted to protect sensitive rare species information from wide dissemination. This need is expressed across the board on the fact sheets for animal Species in Greatest Need of Conservation (SGNC).

There is an ongoing need to educate all citizens about the value of the diversity of life in the state and especially the role all SGNC play in the intricate web of life. Education is a unifying theme throughout the actions section of the fact sheets for most species. In addition there is a need to coordinate with land management agencies and other landowners/managers on the use of Best Management Practices for the conservation of biological resources in general as well as specific practices when SGNC are present.

As a group, the amphibians and reptiles are one of the better studied groups, but despite a fair knowledge of the distribution and status of many individual species, few specific on-the-ground conservation actions have been identified. As additional data are collected, one would anticipate an increasing inventory of specific site-related projects that are desirable for the health and/or continued existence of SGNC throughout the state.

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Taxa: Amphibians

Common name: Streamside Salamander

Scientific name: *Ambystoma barbouri*

STATUS

The ranks and information in the chart below indicate the rarity of the Streamside Salamander in West Virginia. It is listed as rare and in need of conservation and its status is monitored by many groups. In West Virginia there are currently only 4 sites in a very small area of the state. The Streamside Salamander is considered a species of concern in almost all of the five states in which it occurs.

Priority group	Global Rank	State Rank	IUCN Rank	Trend
1*	G4	S1	NT	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places occurrences of Streamside Salamanders into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether the sites are under public or private ownership.

Habitat- The Streamside Salamander adults spend most of their lives underground, emerging in late winter/early spring to breed before returning underground. Throughout the breeding season it may be found under logs, bark, leaves, stones and trash around the breeding area. They generally breed in small, fishless streams or pools fed by such streams.

Watershed	Site Name	Record Type	Ownership
Twelve Pole Creek	Shoals	Recent	Private
	Lavalette- 3 sites	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Streamside Salamander. Because there is inadequate information on the distribution and status of this species in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Streamside Salamander.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled into the database with coordinates.	Complete the WV Herpetological Atlas.
	Public access to general salamander information.	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> . Provide general Streamside Salamander data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	New sites need to be surveyed.	Continue with minnow trap surveys in the Twelve Pole watershed, and in the Big Ugly and Tug Fork rivers. Determine extent of the population near Shoals and Lavalette.

Category	Need	Action
Monitoring	Long-term monitoring.	Monitor Shoals and Lavalette sites.

Category	Need	Action
Research	Life history studies – Habitat requirements, etc.	Coordinate projects with researchers or contractors; little WV life history is known about this species.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Streamside Salamander and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Coordination , Education
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE STREAMSIDE SALAMANDER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Complete the WV Herpetological Atlas.

Surveys:

- Continue with minnow trap surveys in the Twelve Pole watershed and also in the Big Ugly and Tug Fork rivers. Determine extent of the population near Shoals and Lavalette.

Monitoring:

- Monitor Shoals and Lavalette sites.

Coordination:

- Work with Railroad industry personnel to preserve known sites and not drain wet areas where species breed along railroad ditches.
- Coordinate with private landowners under the Landowner Incentive Program.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Streamside Salamander sites.
- Educate motorists by placing road signs at known occurrences warning of salamanders moving across the road to get to breeding sites.
- Educate landowners to protect salamander sites (ponds, marshes, etc.) on their property and the importance of wetlands.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

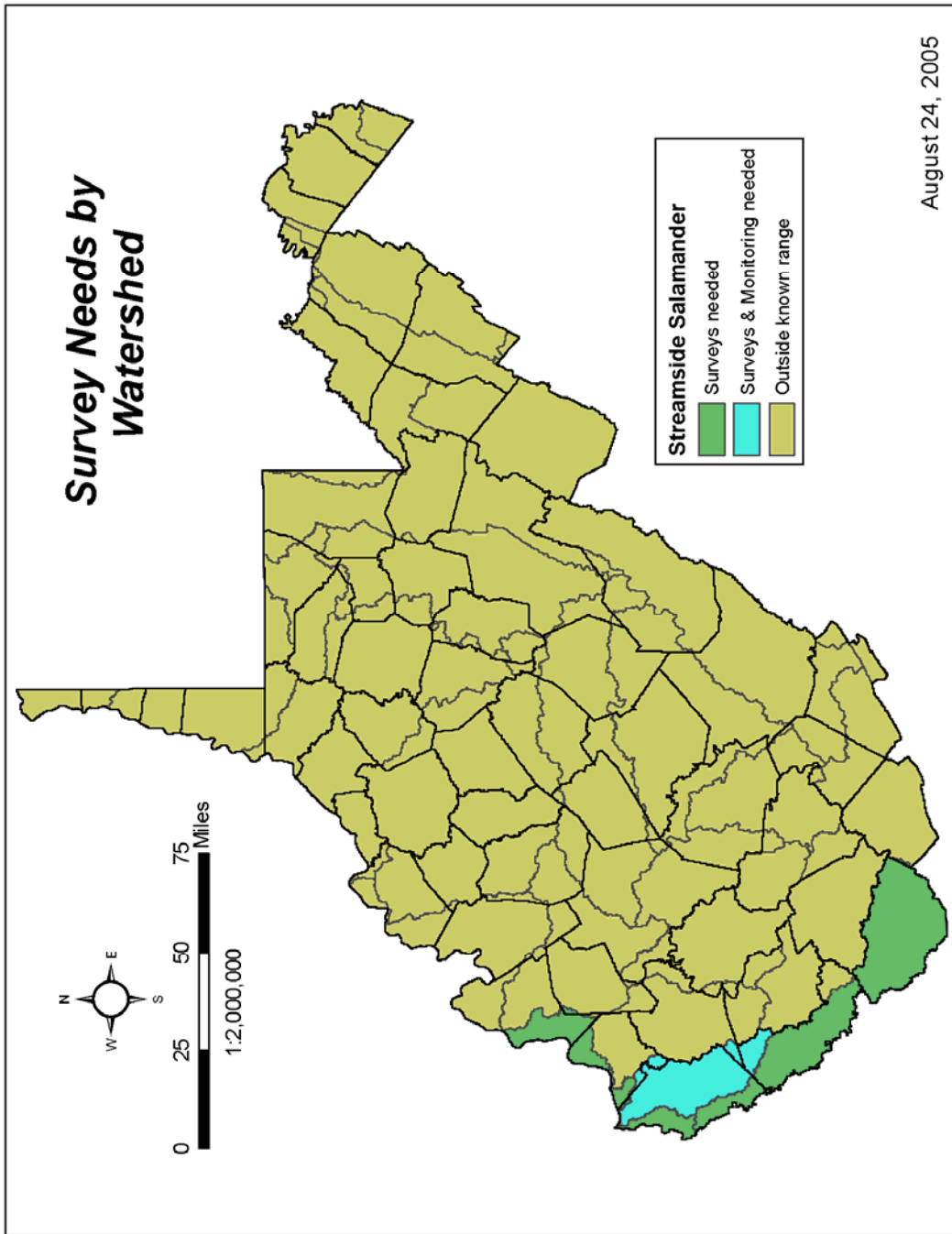
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West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Amphibians

Common name: Cow Knob Salamander

Scientific name: *Plethodon punctatus*

STATUS

The ranks and information in the chart below indicate the rarity of the Cow Knob Salamander in West Virginia. This species is listed as rare and in need of conservation and its status is monitored by many groups. The Cow Knob Salamander only occurs in a small portion of West Virginia and Virginia.

Priority Group	Global Rank	State Rank	USFWS	Jeff Forest	IUCN Rank	Trend
1*	G3	S1	SC	X	NT	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places each known occurrence of Cow Knob Salamanders into watersheds and gives the ages of the records (recent is within 20 years) and indicates whether sites are under public or private ownership.

Habitat: The Cow Knob Salamander occurs on talus slopes in mixed deciduous forests with a strong hemlock component.

Watershed	Site Name	Record Type	Ownership
Cacapon	Hawk Campground	Recent	Public
	Lost River State Park	Recent	Public
	Great North Mountain	Historic	Public
South Branch Potomac	South Branch Mountain- 6 Sites	Recent	Private/ Public
	Shenandoah Mountain- 13 Sites	Recent Historic	Public
	Briery Branch Gap	Recent	Public

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Cow Knob Salamander. Recent surveys have provided much needed distribution data for this species but a thorough delineation of the population is needed for this rare species. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Cow Knob Salamander.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Data sharing among groups.	Share data among researchers (MD, VA, WV) GW National Forest personnel and WVDNR. Continue with Cow Knob Salamander Conservation Action Plan.
	All existing location and biological data need to be compiled into database with coordinates.	Complete WV Herpetological Atlas.
	Public access to general salamander information.	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> . Provide general Cow Knob Salamander data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Determine status at historic sites.	Survey the 1-2 historic known sites and determine presence of species.
	Determine extent of potential habitat for recent occurrence.	Delineate populations on Shenandoah and South Branch Mountains.
	Survey new sites.	Visit adjacent knobs and mountains to determine presence; determine northern-most range extension.

Category	Need	Action
Monitoring	Long-term monitoring.	Monitor 1-2 sites along Shenandoah and South Branch Mountains and possibly a couple of sites at the northern range extension; coordinate with Forest Service; monitor sites to determine status of population and any changes to habitat.

Category	Need	Action
Research	Effects of various habitat disturbances	Studies to determine effects of logging and grazing on all <i>Plethodons</i> .

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Cow Knob Salamander and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE COW KNOB SALAMANDER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Complete WV Herpetological Atlas.

Surveys:

- Delineate populations on Shenandoah and South Branch Mountains.
- Visit adjacent knobs and mountains to determine presence; determine northern-most range extension.

Monitoring:

- Monitor 1-2 sites along Shenandoah and South Branch Mountains and possibly a couple of sites at the northern range extension; coordinate with Forest Service; monitor sites to determine status of population and any changes to habitat.

Coordination:

- Work with George Washington National Forest Service staff and other landowners to reduce or eliminate activities that may be detrimental to Cow Knob Salamander sites. This includes determining buffer zones around sites and encouraging use of Best Management Practices when timbering and other site related issues pertaining to habitat loss and forestland management.
- Work with Department of Highways to mitigate against fill dirt encroaching on Cow Knob Salamander sites along CR- 50.
- Coordinate with private landowners under the Landowner Incentive Program.

Education:

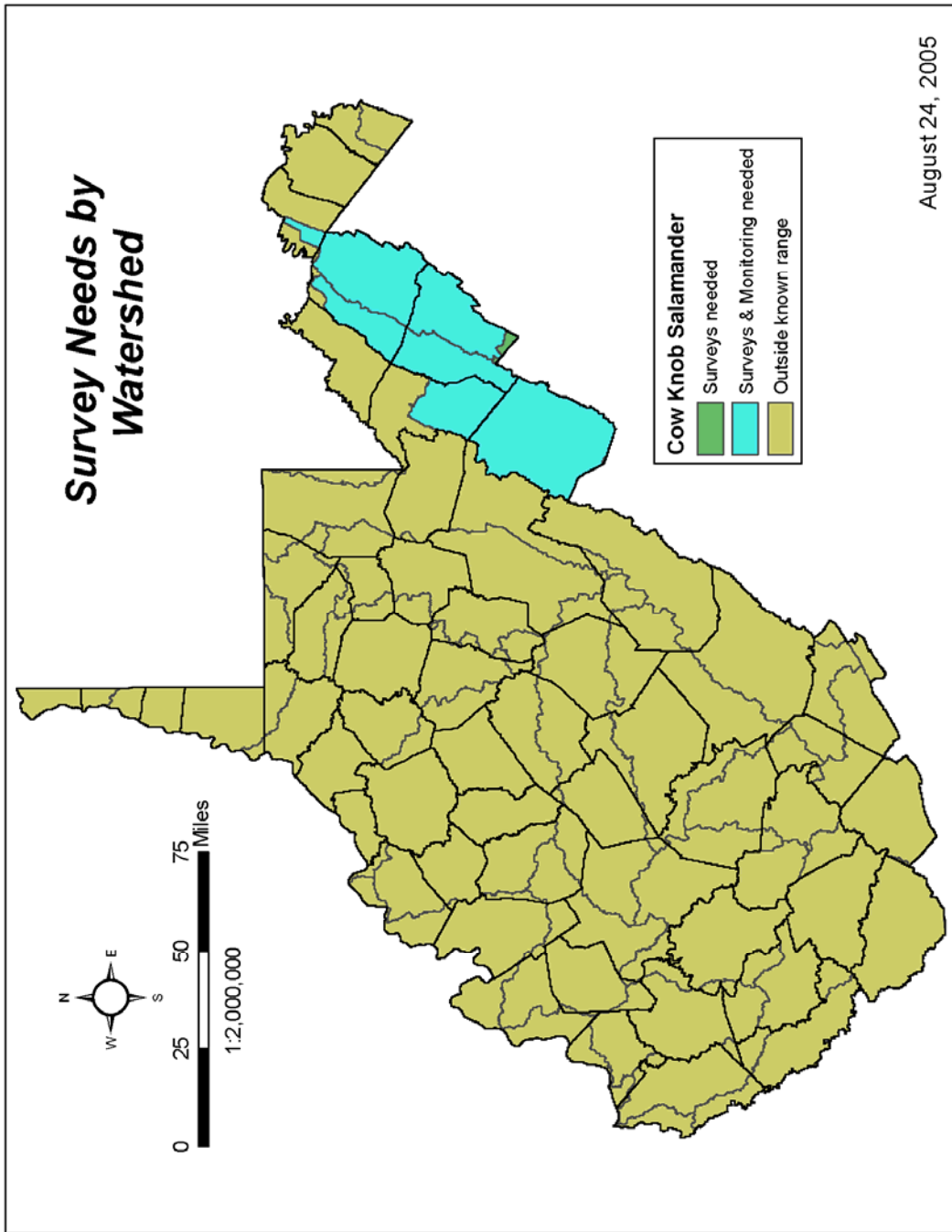
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Cow Knob Salamander sites.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation from FOIA requests.

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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Amphibians

Common name: Eastern Spadefoot Toad

Scientific name: *Scaphiopus holbrooki*

STATUS

The ranks and information in the chart below indicate the rarity of the Eastern Spadefoot Toad in West Virginia. This species is listed as rare and in need of conservation because it had been believed to be extirpated in West Virginia for almost 40 years until sites were discovered in 2000. It appears to be threatened in the northern part of its range as well.

Priority group	Global Rank	State Rank	NE Tech Comm	Trend
1*	G5	S1	X	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places each occurrence of the Spadefoot Toad into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether the sites are under public or private ownership.

Habitat: Eastern Spadefoot Toads live where they can burrow into the ground. They are found in sandy soil or the loose soil of river floodplains. The Eastern Spadefoot Toad will usually emerge after heavy rains in the spring, summer or fall to mate and lay eggs in temporary pools.

Watershed	Site Name	Record Type	Ownership
Cacapon	Moorefield	Historic	Private
Lower New	Shady Spring	Historic	Private
Lower Ohio Valley	Gallipolis Ferry	Historic	Private
	Huntington	Historic	Private
	Virginia Point-Southeast	Recent	Private
	Virginia Point	Recent	Private
Middle Ohio Valley	Parkersburg	Historic	Private
	Point Pleasant-Camp Conley	Historic	Private
	Belleville	Recent	Private

Watershed	Site Name	Record Type	Ownership
Twelve Pole	Ceredo-Wayside Golf Course	Historic	Private
	Kenova	Historic	Private
	Shoals	Historic	Private
	West Huntington	Historic	Private
Upper Kanawha	Hansford	Historic	Private
Lower Guyandotte	Milton Area – 4 Sites	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Spadefoot Toad in West Virginia. Because there is inadequate information on the distribution and status of this species in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Spadefoot Toad.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled into a database with coordinates.	Complete the WV Herpetological Atlas.
	Public access to general toad information.	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> . Provide general Eastern Spadefoot Toad data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Surveys of historic sites.	Survey areas to see if appropriate habitat is still present.
	Surveys of new sites.	Survey along floodplains of the Ohio, Mud, Kanawha and Big Sandy rivers. Also survey the South Branch and Tygart rivers. Follow-up on reports and survey after hard rains in these areas.

Category	Need	Action
Monitoring	Long-term monitoring.	Monitor northern and southern Ohio River populations and the Milton site.

Category	Need	Action
Research	Environmental factors.	Research what triggers breeding.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Eastern Spadefoot Toad and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Education , Coordination, Management
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	Education
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE EASTERN SPADEFOOT TOAD AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.

Surveys:

- Survey along floodplains of the Ohio, Mud, Kanawha and Big Sandy rivers. Also survey the South Branch and Tygart rivers. Follow-up on reports and survey after hard rains in these areas.

Coordination:

- Work with landowners to reduce or eliminate activities that may lead to habitat loss, decreased water quality and impact wetland sites in any way for these species.
- Coordinate with private landowners under the Landowner Incentive Program.

Monitoring:

- Monitor northern and southern Ohio River populations and the Milton site.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Eastern Spadefoot Toad sites.
- Educate landowners to identify possible Eastern Spadefoot Toad sites on their property by giving frog call CDs to landowners in areas where there is a high potential for occurrence of the Eastern Spadefoot Toad.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

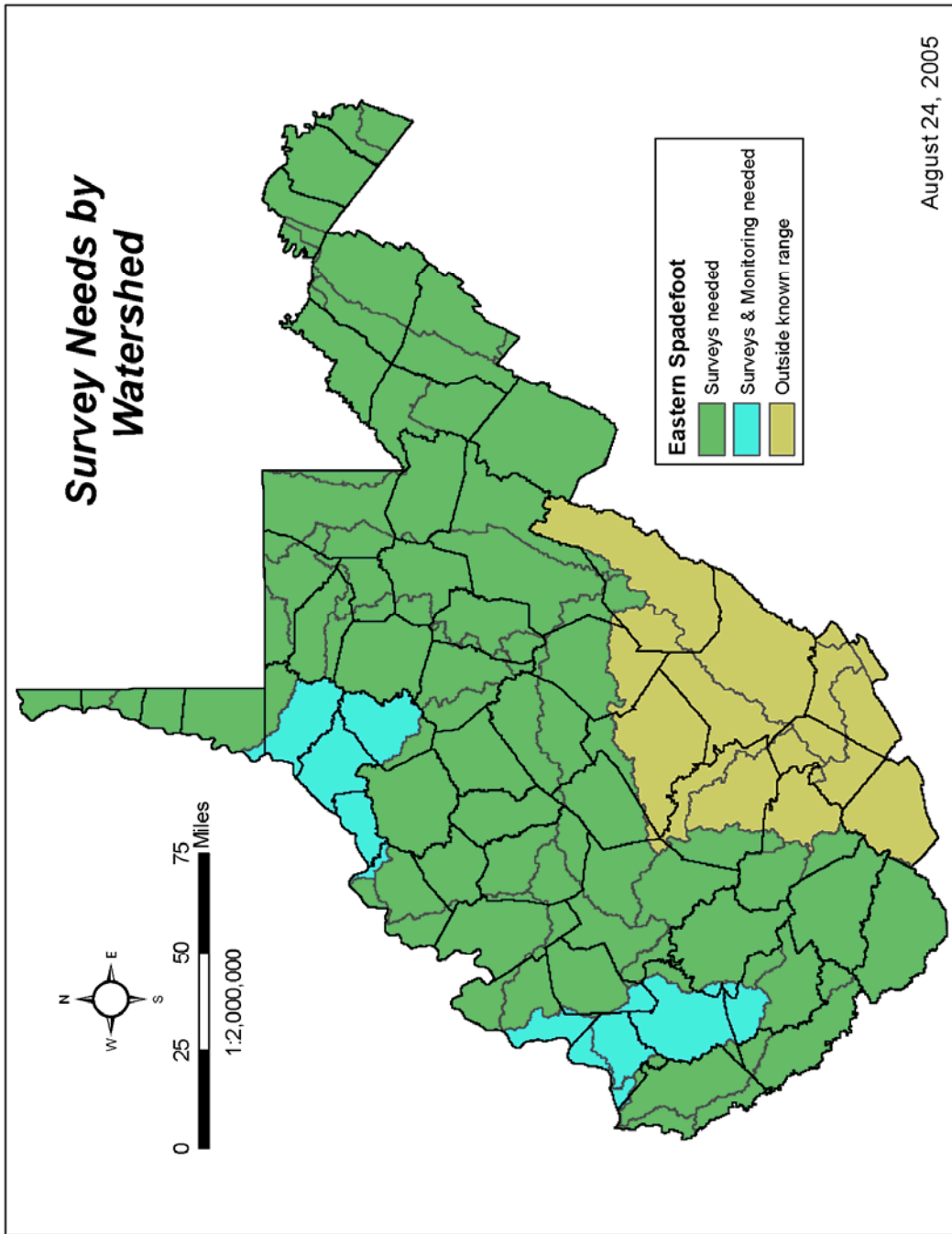
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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Amphibians

Common name: Smallmouth Salamander

Scientific name: *Ambystoma texanum*

STATUS

The ranks and information in the chart below indicate the rarity of the Smallmouth Salamander in West Virginia. This species is listed as rare and in need of conservation because it has declined in West Virginia and is not known from sites in which they previously occurred.

Priority Group	Global Rank	State Rank	Trend
1*	G5	S1	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places records into watersheds and describes the ownership and the ages (recent is within 20 years) of the records.

Habitat: The Smallmouth Salamander adults spend most of their lives underground, emerging early in the spring to breed before returning underground. Throughout the breeding season it may be found under logs, bark, leaves, stones and trash around the breeding area. They breed in small, fishless pools that are usually temporarily filled with water.

Watershed	Site Name	Record Type	Ownership
Middle Ohio Valley	McClintic WMA	Historic	Public
	Boaz Marsh	Recent	Public
	Moose Lodge Wetland	Recent	Private
	Mountaineer Power Plant	Recent	Private
	Lighthouse Gospel Church Road	Recent	Private
Lower Ohio Valley	Pt. Pleasant	Recent	Private
Twelve Pole	Huntington-Vinson High School	Historic	Private
	Buffalo	Historic	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Smallmouth Salamander. Because there is inadequate information on the distribution and status of this species in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Smallmouth Salamander.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled into the database with coordinates.	Complete the WV Herpetological Atlas.
	Public access to general salamander information.	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> . Provide general Smallmouth Salamander data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Status at historic sites needs to be determined.	Historic surveys need to be conducted with priority given to sites with potential habitat and likely to support the species.
	New sites need to be surveyed.	Continue surveys along the Ohio and Kanawha rivers.

Category	Need	Action
Monitoring	Long-term monitoring.	Monitor Moose Lodge wetland due to the high diversity of Ambystomid species.
	Monitor habitat.	Visit sites to determine habitat changes as appropriate. If impacts occur, survey for species.

Category	Need	Action
Research	Study interactions with other Ambystomid species.	Conduct detailed studies at a wetland where all species occur.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Smallmouth Salamander and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Coordination , Education
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE SMALLMOUTH SALAMANDER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Complete the WV Herpetological Atlas.

Surveys:

- Historic surveys need to be conducted with priority given to sites with potential habitat and likely to support the species.
- Continue surveys along the Ohio and Kanawha rivers.

Monitoring:

- Monitor Moose Lodge wetland due to the high diversity of Ambystomid species.

Coordination:

- Work with railroad industry representatives to preserve known sites and not drain wet areas where species is breeding in railroad ditches.
- Coordinate with private landowners under the Landowner Incentive Program.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Smallmouth Salamander sites.
- Educate motorists by placing road signs at known occurrences warning of salamanders moving across the road to get to breeding sites.
- Educate landowners to protect salamander sites (ponds, marshes, etc.) on their property and the importance of wetlands.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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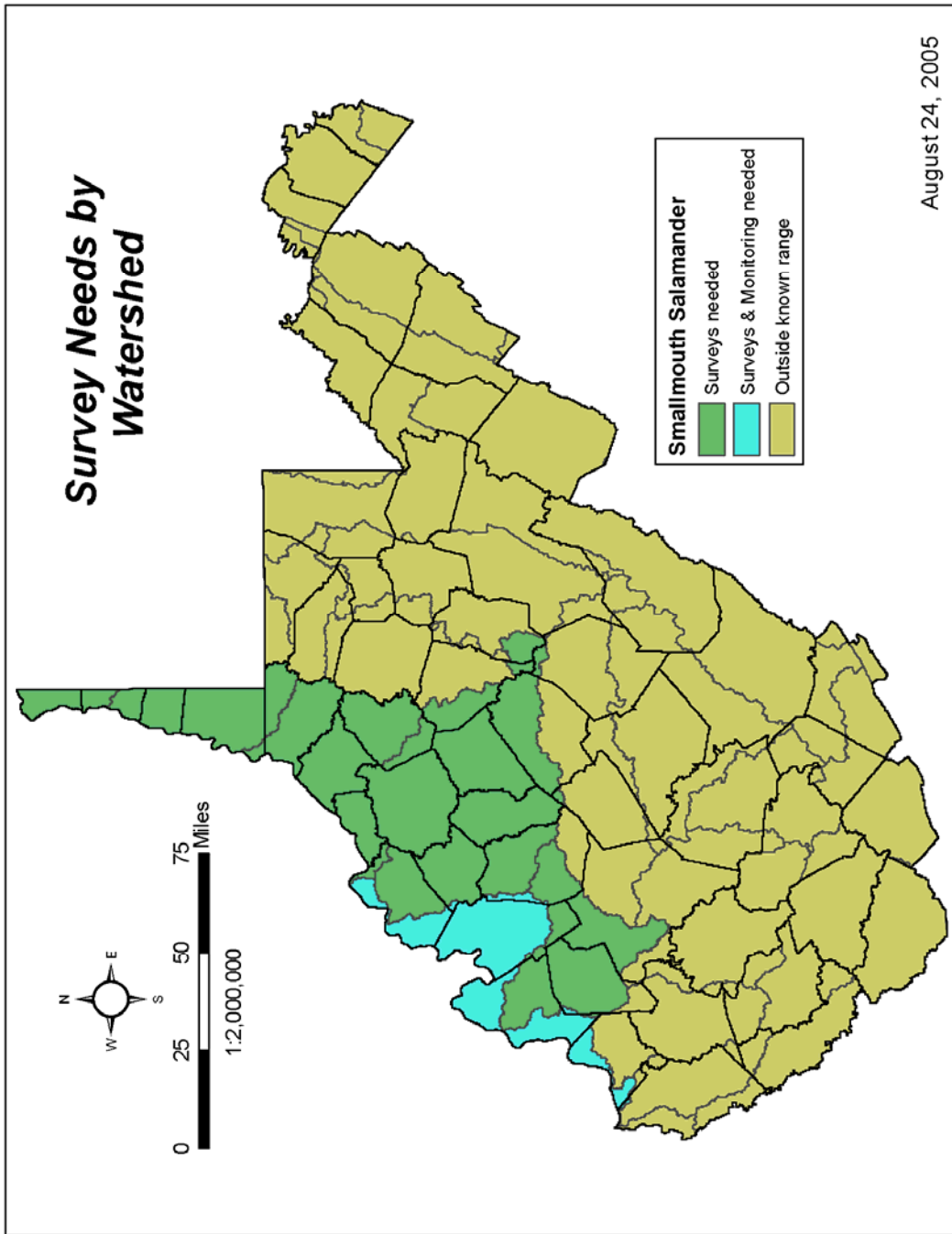
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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Amphibians

Common name: Upland Chorus Frog

Scientific name: *Pseudacris triseriata feriarum*

STATUS

The ranks and information in the chart below indicate the rarity of the Upland Chorus Frog in West Virginia. This species is listed as rare and in need of conservation because it appears to be declining in the southern part of the state where it once occurred.

Priority group	Global Rank	State Rank	Trend
1*	G5T5	S2	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Upland Chorus Frog into watersheds and gives the ages of the records (recent is within 20 years) and indicates whether the sites are under public or private ownership.

Habitat: The Upland Chorus Frog is found in swampy areas of broad valleys, grassy swales, moist areas of woodlands and borders of heavily vegetated ponds.

Watershed	Site Name	Record Type	Ownership
Greenbrier	Alderson	Historic	Private
	Fairlea	Historic	Private
	Second Creek	Historic	Private
	Little Creek Road	Historic	Private
	Boyer	Historic	Private
	Minnehaha Springs	Recent	Public
North Branch Potomac	Burlington	Historic	Private
	Burlington-South	Recent	Private
	Patterson Creek	Recent	Private

Watershed	Site Name	Record Type	Ownership
South Branch Potomac	Jake Hill	Recent	Public
	Romney	Historic	Private
	Old Fields	Historic	Private
	Dry Run	Recent	Public
	Pretty Ridge Pond	Recent	Public
	Big Run	Recent	Private
	Moyer Gap	Recent	Private
	Arthur	Recent	Private
	Moorefield	Recent	Private
Potomac	Unknown	Historic	Unknown
	Shepherdstown	Recent	Private
	Greensburg	Recent	Private
	Sleepy Creek Lake	Recent	Public
	Rt. 522 – 2 Sites	Recent	Private
	Cr 28-2 – 2 Sites	Recent	Private
	Glengary	Recent	Private
	Gerradstown	Recent	Private
Cacapon	Rock Oak	Recent	Private
	Warden Lake / Wardensville – 4 Sites	Recent	Private
	Mill Branch / Capon Bridge – 9 Sites	Recent	Private
	Cr-5 – 2 Sites	Recent	Private
	Campbells	Recent	Private
	Long Hollow Run – 2 Sites	Recent	Private
Shenandoah	Unknown	Historic	Unknown
Upper New	Big Spring Branch	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Upland Chorus Frog. Because there is inadequate information on the distribution and status of this species in West Virginia, the first step in its conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Upland Chorus Frog.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled into database with coordinates.	Complete the WV Herpetological Atlas.
	Public access to general frog information.	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> . Provide general Upland Chorus Frog data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Surveys of historic sites.	Historic Greenbrier River watershed sites are probably extirpated but still need to be surveyed every 2 to 3 years.
	Surveys of new sites.	Survey new sites to fill data gaps in southern and middle Pendleton County, middle Grant County, Pendleton County and the one site in Pocahontas County.

Category	Need	Action
Monitoring	Long-term monitoring station.	Monitor existing sites (identify “good” sites and monitor every 2 to 3 years in the Eastern Panhandle) to determine status of population and any changes to habitat. Also monitor a southern range site in Pocahontas County.

Category	Need	Action
Research	Determine why southern populations are drastically declining.	Conduct detailed habitat analysis of all sites. Coordinate with researchers.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Upland Chorus Frog and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Coordination , Education
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE UPLAND CHORUS FROG AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Complete the WV Herpetological Atlas.

Surveys:

- Historic Greenbrier River watershed sites are probably extirpated but still need to be surveyed every 2 to 3 years.
- Survey new sites to fill data gaps in southern Pendleton County, middle Grant County, Pendleton County and the one site in Pocahontas County.

Monitoring:

- Monitor existing sites (determine “good” sites and monitor every 2 to 3 years in the Eastern Panhandle) to determine status of population and any changes to habitat. Also, monitor the southern range site in Pocahontas County.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in wetlands with Upland Chorus Frogs. Encourage use of Best Management Practices when farming, draining wetlands and other site related issues that pertain to habitat loss and decreased water quality.
- Coordinate with private landowners under the Landowner Incentive Program.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Upland Chorus Frog sites.
- Educate landowners to protect frog sites (ponds, marshes, etc.) on their property and the importance of wetlands and vernal pools.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

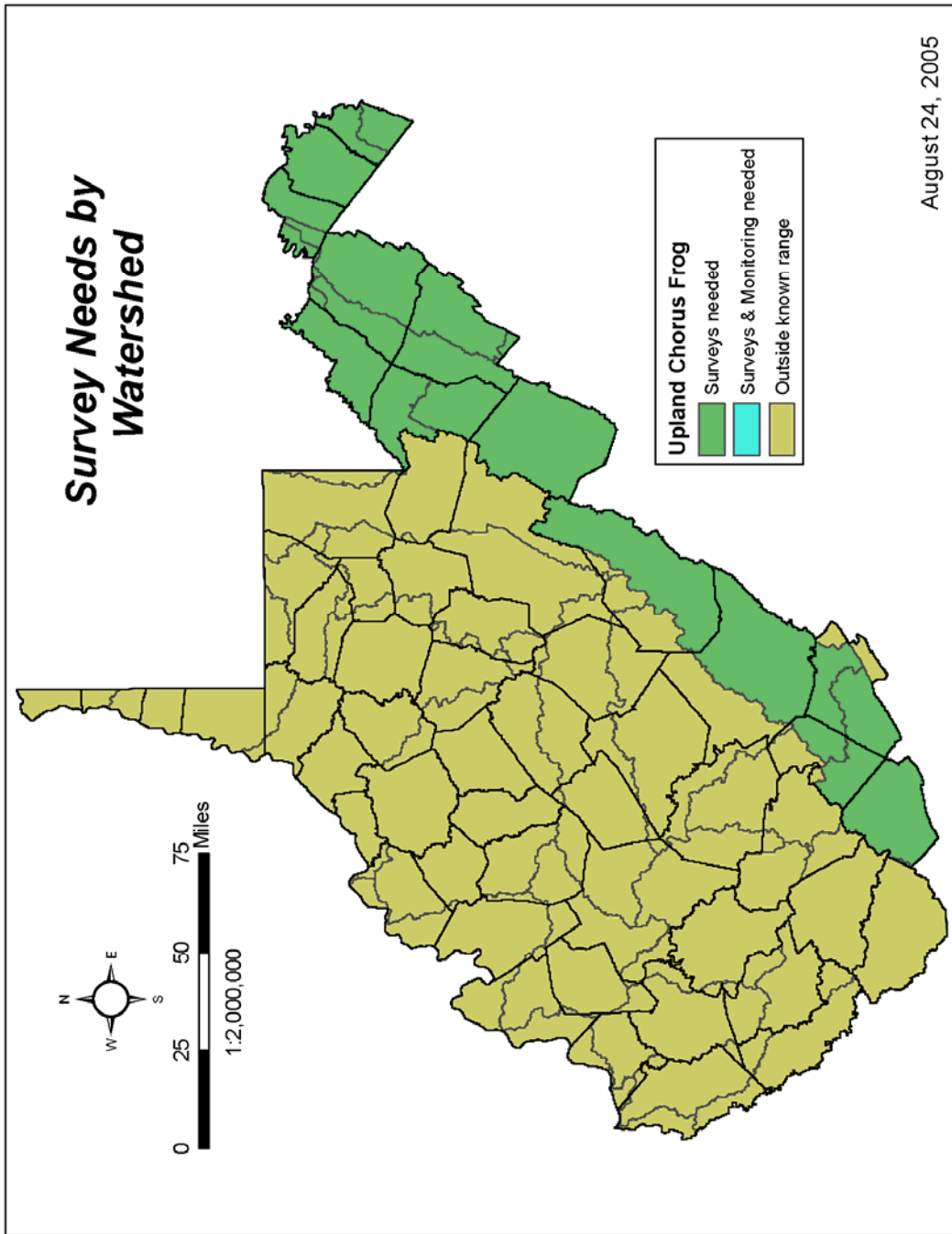
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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Amphibians

Common name: Shenandoah Mountain Salamander

Scientific name: *Plethodon virginia*

STATUS

The ranks and information in the chart below indicate the rarity of the Shenandoah Mountain Salamander in West Virginia. This species is listed as rare and in need of conservation and its status is monitored by many groups. The Shenandoah Mountain Salamander only occurs in a small portion of West Virginia and Virginia. It was split from the Valley and Ridge Salamander in 1999 and physical differences may not be noticeable.

Priority Group	Global Rank	State Rank	IUCN Rank	Trend
1*	G2G3Q	S2	NT	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places records into watersheds and describes the ownership and the ages (recent is within 20 years) of the records.

Habitat: The Shenandoah Mountain Salamander occurs in mixed deciduous forest interspersed with Virginia pine and hemlock in which there are numerous rock outcrops.

Watershed	Site Name	Record Type	Ownership
South Branch Potomac	South Branch Mountain – 1 site	Recent	Private
	Shenandoah Mountain – 2 sites	Recent	Public

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Shenandoah Mountain Salamander. Because there is inadequate information on the distribution and status of the Shenandoah Mountain Salamander in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Shenandoah Mountain Salamander.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled into database with coordinates.	Complete the WV Herpetological Atlas.
	Public access to general salamander information.	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> .
		Provide general Shenandoah Mountain Salamander data, such as distribution maps, on the internet.
Museum specimens.	Look at <i>Plethodon hoffmani</i> specimens to determine if any are P. Virginia.	

Category	Need	Action
Surveys	Determine extent of potential habitat for recent occurrences.	Delineate populations on Shenandoah and South Branch mountains.
	New sites need to be surveyed.	Visit adjacent sites to determine presence of species. Determine the northernmost range extension. Conduct searches from the Little Cacapon to South Branch of Potomac rivers.

Category	Need	Action
Monitoring	Long-term monitoring.	Coordinate with the Forest Service to identify sites. The species co-exists with the Cow Knob Salamander so both species can be monitored simultaneously. Monitor Nathaniel Mountain to determine any changes to habitat.

Category	Need	Action
Research	Study effects of various habitat disturbances.	Conduct studies to determine effects of logging and grazing on all Plethodons.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Shenandoah Mountain Salamander and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE SHENANDOAH MOUNTAIN SALAMANDER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Complete the WV Herpetological Atlas.

Surveys:

- Delineate populations on Shenandoah and South Branch mountains.
- Visit adjacent sites to determine presence of the species. Determine the northernmost range extension. Conduct searches from the Little Cacapon to the South Branch of Potomac rivers.

Monitoring:

- Coordinate with the Forest Service to identify sites. The species co-exists with Shenandoah Mountain salamander so both species can be monitored. Monitor the Nathaniel Mountain site to assess any changes to the habitat.

Coordination:

- Work with George Washington National Forest Service staff and other landowners to reduce or eliminate activities that may be detrimental to Shenandoah Mountain Salamander sites. This includes determining buffer zones around sites and encouraging use of Best Management Practices when timbering and other site related issues pertaining to habitat loss and forestland management.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Shenandoah Mountain Salamander sites.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

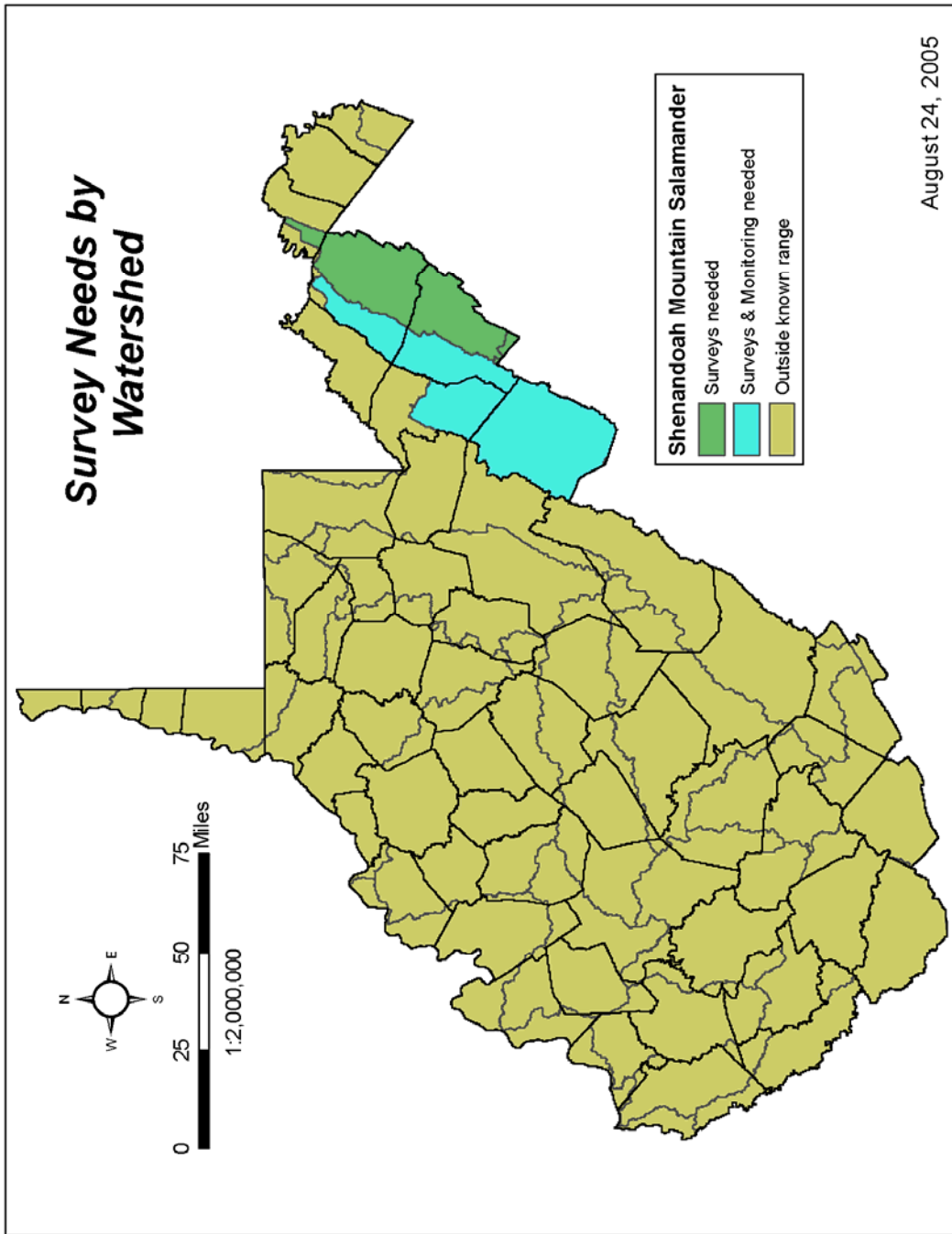
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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Amphibians

Common name: Cheat Mountain Salamander

Scientific name: *Plethodon nettingi*

STATUS

The ranks and information in the chart below indicate the rarity of the Cheat Mountain Salamander in West Virginia. This species is endemic to West Virginia and is listed as threatened by the U.S. Fish and Wildlife Service.

Priority	Global Rank	State Rank	USFWS	Mon Forest	IUCN Rank	NE Tech Comm	Trend
1*	G2	S2	LT	X	NT	X	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places records into watersheds and describes the ownership and the ages (recent is within 20 years) of the records. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. Due to the sensitive nature of this species and the threat of collection, site names are not given.

Habitat: The Cheat Mountain Salamander occurs in red spruce and mixed deciduous forests with Red Spruce, Yellow Birch, American Beech, Sugar Maple, Striped Maple and Eastern Hemlock. It is usually found in cool, moist red spruce forests with a ground cover including the liverwort *Bazzania* and an abundance of leaf litter, fallen logs and sticks.

Watershed	Record Type	Ownership
Cheat	Recent Historic	Public/Private
Elk	Recent	Private
Greenbrier	Recent Historic	Public/Private
South Branch Potomac	Recent Historic	Public
Tygart Valley	Recent	Public

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Cheat Mountain Salamander. Because there is inadequate information on the distribution and status of the Cheat Mountain Salamander in West Virginia, the first step in their conservation is to gain a better understanding of its status and habitat requirements. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Cheat Mountain Salamander.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	GIS layer of Cheat Mountain salamander data.	Create a GIS layer of Cheat Mountain salamander sites utilizing the 300 foot buffer zone recently determined.
	Public access to general salamander information.	Complete 2 nd edition of <i>West Virginia Reptiles and Amphibians</i> .
		Complete the WV Herpetological Atlas.
	Site characteristics.	Provide general WV salamander data, such as distribution maps, on the internet. Compile existing data on site characteristics (vegetation, other salamander species, possible threats, past land use history, etc.)

Category	Need	Action
Surveys	Survey for new sites.	Survey areas with potential Cheat Mountain Salamander habitat to locate new sites. Link Snowshoe Mountain to Back Allegheny Mountain and survey western edge of Grant County. Use GIS to identify potential habitat.
	Extent of populations need to be determined.	Conduct surveys at current salamander sites to determine the total extent of populations.

Category	Need	Action
Monitoring	Monitor existing sites.	Continue monitoring sites. Identify new monitoring sites to determine status of population and any changes to habitat.
	Monitoring protocol.	Develop a protocol for long-term monitoring of Cheat Mountain Salamander populations.

Category	Need	Action
Research	Life history.	Conduct sperm analysis and follicle counts.
	Further research on the impacts of roads and foot trails on salamander populations.	Conduct long-term studies to monitor salamander movements across roads and trails.
	Genetic analysis.	Determine the genetic status of the salamander using tail clips to extract DNA.
	Relocation study.	Attempt to relocate salamanders from areas where impacts cannot be avoided and establish them in protected areas.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There several conservation issues associated with the Cheat Mountain Salamander and its habitat. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management
Forest Health	Coordination, Education, Management, Acquisition, Restoration
Water Quantity and Quality	Legislation/Regulation
Over Collection	Legislation/Regulation, Education
Management Conflicts	Coordination
Invasive Species	
Damaging Recreation	Coordination
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE CHEAT MOUNTAIN SALAMANDER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Create a GIS layer of Cheat Mountain salamander sites utilizing a 300 foot buffer zone.
- Complete the WV Herpetological Atlas.
- Compile existing data on site characteristics (vegetarian, other salamander species, possible threats, past land use history, etc.)

Surveys:

- Survey areas with potential Cheat Mountain Salamander habitat to locate new sites. Link Snowshoe Mountain to Back Allegheny Mountain and survey western edge of Grant County. Use GIS to determine potential habitat.
- Conduct surveys at current salamander sites to determine the extent of populations.

Monitoring:

- Conduct surveys at existing sites to determine status of population and any changes to habitat.
- Develop a protocol for long-term monitoring of Cheat Mountain Salamander populations.

Research:

- Conduct sperm analysis and follicle counts.
- Conduct long-term studies to monitor salamander movements across roads and trails.
- Determine the genetic status of the salamander using tail clips to extract DNA.
- Attempt to relocate salamanders from areas where impacts cannot be avoided, and establish them in protected areas.

Acquisition:

- Acquire easements or ownership of tracts of land (with buffer zones) with known Cheat Mountain Salamander occurrences.

Coordination:

- Continue present cooperation with the U.S. Forest Service to protect salamander sites on the Forest and maintain forest plan strategies. This may include urging the Forest Service to re-route hiking trails or close forest roads.
- Coordinate with project developers and landowners to address impacts of second-home development, timbering, road/trail construction or other projects that may destroy Cheat Mountain Salamander habitat.
- Encourage non-U.S. Forest Service landowners to protect Cheat Mountain Salamander habitat.

Education:

- Discourage the public from removing salamanders from the wild.

Legislation/Regulation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.
- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Support the improvement and enforcement of Clean Air laws to decrease acid precipitation.

Restoration:

- Restore red spruce habitat on public lands, and encourage restoration on private lands.

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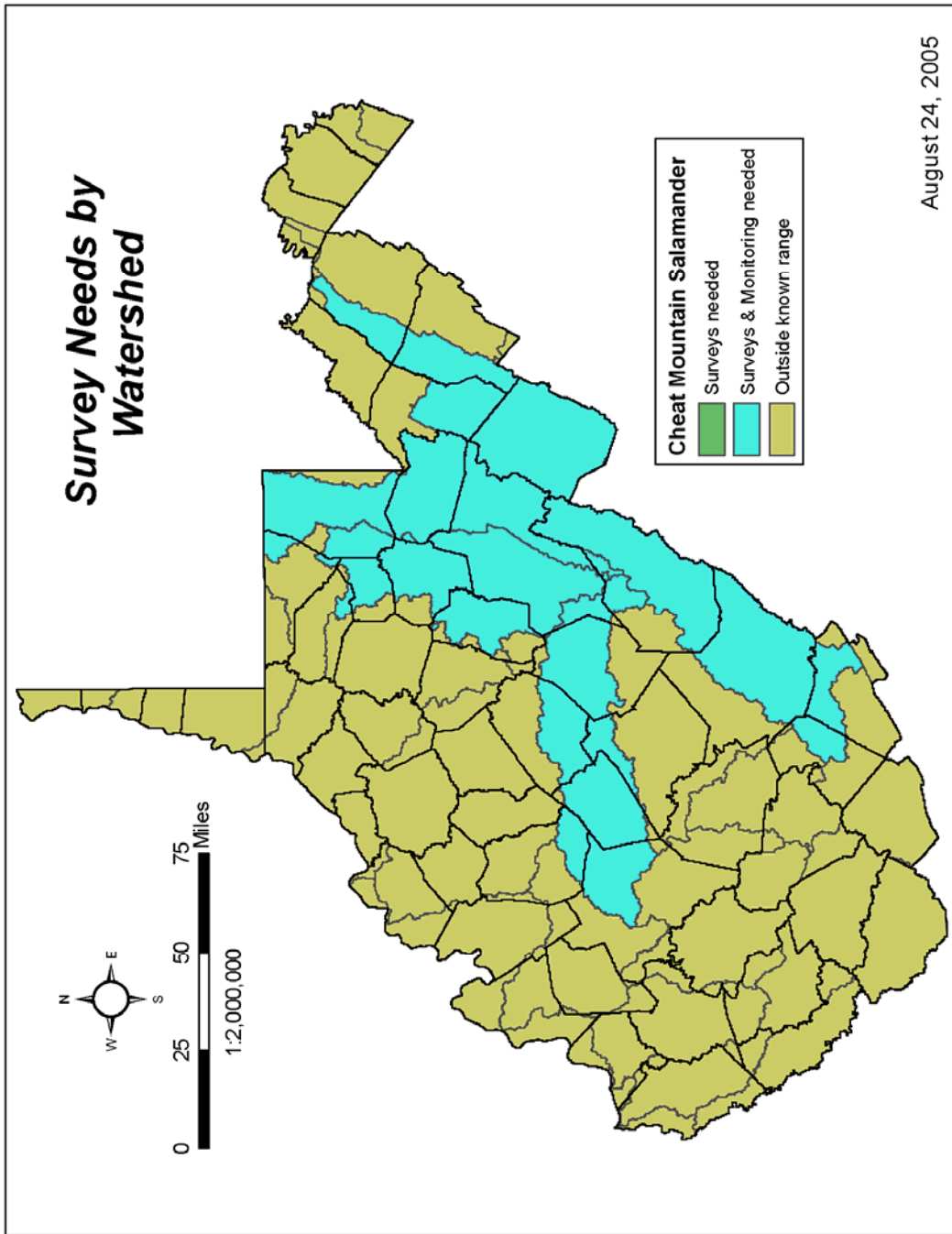
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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Amphibians

Common name: West Virginia Spring Salamander

Scientific name: *Gyrinophilus subterraneus*

STATUS

The ranks and information in the chart below indicate the rarity of the WV Spring Salamander in West Virginia. This species is endemic to West Virginia with only one known site.

Priority group	Global Rank	State Rank	USFWS	IUCN Rank	Trend
1*	G1Q	S1	SC	END	Stable

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table describes the single known occurrence of the West Virginia Spring Salamander relative to a watershed, the age of the record (recent is within 20 years), and indicates whether the site is in public or private ownership.

Habitat: The WV Spring Salamander is restricted to limestone cave stream passages with large amounts of decaying organic matter. It occurs in streams and on mud banks along streams.

Watershed	Site Name	Record Type	Ownership
Greenbrier	General Davis Cave	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the West Virginia Spring Salamander. There is only one known site for this species and monitoring is needed for the conservation of the West Virginia Spring Salamander. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the West Virginia Spring Salamander.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled into database with coordinates.	Complete the WV Herpetological Atlas.
	Public access to general salamander information.	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> . Provide general WV Spring Salamander data, such as distribution maps, on the internet.

Category	Need	Action
Monitoring	Existing site needs to be monitored.	Continue monitoring General Davis Cave.

Category	Need	Action
Research	Genetic analysis.	Determine if the WV Spring Salamander is a distinct species.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the West Virginia Spring Salamander and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Education , Coordination, Management
Over Collection	
Management Conflicts	
Invasive Species	
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE WEST VIRGINIA SPRING SALAMANDER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Complete the WV Herpetological Atlas .

Monitoring:

- Continue monitoring General Davis Cave..

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in the General Davis Cave watershed.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) in the General Davis Cave watershed.

Legislation:

- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

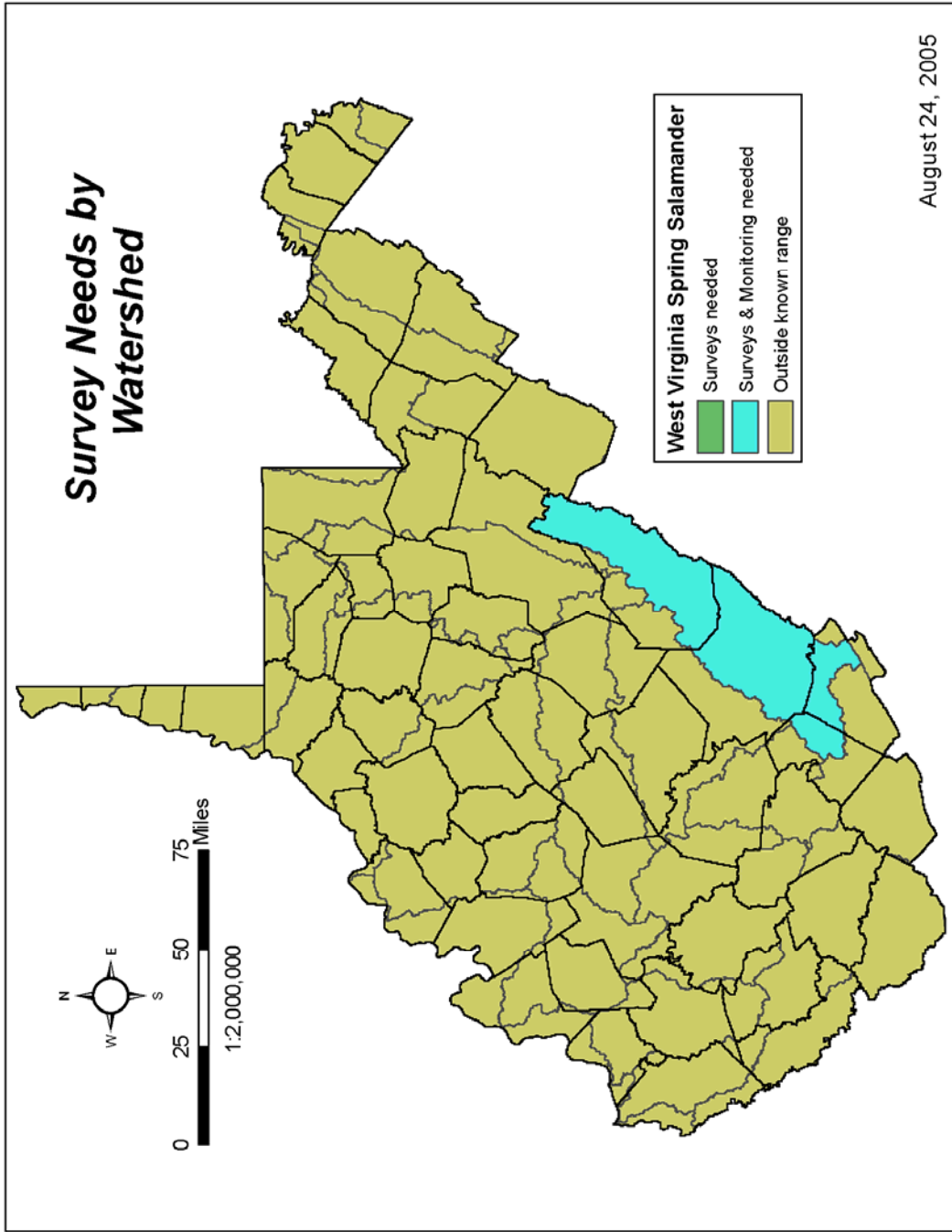
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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Amphibians

Common name: Green Salamander

Scientific name: *Aneides aenus*

STATUS

The ranks and information in the chart below indicate the rarity of the Green Salamander in West Virginia. It is listed as rare and in need of conservation and its status is monitored by many groups. The Green Salamander is considered a species of concern in every state in which it occurs. In West Virginia, it is found in appropriate habitat and the state is a stronghold for this species. However, many sites have declined over recent years and over-collecting is suspected.

Priority group	Global rank	State Rank	Mon Forest	IUCN Rank	NE Tech Comm	Trend
1*	G3G4	S3	X	NT	X	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places records into watersheds and describes the ownership and the ages (recent is within 20 years) of the records. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. Due to the sensitive nature of this species and the threat of collection, site names are not given.

Habitat- Green Salamanders inhabit the crevices in rock faces of rock outcrops, cliffs and emergent rocks. It is becoming increasingly evident that they also utilize large trees surrounding the rock outcrops.

Watershed	Record Type	Ownership
Big Sandy	Historic	Private
Cheat	Recent Historic	Public/ Private
Coal	Recent Historic	Private
Elk	Recent Historic	Private
Gauley	Recent Historic	Public/ Private
Greenbrier	Recent	Private
Little Kanawha	Historic	Private
Lower Guyandotte	Historic	Private
Lower Kanawha	Recent Historic	Private

Watershed	Record Type	Ownership
Lower New	Recent Historic	Public/ Private
Tug Fork	Historic	Private
Twelve Pole	Historic	Private
Tygart Valley	Recent Historic	Public/ Private
Upper Guyandotte	Recent Historic	Private
Upper Kanawha	Historic	Private
Upper New	Recent Historic	Private
West Fork	Historic	Private
Youghiogheny	Historic	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Green Salamander. Many surveys have been conducted for this species in West Virginia but over half of these records are pre-1980. The first step in their conservation is to determine if the Green Salamander is present in these areas. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Green Salamander.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data will be compiled into the database with coordinates.	Complete WV Herpetological Atlas.
	Public access to general salamander information.	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> . Provide general Green Salamander data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Status at historic sites needs to be determined.	A very high percentage of sites are historic. Surveys need to be conducted with priority given to sites with potential habitat and likely to harbor the species.
	Status of tree use at current sites needs to be determined.	Conduct arboreal surveys at existing sites.
	New sites need to be surveyed.	Identify potential habitat using GIS, landscape attributes, etc.

Category	Need	Action
Monitoring	Long-term monitoring.	Monitor 3 to 4 sites in different areas of the state since the species could potentially occur statewide. Monitor known sites for habitat changes.

Category	Need	Action
Research	Life history.	Study arboreal habitat use; look for nests in trees.
	Effects of various habitat disturbances.	Study effects of forestry practices on species and determine size of buffer needed around occurrences.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Green Salamander and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management
Forest Health	Coordination, Education, Management
Water Quantity and Quality	
Over Collection	Legislation/Regulation, Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE GREEN SALAMANDER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Complete WV Herpetological Atlas.

Surveys:

- A very high percentage of sites are historic. Surveys need to be conducted with priority given to sites with potential habitat and likely to harbor the species.
- Conduct arboreal surveys around the rock outcrops at existing sites.

Monitoring:

- Monitor 3 to 4 sites in different areas of the state since the species could potentially occur statewide. Monitor known sites for habitat changes.

Research:

- Study effects of forestry practices on species and determine size of buffer needed around occurrences.

Coordination:

- Work with forest landowners (private and corporate owners as well as National and State Parks and Forests) to reduce or eliminate activities that may be detrimental to Green Salamander sites. This includes determining buffer zones around sites and encouraging use of Best Management Practices when timbering and other site related issues pertaining to habitat loss and forestland management.

Education:

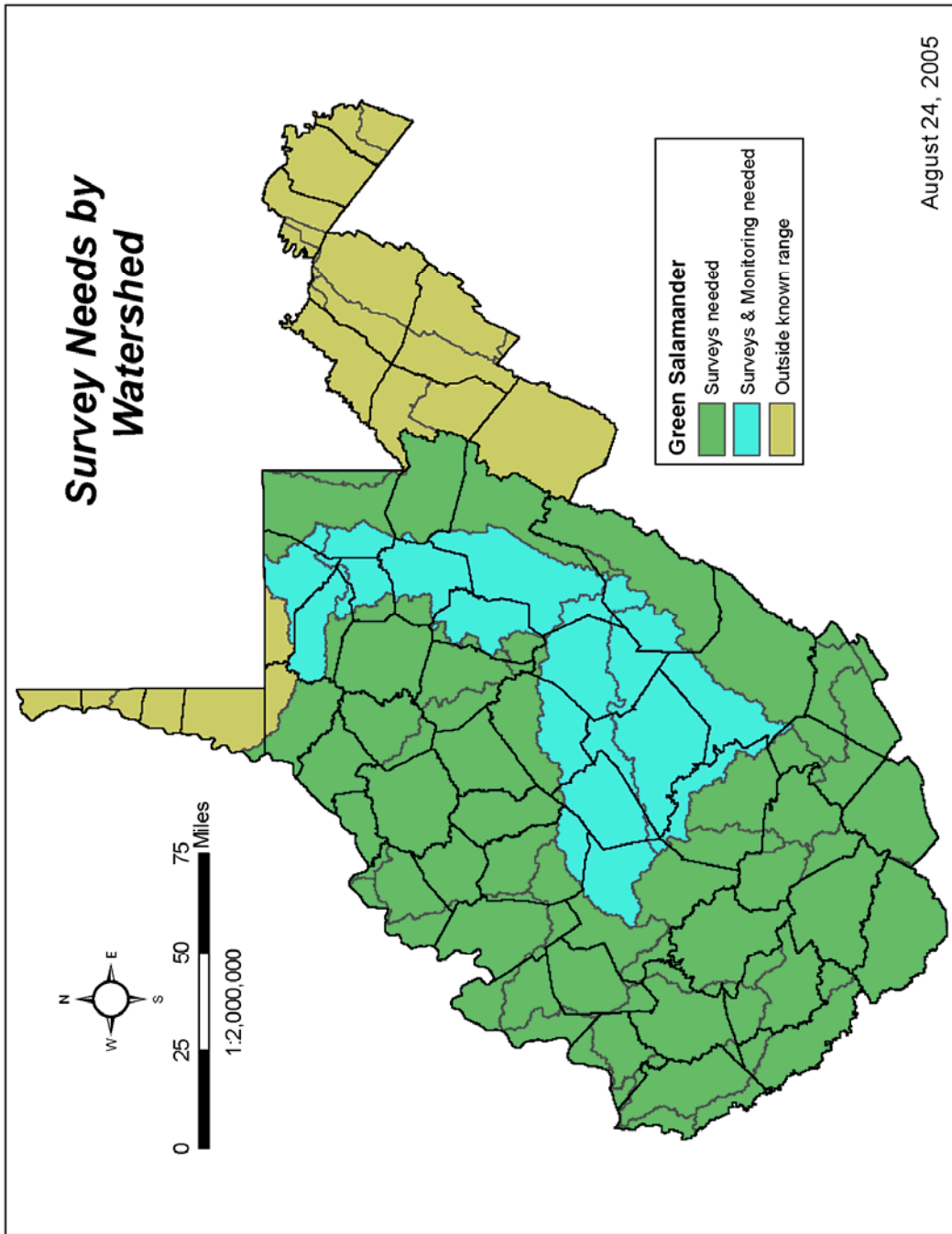
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Green Salamander sites.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Amphibians

Common name: Eastern Hellbender

Scientific name: *Cryptobranchus alleganiensis*

STATUS

The ranks and information in the chart below indicate the rarity of West Virginia hellbenders. The hellbender is listed as rare and in need of conservation in West Virginia because of its decline in many rivers due to habitat alterations. It is considered a species of concern in every state in which it occurs and its status is monitored by many groups.

Priority group	Global Rank	State Rank	USFWS	Mon Forest	IUCN Rank	NE Tech Comm	Trend
1*	G4	S2	SC	X	NT	X	Declining

* The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places records into watersheds and describes the ownership and the ages (recent is within 20 years) of the records. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. Due to the sensitive nature of this species and the threat of collection, site names are not given.

Habitat: Hellbenders typically utilize swift running, fairly shallow, highly oxygenated waters. The presence of riffle areas with flat rocks, logs and other cover is essential for breeding and feeding activities.

Watershed	Record Type	Ownership
Cheat	Recent Historic	Public/Private
Elk	Recent Historic	Private
Gauley	Recent Historic	Public/Private
Greenbrier	Recent Historic	Public/Private
Little Kanawha	Recent Historic	Private
Lower Guyandotte	Historic	Private

Watershed	Record Type	Ownership
Lower New	Recent	Private
Middle Ohio Valley	Historic	Private
Twelve Pole	Historic	Private
Tygart Valley	Historic	Private
Upper Guyandotte	Historic	Private
Upper Kanawha	Historic	Private
Upper Ohio Valley	Recent Historic	Private
Youghiogheny	Historic	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Eastern Hellbender in West Virginia. Because there is inadequate information on the distribution and status of these species in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Eastern Hellbender.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data compiled into database with coordinates.	Complete the WV Herpetological Atlas.
	Public access to general salamander information.	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> .
		Provide general Hellbender data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Determine status at historic sites.	Give priority to conducting surveys on larger, slow moving, impacted rivers such as the Little Kanawha and Gauley rivers to determine presence of species.
	Determine length of stream occupied at each recent occurrence.	Evaluate habitat and determine barriers that would separate populations within the same river system; conduct surveys if possible.
	Survey new sites.	Most streams have the potential to support Hellbender populations (except the Eastern Panhandle). Conduct surveys to fill in data gaps; priority will be given to historic streams.

Category	Need	Action
Monitoring	Long-term monitoring.	Monitor existing sites to determine status of population and any changes to habitat. Monitor West Fork of Greenbrier population on a more regular basis (1-3 years).

Category	Need	Action
Research	Survey methods.	Determine most effective survey method for each habitat type.
	Life history.	Home range, larval habitat and seasonal movement data is needed.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Eastern Hellbender and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Coordination , Education Management
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	Education
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE EASTERN HELLBENDER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Complete the WV Herpetological Atlas.

Surveys:

- Give priority to conducting surveys on larger, slow moving, impacted rivers such as the Little Kanawha and Gauley rivers to determine presence of species.
- Most streams have the potential to support Hellbender populations (except the Eastern Panhandle). Conduct surveys to fill in data gaps; priority will be given to historic streams.

Monitoring:

- Monitor existing sites to determine status of population and any changes to habitat. Monitor West Fork of Greenbrier population on a more regular basis (1-3 years).

Coordination:

- Work with the Corps of Engineers and other interested parties to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc.) in streams with Hellbenders. Assess effects of possible dam construction on rivers and streams as projects arise.

Education:

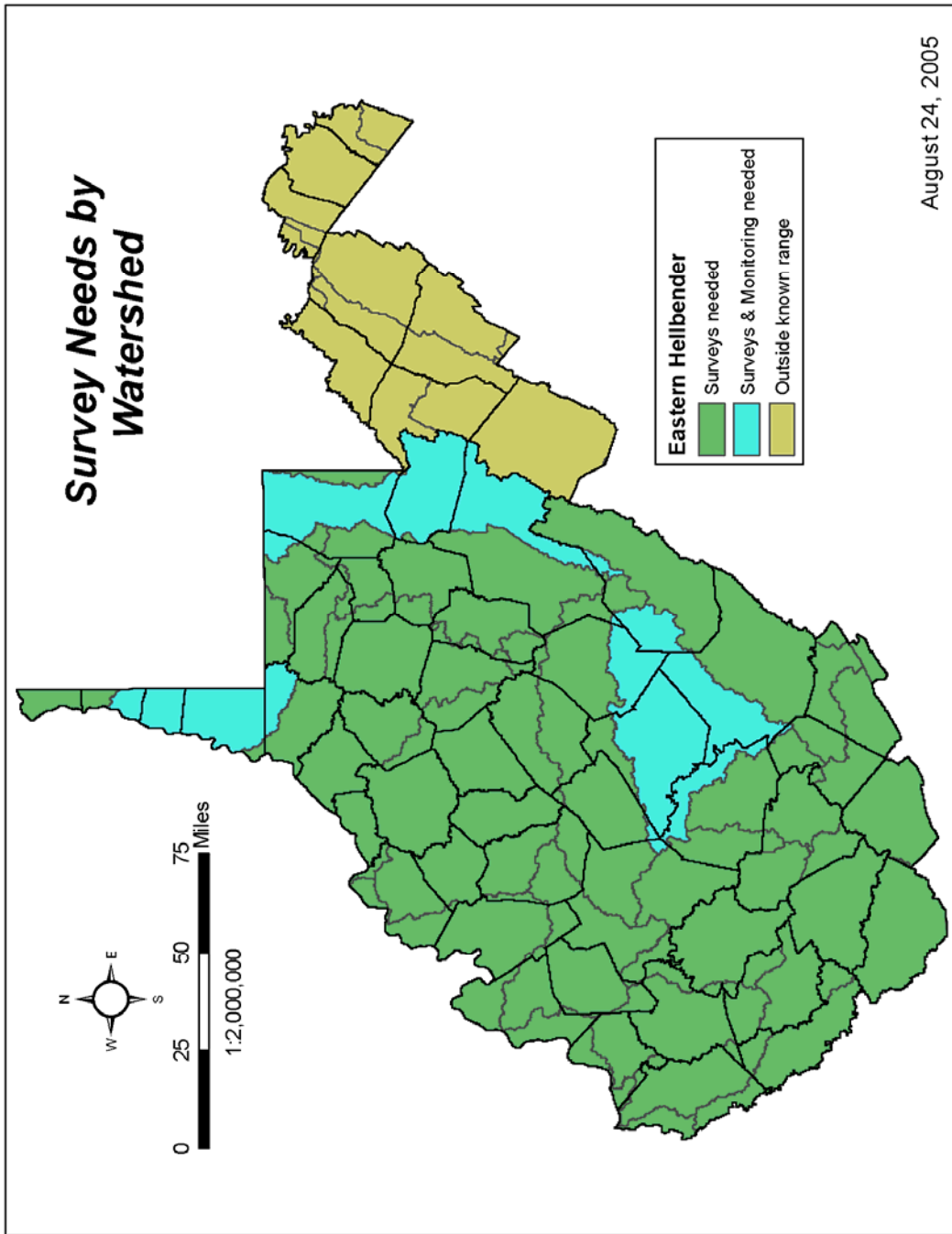
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) on Hellbender streams. Provide information to encourage anglers to release Hellbenders and report their locations.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Amphibians

Common name: Midland Mud Salamander

Scientific name: *Pseudotriton montanus diasticus*

STATUS

The ranks and information in the chart below indicate the rarity of the Midland Mud Salamander in West Virginia. The Midland Mud Salamander is listed as rare and in need of conservation because it is declining in the state and most records are historic. It is considered a species of concern in every state in which it occurs.

Priority group	Global Rank	State Rank	Trend
1*	G5T5	S1	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places records into watersheds and describes the ownership and the ages (recent is within 20 years) of the records.

Habitat- Midland Mud Salamanders inhabit muddy springs, sluggish brooks and swampy, forested areas. They may be found under logs and stones close to muddy streams where they burrow into the banks.

Watershed	Site Name	Record Type	Ownership
Big Sandy	Fort Gay	Historic	Private
Coal	Peytona	Historic	Private
	Bolt	Historic	Private
Gauley	Mount Lookout	Historic	Private
	Strouds Creek	Historic	Private
Little Kanawha	Tygart Creek	Historic	Private
Lower Guyandotte	Barboursville	Historic	Private
	Merrick Creek	Historic	Private
	Chapmanville High School	Historic	Private

Watershed	Site Name	Record Type	Ownership
Lower Kanawha	Crooked Creek	Historic	Private
	Lick Branch	Historic	Private
	Kanawha State Forest.	Historic	Public
	Goldtown	Historic	Private
	Dunbar	Historic	Private
	North Charleston	Historic	Private
Lower New	Fayetteville	Historic	Private
	Edmund-East	Recent	Private
Lower Ohio Valley	Pleasant Valley	Historic	Private
	Upland	Historic	Private
	Beverly Hills Jr. High School	Historic	Private
Middle Ohio Valley	Mount Alto	Historic	Private
	McClintic WMA	Historic	Public
	Gay	Historic	Private
Tug Fork	Trace Fork	Historic	Private
Twelve Pole	Butler Branch Road	Recent	Private
Upper Guyandotte	Pineville	Historic	Private
Upper New	Beech Run	Historic	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Midland Mud Salamander. Many surveys have been conducted for this species in West Virginia but over half of these records are pre-1980. The first step in their conservation is to determine if the Midland Mud Salamander is present in these areas. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Midland Mud Salamander.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data will be compiled into the database with coordinates.	Complete WV Herpetological Atlas.
	Public access to general salamander information.	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> . Provide general Midland Mud Salamander data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Status at historic sites needs to be determined.	A very high percentage of sites are historic. Surveys need to be conducted with priority given to sites with potential habitat most likely to harbor the species.
	New sites need to be surveyed.	Survey for larvae at Beech Fork and Green Bottom WMA.

Category	Need	Action
Monitoring	Long-term monitoring.	Monitor existing sites to determine status of population and any changes to habitat, especially the New River Gorge site.

Category	Need	Action
Research	All life history aspects pertaining to WV populations, especially habitat requirements.	Conduct a natural history study at Cassie Waters, a site in the New River Gorge.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Midland Mud Salamander and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Coordination , Education
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE MIDLAND MUD SALAMANDER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Complete WV Herpetological Atlas.

Surveys:

- A very high percentage of sites are historic. Surveys need to be conducted with priority given to sites with potential habitat most likely to harbor the species.
- Survey for larvae at Beech Fork and Green Bottom WMA.

Monitoring:

- Monitor existing sites to determine status of population and any changes to habitat, especially the New River Gorge site.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in wetlands with Midland Mud Salamanders. Encourage use of Best Management Practices when timbering and other site related issues that pertain to habitat loss and forestland management.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Midland Mud Salamander sites.
- Educate landowners to protect salamander sites (ponds, marshes, etc.) on their property and the importance of wetlands and vernal pools.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation from FOIA requests.

REFERENCES

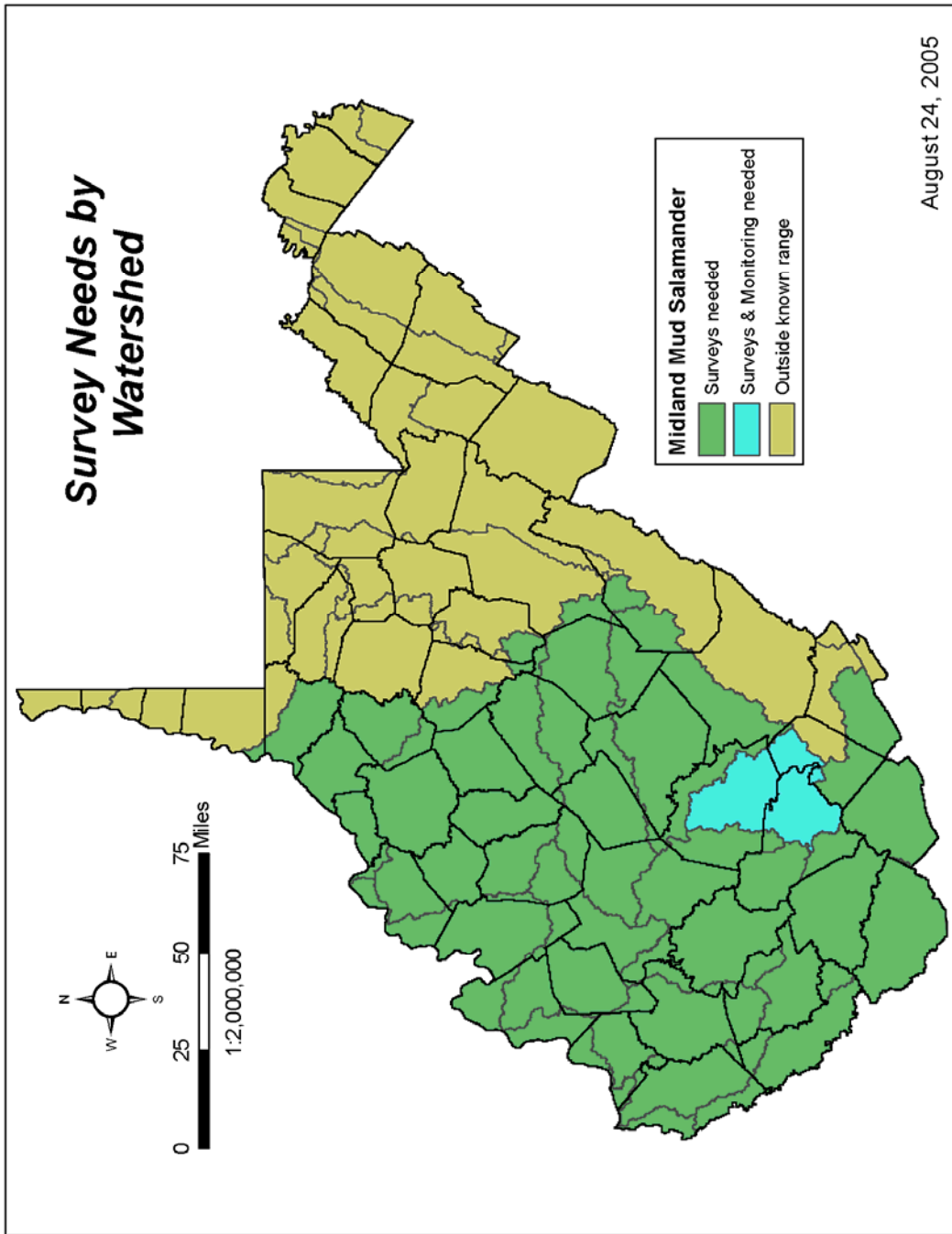
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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Reptiles
Common name: Corn Snake
Scientific name: *Elaphe guttata guttata*

STATUS

The ranks and information in the chart below indicate the rarity of the Corn Snake in West Virginia. It is listed as rare and in need of conservation in West Virginia because there are only two records, and it had not been found in the state until 2000. The subspecies occurs in only four states where it is considered rare and is monitored by each state.

Priority Group	Global Rank	State Rank	Trend
1*	G5T5	S1	Unknown

*The letters and/or numbers in the table refer to each group’s designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Corn Snake into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether the sites are under public or private ownership.

Habitat: The Corn Snake inhabits dry fields and thickets. It is usually found on the ground, hiding beneath surface cover.

Watershed	Site Name	Record Type	Ownership
Cacapon	Orleans Crossroads	Historic	Private
South Branch Potomac	Springfield South	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Corn Snake. Because there is inadequate information on the distribution and status of the Corn Snake in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Corn Snake.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled into a database with coordinates.	Complete the WV Herpetological Atlas.
	Public access to general snake information.	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> . Provide general Corn Snake data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Status at historic sites needs to be determined.	Visit areas with historic records to determine if appropriate habitat still exists.
	New sites need to be surveyed.	Analyze potential habitat in the Eastern Panhandle counties. Opportunistically survey when conducting inventories for other species.

Category	Need	Action
Monitoring	Long-term monitoring.	Revisit recent sites to determine if a viable population exists.

Category	Need	Action
Research	All life history aspects pertaining to WV populations, especially habitat requirements.	Coordinate projects with researchers or contractors. Little life history information has been collected for this species.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Corn Snake and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management
Forest Health	
Water Quantity and Quality	
Over Collection	Legislation/Regulation, Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE CORN SNAKE AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Complete the WV Herpetological Atlas.

Surveys:

- Visit areas with historic records to determine if appropriate habitat still exists.
- Analyze potential habitat in the Eastern Panhandle counties. Opportunistically survey when conducting inventories for other species.

Monitoring:

- Revisit recent sites to determine if a viable population exists.

Coordination:

- Work with landowners to reduce or eliminate activities that may lead to habitat loss for the Corn Snake in and around known sites.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Corn Snake sites.

Legislation/Regulation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

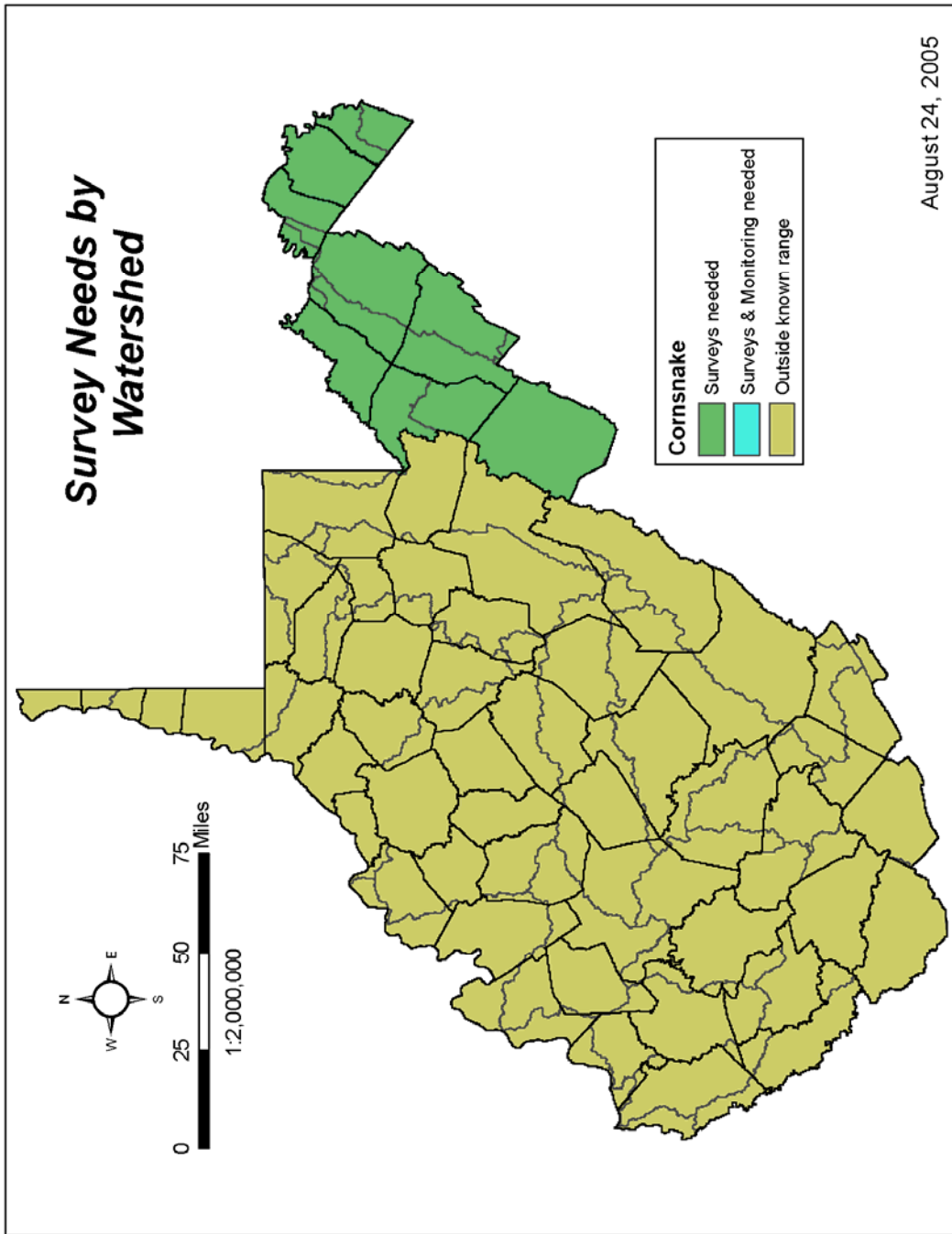
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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Reptiles

Common name: False Map Turtle

Scientific name: *Graptemys pseudogeographica*

STATUS

The ranks and information in the chart below indicate the rarity of the False Map Turtle in West Virginia. This species is listed as rare and in need of conservation because there have been only two sightings since the first sighting in the Little Kanawha River over 50 years ago. It is a species of concern in most states where it is found.

Priority Group	Global Rank	State Rank	Trend
1*	G5	S1	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of False Map Turtles into watersheds, and gives the ages of the records (recent is within 20 years) and indicates whether the sites are under public or private ownership.

Habitat: The False Map Turtle inhabits large impoundments and slow-moving streams.

Watershed	Site Name	Record Type	Ownership
Little Kanawha	Little Kanawha River - Palestine	Historic	Private
Lower Kanawha	Kanawha River - Leon	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the False Map Turtle. Because there is inadequate information on the distribution and status of this species in West Virginia, the first step in its conservation is to determine if a viable population of this species exists in West Virginia. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the False Map Turtle.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled into a database with coordinates.	Complete the WV Herpetological Atlas.
	Public access to general turtle information.	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> . Provide general False Map Turtle data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Surveys of historic sites.	Revisit the Little Kanawha and Kanawha rivers to verify if populations still exist.
	Surveys of new sites.	Survey other rivers in the Little Kanawha and nearby watersheds.

Category	Need	Action
Monitoring	Long-term monitoring.	If species is found, monitor status of population and any changes to its habitat.

Category	Need	Action
Research	Determine why southern populations are drastically declining.	Detailed habitat analysis of all sites is needed; coordinate with researchers.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the False Map Turtle and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Coordination , Education Management
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	Education
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE FALSE MAP TURTLE AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Complete the WV Herpetological Atlas.

Surveys:

- Revisit the Little Kanawha and Kanawha rivers to verify if populations still exist.
- Survey other rivers in the Little Kanawha and nearby watersheds.

Coordination:

- Work with Corps of Engineers and other interested parties to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in streams with False Map Turtles. Assess effects of possible dam construction on rivers and streams as projects arise.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc.) on False Map Turtle streams. Provide information to encourage anglers to release False Map Turtles and report their locations.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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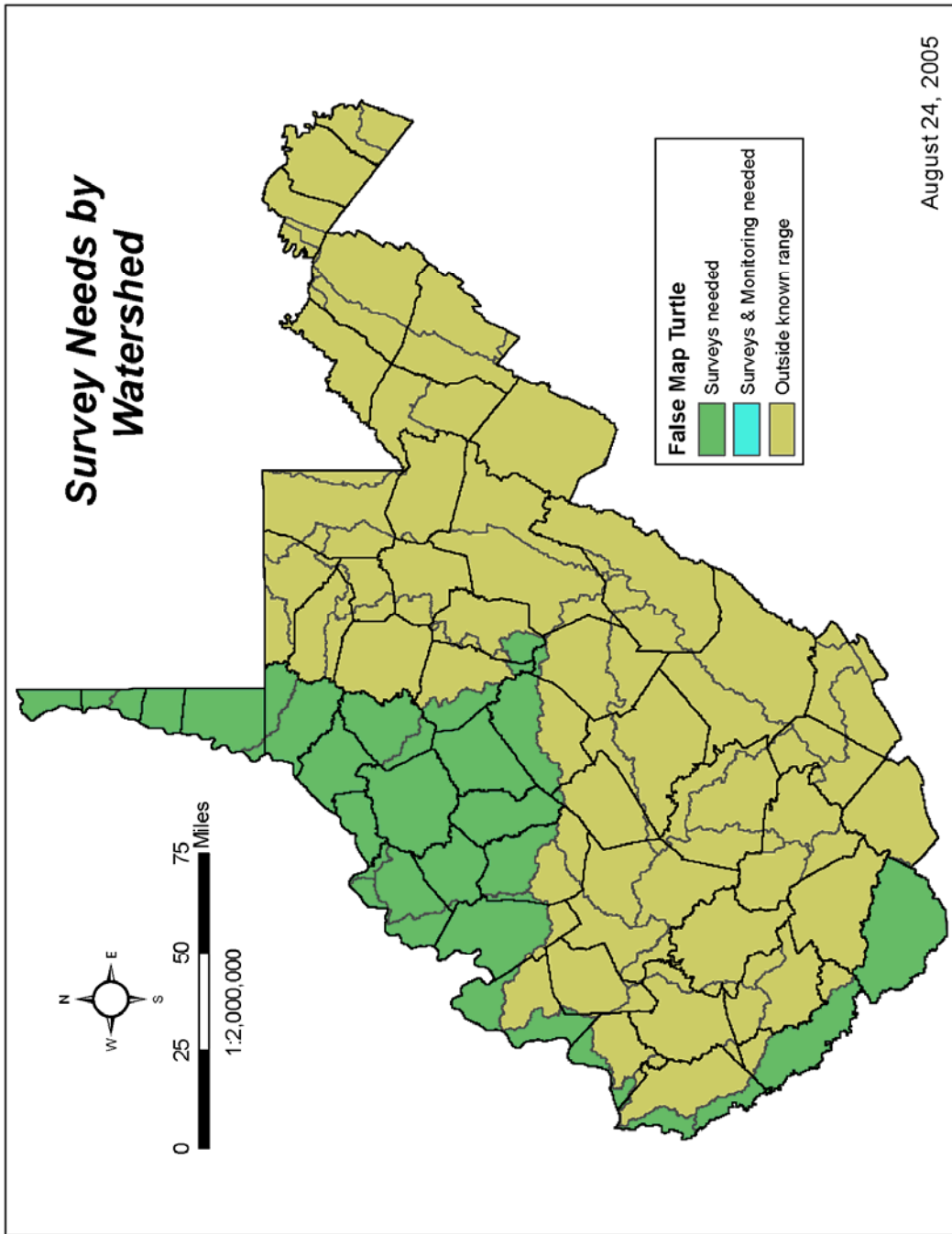
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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Reptiles

Common name: Mountain Earthsnake

Scientific name: *Virginia valeriae pulchra*

STATUS

The ranks and information in the chart below indicate the rarity of the Mountain Earthsnake in West Virginia. The Mountain Earthsnake is listed as rare and in need of conservation because its status is unknown and the number of sites is limited and considered historic. The subspecies occurs in only four states where it is considered rare and is monitored by each state.

Priority group	Global Rank	State Rank	NE Tech Comm	Trend
1*	G5T3T4	S1	X	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places records into watersheds and describes the ownership and the ages (recent is within 20 years) of the records.

Habitat: The Mountain Earthsnake is most frequently found on short, grassy slopes with flat sandstone rocks, especially in areas associated with deciduous forests. It is secretive and spends most of its life underground.

Watershed	Site Name	Record Type	Ownership
Cheat	Laurel Run	Recent	Private
	Hile Run	Recent	Private
	Spruce Knob Lake	Historic	Public
Greenbrier	Elleber Knob	Historic	Public
	Collar Hollow Headwaters	Historic	Private
North Branch Potomac	Stony River	Historic	Private
South Branch Potomac	Spruce Knob Road	Historic	Public
Youghiogheny	Cranesville Swamp-South	Historic	Private
	Terra Alta Lake	Historic	Public

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Mountain Earthsnake. Because there is inadequate information on the distribution and status of the Mountain Earthsnake in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Mountain Earthsnake.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data will be compiled into a database with coordinates	Complete the WV Herpetological Atlas.
	Public access to general snake information	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> . Provide general Mountain Earthsnake data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Determine status at historic sites.	A very high percentage of sites are historic, surveys need to be conducted with priority given to sites with potential habitat most likely to harbor the species.
	Survey new sites.	Analyze potential habitat within the mountainous counties to determine new survey areas; also opportunistically survey when conducting inventories for other species.

Category	Need	Action
Monitoring	Long-term monitoring.	Monitor sites at Spruce Knob.

Category	Need	Action
Research	Life history.	Coordinate research projects with researchers and/or contractors; all natural history data is needed for this species.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Mountain Earthsnake and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE MOUNTAIN EARTHSNAKE AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Complete the WV Herpetological Atlas.

Surveys:

- A very high percentage of sites are historic, surveys need to be conducted with priority given to sites with potential habitat most likely to harbor the species.
- Analyze potential habitat within the mountainous counties to determine new survey areas; also opportunistically survey when conducting inventories for other species.

Coordination:

- Work with forest landowners to reduce or eliminate activities that may be detrimental to Mountain Earthsnake sites. This includes determining buffer zones around sites and encouraging use of Best Management Practices when timbering and other site related issues pertaining to habitat loss and forestland management.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Mountain Earthsnake sites.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

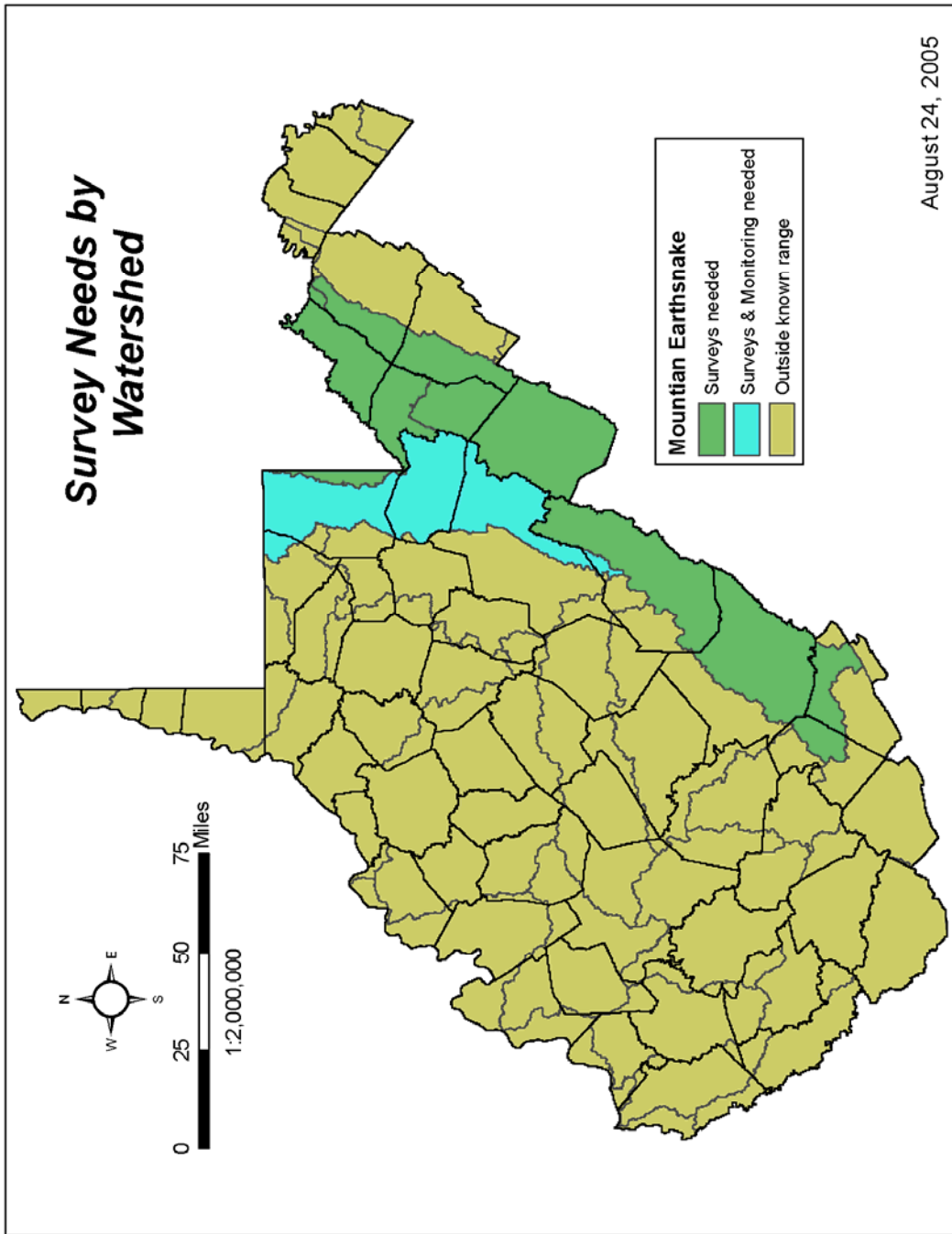
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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Reptiles

Common name: Timber Rattlesnake

Scientific name: *Crotalus horridus*

STATUS

The ranks and information in the chart below indicate the rarity of West Virginia rattlesnakes. The Timber Rattlesnake is listed as rare and in need of conservation and its status is monitored by many groups. It is considered a species of concern in most states in which it occurs.

The Timber Rattlesnake was once common throughout the mountain state but deforestation, opening of recreation areas, forest fires, highway development and senseless killing have reduced its numbers, and in many areas it is uncommon. The Timber Rattlesnake is declining throughout its range and West Virginia may be a stronghold for its distribution as a whole.

Priority group	Global Rank	State Rank	USFWS	Mon Forest	NE Tech Comm	Trend
1*	G4	S3	SC	X	X	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places records into watersheds and describes the ages (recent is within 20 years) of the records. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. Due to the sensitive nature of this species and the threat of collection, site names are not given.

Habitat: The Timber Rattlesnake is most frequently found in rough, mountainous terrain of brushy ridges and rocky hillsides with ledges, where they den. It is common in wooded areas, but may occur in valleys, along streams and among slab piles around old sawmill sites.

Watershed	Record Type
Cheat	Recent
Gauley	Recent
Elk	Recent
South Branch of Potomac	Recent
North Branch of Potomac	Recent
Potomac	Recent
Upper Kanawha	Recent

Watershed	Record Type
Cacapon	Recent
Upper New	Recent
Lower New	Recent
Tygart	Recent
Monongahela	Recent
West Fork	Recent
Upper Guyandotte	Recent
Tug Fork	Recent

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Timber Rattlesnake. Surveys and den verification have been initiated but surveys still need to be conducted. Since the Timber Rattlesnake is declining in other areas, monitoring West Virginia populations is a priority as well. Needs and actions for each category are outlined below.

Bolded text indicates primary actions required to identify conservation needs of the Timber Rattlesnake.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Data sharing among groups	Researchers will continue with the Timber Rattlesnake Conservation Action Plan started in the mid 1990's.
	All existing location and biological data needs to be compiled into a database with coordinates.	Complete the WV Herpetological Atlas.
	Public access to general snake information.	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> . Provide general snake data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Verify den sites.	There are many reports of den sites; these need to be verified.
	Surveys for new sites.	Survey for rattlesnakes in the western and northern part of the state to determine presence and abundance of populations.

Category	Need	Action
Monitoring	Long-term monitoring.	Monitor existing sites to determine status of population and any changes to habitat. Long-term presence/absence data exists for many sites; continue to monitor these sites.

Category	Need	Action
Research	Life history.	A current study is almost completed. Additional longer term natural history data is needed on this species. Environmental data at den sites needs to be collected.
	Effects of various habitat disturbances	Study effects of forestry practices on species and determine size of buffer needed around den sites.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Timber Rattlesnake and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	Education
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE TIMBER RATTLESNAKE AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Complete the WV Herpetological Atlas.

Surveys:

- There are many identified rattlesnake dens and reports of dens; these need to be verified.
- Survey for rattlesnakes in the western and northern part of the state to determine presence and abundance of populations.

Monitoring:

- Monitor existing sites to determine status of population and any changes to habitat. Long-term presence/absence data exists for many sites; continue to monitor these sites.

Coordination:

- Work with forest landowners (private and National and State Parks, Mead WestVaco Research Forest) to reduce or eliminate activities that may be detrimental to Timber Rattlesnake sites. This includes determining buffer zones around den and basking sites and encouraging the use of Best Management Practices when timbering and other site related issues pertaining to habitat loss and forestland management.
- Coordinate with private landowners under the Landowner Incentive Program.

Education:

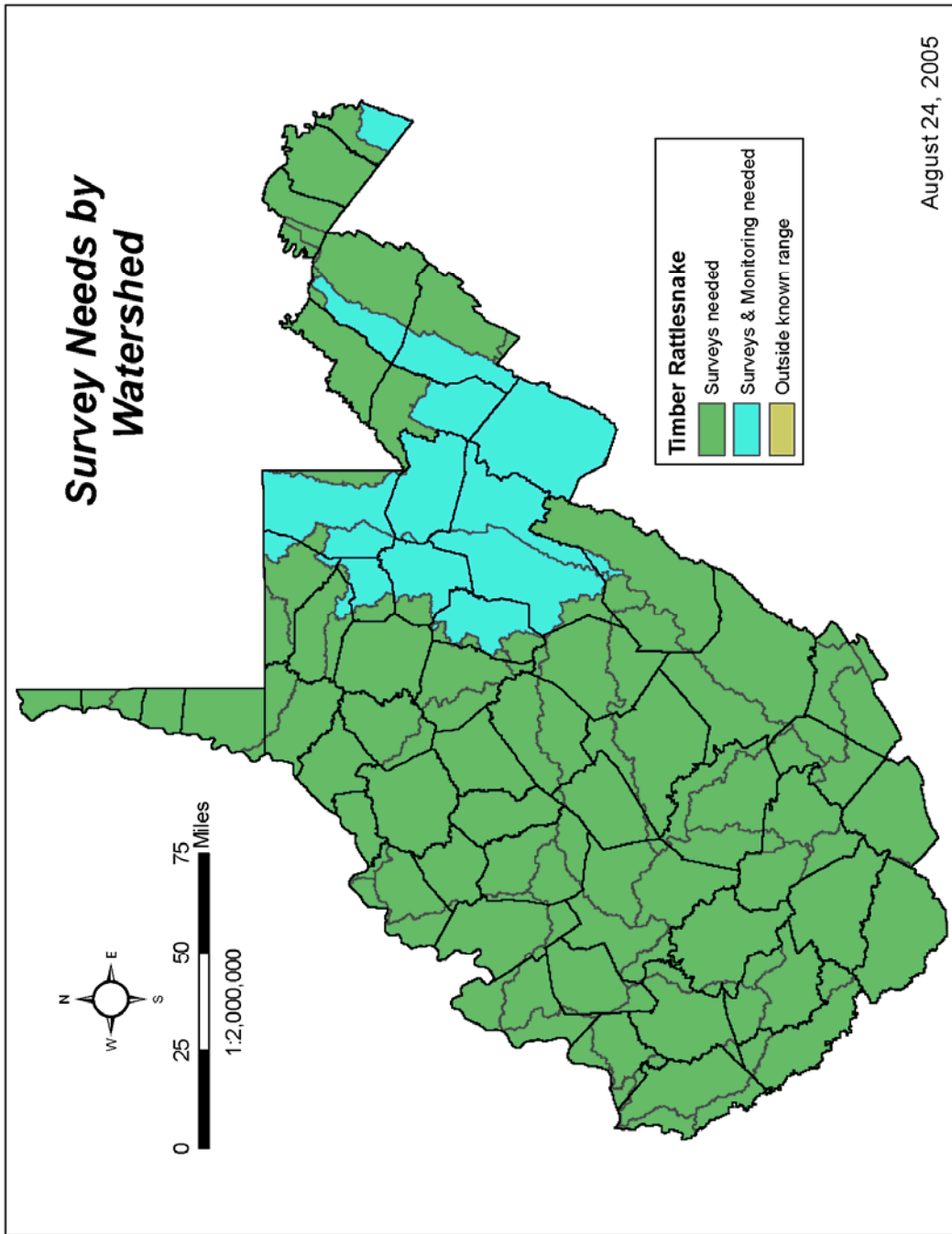
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Timber Rattlesnake sites.
- Educate citizens and state personnel on the importance of rattlesnakes and discourage senseless killing and hunting of snakes.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.
- Develop and introduce legislation to restrict rattlesnake round-ups in West Virginia.
- Enforce existing regulations on National Forests.

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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Reptiles

Common name: Eastern Six-lined Racerunner

Scientific name: *Aspidoscelis sexlineata*

STATUS

The ranks and information in the chart below indicate the rarity of the Eastern Six-lined Racerunner in West Virginia. It is listed as rare and in need of conservation because it is known from only one site in the state and it was not found until 1999. It is common in surrounding states and, with further survey, this species should be found in appropriate habitat.

Priority group	Global rank	State rank	Trend
1*	G5	S1	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table describes the single known occurrence of the Eastern Six-lined Racerunner by placing it into a watershed, giving the age of the record (recent is within 20 years) and indicating whether the site is under public or private ownership.

Habitat: Racerunners inhabit open forests and open areas such as fields and rocky outcrops. They are most frequently encountered in these habitats where loose soil and sand are found. West Virginia's single site is along a railroad on a shaley outcrop with sparse scrub vegetation.

Watershed	Site Name	Record Type	Ownership
Cacapon River	Randolph Tunnel	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Eastern Six-lined Racerunner. Because there is only one site and inadequate information on the distribution and status of the Eastern Six-line Racerunner in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Eastern Six-lined Racerunner.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data will be compiled into the database with coordinates.	Complete the WV Herpetological Atlas.
	Public access to general snake information.	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> . Provide general Six-lined Racerunner data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	New sites need to be surveyed.	Survey North Fork Mountain. Other dry ridge tops in the Eastern Panhandle with appropriate habitat should be surveyed.

Category	Need	Action
Monitoring	Long-term monitoring.	Revisit Randolph Tunnel on a 1-2 year basis to determine extent of population.

Category	Need	Action
Research	Life history.	Coordinate projects with researchers and/or contractors. All WV natural history data is needed for this species.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Eastern Six-lined Racerunner and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE EASTERN SIX-LINED RACERUNNER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Complete the WV Herpetological Atlas.

Surveys:

- Survey North Fork Mountain. Other dry ridge tops in the Eastern Panhandle with appropriate habitat should be surveyed.

Monitoring:

- Revisit Randolph Tunnel on a 1-2 year basis to determine extent of population.

Coordination:

- Coordinate with railroad personnel to maintain current population, mitigate threats and possibly survey for other populations on their land.
- Coordinate with private landowners under the Landowner Incentive Program.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Six-lined Racerunner sites.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

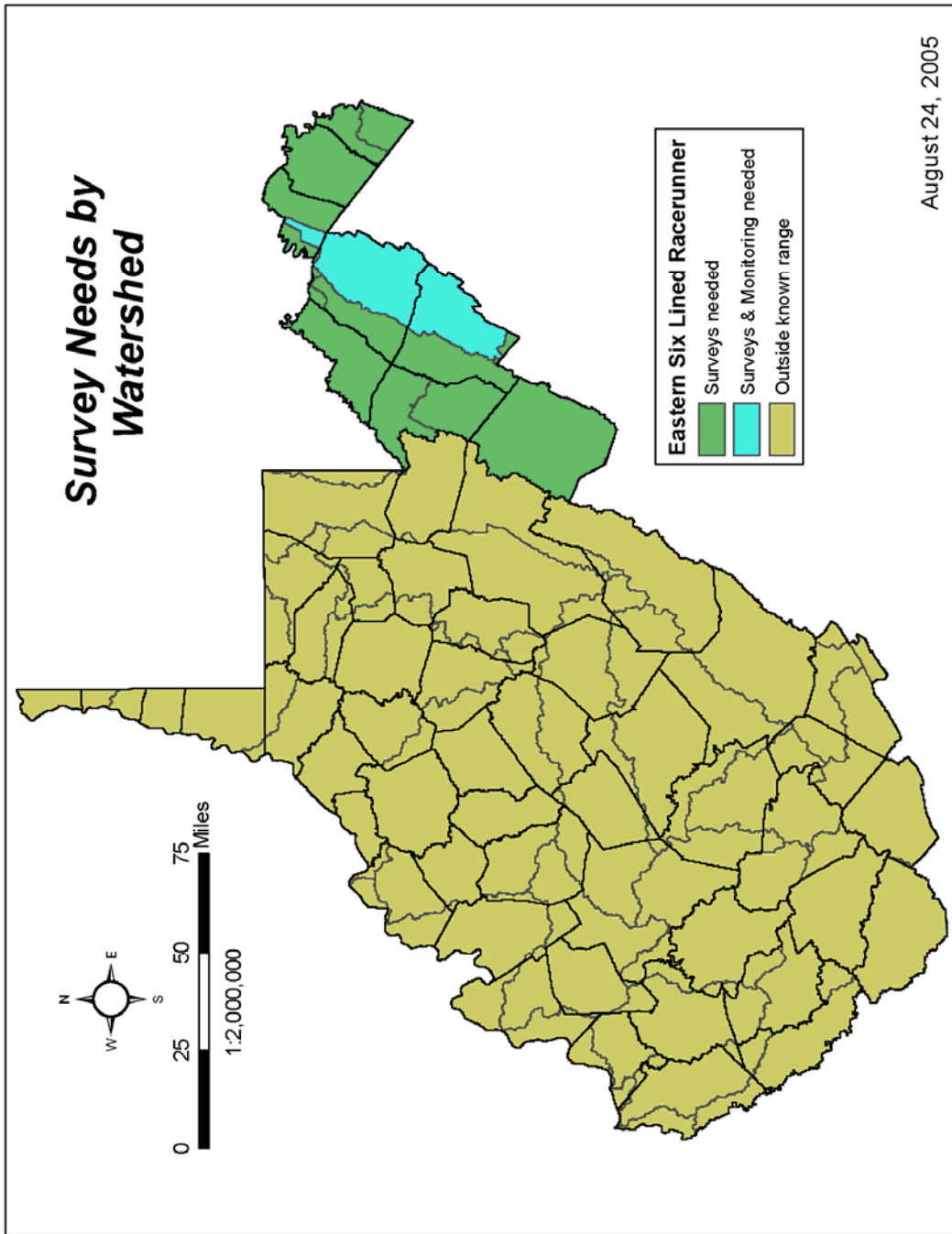
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West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Reptiles

Common name: Midland Smooth Softshell Turtle

Scientific name: *Apalone mutica mutica*

STATUS

The ranks and information in the chart below indicate the rarity of the Midland Smooth Softshell in West Virginia. This species is listed as rare and in need of conservation because there have been only two sightings since the first sighting in the Little Kanawha over 35 years ago. It is a species of concern in most states where it is found.

Priority Group	Global Rank	State Rank	Trend
1*	G5T5	S1	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Midland Smooth Softshell into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether the sites are under public or private ownership.

Habitat: Softshell turtles are strictly aquatic and are found on land only when depositing eggs. They like shallow or deep water. The Midland Smooth Softshell seems to prefer streams with sand bottoms and swift current.

Watershed	Site Name	Record Type	Ownership
Lower Kanawha	Tenmile Creek	Historic	Private
Lower Ohio Valley	Ohio River- Robert C. Byrd Locks and Dams	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Midland Smooth Softshell Turtle. Because there is inadequate information on the distribution and status of this species in West Virginia, the first step in its conservation is to determine if a viable population of this species exists. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Midland Smooth Softshell Turtle.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled into a database with coordinates.	Complete the WV Herpetological Atlas.
	Public access to general turtle information.	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> . Provide general Smooth Softshell data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Status at historic sites needs to be determined.	Resurvey Ten-mile Creek.
	New sites need to be surveyed.	Tributaries of the Little Kanawha and mainstem were surveyed in 2000 but need to be surveyed again to target this species. Other rivers in the Little Kanawha watershed should be surveyed as well as the Kanawha and Ohio rivers.

Category	Need	Action
Monitoring	Long-term monitoring.	Captured turtles should be marked. Long-term monitoring sites should be established at known sites.

Category	Need	Action
Research	Life history.	Coordinate projects with researchers and/or contractors; all natural history data is needed for this species.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Midland Smooth Softshell Turtle and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Coordination , Education Management
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	Education
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE MIDLAND SMOOTH SOFTSHELL TURTLE AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Complete the WV Herpetological Atlas.

Surveys:

- Resurvey Tenmile Creek.
- Tributaries of the Little Kanawha and mainstem were surveyed in 2000 but need to be surveyed again to target this species. Other rivers in the Little Kanawha watershed should be surveyed as well as the Kanawha and Ohio rivers.

Coordination:

- Work with Corps of Engineers and other interested parties to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc.) in streams with Midland Smooth Softshell Turtles. Assess effects of possible dam construction on rivers and streams as projects arise.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc.) on Midland Smooth Softshell Turtle streams. Provide information to encourage anglers to release Midland Smooth Softshell Turtles and report their locations.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

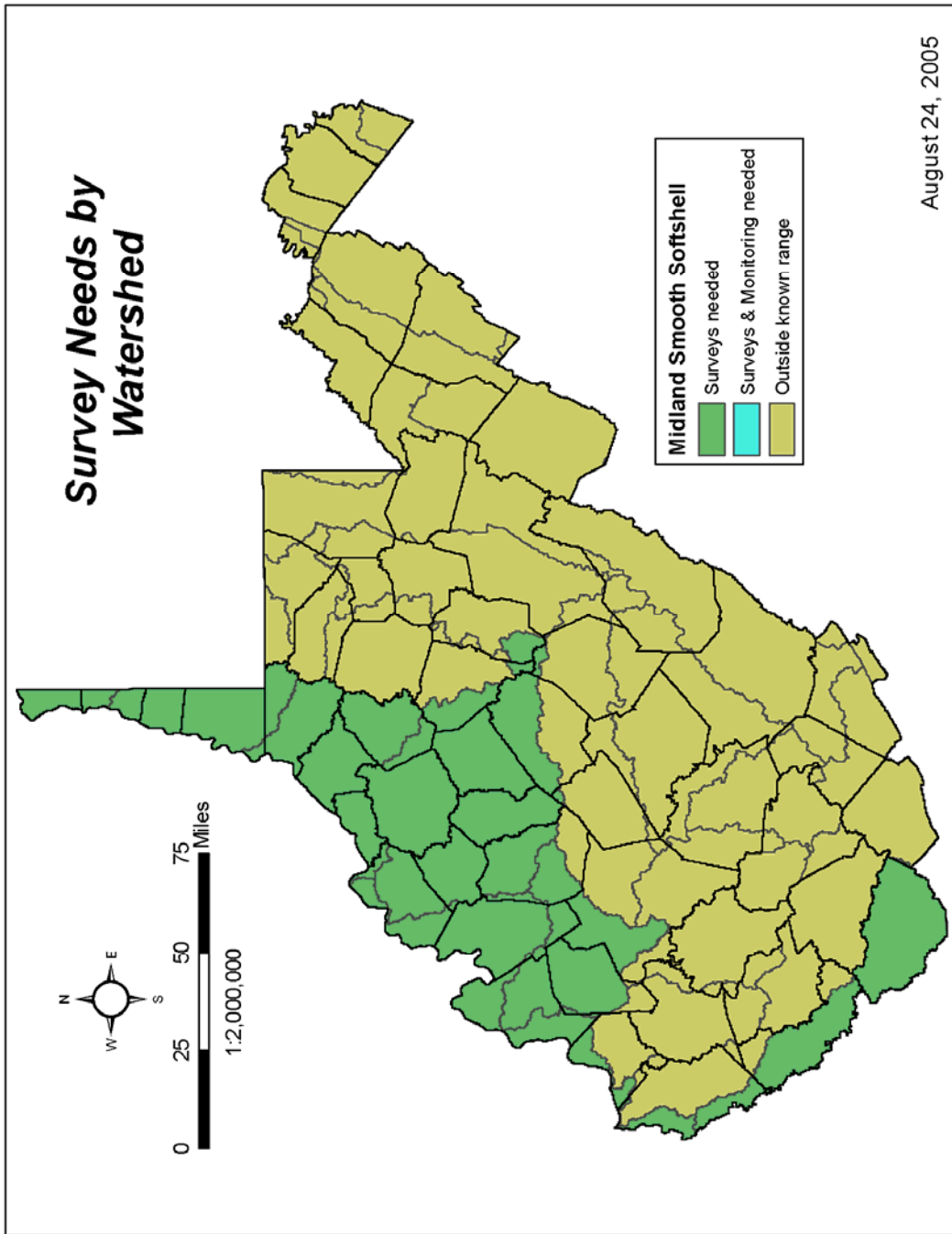
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West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.



This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Reptiles

Common name: Spotted Turtle

Scientific name: *Clemmys guttata*

STATUS

The ranks and information in the chart below indicate the rarity of the Spotted Turtle in West Virginia. This species is listed as rare and in need of conservation and many groups monitor its status. In West Virginia this species occurs in only a few sites, and these sites are threatened due to wetland draining and development in the Eastern Panhandle. The Spotted Turtle is considered a species of concern in almost every state in which it occurs.

Priority Group	Global Rank	State Rank	IUCN Rank	NE Tech Comm	Trend
1*	G5*	S1	VU A1cd+2cd	X	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places records into watersheds and describes the ownership and the ages (recent is within 20 years) of the records. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. Due to the sensitive nature of this species and the threat of collection, site names are not given.

Habitat: Spotted Turtles are found in the shallow, quieter waters of ponds, wet meadows and small streams.

Watershed	Record Type	Ownership
Cacapon	Recent	Public
Potomac	Recent Historic	Public/Private
Shenandoah	Recent Historic	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Spotted Turtle. Surveys have been conducted in recent years for this species and while more sites may exist, monitoring is the next step to conserve this species in West Virginia. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Spotted Turtle.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled into the database with coordinates.	Complete the WV Herpetological Atlas.
	Public access to general turtle information.	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> . Provide general Spotted Turtle data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Status at historic sites needs to be determined.	Historic sites have been visited with no turtles found; however some sites appear to have some marginal habitat left and all sites should be thoroughly surveyed again.
	Surveys of new sites.	Identify potential sites adjacent to nearby existing sites. Willing private landowners with appropriate habitat should be contacted for surveys. Sites throughout Morgan County with appropriate habitat should be surveyed.

Category	Need	Action
Monitoring	Long-term monitoring.	Visit 2 to 3 current sites every year, alternating sites each year. Record any habitat changes.
	Monitor habitat.	Visit sites to determine habitat changes at reasonable intervals. If impacts occur, survey for species.

Category	Need	Action
Research	Determine nesting sites at existing sites.	Conduct a radio-telemetry project for the last of 3 of the known sites (2 have been done) by coordinating with turtle researchers or actively seek contractors.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Spotted Turtle and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Coordination, Education
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE SPOTTED TURTLE AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Complete the WV Herpetological Atlas.

Surveys:

- Historic sites have been visited with no turtles found; however some sites appear to have some marginal habitat left and all sites should be thoroughly surveyed again.
- Determine new sites adjacent to nearby existing sites. Willing private landowners with appropriate habitat should be contacted for surveys. Sites throughout Morgan County with appropriate habitat should be surveyed.

Monitoring:

- Visit 2 to 3 current sites every year, alternating sites each year. Record any habitat changes.
- Visit sites to determine habitat changes at reasonable intervals. If impacts occur, survey for species.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in wetlands with Spotted Turtles.
- Habitat loss due to development is a severe problem for this species and Best Management Practices need to be followed by working with developers.

Education:

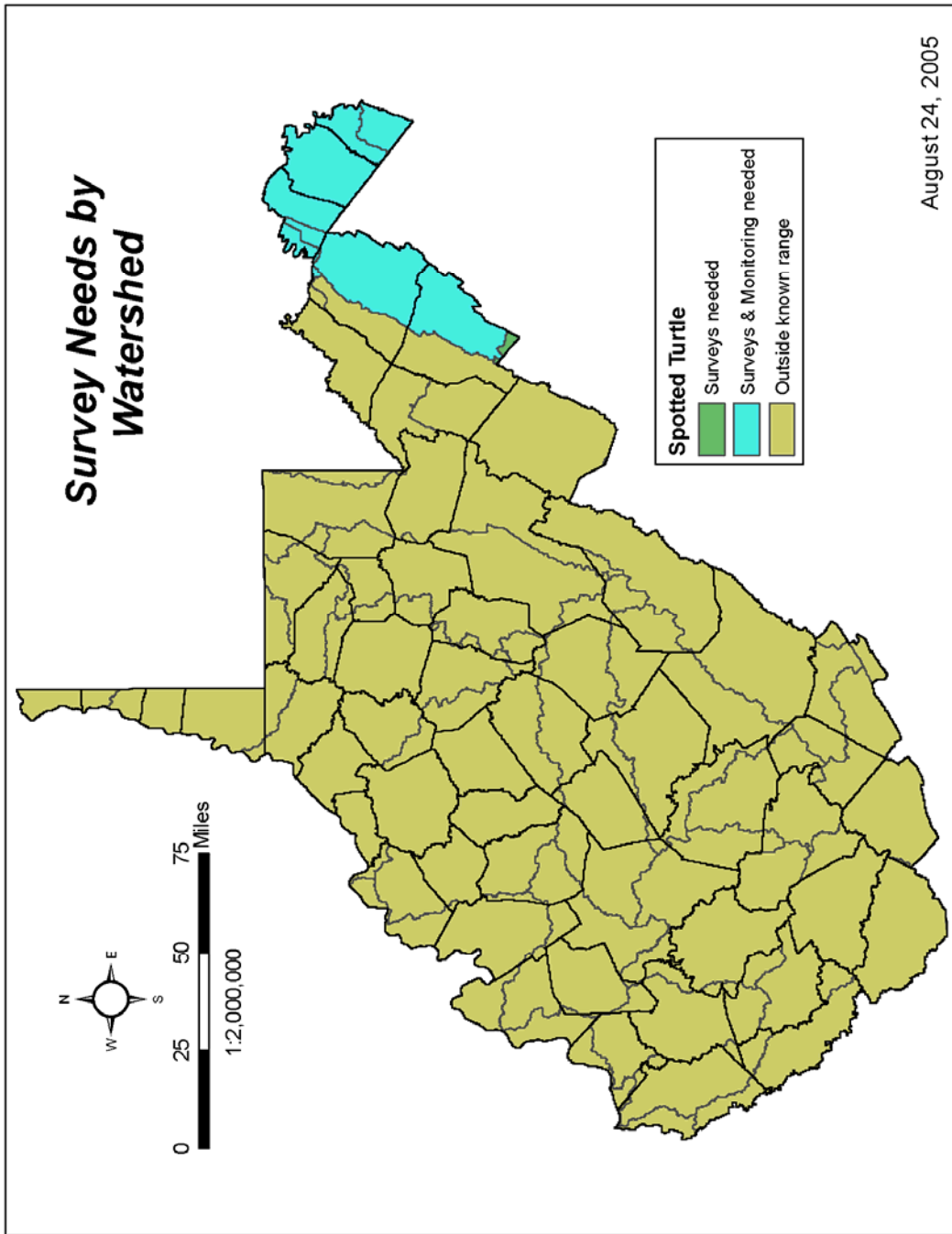
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Spotted Turtle sites.
- Educate landowners to protect turtle sites (ponds, marshes, etc.) on their property and the importance of wetlands and vernal pools.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

- Breisch, Ariana. 2003. *Information on the Distribution of the Spotted Turtle and Wood Turtle in West Virginia*. Report to WVDNR Wildlife Diversity Cooperative / Research Program. Elkins, WV.
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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Reptiles
Common name: Wood Turtle
Scientific name: *Glyptemys insculpta*

STATUS

The ranks and information in the chart below indicate the rarity of the Wood Turtle in West Virginia. This species is listed as rare and in need of conservation and its status is monitored by many groups. In West Virginia its habitat is threatened due to wetland draining and development in the Eastern Panhandle. Wood Turtles are considered species of concern in almost every state in which they occur.

Priority Group	Global Rank	State Rank	IUCN Rank	CITES	NE Tech Comm	Trend
1*	G4	S2	VU A1abcd+2cd	App II	X	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the group.

LOCATION, RECORD STATUS AND HABITAT

The following table places records into watersheds and describes the ownership and the ages (recent is within 20 years) of the records. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. Due to the sensitive nature of this species and the threat of collection, site names are not given.

Habitat: Wood Turtles spend the winter in streams, but are mostly terrestrial during the summer.

Watershed	Record Type	Ownership
Cacapon	Recent Historic	Public/ Private
North Branch Potomac	Recent	Private
Potomac	Recent Historic	Private
South Branch Potomac	Recent Historic	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Wood Turtle. Surveys have been conducted in recent years for this species and while more sites may exist, monitoring is the next step to conserve this species in West Virginia. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Wood Turtle.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Data sharing among groups.	Researchers (MD, VA, WV, PA, NY) and WVDNR and GW Nat'l Forest personnel need to share data. Continue with Wood Turtle Conservation Action Plan.
	All existing location and biological data need to be compiled into a database with coordinates.	Publish the WV Herpetological Atlas.
	Public access to general wood turtle information.	Complete 2 nd edition of <i>Amphibians and Reptiles of West Virginia</i> . Provide general Wood Turtle data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Status at historic sites needs to be determined.	Surveys should be conducted with priority given to sites in which the habitat could have been altered since the species was documented.
	Extent of potential habitat for recent occurrence needs to be determined.	Conduct detailed habitat documentation along with surveys in all current creeks to delineate population.
	Surveys of new sites.	Check tributaries of the Cacapon, South and North Forks of South Branch Potomac, North Branch Potomac and for other populations on the Potomac mainstem.

Category	Need	Action
Monitoring	Long-term monitoring.	Monitor existing sites to determine the status of the population and any changes to the habitat.

Category	Need	Action
Research	Life history.	Determine over-wintering sites by radio- telemetry studies.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Wood Turtle and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Coordination, Education
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE WOOD TURTLE AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Publish the WV Herpetological Atlas.

Surveys:

- Surveys should be conducted with priority given to sites in which the habitat could have been altered since the species was documented.
- Check tributaries of the Cacapon, South and North Forks of South Branch Potomac, North Branch Potomac and for other populations on the Potomac mainstem.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in wetlands with Wood Turtles.
- Coordinate with Forest Service to identify Best Management Practices to protect wood turtle sites on their land.
- Habitat loss due to development is a severe problem for this species and developers need to be encouraged to follow Best Management Practices when working.

Education:

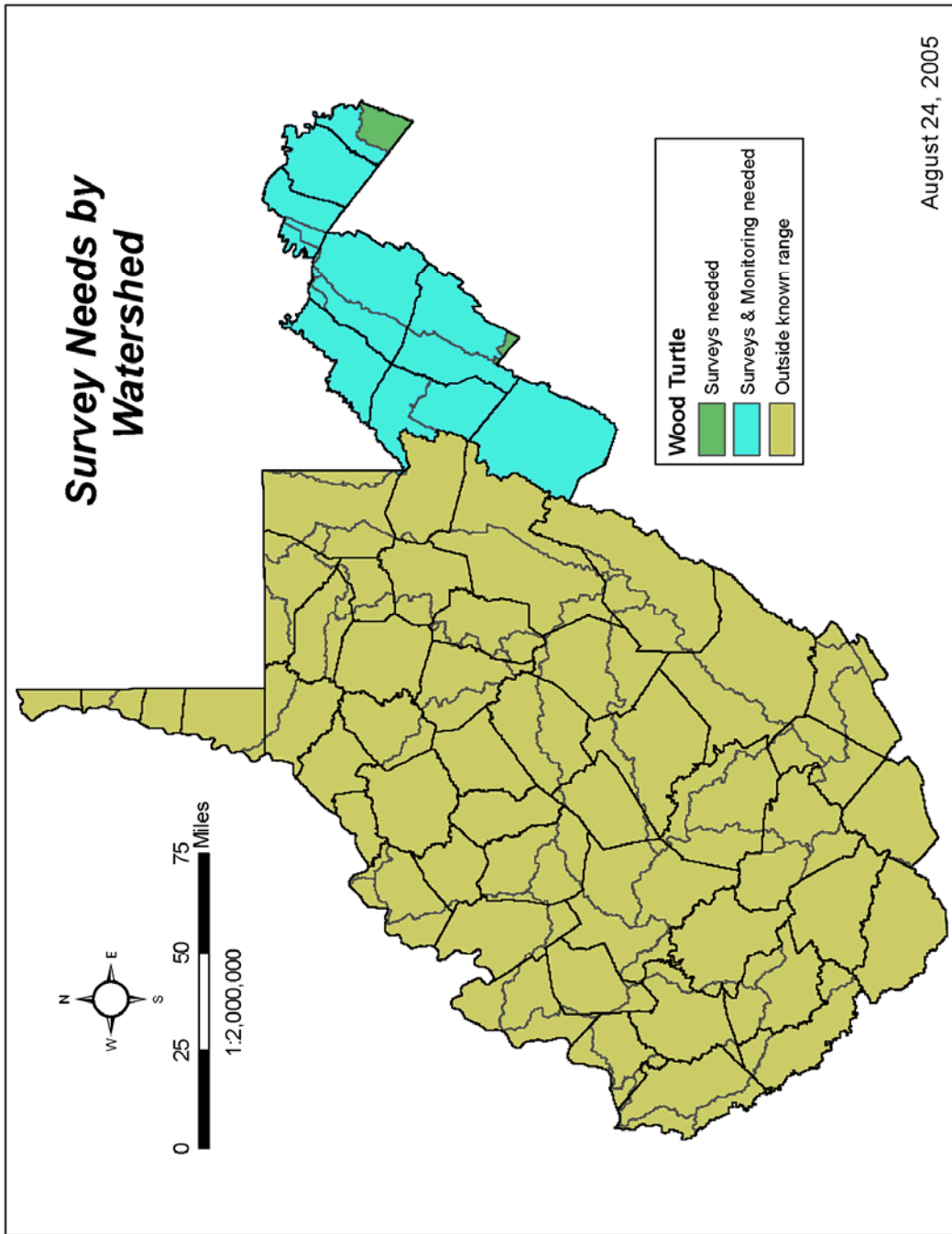
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Wood Turtle sites.
- Educate landowners to protect turtle sites (ponds, marshes, etc.) on their property and the importance of wetlands.
- Erect road signs warning motorists to avoid turtles in areas where Wood Turtles move from hibernation sites to foraging sites.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

- Breisch, Ariana. 2003. *Information on the Distribution of the Wood Turtle and Wood Turtle in West Virginia*. Report to WVDNR Wildlife Diversity Cooperative / Research Program. Elkins, WV.
- Green, N. B. and T. K. Pauley. 1987. *Amphibians and Reptiles in West Virginia*. University of Pittsburgh Press. 241 pp.
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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Amphibians

Common name: Blackbellied and Black Mountain Salamanders

Scientific name: *Desmognathus quadramaculatus* and *D. welteri*

STATUS

The ranks and information in the chart below indicate the rarity of the Blackbelly and the Black Mountain Salamanders in West Virginia. The Blackbelly is listed as rare and in need of conservation because it is only found in a small area in southern West Virginia where it reaches its northern range extension. The Black Mountain Salamander is only found in 4 states and it is monitored in three. The species was first reported from West Virginia by McCleary and Orr in 1987. Specimens from the West Virginia Biological Survey were re-analyzed and specimens originally classified as Northern Dusky Salamanders, *Desmognathus fuscus*, were actually Black Mountain Salamanders.

Species	Priority Group	Global Rank	State Rank	Trend
Black-bellied Salamander	2*	G5	S3	Stable
Black Mountain Salamander	2	G4	S1	Stable

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places records into watersheds and describes the ownership and the ages (recent is within 20 years) of the records. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. Due to the sensitive nature of this species and the threat of collection, site names are not given.

Habitat: Both salamanders favor swiftly flowing mountain streams with numerous boulders and waterfalls (with forested watersheds). They inhabit the rocky interface of the streambank and water where they find refuge and forage for prey.

Species	Watershed	Record Type	Ownership
Blackbelly Salamander	Gauley	Recent Historic	Private
	Greenbrier	Recent	Private
	James	Recent	Private/ Public
	Lower New	Recent Historic	Private/ Public
	Upper Kanawha	Recent Historic	Public
	Upper New	Recent Historic	Private/ Public
Black Mountain Salamander	Tug Fork	Recent	Private/ Public
	Upper Guyandotte	Recent Historic	Private/ Public
	Upper New	Recent	Private/ Public

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Blackbelly and the Black Mountain Salamanders. Because there is inadequate information on the distribution and status of the Blackbelly and the Black Mountain Salamanders in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Blackbelly and the Black Mountain Salamanders.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled into a database with coordinates.	Complete the WV Herpetological Atlas.
	Public access to general salamander information.	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> . Provide general Blackbelly and Black Mountain Salamander data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Status at historic sites needs to be determined.	Blackbelly- Many sites are historic, surveys need to be conducted with priority given to sites with potential habitat and most likely to support the species.
	New sites need to be surveyed.	Determine how far Blackbelly Salamanders occur up the Greenbrier River tributaries. Survey creeks in southwest Raleigh, Logan, Mingo, Boone and Mercer counties for the Black Mountain Salamander.

Category	Need	Action
Monitoring	Long-term monitoring station	Monitor 2-3 sites to document changes in the populations or habitat, and to monitor for any potential threats.

Category	Need	Action
Research	Blackbelly life history	Determine diet for adults and larvae.
	Extent of collection	Determine extent of collection of these species for fish bait.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Blackbelly and the Black Mountain Salamanders and their habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Education , Coordination, Management
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	Education
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE BLACKBELLY AND BLACK MOUNTAIN SALAMANDERS AND THEIR HABITATS

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Complete the WV Herpetological Atlas.
- Develop and implement standardized protocols, associated forms, databases, instruction and training.

Surveys:

- Many sites for the Blackbelly Salamander are historic; surveys need to be conducted with priority given to sites with potential habitat and most likely to support the species.
- Determine how far Blackbelly Salamanders occur up the Greenbrier River tributaries. Survey creeks in southwest Raleigh, Logan, Boone and Mercer counties for the Black Mountain Salamander.

Coordination:

- Coordinate with National Park Service, State Parks and State Forest staff to preserve salamander streams by encouraging use of Best Management Practices when timbering, filling in streams and other site related issues.
- Mitigate against impacts of mining and other development activities in the vicinity of *Desmognathus* streams.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality, such as the filling of first and second order streams.
- Provide information to encourage anglers to limit their collection of salamanders for fish bait in the areas where these species occur.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

Felix, Z. and T.K. Pauley. 2002. Dietary habits of *Desmognathus welteri* and a comparison with sympatric *Desmognathus monticola*. Herpetological Natural History (In Press).

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Pauley, Tom. 2005. Personal Communication. Marshall University, Huntington, WV.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.

Taxa: Amphibians

Common name: Cave Salamander

Scientific name: *Eurycea lucifuga*

STATUS

The ranks and information in the chart below indicate the rarity of the Cave Salamander in West Virginia. This species is listed as rare and in need of conservation due to the sensitive nature of its habitat. The Cave Salamander is considered a species of concern in many states in which it occurs.

Priority group	Global Rank	State Rank	USFWS	Trend
2*	G5	S3	SC	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places records into watersheds and describes the ownership and the ages of the records. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species. Due to the sensitive nature of this species and the threat of collection, site names are not given.

Habitat: The Cave Salamander is most often found in limestone caves, usually near the mouth or in the twilight zone. It may also occur outside of caves, where it hides under logs or other objects during the day. Eggs are laid in pools, springs or streams within caves, or streams outside of caves.

Watershed	Record Type	Ownership
Greenbrier	Recent Historic	Private
Lower New	Recent	Public
Upper New	Recent Historic	Private/ Public

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Cave Salamander. There are many caves in West Virginia known to have Cave Salamander occurrences. Further surveys are needed to fill in the distribution holes but monitoring is the next step in the conservation of this species in West Virginia. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Cave Salamander.

Category	Need	Activity
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled into the database with coordinates.	Complete the WV Herpetological Atlas.
	Public access to general salamander information.	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> .
		Provide general Cave Salamander data, such as distribution maps, on the internet.

Category	Need	Activity
Surveys	Status at historic sites needs to be determined.	Visit historic sites to determine if appropriate habitat still exists; if so, survey for species.
	New sites need to be determined.	Survey caves and adjacent areas to locate new sites for the Cave Salamander; also survey abandoned coal mines.

Category	Need	Activity
Monitoring	Monitoring of existing sites.	Monitor several existing sites throughout this species' range every 2-3 years to determine population status and any changes to habitat.

Category	Need	Activity
Research	Cave studies	Conduct research projects on water quality effects on salamander populations and other cave species.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Cave Salamander and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Education, Coordination , Management
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	Education
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE CAVE SALAMANDER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Complete the WV Herpetological Atlas.

Surveys:

- Visit historic sites to determine if appropriate habitat still exists; if so, survey for the species.

Monitoring:

- Monitor several of the existing sites throughout its range every 2-3 years to determine population status and any changes to habitat.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to caves. All forestry, mining, highway, etc. practices can affect the water quality (sedimentation, nutrient loading, pollution, etc.) of cave streams.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Cave Salamander caves.
- Educate spelunkers about the importance of not disturbing Cave Salamanders or their eggs while exploring caves.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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Green, N. B. and T. K. Pauley. 1987. *Amphibians and Reptiles in West Virginia*. University of Pittsburgh Press. 241 pp.

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Taxa: Amphibians

Common name: Jefferson Salamander

Scientific name: *Ambystoma jeffersonianum*

STATUS

The ranks and information in the chart below indicate the rarity of the Jefferson Salamander in West Virginia. This species is listed as rare and in need of conservation in West Virginia due to the high number of historic records throughout the state. The Jefferson Salamander is considered a species of concern in almost every state in which it occurs.

Priority Group	Global Rank	State Rank	NE Tech Comm	Trend
2	G5	S3	X	Stable

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of Jefferson Salamanders into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether the sites are under public or private ownership.

Habitat: Jefferson Salamander adults spend most of their lives underground or in stacks of wet leaves where they frequently aggregate in sizeable numbers. Some have been reported from caves. They are most frequently observed during early spring when they leave their underground burrows and move in mass migrations to the breeding pools.

Watershed	Site Name	Record Type	Ownership
Elk	Big Run	Recent	Public
Greenbrier	Lost World Cave	Historic	Private
	Organ Cave	Historic	Private
	Droop Mountain	Historic	Public
Little Kanawha	Spring Heights Education Center	Recent	Private
Lower New	McKendree Hospital Site	Recent	Private
Lower Ohio Valley	Green Bottom Swamp	Recent	Public
	Moose Lodge Wetland	Recent	Private
North Branch Potomac	Gerstell	Historic	Private
	Keyser - West	Historic	Private

Watershed	Site Name	Record Type	Ownership
Potomac	Morgans Grove	Historic	Private
	Sleepy Creek WMA	Historic	Public
South Branch Potomac	Romney-South	Recent	Private
	Old Fields-West	Historic	Private
	Hellhole Cave	Historic	Private
	Romney	Recent	Public
Tug Fork	Big Creek Hollow-Newhall	Historic	Private
Twelve Pole Creek	Beech Fork Lake	Recent	Public
Upper New	Bluestone River	Recent	Public
Upper New	New River Gorge National River	Recent	Public
	Salt Sulphur Springs	Historic	Private
	Brush Creek-Gardner Junction	Recent	Private
	Concord College	Historic	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Jefferson Salamander. Many surveys have been conducted for this species in West Virginia but over half of these records are pre-1980. The first step in their conservation is to determine if the Jefferson Salamander is present in these areas. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Jefferson Salamander.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data compiled into a database with coordinates	Complete the WV Herpetological Atlas.
	Public access to general salamander information.	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> . Provide general Jefferson Salamander data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Status at historic sites.	A very high percentage of sites are historic- surveys need to be conducted with priority given to sites with potential habitat and most likely to support the species.
	New sites need to be surveyed.	This animal is found statewide – prioritize areas and opportunistically search for Jeffersons when studying other species; survey Northern Panhandle, Mingo, Wyoming and McDowell counties.

Category	Need	Action
Monitoring	Long-term monitoring.	Monitor Moose Lodge in Mason County wetland due to the high diversity of Ambystomid species.
	Monitor habitat.	Visit sites to determine habitat changes as appropriate; if impacts occur, survey for species.

Category	Need	Action
Research	Interactions with other Ambystomid species.	A detailed study at a wetland where all species occur is being conducted at the present.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Jefferson Salamander and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Coordination , Education
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE JEFFERSON SALAMANDER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Complete the WV Herpetological Atlas.

Surveys:

- A very high percentage of sites are historic- surveys need to be conducted with priority given to sites with potential habitat and most likely to harbor the species.
- This animal is found statewide – prioritize areas and opportunistically search for Jefferson's when studying other species; survey Northern panhandle, Mingo, Wyoming and McDowell counties.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in wetlands with Jefferson Salamanders. Encourage use of Best Management Practices when timbering and other site related issues that pertain to habitat loss and forestland management.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Jefferson Salamander sites.
- Educate motorists by constructing road signs at known occurrences warning of salamanders moving across the road to get to breeding sites.
- Educate landowners to protect salamander sites (ponds, marshes, etc.) on their property and the importance of wetlands and vernal pools.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation from FOIA requests.

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West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.

Taxa: Amphibians
Common name: Leopard Frog
Scientific name: *Rana pipiens*

STATUS

The ranks and information in the chart below indicate the rarity of the Leopard Frog in West Virginia. This species is listed as rare and in need of conservation because it appears to be declining rangewide and there are very few sites in the state. West Virginia is also on the southern edge of its eastern range.

Priority Group	Global Rank	State Rank	NE Tech Comm	Trend
2*	G5	S2	X	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places occurrences of the Leopard Frog into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether the sites are under public or private ownership.

Habitat: The Leopard Frog utilizes a wide variety of aquatic habitats including swamps, ponds, lakes, marshes, rivers and creeks. During the summer it may venture far from water into fields, meadows, pastures and occasionally into wooded areas.

Watershed	Site Name	Record Type	Ownership
Lower Ohio Valley	Green Bottom Swamp	Recent	Public
	Huntington-Ritter Park	Historic	Public
	Ashton Wetland-Rt. 2	Recent	Private
Middle Ohio Valley	Conaway Run Lake	Historic	Public
Little Kanawha	North Bend State Park	Recent	Public
Potomac	North Mountain	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Leopard Frog. Because there is inadequate information on the distribution and status of this species in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Leopard Frog.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data will be compiled into a database with coordinates.	Complete the WV Herpetological Atlas.
	Public access to general frog information.	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> .
		Provide general Leopard Frog data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Historic sites need to be surveyed.	Survey known areas to determine if appropriate habitat is still present.
	New sites need to be surveyed.	Verify reports of Leopard Frogs in Tucker County and survey more of the Eastern Panhandle.

Category	Need	Action
Monitoring	Long-term monitoring.	Monitor existing sites to determine status of populations and any changes to habitat. Monitor Green Bottom Swamp and Berkeley County site on a regular basis.

Category	Need	Action
Research	A life history study was recently completed.	Update life history data as needed.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Leopard Frog and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Coordination , Education
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE LEOPARD FROG AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Complete the WV Herpetological Atlas.

Surveys:

- Survey known areas to determine if appropriate habitat is still present.
- Verify reports of Leopard Frogs in Tucker County and survey more of the Eastern Panhandle.

Monitoring:

- Monitor existing sites to determine status of populations and any changes to the habitat. Monitor Green Bottom Swamp and Berkeley County sites on a regular basis.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc.) in wetlands with Leopard Frogs. Encourage use of Best Management Practices when farming, or engaged in other activities that might impact habitat or water quality.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Leopard Frog sites.
- Educate landowners to protect Leopard Frog sites (ponds, marshes, etc.) on their property and the importance of wetlands and vernal pools.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

Green, N. B. and T. K. Pauley. 1987. *Amphibians and Reptiles in West Virginia*. University of Pittsburgh Press. 241 pp.

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West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.

Taxa: Reptiles

Common name: Northern Map Turtle

Scientific name: *Graptemys geographica*

STATUS

The ranks and information in the chart below indicate the rarity of the Northern Map Turtle in West Virginia. This species is listed as rare and in need of conservation because, while it appears to be stable on the Kanawha River and its tributaries, it is still a rare turtle in other areas with only historic records to mark its distribution.

Priority Group	Global Rank	State Rank	Trend
2*	G5	S2	Stable

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Northern Map Turtle into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether the sites are under public or private ownership.

Habitat: The Northern Map Turtle usually prefers large, slow-moving, or quiet bodies of water with aquatic vegetation, a soft bottom and large logs for basking. They will also move up into smaller creeks.

Watershed	Site Name	Record Type	Ownership
Cheat	Cheat Lake	Historic	Private
Little Kanawha	Little Kanawha River - Palestine Fish Hatchery	Recent	Private
Lower Kanawha	Bills Creek	Historic	Private
	Tenmile Creek	Historic	Private
	Kanawha River	Recent	Private
	Crooked Creek	Recent	Private
Lower Ohio Valley	Huntington	Historic	Private
Middle Ohio Valley	Point Pleasant	Historic	Private
West Fork	Jackson's Mill	Historic	Private
Gauley	Gauley River	Recent	Public

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Northern Map Turtle. Because there is inadequate information on the distribution and status of its species in West Virginia, the first step in its conservation is to gain a better understanding of their distribution, habitat requirements and status. **Bolded** text indicates primary actions required to identify conservation needs of the Northern Map Turtle.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled into database with coordinates.	Complete the WV Herpetological Atlas.
	Public access to general salamander information.	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> . Provide general Northern Map Turtle data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Historic sites need to be surveyed.	Visit all rivers with historic records.
	New sites need to be surveyed.	Survey the Ohio River and its tributaries. Fill data gaps from the northern to the southwestern part of the state.

Category	Need	Action
Monitoring	Long-term monitoring.	Monitor the Kanawha River sites to track the status of the population and any changes to the habitat.

Category	Need	Action
Research	Determine why southern populations are drastically declining.	Conduct detailed habitat analysis of all sites and coordinate with researchers.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Northern Map Turtle and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Coordination , Education Management
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	Education
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE NORTHERN MAP TURTLE AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Complete a WV Herpetological Atlas.

Surveys:

- Visit all rivers with historic records.
- Survey the Ohio River and its tributaries. Fill data gaps from the northern to the southwestern part of the state.

Monitoring:

- Monitor the Kanawha River sites to determine the status of the population and any changes to the habitat.

Coordination:

- Work with the Corps of Engineers and other interested parties to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc) in streams with Northern Map Turtles. Assess effects of possible dam construction on rivers and streams as projects arise.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) on Northern Map Turtle streams. Provide information to encourage anglers to release Northern Map Turtles and report their locations.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

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Taxa: Amphibians

Common name: Northern Red Salamander

Scientific name: *Pseudotriton ruber ruber*

STATUS

The ranks and information in the chart below indicate the rarity of the Northern Red Salamander in West Virginia. The Northern Red Salamander is listed as rare and in need of conservation because it may be declining in the state and many records are historic.

Priority group	Global Rank	State Rank	Trend
2*	G5	S3	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places records into watersheds and describes the ownership and the ages (recent is within 20 years) of the records.

Habitat: The Northern Red Salamander occurs in small streams or springs. It may also be found near water in open or wooded areas, often under logs, damp leaf litter, moss, etc.

Watershed	Site Name	Record Type	Ownership
Cacapon	Camp Branch	Historic	Private
Cheat	Camp Dawson – 3 Sites	Recent	Public
	Rt.72	Historic	Private
	Briery Mountain WMA	Recent	Public
	Olson Lookout Tower	Recent	Public
	Fernow Experimental Forest	Recent	Public
Coal	Danville	No date	Private
Gauley	Route 19 Bridge	Recent	Public
	Mount Lookout	Historic	Private
	Camp Woodbine	Historic	Public
	Camden On Gauley-West	Historic	Private

Watershed	Site Name	Record Type	Ownership
Greenbrier	House Cave	Historic	Private
	Organ Cave	Historic	Private
	Overholt Blowing Cave	Historic	Private
	Paddy Knob	Historic	Public
	Shock Run	Recent	Private
	Green Bank	Historic	Private
Little Kanawha	North Bend State Park	Recent	Public
	Parkersburg	Historic	Private
	Simms Run	Historic	Private
	Linden-East	Historic	Private
	Grantsville	Historic	Private
Lower Guyandotte	Ranger	Historic	Private
	Chapmanville High School	Historic	Public
Lower Kanawha	Hometown-East	Historic	Private
	Cedar Creek State Park	Historic	Public
	Charleston	Historic	Private
Lower New	Fayetteville	Historic	Private
	Kaymoor	Recent	Public
	Ames Heights-West	Recent	Public
	Camp Beckwith 4-H Camp	Historic	Private
	Kates Branch	Recent	Public
Middle Ohio River Valley	Point Pleasant	Historic	Private
	Mill Creek	Historic	Private
	Varner	Historic	Private
	Center Point	No date	Private

Watershed	Site Name	Record Type	Ownership
Monongahela River	Greer-Southeast	Historic	Private
North Branch Potomac River	Rt.50	Historic	Private
Potomac River	Sleepy Creek WMA - 2 Sites	Recent	Public
	Big Run	Historic	Private
South Branch Potomac River	Romney	Historic	Private
	South Branch Potomac River	Historic	Private
	Moorefield-West	Historic	Private
	Bass	Historic	Private
	Judy Gap	Historic	Private
Tug Fork River	Jenkinsjones	Historic	Private
Tygart Valley River	Elkins	Historic	Private
	Elkwater	Historic	Private
	Montrose	Recent	Private
	Montrose-South	Recent	Private
	Crystal Springs	Historic	Private
	Laurel Mountain Road	Historic	Private
	Right Fork Chenoweth Creek	Recent	Private
	Little Elliotts Ridge	Recent	Private
	French Creek	Historic	Private

Watershed	Site Name	Record Type	Ownership
Upper Guyandotte River	Pineville	Historic	Private
	Accoville	Historic	Private
Upper Kanawha River	Dupont High School	Historic	Public
Upper New River	Toms Run-Bluestone WMA	Recent	Public
	Tate Lohr Hatchery	Recent	Public
Upper Ohio River Valley	Sherrad	Recent	Private
Youghiogheny River	Cranesville Swamp	Historic	Private
	Terra Alta Biological Station	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Northern Red Salamander. Many surveys have been conducted for this species in West Virginia but over half of these records are pre-1980. The first step in their conservation is to determine if the Northern Red Salamander is present in these areas. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Northern Red Salamander.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data compiled into a database with coordinates.	Complete the WV Herpetological Atlas.
	Public access to general salamander information	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> .
		Provide general Northern Red Salamander data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	New sites need to be surveyed.	Survey for larvae. Survey for this species while surveying for other amphibians and reptiles.
	Historic sites need to be revisited.	Visit historic sites to determine if appropriate habitat still exists. If so, survey to determine if the salamander is still present.

Category	Need	Action
Monitoring	Monitor existing sites.	Monitor existing sites to determine status of population and any changes to habitat. Survey the site in Preston County.

Category	Need	Action
Research	All life history aspects pertaining to WV populations, especially habitat requirements.	Conduct life history study at the Preston County site.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Northern Red Salamander and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	Coordination , Education
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE NORTHERN RED SALAMANDER AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Complete the WV Herpetological Atlas.

Surveys:

- Survey for larvae. Survey for this species while surveying for other amphibians and reptiles.
- Visit historic sites to determine if appropriate habitat still exists. If so, survey to determine if the salamander is still present.

Research:

- Conduct life history study at the Preston County site.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc.) in wetlands with Northern Red Salamanders. Encourage use of Best Management Practices when timbering and other site related issues that pertain to habitat loss and forestland management.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Northern Red Salamander sites.
- Educate landowners to protect salamander sites (ponds, marshes, etc.) on their property and the importance of wetlands and vernal pools.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

- Green, N. B. and T. K. Pauley. 1987. *Amphibians and Reptiles in West Virginia*. University of Pittsburgh Press. 241 pp.
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- West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.

Taxa: Reptiles

Common name: Northern Red-bellied Cooter and River Cooter

Scientific name: *Pseudemys rubiventris* and *Pseudemys concinna*

STATUS

The ranks and information in the chart below indicate the rarity of the Northern Red-bellied and River Cooters in West Virginia. These species are listed as rare and in need of conservation because their status is unknown and records are scarce.

Species Name	Common Name	Priority group	Global Rank	State Rank	IUCN Rank	NE Tech Comm	Trend
<i>Pseudemys rubiventris</i>	Northern Red-bellied Cooter	2*	G5	S2	NT	X	Unknown
<i>Pseudemys concinna</i>	River Cooter	2	G5	S1S2			Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix 1 for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places records into watersheds and describes the ownership and the ages (recent is within 20 years) of the records. General habitat is also given.

Species	Watershed	Record Type	Habitat
Northern Red-bellied Cooter	Cacapon	Historic	Deep Ponds, Lakes, Streams and Rivers; In Swift or Slow-Moving Water
	Potomac	Recent Historic	
	Shenandoah	Recent	
	South Branch Potomac	Historic	
	Upper New	Historic	
River Cooter	Lower Kanawha	Historic	Quiet, Back-Waters Associated With Large, Open Bodies of Water
	Upper New	Historic	

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Northern Red-bellied and River Cooters. Because there is inadequate information on the distribution and status of these species in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. **Bolded** text indicates primary actions required to identify conservation needs of the Northern Red-bellied and River Cooter.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled into database with coordinates.	Complete the WV Herpetological Atlas.
	Public access to general turtle information.	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> . Provide general <i>Pseudemys</i> turtle data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Status at historic sites needs to be determined.	Prioritize rivers and streams to conduct surveys and inventories.
	Extent of potential habitat for recent occurrence needs to be determined.	Conduct detailed habitat documentation with surveys in all current creeks to delineate populations.
	New sites need to be determined.	Survey all Eastern Panhandle streams and rivers with suitable habitat for the Red-bellied Cooter. Conduct surveys for the River Cooter on the Bluestone, New, Greenbrier, Gauley, Kanawha, Little Kanawha and Elk rivers.

Category	Need	Action
Monitoring	Long-term monitoring station.	Determine best sites and monitor populations every 2-3 years. Also monitor to determine any changes to the habitat.

Category	Need	Action
Research	Survey methods.	River Cooters do not enter baited traps, additional survey methods need to be researched.
	Life history.	A study to determine nesting sites, movement, habitat requirements and other life history data for the Red-bellied Cooter will be completed in 2006. All life history aspects of the River Cooter need study.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Northern Red-bellied and River Cooters and their habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Coordination , Education Management
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	Education
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE NORTHERN RED-BELLIED COOTER AND RIVER COOTER AND THEIR HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Complete the WV Herpetological Atlas.

Surveys:

- Prioritize rivers and streams to conduct surveys.
- Survey all Eastern Panhandle streams and rivers with suitable habitat for the Red-bellied Cooter. Conduct surveys for the River Cooter on the Bluestone, New, Greenbrier, Gauley, Kanawha, Little Kanawha and Elk rivers.

Coordination:

- Work with Corps of Engineers, Park Service, and private landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, etc.) in streams and rivers with the Northern Red-bellied and River Cooters. Assess effects of possible dam construction on rivers and streams as projects arise.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc.) on Northern Red-bellied and River Cooter streams.
- Provide information to encourage anglers to release the Northern Red-bellied and River Cooters and report their locations.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

Green, N. B. and T. K. Pauley. 1987. *Amphibians and Reptiles in West Virginia*. University of Pittsburgh Press. 241 pp.

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Pauley, Tom. 2005. Personal Communication. Marshall University, Huntington, WV.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.

Taxa: Amphibians

Common name: Blanchard's and Eastern Cricket Frogs

Scientific name: *Acris crepitans blanchardi* and *Acris c. crepitans*

STATUS

The ranks and information in the chart below indicate the rarity of Cricket Frogs in West Virginia. The Blanchard Cricket Frog is listed as rare and in need of conservation because it is considered to be extirpated in West Virginia. It is a species of concern in many states in which it occurs. In recent years the Eastern Cricket Frog appears to be stable, following many years with little site documentation.

Species Name	Common Name	Priority Group	Global Rank	State Rank	Trend
<i>Acris crepitans blanchardi</i>	Blanchard's Cricket Frog	2*	G5T5	SH	Declining
<i>Acris crepitans crepitans</i>	Eastern Cricket Frog	2	G5T5	S2	Stable

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of Cricket Frogs into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether the sites are under public or private ownership.

Habitat: Both Cricket Frogs frequent aquatic vegetation around ponds, swamps and sluggish streams where they rest on algal mats or leaves of spatterdock. The Blanchard's Cricket Frog prefers the more open sandy or muddy edges of streams and ponds.

Species	Watershed	Site Name	Record Type	Ownership
Blanchard's Cricket Frog	Big Sandy	Kenova-SE	Historic	Private
	Elk	Indore	Historic	Private
	Lower Guyandotte	Myra - South	Historic	Private
	Lower Kanawha	Winfield	Historic	Private
	Lower Ohio Valley	Ashton - North	Historic	Private

Species	Watershed	Site Name	Record Type	Ownership
Eastern Cricket Frog	North Branch Potomac	Reeses Mill	Historic	Private
		Long Pasture Run	Historic	Private
		Burlington - N	Historic	Private
		Burlington	Historic	Private
		Patterson Creek	Historic	Private
	Potomac	Shanghai - South	Historic	Private
		Leetown	Historic	Public
		Lake Louise	Recent	Private
		Back Creek	Historic	Private
		Glengary - West	Historic	Private
		Back Creek	Recent	Private
		Shanghai Marsh	Recent	Private
	Potomac	Rt. 9 - Camp Frame Rd.	Recent	Private
		Elk Branch	Recent	Private
		Cherry Run - Sleepy Hollow Subdiv.	Historic	Private
		Sleepy Creek	Recent	Private
		Sleepy Creek WMA	Historic	Public
		Ganotown Marsh	Recent	Private
		Mills Gap	Recent	Private
		Pine Valley School	Recent	Private
Shenandoah	Altona Marsh	Historic	Private	
South Branch Potomac	Springfield	Historic	Private	

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the two Cricket Frog species in West Virginia. Because there is inadequate information on the distribution and status of these species in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Cricket Frogs.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data compiled into a database with coordinates.	Complete the WV Herpetological Atlas.
	Public access to general frog information.	Complete 2 nd edition of <i>West Virginia Reptiles and Amphibians</i> . Provide general Cricket Frog data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Historic sites need to be surveyed.	Historic areas were surveyed in 2001 with no frogs documented (except at Lake Louise for the Eastern Cricket Frog). Suitable habitat still exists and sites need to be visited again in appropriate weather conditions for both species.
	New sites need to be surveyed.	Eastern CF: Survey historic sites first. Next fill in data gaps throughout its range in the Eastern Panhandle. Blanchard's CF: Follow-up on a possible occurrence in McDowell County. Visit sites along the Ohio River floodplain.

Category	Need	Action
Monitoring	Long-term monitoring station.	Monitor 2-3 sites to document changes in the populations or habitat and to monitor any potential threats. If Blanchard's CF is found, monitor site.

Category	Need	Action
Research	Update life history as needed.	Life history studies have been conducted on the Eastern Cricket Frog. If Blanchard's CF is found, conduct life history studies.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Cricket Frogs and their habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Education , Coordination, Management
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	Education
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE BLANCHARD'S AND EASTERN CRICKET FROGS AND THEIR HABITATS

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Complete the WV Herpetological Atlas.

Surveys:

- For the Eastern Cricket Frog, survey historic sites. Fill data gaps throughout its range in the Eastern Panhandle. For the Blanchard's Cricket Frog, follow-up on a possible occurrence in McDowell County. Visit sites along the Ohio River floodplain.

Coordination:

- Work with landowners to reduce or eliminate activities that may lead to habitat loss, decreased water quality and impact wetland sites in any way for these species.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Cricket Frog sites.
- Educate landowners to identify possible Blanchard's Cricket Frog sites on their property by distributing frog call CDs to landowners in areas where there is a high potential for occurrence of the Blanchard's Cricket Frog.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

- Bayne, Kimberly. 2002. The Natural History and Distribution of the Eastern Cricket Frog, *Acris c. crepitans* in West Virginia. Unpublished thesis. Marshall University, Huntington, West Virginia.
- Dickson, Nancy. 2002. The Natural History and Possible Extirpation of Blanchard's cricket frog, *Acris crepitans blanchardi*, in West Virginia. Unpublished thesis. Marshall University, Huntington, West Virginia.
- Green, N. B. and T. K. Pauley. 1987. *Amphibians and Reptiles in West Virginia*. University of Pittsburgh Press. 241 pp.
- NatureServe. 2005. NatureServe Explorer: *An online encyclopedia of life* [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: April 13, 2005).
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- West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.

Taxa: Reptiles
Group: Skinks

STATUS

The ranks and information in the chart below indicate the rarity and status of SGCN Skinks in West Virginia. These skink species are listed as rare and in need of conservation because few sites exist for many and most records are historic. The secretive nature of Skinks makes this group difficult to study and record distribution. Life history and distribution studies are needed to determine the actual rarity and status of these animals.

Species Name	Common Name	Priority Listing	Global Rank	State Rank	NE Tech Comm	Trend
<i>Eumeces anthracinus anthracinus</i>	Northern Coal Skink	2*	G5T5	S2	X	Unknown
<i>Eumeces laticeps</i>	Broad-headed Skink	2	G5	S2	X	Unknown
<i>Scincella lateralis</i>	Little Brown Skink	2	G5	S3		Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table lists the number of records and the watersheds in which each skink species occurs. It also gives the ages of the records (recent is within 20 years) and general habitat. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species.

Species	Watershed	Record Type	Habitat
Northern Coal Skink	Cacapon	Recent Historic	Damp, wooded hillsides with an abundance of leaf litter and loose stones; likes rotten logs, brush piles, etc.
	Lower Guyandotte		
	Upper Guyandotte		
	Lower Kanawha		
	Upper Kanawha		
	Lower New		
	Greenbrier		
	South Branch Potomac		

Species	Watershed	Record Type	Habitat
Broad-headed Skink	Cheat	Recent	Most arboreal of WV skinks
Skink	Little Kanawha	Historic	Skinks; found in hollow trees and holes in trees; will hide under loosened bark
	Upper Kanawha		
	Lower New		
	Lower Ohio Valley		
	Twelve Pole		
	Upper Guyandotte		
	Shenandoah		
Little Brown Skink	Lower Guyandotte	Historic	Dry, open woodlands; rarely climbs
	Lower Kanawha		
	Tug		
	Coal		
	Twelve Pole		
	South Branch of Potomac		

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of Skink species in West Virginia. Because there is inadequate information on the distribution and status of most Skink species in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of Skink species.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled into a database with coordinates.	Complete the WV Herpetological Atlas.
	Public access to general Skink information.	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> . Provide general Skink data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Status at historic sites.	A very high percentage of sites are historic. Surveys need to be conducted with priority given to sites with potential habitat most likely to support the species.
	New sites need to be surveyed.	Analyze potential habitat statewide to determine new survey areas; surveys should be geared to Skink species as a group rather than by individual species.

Category	Need	Action
Monitoring	Long-term monitoring sites.	Monitor existing sites to determine status of population and any changes to habitat. Identify possible sites as new Skink data become available (A good Broadhead site is Beech Fork State Park).

Category	Need	Action
Research	Life history.	Coordinate research projects with researchers and/or contractors; all natural history data is needed for each species. Skinks are poorly understood.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with Skink species and their habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF SKINKS AND THEIR HABITATS

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Complete the WV Herpetological Atlas.

Surveys:

- A very high percentage of sites are historic. Surveys need to be conducted with priority given to sites with potential habitat most likely to support the species.
- Analyze potential habitat statewide to identify new survey areas. Surveys should be geared to Skink species as a group rather than by individual species.

Coordination:

- Work with all landowners to reduce or eliminate activities that may be detrimental to Skink sites. This includes determining buffer zones around sites and encouraging use of Best Management Practices when timbering and other site related issues pertaining to habitat loss and forestland management.

Education:

- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact Skink sites.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

REFERENCES

Green, N. B. and T. K. Pauley. 1987. *Amphibians and Reptiles in West Virginia*. University of Pittsburgh Press. 241 pp.

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Pauley, T.K. 1993. Report of the Upland Vertebrates in the New River Gorge National River. National Park Service. Volume I-III. 1,119 pp.

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Taxa: Reptiles
Group: Snakes

STATUS

The ranks and information in the chart below indicate the rarity and status of some rare Snakes in West Virginia. The Timber Rattlesnake and the Mountain Earth snake are addressed elsewhere. These Snake species are listed as rare and in need of conservation because few sites exist for many and most records are historic. The secretive nature of Snakes makes this group difficult to study and determine distribution. Life history and distribution studies are needed to establish the actual rarity and status of these animals.

Species Name	Common Name	Priority group	Global Rank	State Rank	NE Tech Comm	Trend
<i>Carphophis amoenus</i>	Wormsnake	2*	G5	S3		Stable
<i>Heterodon platirhinos</i>	Eastern Hog-nosed Snake	2	G5	S3	X	Declining
<i>Lampropeltis getula getula</i>	Eastern Kingsnake	2	G5T5	S2		Unknown
<i>Opheodrys aestivus</i>	Rough Greensnake	2	G5	S3		Declining
<i>Thamnophis sauritus</i>	Eastern Ribbonsnake	2	G5	S2	X	Declining
<i>Virginia valeriae valeriae</i>	Eastern Earthsnake	2	G5	S3		Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table lists the number of records and the watersheds in which each snake species occurs. It also gives the ages of the records (recent is within 20 years) and general habitat. The number of records is not indicated in this table. Each watershed listed may have more than one record for the species.

Species	Watershed	Record Type	Habitat
Wormsnake	Cheat	Recent Historic	Forest animals preferring a moist rocky soil with partially wooded or grassy hillsides
	Elk		
	Greenbrier		
	Middle Ohio Valley		
	Lower Ohio Valley		
	South Branch Potomac		
	Tug Fork		
	Twelve Pole		
	Upper Guyandotte		
	Lower Guyandotte		
	Upper New		
	Lower Kanawha		
	Lower New		
	Upper Kanawha		
West Fork			
Cacapon			
Eastern Hog-nosed Snake	Lower Guyandotte	Recent Historic	Dry, open sites such as sandy areas, cultivated or abandoned fields and woodland borders
	Upper Guyandotte		
	Upper New		
	Coal		
	Gauley		
	Greenbrier		
	Little Kanawha		
	Middle Ohio Valley		
	Potomac		
	Shenandoah		
	South Branch Potomac		
	Twelve Pole		
West Fork			

Species	Watershed	Record Type	Habitat
Eastern Kingsnake	South Branch Potomac	Unknown	River valleys, dry upland pine woods, abandoned dwellings
	Cacapon		
	Potomac		
Rough Greensnake	Cheat	Recent Historic	Open sunny areas and roadside vegetation such as greenbrier thickets and berry bushes
	Lower New		
	Upper New		
	Lower Guyandotte		
	Upper Guyandotte		
	Coal		
	Lower Ohio Valley		
	Middle Ohio Valley		
	Shenandoah		
	Tug Fork		
	Lower Kanawha		
	Upper Kanawha		
Little Kanawha			
Twelve Pole			
Eastern Ribbonsnake	Cheat	Recent Historic	Swamps, margins of oxbow ponds, grassy stream borders, weedy lake shores
	Lower New		
	Upper New		
	Potomac		
	South Branch Potomac		
	Tygart Valley		
Eastern Earthsnake	South Branch Potomac	Recent Historic	Grassy areas near or in forests; hides under logs, stones, or leaf litter
	Upper Kanawha		
	Lower Kanawha		
	Little Kanawha		
	Lower Ohio Valley		
	Lower Guyandotte		

DECISION MAKING PROCESS – NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of Snake species in West Virginia. Because there is inadequate information on the distribution and status of most Snake species in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of Snake species.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	All existing location and biological data need to be compiled into a database with coordinates.	Complete the WV Herpetological Atlas.
	Public access to general snake information .	Complete 2 nd edition of <i>Amphibians and Reptiles in West Virginia</i> . Provide general Snake data, such as distribution maps, on the internet.

Category	Need	Action
Surveys	Status at historic sites needs to be determined.	A very high percentage of sites are historic, surveys need to be conducted with priority given to sites with potential habitat most likely to support the species.
	Extent of potential habitat for recent occurrences needs to be determined.	Conduct detailed habitat documentation with site visits and possible surveys.
	Surveys of new sites.	Analyze potential habitat statewide to determine new survey areas.

Category	Need	Action
Monitoring	Long-term monitoring.	Examine all current snake sites to determine if an area of high diversity exists and set-up monitoring stations. Determine possible sites as new snake data becomes available (The Meadow River is a good site for the Ribbonsnake and the Gauley River area is good for the Wormsnake). Monitor existing sites to determine status of populations and any changes to habitat.

Category	Need	Action
Research	Life history.	Coordinate projects with researchers and/or contractors. All natural history data are needed for each species; Snakes are poorly understood.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with Snake species and their habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Education, Management
Water Quantity and Quality	
Over Collection	Legislation/Regulation , Education
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE SNAKES AND THEIR HABITATS

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Complete the WV Herpetological Atlas.

Surveys:

- A very high percentage of sites are historic; surveys need to be conducted with priority given to sites with potential habitat most likely to support the species.
- Analyze potential habitat statewide to identify new survey areas.

Research:

- Coordinate projects with researchers and/or contractors. All natural history data are needed for each species; Snakes are poorly understood.

Coordination:

- Work with all landowners to reduce or eliminate activities that may be detrimental to Snake sites. This includes determining buffer zones around sites and encouraging use of Best Management Practices when timbering and other site related issues pertaining to habitat loss and forestland management.

Education:

- Educate citizens on the importance of Snakes and discourage senseless killing and hunting of Snakes.
- Conduct presentations and create an educational pamphlet outlining the effects of various land use activities that might impact snake sites.

Legislation:

- Develop appropriate regulations and collection limits on all amphibian and reptile species.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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Green, N. B. and T. K. Pauley. 1987. *Amphibians and Reptiles in West Virginia*. University of Pittsburgh Press. 241 pp.

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Tiger Beetles

Tiger beetles are among the most colorful and interesting of all West Virginia beetles. Their predacious habits, as both adults and larvae, put them at the top of the insect food chain. Adults of nearly all species are diurnal, actively moving about during daylight hours. A few species remain active at night, and one species is strictly nocturnal. While on the ground, adults are very wary and quick to take flight if disturbed.

Tiger beetles occur worldwide from the tropics to the boreal regions, and are represented by about 100 species and another 100 subspecies in many color forms across the United States. West Virginia has 20 species, known either from the state or found close enough to its borders to have a reasonable likelihood of future discovery here. Of the 20 known species, all belong to the genus *Cicindela*, except for one *Megacephala* species which belongs to a primarily neotropical group. An overview of the state's Tiger Beetles can be found in the "*Tiger Beetles of West Virginia*" by Thomas Allen and Robert Acciavatti (WVDNR 2002). Because the state has limited habitat for a number of the species, a full 60 percent (12 species) are listed as being in Greatest Need of Conservation.

Common Name	Scientific Name
A Tiger Beetle	<i>Cicindela ancocisconensis</i>
Cobblestone Tiger Beetle	<i>Cicindela marginipennis</i>
A Tiger Beetle	<i>Cicindela patruela</i>
A Tiger Beetle	<i>Cicindela cuprascens</i>
A Tiger Beetle	<i>Cicindela cursitans</i>
A Tiger Beetle	<i>Cicindela formosa generosa</i>
Beach-Dune Tiger Beetle	<i>Cicindela hirticollis</i>
A Tiger Beetle	<i>Cicindela purpurea</i>
A Tiger Beetle	<i>Cicindela scutellaris</i>
A Tiger Beetle	<i>Cicindela splendida</i>
A Tiger Beetle	<i>Cicindela unipunctata</i>
Virginia Big-Headed Tiger Beetle	<i>Megacephala virginica</i>

Tiger Beetles usually occupy open areas with little vegetative cover. Larvae occupy burrows in soils that are usually sandy in nature but may also be in clay or shale soils. Often these types of habitats are riparian, along dirt roads or near natural barrens around the state. All of these habitats are either restricted in distribution or in total area, hence the limited distribution of many species.

A review of the conservation needs for Tiger Beetles, as outlined on the following fact sheets, indicates that initial actions for the listed species are centered on survey, inventory and data management. Information on the distribution and status of many Tiger Beetles is lacking and filling these information gaps is a necessary first step for the future conservation assessment of

each species. Standardized data acquisition and management both within the WV DNR Wildlife Resources Section and by all other research partners will greatly assist with these conservation assessments. Centralized and shared information is a prerequisite to the formulation of on-the-ground conservation plans for all listed species.

Because the WRS acts as a statewide repository for information, we rely on partners to share information to maximize understanding of our biological resources. Occasionally researchers are reluctant to share information for fear that the information will be requested from state government via the Freedom of Information Act (FOIA) and used to the detriment of the species involved. For this reason it is believed appropriate to have legislation enacted to protect sensitive rare species information from wide dissemination. This need is expressed across the board on the fact sheets for animal Species in Greatest Need of Conservation.

There is an ongoing need to educate all citizens about the value of the diversity of life in the state and especially the role all SGNC play in the intricate web of life. Education is a unifying theme throughout the actions section of the fact sheets for most species. In addition there is a need to coordinate with land management agencies and other landowners/managers on the use of Best Management Practices for the conservation of biological resources in general as well as specific practices when SGNC are present.

Unfortunately because of the dearth of data on the distribution and status of many individual species, few specific on-the-ground conservation actions have been identified. As additional data are collected, one would anticipate an increasing inventory of specific site-related projects that are desirable for the health and/or continued existence of SGNC throughout the state.

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Taxa: Tiger Beetles

Common name: Appalachian Tiger Beetle

Scientific name: *Cicindela ancocisconensis*

STATUS

The ranks and information in the chart below indicate the rarity of the Appalachian Tiger Beetle in West Virginia. This species is listed as rare and in need of conservation and its status is monitored by many groups. It is considered a species of concern in every state in which it occurs.

Priority Group	Global Rank	State Rank	Mon Forest	Jeff Forest	Trend
1*	G3	S3	X	X	Stable

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Appalachian Tiger Beetle into watersheds and gives the ages of the records (recent is within 20 years) and indicates whether sites are under public or private ownership.

Habitat: The Appalachian Tiger Beetle inhabits dry sandy banks and islands along major rivers in West Virginia from the Allegheny Mountains eastward. It is usually found in dry, sandy openings among sparse vegetation above the river shoreline.

Watershed	Site Name	Record Type	Ownership
Cacapon	Ice Mountain	Recent	Private
Cheat	Cheat River - 4 Sites	Historic	Private
	Shavers Fork – 3 Sites	Recent	Public
Elk	Elk River – 2 Sites	Recent	Private
Greenbrier	Greenbrier River	Recent	Private
Lower New	New River – 4 Sites	Recent	Public
South Branch Potomac	South Branch Potomac River 4 Sites	Recent	Public
Tug Fork	Panther State Forest	Recent	Public
Tygart Valley	Tygart Valley River-Arden	Recent	Private
Upper New	Bluestone River	Recent	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Appalachian Tiger Beetle. Because there is inadequate information on the distribution and status of the Appalachian Tiger Beetle in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Appalachian Tiger Beetle.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Better organized, more useful data.	Augment existing tiger beetle data with coordinate information and consolidate all data into a database.
	UTM coordinates	Plot sites on map to obtain coordinates.
	Public access to general Tiger Beetle information on the web.	Provide general Tiger Beetle data, such as distribution maps, on the internet.

Category	Need	Action
Survey	Additional survey sites.	Make staff and interested individuals aware of the need to record serendipitous observations of this species while conducting other work.

Category	Need	Action
Monitoring	Long-term species monitoring sites.	Plan to visit sites after major flooding events to determine if populations are present and estimate if these events influence density trends.

Category	Need	Action
Research	Life history projects.	Compare habitat where this tiger beetle is abundant to that where it is scarce. Investigate adult activity patterns and predator avoidance behavior to determine how they might influence survival at a site.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Appalachian Tiger Beetle and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Education, Coordination , Management
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE APPALACHIAN TIGER BEETLE AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Augment existing Tiger Beetle data with coordinate information and consolidate into a database.
- Plot sites on map to obtain coordinates.

Survey:

- Make staff and interested individuals aware of the need to record serendipitous observations of this species while conducting other work.

Research:

- Compare habitat where this Tiger Beetle is abundant to that where it is scarce. Investigate adult activity patterns and predator avoidance behavior to determine how they might influence survival at a site.

Coordination:

- Work with private landowners to preserve riparian areas on their properties that do or could provide habitat for the Appalachian Tiger Beetle.
- Encourage the U.S. Forest Service to consider the Appalachian Tiger Beetle in their management practices, protect current populations and initiate surveys at new locations.
- Mitigate for impacts of land use activities, such as stream channel modification, that may alter the habitat for the Appalachian Tiger Beetle.

Education:

- Educate the public about the importance of biodiversity and what they can do protect Tiger Beetles and their habitat.
- Educate the public about invasive species and the impacts they have on rare species habitat.

Legislation/Regulation:

- Rewrite and introduce into legislation a new definition of “wildlife” which would include Tiger Beetles and other Terrestrial Insects.
- Pass legislation to protect Species of Greatest Need Conservation sites from FOIA requests.

Management:

- Develop management plans for the control of invasive species.

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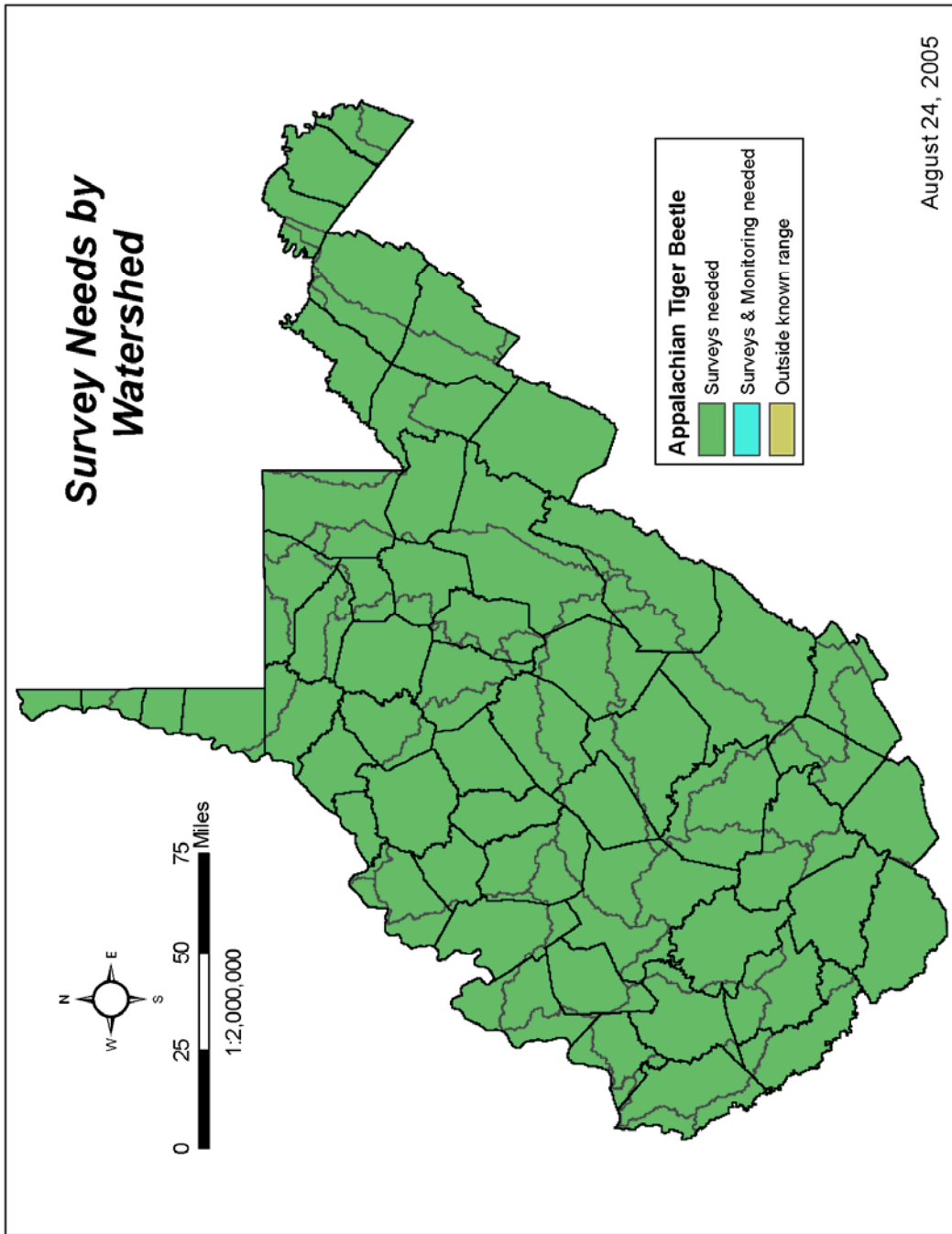
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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Tiger Beetles

Common name: Cobblestone Tiger Beetle

Scientific name: *Cicindela marginipennis*

STATUS

The ranks and information in the chart below indicate the rarity of the Cobblestone Tiger Beetle in West Virginia. This species is listed as rare and in need of conservation and its status is monitored by many groups. It is considered a species of concern in every state in which it occurs.

Priority Group	Global Rank	State Rank	USFWS	IUCN Rank	Trend
1*	G2G3	S1	SC	LR/nt	Declining

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Cobblestone Tiger Beetle into watersheds, gives the ages of the records (recent is within 20 years) and indicates whether site are in public or private ownership.

Habitat: The Cobblestone Tiger Beetle inhabits the cobblestone heads of islands or shorelines which appear in certain major rivers of the eastern United States. Adults frequent the open areas of cobblestones and gravel beaches, whereas larvae are found in burrows up slope above the cobblestones where the beach grades to small stones, gravel and sand intermixed with sparse vegetation.

Watershed	Site Name	Record Type	Ownership
Middle Ohio Valley	Calf Creek	Recent	Private
	Muskingum Island	Recent	Public
	Williamstown	Recent	Private
	Waverly Beach	Recent	Private
	Buckley Island	Recent	Public
Monongahela	Morgantown	Historic	Private

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Cobblestone Tiger Beetle. Because there is inadequate information on the distribution and status of the Cobblestone Tiger Beetle in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Cobblestone Tiger Beetle.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Consolidated data with coordinates.	Contract to determine coordinates and capture data.
	Public access to general Tiger Beetle information on the web.	Provide general Tiger Beetle data, such as distribution maps, on the internet.

Category	Need	Action
Survey	New sites need to be surveyed.	Analyze habitat on all unsurveyed Ohio River islands, and survey islands with potential habitat or the right conditions.
		Survey shoreline along the Ohio River for potential new sites. Concentrate efforts in the Belleville Pool where known populations exist, and then expand to other shoreline habitats if this species is discovered elsewhere.
	Further surveys are needed at existing sites.	Resurvey Muskingum Island, Blennerhassett Island and some of the other islands along the Ohio River where surveys were not conducted recently for life stages or suitable habitats.

Category	Need	Action
Monitoring	Long-term species monitoring sites.	Monitor both recent populations at Buckley Island and the shoreline at Waverly during July and August every other year or following major flooding of the Ohio River during the previous year.

Category	Need	Action
Research	Life history projects.	Publish a larval description of this species. Determine the tolerance of its larvae to anaerobic conditions experienced during periodic and regular inundation of its habitat.
		Determine how the frequency and duration of habitat submergence along a major controlled navigation river (Ohio River) compares to a major uncontrolled one (Scioto River in Ohio) in terms of impacts on larval and adult population densities on each river type.
		Study adult behavior and predator avoidance strategies to determine threats to its survival.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Cobblestone Tiger Beetle and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Education, Coordination , Management
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE COBBLESTONE TIGER BEETLE AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Contract to determine coordinates and capture all existing tiger beetle data into a database.

Surveys:

- Analyze habitat on all unsurveyed Ohio River islands, and survey ones with potential habitat or the right conditions.
- Survey shoreline along the Ohio River for potential new sites. Concentrate efforts in the Belleville Pool where known populations exist, then expand to other shoreline habitats if this species is discovered elsewhere.
- Resurvey Muskingum Island, Blennerhassett Island and some of the other islands along the Ohio River where surveys were not conducted recently for life stages or suitable habitats.

Research:

- Publish a larval description of this species. Determine the tolerance of its larvae to anaerobic conditions experienced during periodic and regular inundation of its habitat.
- Determine how the frequency and duration of habitat submergence along a major controlled navigation river (Ohio River) compares to a major uncontrolled one (Scioto River in Ohio) in terms of impacts on larval and adult population densities on each river type.
- Study adult behavior and predator avoidance strategies to determine threats to its survival.

Coordination:

- Work with private landowners to preserve riparian areas on their properties that do or could provide habitat for the Cobblestone Tiger Beetle, especially for sites within the Belleville Pool of the Ohio River.
- Encourage the Ohio River Islands National Wildlife Refuge to consider the Cobblestone Tiger Beetle in their management plans. Coordinate with them to maintain populations, mitigate threats associated with water quality and riparian areas (including invasive plant species), and to establish monitoring sites.

Education:

- Educate the public as to the importance of biodiversity and what they can do protect tiger beetles and their habitat.
- Educate the public about invasive species and the impacts they have on rare species habitat.

Management:

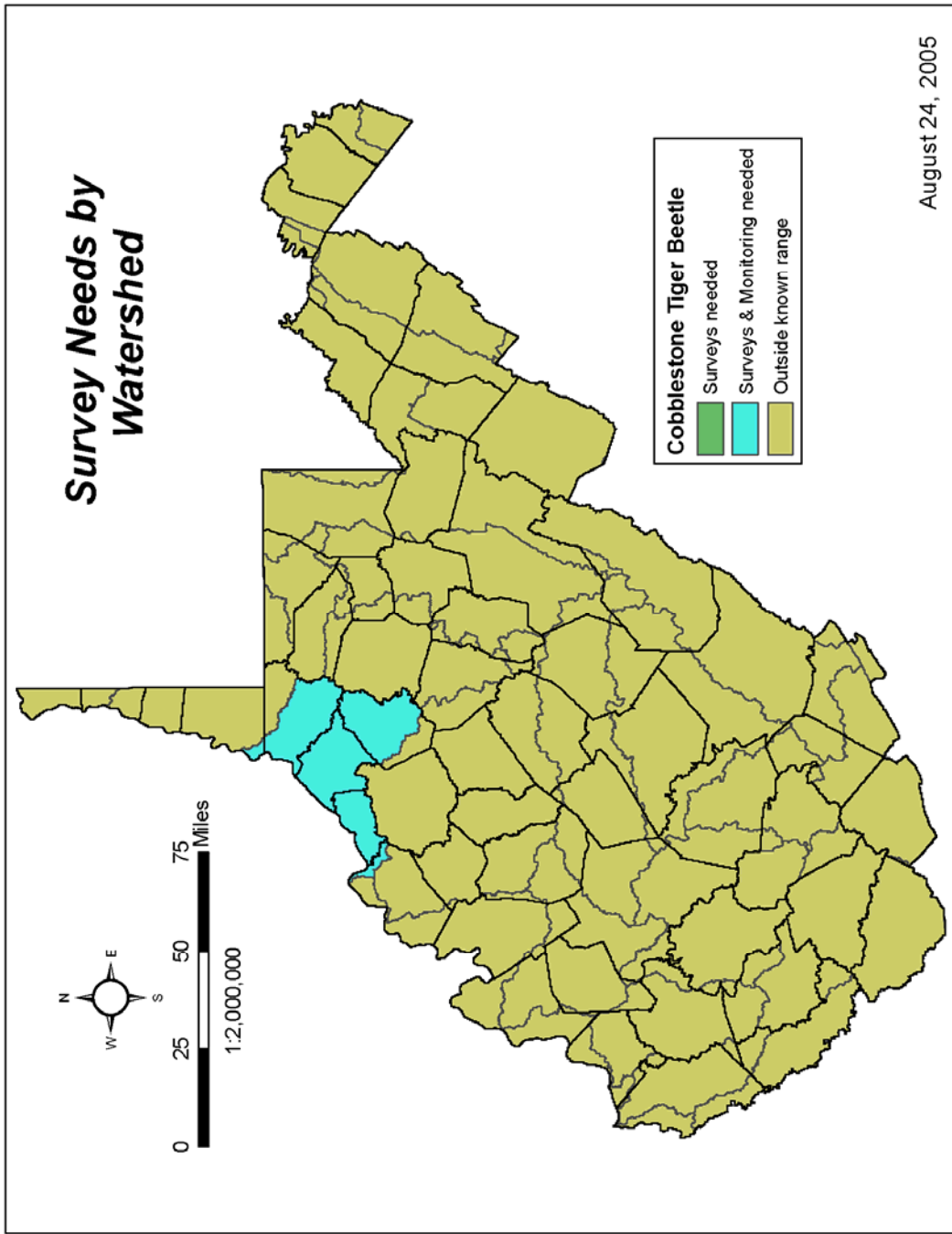
- Develop management plans for the control of invasive species, especially Japanese knotweed.

Legislation/Regulation:

- Develop and introduce into legislation a new definition of “wildlife” which would include Tiger Beetles and other Terrestrial Insects.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Tiger Beetles

Common name: Northern Barrens Tiger Beetle

Scientific name: *Cicindela patruela*

STATUS

The ranks and information in the chart below indicate the rarity of the Northern Barrens Tiger Beetle in West Virginia. This species is listed as rare and in need of conservation and its status is monitored by many groups. It is considered a species of concern in every state in which it occurs.

Priority Group	Global Rank	State Rank	Mon Forest	Jeff Forest	Trend
1*	G3	S2S3	X	X	Unknown

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, SITE STATUS AND HABITAT

The following table places known occurrences of the Northern Barrens Tiger Beetle into watersheds and gives the ages of the records (recent is within 20 years) and indicates whether sites are under public or private ownership.

Habitat: Species occurs on dry sandy soils with sparse vegetation, such as mosses, lichens and low forbs where sandstone strata create natural forest openings. They can also be found along woodland roads and at the edges of abandoned sandstone quarries.

Watershed	Site Name	Record Type	Ownership
Monongahela River	Greer-South	Recent	Private
	Triune	Recent	Private
South Branch Potomac	Petersburg-West-Southwest	Recent	Public
	North Fork Mountain Trail	Recent	Public
	Brushy Run Road	Recent	Private
	Romney	Recent	Private
Greenbrier River	Mill Creek	Historic	Private
Lower Guyandotte River	Big Ugly WMA	Recent	Public

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Northern Barrens Tiger Beetle. Because there is inadequate information on the distribution and status of the Northern Barrens Tiger Beetle in West Virginia, the first step in its conservation is to gain a better understanding of its distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of the Northern Barrens Tiger Beetle.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Legacy and museum data.	Augment all existing Tiger Beetle data with coordinate information and capture all data into a database.
	Distribution.	Plot sites on map to obtain coordinates.
	Public access to general Tiger Beetle information on the web.	Provide general Tiger Beetle data, such as distribution maps, on the internet.

Category	Need	Action
Survey	Current sites need to be surveyed.	Visit recent sites and determine if the species still occurs there or if their habitat has been altered.
	Habitat needs to be delineated.	Delineate extent of occupied and potential habitat at current Northern Barrens Tiger Beetle sites.
	New sites need to be surveyed.	Analyze habitat and identify possible new sites in the Eastern Panhandle.
		Using old maps and geologic records, locate and survey old sandstone quarries for species.

Category	Need	Action
Monitoring	Long-term species monitoring.	Monitor existing sites to determine changes in population.

Category	Need	Action
Research	Life history.	Conduct a comparison of habitats in WV where each color morph occurs.
		Investigate adult activity patterns and predator avoidance behavior to determine how they might influence survival at a site.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with the Northern Barrens Tiger Beetle and its habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	Coordination , Management, Education
Water Quantity and Quality	Education, Coordination , Management
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF THE NORTHERN BARRENS TIGER BEETLE AND ITS HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Augment all existing Tiger Beetle data with coordinate information and capture all data into a database.
- Plot sites on map to obtain coordinates.

Survey:

- Visit recent sites and determine if the species still occurs there or if their habitat has been altered.
- Determine and document the habitat and extent of potential habitat at current Northern Barrens Tiger Beetle sites.
- Analyze habitat and identify possible new sites in the Eastern Panhandle.
- Using old maps and geologic records, survey old sandstone quarries for the species.

Research:

- Conduct a comparison of habitats in WV where each color morph occurs.
- Investigate adult activity patterns and predator avoidance behavior to determine how they might influence survival at a site.

Coordination:

- Work with private landowners to preserve areas on their properties that do or could provide habitat for the Northern Barrens Tiger Beetle.
- Encourage the U.S. Forest Service to consider the Northern Barrens Tiger Beetle in their management practices, as well as protect current populations and coordinate surveys for new locations.
- Coordinate with the Department of Environmental Protection to control acid mine drainage.
- Mitigate against impacts of land use activities (such as sand quarrying, road construction and utility corridors) that may alter the habitat for the Northern Barrens Tiger Beetle.

Education:

- Educate the public as to the importance of biodiversity and what they can do protect Tiger Beetles and their habitat.
- Educate the public about invasive species and the impacts they have on rare species habitat.

Management:

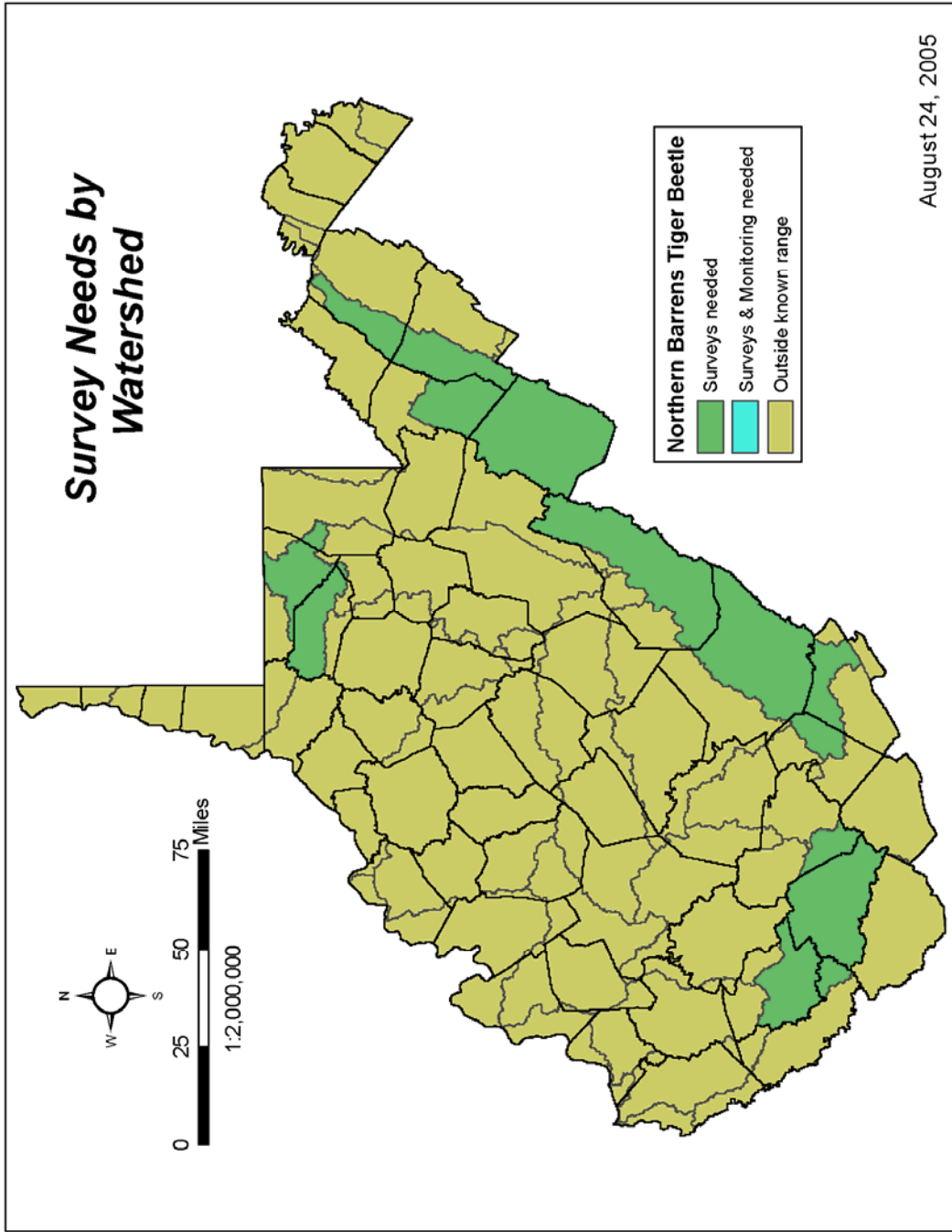
- Develop management plans for the control of invasive species.

Legislation:

- Rewrite and introduce into legislation a new definition of "wildlife" which would include Tiger Beetles and other Terrestrial Insects.
- Pass legislation to protect Species in Greatest Need for Conservation from FOIA requests.

REFERENCES

- Acciavatti, Robert. 2005. Personal Communication. US Department of Agriculture, Forest Service. Morgantown, WV.
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This is not a distribution map. Species are expected to occur only in appropriate habitats within watersheds.

Taxa: Coleoptera
Group: Tiger Beetles

STATUS

There are a total of 20 species of Tiger Beetles in West Virginia or found close enough to its borders to have a reasonable likelihood of future discovery in the state. Twelve are on the Species in Greatest Need of Conservation list. Three of these are globally rare and are addressed in separate fact sheets. The remaining nine species are addressed here as a group since their needs and actions are similar. Carabids as a group also are in need of further survey work. A rare species list needs to be generated along with a database of site and survey information.

Species Name	Common Name	Priority Group	Global Rank	State Rank	Trend
<i>Cicindela cuprascens</i>	Coppery Tiger Beetle	2*	G5	S1	Declining
<i>Cicindela cursitans</i>	Ant-like Tiger Beetle	2	G5	S1	Unknown
<i>Cicindela formosa generosa</i>	Big Sand Tiger Beetle	2	G5T5	S1	Stable
<i>Cicindela hirticollis</i>	Beach-dune Tiger Beetle	2	G5	S1	Declining
<i>Cicindela limbalis</i>	Common Claybank Tiger Beetle	2	G5	S1	Stable
<i>Cicindela scutellaris</i>	Festive Tiger Beetle	2	G5	S1	Stable
<i>Cicindela splendida</i>	Splendid Tiger Beetle	2	G5	S1	Unknown
<i>Cicindela purpurea</i>	Cow Path Tiger Beetle	2	G5	S3	Unknown
<i>Cicindela unipunctata</i>	One-spotted Tiger Beetle	2	G4	S3	Stable
<i>Megacephala virginica</i>	Virginia Big-headed Tiger Beetle	2	G5	S3	Stable

*The letters and/or numbers in the chart refer to each group's designation or rank system for the species. See Appendix I for an explanation of various designations or ranks used by the groups.

LOCATION, RECORD STATUS AND HABITAT

The following table places each species of Tiger Beetle into watersheds and describes their habitat. Recent (within 20 years) and historic records are also given. Each watershed listed may have more than one record for the species.

Species	Watershed	Record Type	Habitat
Coppery Tiger Beetle	Lower Ohio Valley	Recent	Damp, Sandy and Clay Shorelines of Major Rivers and Tributaries
Ant-like Tiger Beetle	Lower Ohio Valley	Recent	Grasslands, Old Fields and Other Non-Forested Areas
Big Sand Tiger Beetle	Middle Ohio Valley Lower Ohio Valley	Recent	Alluvial Sand Deposits Exposed by Excavations in Sand and Gravel Pits
Beach-dune Tiger Beetle	Lower Ohio Valley	Historic	Sandy, Moist Habitats, Both Inland and on Sandbars of Major Rivers
Cow Path Tiger Beetle	Lower New River South Branch Potomac	Recent	Sparsely Vegetated Slopes with Shale Soils, Meadow Paths, Grassy Roadsides and Clearings
Festive Tiger Beetle	Middle Ohio Valley	Recent	Disturbed, Deep Sand Deposits away from Water
	Lower Ohio Valley		
Splendid Tiger Beetle	Cheat	Recent	Sandy and Clay Soils in Open Slopes of Gullies And Road Cuts
	Lower Kanawha River		
	Twelvepole Creek		
One-spotted Tiger Beetle	Cacapon	Recent Historic	Shaded Forest Settings; Abandoned Roads or Natural Forest Openings
	Elk		
	Lower Kanawha		
	South Branch Potomac		
	Tug		
	Upper New		
Common Claybank Tiger Beetle	South Branch Potomac	Recent	Uplands on Eroded Road Banks and Shale Slopes With Sparse Plants in Woodland Habitats
	Cheat		
Virginia Big-headed Tiger Beetle	Lower Kanawha	Recent	Along Rivers and Streams in the Open and in Vegetation

DECISION MAKING PROCESS - NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of Tiger Beetles. Because there is inadequate information on the distribution and status of Tiger Beetles in West Virginia, the first step in their conservation is to gain a better understanding of their distribution, habitat requirements and status. Needs and actions for each category are outlined below. **Bolded** text indicates primary actions required to identify conservation needs of Tiger Beetles.

Category	Need	Action
Data	Standardize data collection protocols to allow integration with other data.	Develop and implement standardized protocols, associated forms, databases, instruction and training.
	Legacy and museum data.	Augment all existing Tiger Beetle data with coordinate information and capture all data into a database.
	Distribution.	Plot sites on map to obtain coordinates and enter into biotics.
	Public access to general Tiger Beetle information on the web.	Provide general Tiger Beetle data, such as distribution maps, on the internet.

Category	Need	Action
Survey	Historic sites need to be surveyed.	Return to historic sites to determine presence of species.
	The extent of potential habitat for recent occurrences needs to be determined.	Conduct detailed habitat documentation with site visits.
	Additional sites need to be determined.	Determine potential habitat that could support species and conduct surveys.

Category	Need	Action
Monitoring	Long-term species monitoring sites.	Plan to visit sites every 3 years to determine if populations are present, estimate densities and measure habitat change to establish trends. Emphasis should be placed on species in sensitive habitats like <i>C. cuprascens</i> and <i>C. cursitans</i> with few WV records.

Category	Need	Action
Research	Taxonomy.	Determine the relationship between <i>C. splendida</i> and <i>C. limbalis</i> by searching for populations of each species in the central WV mountains to determine if these species co-exist or hybridize, and use morphological and mDNA characters to confidently establish this relationship.
	Life history projects.	Describe larvae by rearing and photographing of larvae.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are conservation issues associated with Tiger Beetles and their habitat. This section outlines the issues and the appropriate actions to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination , Education, Management
Forest Health	
Water Quantity and Quality	Education , Coordination, Management
Over Collection	Legislation/Regulation
Management Conflicts	
Invasive Species	Management, Education
Damaging Recreation	
Data Protection	Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF TIGER BEETLES AND THEIR HABITAT

These actions were selected, through a consensus of expert opinion, to be the initial and/or ongoing actions needed in a sequential process to conserve these species in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of these species. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of these species.

Data:

- Develop and implement standardized protocols, associated forms, databases, instruction and training.
- Augment all existing Tiger Beetle data with coordinate information and consolidate all data into a database.
- Plot sites on map to obtain coordinates and enter into Biotics.

Survey:

- Return to historic sites to determine presence of species.
- Conduct detailed habitat documentation with site visits.
- Determine potential habitat that could support species and conduct surveys.

Research:

- Determine the relationship between *C. splendida* and *C. limbalis* by searching for populations of each species in the central WV mountains to determine if these species co-exist or hybridize, and use morphological and mDNA characters to confidently establish this relationship.
- Describe larvae by rearing and photographing of larvae.

Coordination:

- Work with private landowners regarding protecting Tiger Beetles on their lands and allowing surveying/monitoring for the species.
- Encourage the U.S. Forest Service to consider Tiger Beetles in their management practices, protect current populations and initiate surveys for new locations.
- Mitigate for impacts of land use activities that may alter Tiger Beetle habitat.

Education:

- Educate the public as to the importance of biodiversity and what they can do protect Tiger Beetles and their habitat.
- Educate the public about invasive species and the impacts they have on rare species habitat.

Management:

- Develop management plans for the control of invasive species.

Legislation/Regulation:

- Develop and introduce into legislation a new definition of “wildlife” which would include Tiger Beetles and other terrestrial insects.
- Pass legislation to protect Species in Greatest Need of Conservation sites from FOIA requests.

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Section 5-F. Fact Sheets for At-Risk Habitats Harboring Species in Greatest Need of Conservation

Conservation of habitats that are considered at risk requires a sequence of actions. These fact sheets for habitat systems considered in need of management to maintain their health and long-term viability are constructed in the following sequence:

- The **Description** gives a general overview of the characteristics of the habitat and some associated plants that may occur in the habitat type.
- **Species in Greatest Need of Conservation** that are known to be associated with this habitat type are listed in tabular format.
- **Location and Status** – The range of the habitat is shown by county and major watersheds (eight digit federal Hydrologic Unit Code watersheds).
- The **Data, Survey, Research and Monitoring** needs and subsequent actions for conservation of the Spruce Forest habitat are presented in tabular form. These are the data and information that form the background for the selection of on-the-ground conservation sites.
- The Conservation Process table lists **Issues** that relate to the conservation of each habitat or group and the various categories of action that may assist in addressing these conservation issues.
- Selected **Conservation Actions** summarize specific actions taken from the previous tables, and compiled and expanded on here, in order to facilitate review of priorities and to establish annual work plans for the habitats.

Fact sheets for the following habitats systems are included in the final draft plan.

- Red Spruce Forests
- Calcareous Forests and Woodlands
- Shale Barrens
- Limestone Barrens and Glades
- Sandstone Glades
- Hemlock Forests
- All Wetland types
- Floodplain Forests and Swamps
- Rock Outcrop/Cliffs/Talus
- Caves and Karst
- All Aquatic Systems

Habitat System: Red Spruce Forest

DESCRIPTION

Red Spruce Forests are upland evergreen and mixed forests dominated by Red Spruce, and found at higher elevations (above 2,500 feet) in the Allegheny Mountains. Several associated dominant understory plants, in areas with a primarily Red Spruce canopy, include Giant Rhododendron, Southern Mountain Cranberry, and/or Bryophytes.

SPECIES IN GREATEST NEED OF CONSERVATION

The Red Spruce Forest system harbors several species that are dependent on this habitat system and essentially restricted to it within the state. Examples are the Cheat Mountain Salamander, Virginia Northern Flying Squirrel, Northern Saw-whet Owl, and breeding populations of the Pine Siskin. Twenty SGNC are found in this habitat, although not all are restricted to only this habitat type.

SPECIES IN GREATEST NEED OF CONSERVATION RED SPRUCE FOREST	
Scientific Name	Common Name
<i>Glaucomys sabrinus fuscus</i>	West Virginia Northern Flying Squirrel
<i>Microtus chrotorrhinus carolinensis</i>	Southern Rock Vole
<i>Neotoma magister</i>	Allegheny Woodrat
<i>Sorex palustris punctulatus</i>	Southern Water Shrew
<i>Accipiter gentilis</i>	Northern Goshawk
<i>Aegolius acadicus</i>	Northern Saw-Whet Owl
<i>Carduelis pinus</i>	Pine Siskin
<i>Catharus ustulatus</i>	Swainson's Thrush
<i>Contopus cooperi</i>	Olive-Sided Flycatcher
<i>Sphyrapicus varius</i>	Yellow-Bellied Sapsucker
<i>Plethodon nettingi</i>	Cheat Mountain Salamander
<i>Virginia valeriae pulchra</i>	Mountain Earthsnake
<i>Sorex dispar</i>	Long-Tailed Shrew
<i>Sorex hoyi winnemana</i>	Southern Pygmy Shrew
<i>Sylvilagus obscurus</i>	Appalachian Cottontail
<i>Certhia americana</i>	Brown Creeper
<i>Seiurus noveboracensis</i>	Northern Waterthrush
<i>Dendroica coronata</i>	Yellow-Rumped Warbler
<i>Dendroica fusca</i>	Blackburnian Warbler
<i>Cambarus monongalensis</i>	A Crayfish

LOCATION AND STATUS

Red Spruce is known from Preston, Tucker, Pendleton, Grant, Randolph, Pocahontas, Webster, Greenbrier and Nicholas counties. This type was more abundant prior to logging (circa 1900) and significant portions of the previously occupied area now support Northern Hardwood forests. Original estimates put the cover of this forest type at 469,000 acres; less than 30,000 acres of Red Spruce Forest remain today.

Watersheds with Red Spruce are listed below; most of these watersheds have Red Spruce only in their headwaters.

Watersheds with Red Spruce Forest Habitat
Cheat
North Branch Potomac
South Branch Potomac
Elk
Tygart Valley
Gauley
Greenbrier
West Fork

DECISION MAKING PROCESS – NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Red Spruce Forest in West Virginia. Needs and actions for each category are outlined below. **Bolded** text indicates initial actions required to identify conservation needs of this habitat type in the state.

Category	Need	Action
Data	Develop working definition of Red Spruce system.	Compile existing plot data; identify environmental parameters.
	Determine vegetation communities.	Classify plot data into vegetation communities, using multivariate analysis and ordination. A preliminary classification has been developed for this system, but it does not include all communities within the system. Vegetation will be classified according to the National Vegetation Classification.
	Map extent.	Use aerial photography and known vegetation communities to estimate the areal extent of the system.
	Assess plot sampling coverage and needs.	Compare existing plot coverage with estimated extent of the system to determine high-priority sampling needs.

Category	Need	Action
Data (con't)	Assess rarity.	Based on existing data, estimate rarity of the system at the state and global level. Historic data, where available, will be used to assess trends in rarity and/or comparisons with the pre-settlement extent of the system.
	Assess environmental integrity.	Document size, patch dynamics, environmental condition (age, successional state, composition, structure, land use history, disturbance), and landscape context (fragmentation, natural disturbance regime, landscape dynamics, surrounding land use) of each system. Describe the ecological processes that maintain the habitat.
	Maintain and improve plot sampling methodology and geodatabase.	Continue to maintain and improve plot sampling methodology in accordance with national standards. Maintain and update the Plots2-WV database, including interface with WVDNR geodatabases, Biotics, and national standards for ecological data storage.
	Identify threats.	Identify threats including human disturbance, invasive species, pathogens, or alterations in natural processes.
	Identify management opportunities to increase quality of habitat.	Match identified threats and critical ecological processes with possible management interventions (including a prescription for non-intervention) to increase quality of habitat.
	Identify Species in Greatest Need of Conservation that rely on Red Spruce systems.	Working with wildlife staff, compile existing data on wildlife use of the system to identify a preliminary list of species that rely on Red Spruce.

Category	Need	Action
Surveys	Sample under-represented vegetation community types.	Survey Red Spruce communities in under-sampled areas.
	Ground truth maps.	Once areal extent has been estimated, use provisional maps to check accuracy on the ground and to revise sampling priorities.
	Sample vegetation communities within the home ranges of Species in Greatest Need of Conservation.	Beginning with a small number of targeted Species in Greatest Need of Conservation, work with zoologists to define and map critical habitat types for these species.

Category	Need	Action
Surveys (con't)	Identify high quality stands and stands with potential for reclamation.	Using geologic maps, air photos, and species data, identify and sample potentially high quality stands and make recommendations (as appropriate) for conservation or reclamation of these areas.

Category	Need	Action
Monitoring	Monitor status of identified threats to habitat.	Connect vegetation ecology database/GIS layers efficiently with WVDNR geodatabases (as they are developed) that track threats such as invasive species, land use changes, spread of pathogens, or other threats. Regularly assess overlays of threats on mapped systems.
	Monitor rarity and ecological integrity of habitat.	Continue to sample and/or re-visit sampling sites periodically to monitor size, environmental condition, and landscape context of mapped habitat. Obtain most recent aerial photography to assess major trends in areal extent of each system.
	Monitor use of habitat by Species in Greatest Need of Conservation.	Develop efficient database connections between vegetation ecology data and incoming data on populations of Species in Greatest Need of Conservation.

Category	Need	Action
Research	Identify Species in Greatest Need of Conservation that rely on the Red Spruce system for portions of their life-cycles.	Work with wildlife staff and researchers to match wildlife species data with habitat data via GIS overlays and field surveys.
	Determine stand attributes that are most important for Species in Greatest Need of Conservation.	Work with wildlife staff and researchers to connect wildlife species behavioral data with specific habitat attributes.
	Determine successional sequences within the system.	Sample multiple age classes and disturbance regimes within the system and relate to classification of habitats and the species that use them.
	Assess effects of acid deposition on vegetation composition, structure and viability.	Sample stands exposed to varying amounts of acid rain and relate to ecological integrity of the stand.

	Assess effects of browsing on regeneration of vegetation.	Establish exclosures on sampled stands and monitor effects on vegetation composition and regeneration of palatable species.
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CONSERVATION PROCESS – ISSUES AND ACTIONS

There are several conservation issues associated with the Red Spruce Forest habitat system. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition
Forest Health	Coordination, Education, Management
Acid Deposition	Coordination, Management
Harvest	Coordination, Education, Management
Management Conflicts	Coordination
Invasive Species	Education, Management
Damaging Recreation	Education

SELECTED ACTIONS FOR THE CONSERVATION OF RED SPRUCE FOREST IN WEST VIRGINIA

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this habitat system in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the habitat. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the habitat.

Data:

- Compile existing plot data; identify environmental parameters.
- Classify plot data into vegetation communities, using multivariate analysis and ordination. A preliminary classification has been developed for this system, but it does not include all communities within the system.
- Use aerial photography and known vegetation communities to estimate the areal extent of the system.
- Compare existing plot coverage with estimated extent of the system to determine high-priority sampling needs.

- Continue to maintain and improve plot sampling methodology in accordance with national standards. Maintain and update the Plots2-WV database, including interface with WVDNR geodatabases, Biotics, and national standards for ecological data storage.

Surveys:

- Survey Red Spruce communities in under-sampled areas.
- Once areal extent has been estimated, use provisional maps to check accuracy on the ground and to revise sampling priorities.
- Beginning with a small number of targeted Species in Greatest Need of Conservation, work with zoologists to define and map critical habitat types for these species.

Coordination:

- Coordinate management with willing landowners and land managers on lands that have this habitat type.
- Continue to encourage the Monongahela National Forest to incorporate conservation and restoration of this habitat in their operational plans.

Management:

- Work with Red Spruce Forest landowners to develop management plans for their land that conserves spruce over the long run.
- Plan timber harvests to minimize encroachment of invasive plants.

Education:

- Educate the public in general and landowners with Red Spruce on their lands about the importance of maintaining Red Spruce Forests.
- Educate the public and landowners about the negative effects of invasive plants on natural habitats.

Acquisition:

- Acquire or obtain non-development easements on Red Spruce Forests from willing landowners.
- Encourage owners of Red Spruce Forests to enroll their land in the Forest Legacy or similar Programs.

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Habitat System: Calcareous Forests and Woodlands

DESCRIPTION

Calcareous Forests and Woodlands are upland deciduous forests on soils derived from limestone and dolomite, most abundant in the Ridge and Valley physiographic region but also found elsewhere. Dominant trees include Chinquapin Oak, White Ash, Sugar Maple, Black Maple, Black Walnut, Hackberry and Bitternut Hickory. Forests and Woodlands are separated by the percent cover of the canopy, with Woodlands having less than 60 percent canopy cover.

SPECIES IN GREATEST NEED OF CONSERVATION

There is not yet a comprehensive listing of species that are highly dependant on these forests and woodlands. Many naturalists and other researchers have not been aware of the nature of these forests or their distribution. This lack of awareness has made correlations of species with this habitat difficult. Below is a listing of species thought to use this habitat although none are known solely from Calcareous Forests and Woodlands.

SPECIES IN GREATEST NEED OF CONSERVATION CALCAREOUS FORESTS AND WOODLANDS	
Scientific Name	Common Name
<i>Corynorhinus townsendii virginianus</i>	Virginia Big-Eared Bat
<i>Neotoma magister</i>	Allegheny Woodrat
<i>Caprimulgus carolinensis</i>	Chuck-Will's-Widow
<i>Contopus virens</i>	Eastern Wood Peewee
<i>Dendroica cerulea</i>	Cerulean Warbler
<i>Empidonax virescens</i>	Acadian Flycatcher
<i>Haliaeetus leucocephalus</i>	Bald Eagle
<i>Helmitheros vermivorus</i>	Worm-Eating Warbler
<i>Hylocichla mustelina</i>	Wood Thrush
<i>Oporornis formosus</i>	Kentucky Warbler
<i>Plethodon virginia</i>	Shenandoah Mountain Salamander
<i>Crotalus horridus</i>	Timber Rattlesnake
<i>Accipiter cooperii</i>	Cooper's Hawk
<i>Accipiter striatus</i>	Sharp-Shinned Hawk
<i>Coccyzus erythrophthalmus</i>	Black-Billed Cuckoo
<i>Ambystoma jeffersonianum</i>	Jefferson Salamander
<i>Carphophis amoenus</i>	Wormsnake
<i>Eumeces laticeps</i>	Broad-Headed Skink
<i>Heterodon platirhinos</i>	Eastern Hog-Nosed Snake
<i>Erynnis lucilius</i>	Columbine Duskywing
<i>Cambarus monongalensis</i>	A Crayfish

LOCATION AND STATUS

The distribution of forests over calcareous substrate is poorly understood in the state. Existing geological maps do not adequately delineate limestone and calcareous substrate thereby making even a basic assessment of acreage difficult. Much of the original forest on limestone has been converted to agricultural use making this the preeminent habitat loss issue for the last couple of centuries. We will need to learn much more about the distribution and current status of this habitat before an integrated plan can be formulated to conserve or restore adequate quantities to conserve species that are dependent on the unique edaphic and floristic characters of the habitat.

Watersheds with Calcareous Forest and Woodland Habitat
Cheat
North Branch Potomac
South Branch Potomac
Elk
Tygart Valley
Gauley
Greenbrier
West Fork
Potomac
Cacapon
Shenandoah

DECISION MAKING PROCESS – NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Calcareous Forests and Woodlands in West Virginia. Needs and actions for each category are outlined below. **Bolded** text indicates initial actions required to identify conservation needs of this habitat type in the state.

Category	Need	Action
Data	Develop working definition of system.	Compile existing plot data; identify environmental parameters.
	Determine vegetation communities.	Classify plot data into vegetation communities, using multivariate analysis and ordination. Vegetation will be classified according to the National Vegetation Classification.

Category	Need	Action
Data (con't)	Map extent.	Use aerial photography, geologic maps, and known vegetation communities to estimate the areal extent of the system. Determine environmental and geographic patterns related to species composition and habitat suitability.
	Assess plot sampling coverage and needs.	Compare existing plot coverage with estimated extent of the system to determine high-priority sampling needs.
	Assess rarity.	Based on existing data, estimate rarity of the system at the state and global level. Historic data, where available, will be used to assess trends in rarity and/or comparisons with the pre-settlement extent of the system.
	Assess environmental integrity.	Document size, patch dynamics, environmental condition (age, successional state, composition, structure, land use history, disturbance) and landscape context (fragmentation, natural disturbance regime, landscape dynamics, surrounding land use) of each system. Describe the ecological processes that maintain the habitat. Calcareous forests and woodlands are particularly susceptible to exotic and invasive species. Buffer zones of undisturbed natural vegetation are important in maintaining the quality of stands in this system.
	Maintain and improve plot sampling methodology and geodatabase.	Continue to maintain and improve plot sampling methodology in accordance with national standards. Maintain and update the Plots2-WV database, including interface with WVDNR geodatabases, Biotics and national standards for ecological data storage.
	Identify threats.	Identify threats including human disturbance, invasive species, pathogens or alterations in natural processes.

Category	Need	Action
Data (con't)	Identify management opportunities to increase quality of habitat.	Match identified threats and critical ecological processes with possible management interventions (including a prescription for non-intervention) to increase quality of habitat. Where possible, identify land ownership of high quality stands and stands with potential for reclamation, for referral to partners who may wish to initiate a dialog concerning opportunities for management or conservation.
	Identify Species in Greatest Need of Conservation that rely on this system.	Working with wildlife staff, compile existing data on wildlife use of the system to identify a preliminary list of species that rely on it.

Category	Need	Action
Surveys	Sample under-represented vegetation community types.	Sample communities in data-poor areas.
	Ground truth maps.	Once areal extent has been estimated, use provisional maps to check accuracy on the ground and to revise sampling priorities.
	Sample vegetation communities within the home ranges of Species in Greatest Need of Conservation.	Beginning with a small number of targeted Species in Greatest Need of Conservation, work with zoologists to define and map critical habitat types for these species.
	Identify high quality stands and stands with potential for reclamation.	Using geologic maps, air photos, and species data, identify and sample potentially high quality stands and make recommendations (as appropriate) for conservation or reclamation of these areas.

Category	Need	Action
Research	Identify Species in Greatest Need of Conservation that rely on the system for portions of their life-cycles.	Work with researchers to match wildlife species data with habitat data via GIS overlays and field surveys.
	Determine stand attributes that are most important for Species in Greatest Need of Conservation.	Work with researchers to connect wildlife species behavioral data with specific habitat attributes.

Category	Need	Action
Research (con't)	Determine successional sequences within the system.	Sample multiple age classes within the system and relate to classification of habitats and the species that use them. Interpret historical aerial photography and conduct dendrochronological research.
	Assess effects of acid deposition on vegetation composition, structure and viability.	Sample stands exposed to varying amounts of acid rain and relate to ecological integrity of the stand.
	Assess effects of browsing on regeneration of vegetation.	Establish exclosures on sampled stands and monitor effects on vegetation composition and regeneration of palatable species.

Category	Need	Action
Monitoring	Monitor status of identified threats to habitat.	Connect vegetation ecology database/GIS layers efficiently with WVDNR geodatabases (as they are developed) that track threats such as invasive species, land use changes, spread of pathogens, or other threats. Regularly assess overlays of threats on mapped systems.
	Monitor rarity and ecological integrity of habitat.	Continue to sample and/or re-visit sampling sites periodically to monitor size, environmental condition, and landscape context of mapped habitat. Obtain most recent aerial photography to assess major trends in areal extent of each system.
	Monitor use of habitat by Species in Greatest Need of Conservation.	Develop efficient database connections between vegetation ecology data and incoming data on populations of Species in Greatest Need of Conservation.

CONSERVATION PROCESS – ISSUES AND ACTIONS

Because it is known that much of this habitat has been lost to uses other than naturally functioning forest land, viable examples should be conserved as the means to do so become available. In other words, although our understanding of this habitat is incomplete, we are confident that immediate conservation/restoration of this habitat is critical to the ecological communities dependent upon it because of the wholesale conversion that has occurred over the last two hundred years.

There are several conservation issues associated with the Calcareous Forests habitat system. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition
Forest Health	Coordination, Education, Management
Acid Deposition	
Management Conflicts	Coordination
Invasive Species	Education, Management
Damaging Recreation	Education

SELECTED ACTIONS FOR THE CONSERVATION OF CALCAREOUS FORESTS AND WOODLANDS IN WEST VIRGINIA

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this habitat system in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the habitat. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the habitat.

Data:

- Compile existing plot data; identify environmental parameters.
- Classify plot data into vegetation communities, using multivariate analysis and ordination. Vegetation will be classified according to the National Vegetation Classification.
- Use aerial photography, geologic maps, and known vegetation communities to estimate the areal extent of the system. Determine environmental and geographic patterns related to species composition and habitat suitability.
- Compare existing plot coverage with estimated extent of the system to determine high-priority sampling needs.
- Continue to maintain and improve plot sampling methodology in accordance with national standards. Maintain and update the Plots2-WV database, including interface with WVDNR geodatabases, Biotics, and national standards for ecological data storage.

Surveys:

- Sample communities in data-poor areas.

Research:

- Work with researchers to match wildlife species data with habitat data via GIS overlays and field surveys.

Coordination:

- Coordinate conservation efforts with land managers on lands that have this habitat type.

Management:

- Work with Calcareous Forest and Woodland landowners to develop management plans for their land that conserves these habitats over the long run.
- Continue to encourage the Monongahela National Forest to incorporate conservation and restoration of this habitat in their operational plans.
- Plan timber harvests to minimize encroachment of invasive plants.

Education:

- Educate the public in general and landowners with Calcareous Forest and Woodlands on their lands about the importance of maintaining these habitats.
- Educate the public and landowners about the negative effects of invasive plants on natural habitats.

Acquisition:

- Acquire or obtain non-development easements on Calcareous Forests and Woodlands from willing landowners.

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Habitat System: Shale Barrens

DESCRIPTION

Shale Barrens are small patch woodlands and openings on hot, dry aspects on Devonian shale in the Ridge and Valley physiographic region. The open stand structure is probably maintained by drought stress to trees. The most common trees are Virginia Pine and Chestnut Oak. The herb layer is often diverse and includes a distinct assemblage of herbs called "Shale Barren endemics," which occur nowhere else in the world.

SPECIES IN GREATEST NEED OF CONSERVATION

Shale Barrens harbor several species that are dependent on this type and essentially restricted to it within the state. In general, fauna of shale barrens is poorly documented.

SPECIES IN GREATEST NEED OF CONSERVATION SHALE BARRENS	
Scientific Name	Common Name
<i>Calephelis borealis</i>	Northern Metalmark
<i>Pygrus wyandot</i>	Grizzled Skipper
<i>Euchloe olympia</i>	Olympia Marble
<i>Fixsenia favonius ontario</i>	Northern Hairstreak
<i>Hesperia metea</i>	Cobweb Skipper
<i>Phyciodes cocyta</i>	Northern Crescent
<i>Cicindela purpurea</i>	A Tiger Beetle

LOCATION AND STATUS

Shale Barrens are known from Berkeley, Grant, Greenbrier, Hampshire, Hardy, Mercer, Mineral, Monroe, Pocahontas and Summers counties.

Watersheds with Shale Barrens Habitat
North Branch Potomac
South Branch Potomac
Greenbrier
Cacapon
Potomac
Upper New

DECISION MAKING PROCESS – NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of Shale Barrens in West Virginia. Needs and actions for each category are outlined below. **Bolded** text indicates initial actions required to identify conservation needs of this habitat type in the state.

Category	Need	Action
Data	Develop working definition of system.	Compile existing vegetation community descriptions into a system description.
	Determine vegetation communities.	Vegetation has been classified according to the National Vegetation Classification (NVC), and is awaiting final approval by the NVC. Finalize incorporation into NVC.
	Map extent.	Expand existing point locations into polygons showing the extent of Shale Barrens. Provide community attributes from existing classification for each of the mapped locations.
	Assess plot sampling coverage and needs.	Compare existing plot coverage with estimated extent of the system to determine high-priority sampling needs. Additional sampling is needed on private lands, especially in the northern extent of this system.
	Assess rarity.	Based on existing data, estimate rarity of the system at the state and global level. Historic data, where available, will be used to assess trends in rarity and/or comparisons with the pre-settlement extent of the system.
	Assess environmental integrity.	Document size, patch dynamics, environmental condition (age, successional state, composition, structure, land use history, disturbance), and landscape context (fragmentation, natural disturbance regime, landscape dynamics, surrounding land use) of each system. Describe the ecological processes that maintain the habitat.
	Maintain and improve plot sampling methodology and geodatabase.	Continue to maintain and improve plot sampling methodology in accordance with national standards. Maintain and update the Plots2-WV database, including interface with WVDNR geodatabases, Biotics, and national standards for ecological data storage.
	Identify threats.	Identify threats including human disturbance, invasive species, pathogens, or alterations in natural processes.

Category	Need	Action
Data (con't)	Identify management opportunities to increase quality of habitat.	Match identified threats and critical ecological processes with possible management interventions (including a prescription for non-intervention) to increase quality of habitat. Where possible, identify land ownership of high quality stands and stands with potential for reclamation, for referral to partners who may wish to initiate a dialog concerning opportunities for management or conservation.
	Identify Species in Greatest Need of Conservation that rely on this system.	Working with researchers, compile existing data on wildlife use of the system to identify a preliminary list of species that rely on it.

Category	Need	Action
Surveys	Sample under-represented vegetation community types.	Sample communities in data-poor areas, especially on private land in the northern extent of the system (Berkeley, Grant, Hampshire and Mineral counties).
	Ground truth maps.	Once areal extent has been estimated, use provisional maps to check accuracy on the ground and to revise sampling priorities.
	Sample vegetation communities within the home ranges of Species in Greatest Need of Conservation.	Beginning with a small number of targeted Species in Greatest Need of Conservation, work with zoologists to define and map critical habitat types for these species.
	Identify high quality communities and communities with potential for reclamation.	Using geologic maps, air photos, and species data, identify and sample potentially high quality communities and make recommendations (as appropriate) for conservation or reclamation of these areas.

Category	Need	Action
Monitoring	Monitor status of identified threats to habitat.	Connect vegetation ecology database/GIS layers efficiently with WVDNR geodatabases (as they are developed) that track threats such as invasive species, land use changes, spread of pathogens, or other threats. Regularly assess overlays of threats on mapped systems.

Category	Need	Action
Monitoring (con't)	Monitor rarity and ecological integrity of habitat.	Re-visit sampling sites periodically to monitor environmental condition and landscape context of shale barrens. Survey exotic plants, rare plants and butterflies.
	Monitor use of habitat by Species in Greatest Need of Conservation.	Develop efficient database connections between vegetation ecology data and incoming data on populations of SGNC.

Category	Need	Action
Research	Identify Species in Greatest Need of Conservation that rely on the system for portions of their life-cycles.	Work with researchers to match wildlife species data with habitat data via GIS overlays and field surveys.
	Determine stand attributes that are most important for Species in Greatest Need of Conservation.	Work with researchers to connect wildlife species behavioral data with specific habitat attributes.
	Determine successional sequences within the system.	Sample multiple age classes within the system and relate to classification of habitats and the species that use them. Interpret historical aerial photography and conduct dendrochronological research.
	Assess effects of acid deposition on vegetation composition, structure and viability.	Sample stands exposed to varying amounts of acid rain and relate to ecological integrity of the stand.
	Assess effects of browsing on regeneration of vegetation.	Establish exclosures on sampled stands and monitor effects on vegetation composition and regeneration of palatable species.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are several conservation issues associated with the Shale Barren habitat system. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition
Forest Health	Coordination, Education, Management
Acid Deposition	
Over Collection	
Management Conflicts	Coordination
Invasive Species	Education, Management
Damaging Recreation	Education

SELECTED ACTIONS FOR THE CONSERVATION OF SHALE BARRENS IN WEST VIRGINIA

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this habitat system in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the habitat. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the habitat.

Data:

- Compile existing vegetation community descriptions into a system description.
- Vegetation has been classified according to the National Vegetation Classification (NVC), and is awaiting final approval by the NVC. Finalize incorporation into NVC.
- Expand existing point locations into polygons showing the extent of Shale Barrens. Provide community attributes from existing classification for each of the mapped locations.
- Compare existing plot coverage with estimated extent of the system to determine high-priority sampling needs. Additional sampling is needed on private lands, especially in the northern extent of this system.
- Continue to maintain and improve plot sampling methodology in accordance with national standards. Maintain and update the Plots2-WV database, including interface with WVDNR geodatabases, Biotics, and national standards for ecological data storage.

Surveys:

- Sample communities in data-poor areas, especially on private land in the northern extent of the system (Berkeley, Grant, Hampshire, and Mineral counties).

Coordination:

- Coordinate conservation efforts with land managers on lands that have this habitat type.

Management:

- Work with Shale Barren landowners to develop management plans for their land that conserves these habitats over the long run.
- Continue to encourage the Monongahela National Forest to incorporate conservation and restoration of this habitat in their operational plans.
- Plan timber harvests to minimize disturbance to Shale Barrens and encroachment of invasive plants.

Education:

- Educate the public in general and landowners with Shale Barrens on their lands about the importance of maintaining these habitats.
- Educate the public and landowners about the negative effects of invasive plants on natural habitats.

Acquisition:

- Acquire or obtain non-development easements on Shale Barrens from willing landowners.

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Habitat System: Limestone Barrens and Glades

DESCRIPTION

These Barrens and Glades are characterized as small patch woodlands and openings on hot, dry aspects over limestone in the Ridge and Valley and possibly in the Western Allegheny Plateau Regions. The open stand structure is probably maintained by drought stress to trees. Dominant trees include Red Cedar, Eastern White Cedar and Chinquapin Oak. The herb layer is usually diverse and often includes several rare species.

SPECIES IN GREATEST NEED OF CONSERVATION

The Limestone Barren and Glade system harbors several species that are dependent on this type and are essentially restricted to it within the state. In general, the fauna occurring in these systems is poorly documented.

SPECIES IN GREATEST NEED OF CONSERVATION LIMESTONE BARRENS AND GLADES	
Scientific Name	Common Name
<i>Corynorhinus townsendii virginianus</i>	Virginia Big-Eared Bat
<i>Calephelis borealis</i>	Northern Metalmark
<i>Hesperia metea</i>	Cobweb Skipper
<i>Cicindela purpurea</i>	A Tiger Beetle

LOCATION AND STATUS

Limestone Barrens and Glades are known from Grant, Greenbrier, Hardy, Jefferson, Mercer, Mineral, Monroe, Morgan, Pocahontas, Raleigh and Summers counties.

Watersheds with Limestone Barrens and Glades
Shenandoah
Cacapon
South Branch Potomac
North Branch Potomac
Greenbrier
Upper New

DECISION MAKING PROCESS – NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Limestone Barren and Glades in West Virginia. Needs and actions for each category are outlined below. **Bolded** text indicates initial actions required to identify conservation needs of this habitat type in the state.

Category	Need	Action
Data	Develop working definition of system.	Compile existing plot data; identify environmental parameters.
	Determine vegetation communities.	Classify plot data into vegetation communities, using multivariate analysis and ordination. A preliminary study has been completed, but needs additional data. Vegetation will be classified according to the National Vegetation Classification.
	Map extent.	Use aerial photography, geologic maps, and known vegetation communities to estimate the areal extent of the system. Determine environmental and geographic patterns related to species composition and habitat suitability.
	Assess plot sampling coverage and needs.	Compare existing plot coverage with estimated extent of the system to determine high-priority sampling needs.
	Assess rarity.	Based on existing data, estimate rarity of the system at the state and global level. Historic data, where available, will be used to assess trends in rarity and/or comparisons with the pre-settlement extent of the system.
	Assess environmental integrity.	Document size, patch dynamics, environmental condition (age, successional state, composition, structure, land use history, disturbance), and landscape context (fragmentation, natural disturbance regime, landscape dynamics, surrounding land use) of each system. Describe the ecological processes that maintain the habitat. Limestone barrens and glades are particularly susceptible to exotic and invasive species. Buffer zones of undisturbed natural vegetation are important in maintaining the quality of stands in this system.

Data (Con't)	Maintain and improve plot sampling methodology and geodatabase.	Continue to maintain and improve plot sampling methodology in accordance with national standards. Maintain and update the Plots2-WV database, including interface with WVDNR geodatabases, Biotics, and national standards for ecological data storage.
	Identify threats.	Identify threats including human disturbance, invasive species, pathogens, or alterations in natural processes.
	Identify management opportunities to increase quality of habitat.	Match identified threats and critical ecological processes with possible management interventions (including a prescription for non-intervention) to increase quality of habitat. Where possible, identify land ownership of high quality stands and stands with potential for reclamation, for referral to partners who may wish to initiate a dialog concerning opportunities for management or conservation.
	Identify SGNC that rely on this system.	Working with researchers, compile existing data on wildlife use of the system to identify a more complete list of species that rely on it.

Category	Need	Action
Surveys	Sample under-represented vegetation community types.	Sample communities in data-poor areas.
	Ground truth maps.	Once areal extent has been estimated, use provisional maps to check accuracy on the ground and to revise sampling priorities.
	Sample vegetation communities within the home ranges of Species in Greatest Need of Conservation.	Beginning with a small number of targeted Species in Greatest Need of Conservation, work with zoologists to define and map critical habitat types for these species.
	Identify high quality stands and stands with potential for reclamation.	Using geologic maps, air photos, and species data, identify and sample potentially high quality stands and make recommendations (as appropriate) for conservation or reclamation of these areas.

Category	Need	Action
Monitoring	Monitor status of identified threats to habitat.	Connect vegetation ecology database/GIS layers efficiently with WVDNR geodatabases (as they are developed) that track threats such as invasive species, land use changes, spread of pathogens, or other threats. Regularly assess overlays of threats on mapped systems.
	Monitor rarity and ecological integrity of habitat.	Continue to sample and/or re-visit sampling sites periodically to monitor size, environmental condition, and landscape context of mapped habitat. Obtain most recent aerial photography to assess major trends in areal extent of each system.
	Monitor use of habitat by Species in Greatest Need of Conservation.	Develop efficient database connections between vegetation ecology data and incoming data on populations of Species in Greatest Need of Conservation.

Category	Need	Action
Research	Identify Species in Greatest Need of Conservation that rely on the system for portions of their life-cycles.	Work with researchers to match wildlife species data with habitat data via GIS overlays and field surveys.
	Determine stand attributes that are most important for Species in Greatest Need of Conservation.	Work with researchers to connect wildlife species behavioral data with specific habitat attributes.
	Determine successional sequences within the system.	Sample multiple age classes within the system and relate to classification of habitats and the species that use them. Investigate the possible role of fire in this system.
	Assess effects of acid deposition on vegetation composition, structure, and viability.	Sample stands exposed to varying amounts of acid rain and relate to ecological integrity of the stand.
	Assess effects of browsing on regeneration of vegetation.	Establish exclosures on sampled stands and monitor effects on vegetation composition and regeneration of palatable species.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are several conservation issues associated with the Limestone Barrens and Glades habitat system. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Action
Habitat Loss	Coordination, Education, Management, Acquisition
Forest Health	Coordination, Education, Management
Acid Deposition	
Harvest	Coordination, Education, Management
Management Conflicts	Coordination
Invasive Species	Education, Management
Damaging Recreation	Education

SELECTED ACTIONS FOR THE CONSERVATION OF LIMESTONE BARRENS AND GLADES IN WEST VIRGINIA

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this habitat system in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the habitat. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the habitat.

Data:

- Compile existing plot data; identify environmental parameters.
- Classify plot data into vegetation communities, using multivariate analysis and ordination. A preliminary study has been completed, but needs additional data. Vegetation will be classified according to the National Vegetation Classification.
- Use aerial photography, geologic maps, and known vegetation communities to estimate the areal extent of the system. Determine environmental and geographic patterns related to species composition and habitat suitability.
- Compare existing plot coverage with estimated extent of the system to determine high-priority sampling needs.

- Continue to maintain and improve plot sampling methodology in accordance with national standards. Maintain and update the Plots2-WV database, including interface with WVDNR geodatabases, Biotics, and national standards for ecological data storage.

Surveys:

- Sample communities in data-poor areas.

Coordination:

- Coordinate management with willing landowners and land managers on lands that have this habitat type.
- Continue to encourage the Monongahela National Forest to incorporate conservation and restoration of this habitat in their operational plans.

Management:

- Work with landowners to develop management plans for their land that conserves these habitats over the long run.
- Plan timber harvests to minimize encroachment of invasive plants.

Education:

- Educate the public in general and landowners with these habitats on their lands about the uniqueness of these systems.
- Educate the public and landowners about the negative effects of invasive plants on natural habitats.

Acquisition:

- Acquire or obtain non-development easements on these habitats from willing landowners.

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Habitat System: Sandstone Glades

DESCRIPTION

Sandstone Glades are small patch woodlands and openings on hot, dry aspects on sandstone in the Ridge and Valley and possibly in the Western Allegheny Plateau physiographic regions. The open stand structure is probably maintained by drought stress to trees due to thin or absent soil layers. Woody and herbaceous plants are often restricted to soil accumulations in fissures running across these bed rock communities. Dominant trees include Red Cedar, Virginia Pine and stunted Oaks and Hickories. The herb layer is usually sparse and often includes various Bryophytes and Lichens.

SPECIES IN GREATEST NEED OF CONSERVATION

The Sandstone Glade system harbors several species that are dependent on this type and essentially restricted to it within the state. In general, the fauna utilizing or dependent on Sandstone Glades is poorly known.

SPECIES IN GREATEST NEED OF CONSERVATION SANDSTONE GLADE	
Scientific Name	Common Name
<i>Corynorhinus townsendii virginianus</i>	Virginia Big-eared Bat
<i>Cicindela patruela</i>	A Tiger Beetle
<i>Hesperia metea</i>	Cobweb Skipper
<i>Cicindela purpurea</i>	A Tiger Beetle

LOCATION AND STATUS

Sandstone Glades are known from Grant, Hampshire, Hardy and Preston counties with smaller examples potentially scattered over much of the state.

Watersheds with Sandstone Glade Habitat
Youghiogheny
Cheat
North Branch Potomac
South Branch Potomac
Cacapon

DECISION MAKING PROCESS – NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of Sandstone Glades in West Virginia. Needs and actions for each category are outlined below. **Bolded** text indicates initial actions required to identify conservation needs of this habitat type in the state.

Category	Need	Action
Data	Develop working definition of system.	Compile existing plot data; identify environmental parameters.
	Determine vegetation communities.	Classify plot data into vegetation communities, using multivariate analysis and ordination. Vegetation will be classified according to the National Vegetation Classification.
	Map extent.	Use aerial photography, geologic maps, and known vegetation communities to estimate the areal extent of the system.
	Assess plot sampling coverage and needs.	Compare existing plot coverage with estimated extent of the system to determine high-priority sampling needs.
	Assess rarity.	Based on existing data, estimate rarity of the system at the state and global level. Historic data, where available, will be used to assess trends in rarity and/or comparisons with the pre-settlement extent of the system.
	Assess environmental integrity.	Document size, patch dynamics, environmental condition (age, successional state, composition, structure, land use history, disturbance), and landscape context (fragmentation, natural disturbance regime, landscape dynamics, surrounding land use) of each system. Describe the ecological processes (e.g. drought stress) that maintain the habitat.
	Maintain and improve plot sampling methodology and geodatabase.	Continue to maintain and improve plot sampling methodology in accordance with national standards. Continue to maintain and update the Plots2-WV database, including interface with WVDNR geodatabases, Biotics, and national standards for ecological data storage.

Data (con't)	Identify threats.	Identify threats including human disturbance, invasive species, pathogens, or alterations in natural processes.
	Identify management opportunities to increase quality of habitat.	Match identified threats and critical ecological processes with possible management interventions (including a prescription for non-intervention) to increase quality of habitat. Where possible, identify land ownership of high quality stands and stands with potential for reclamation, for referral to partners who may wish to initiate a dialog concerning opportunities for management or conservation.
	Identify SGNC that rely on this system.	Working with researchers, compile existing data on wildlife use of the system to identify a preliminary list of species that rely on it.

Category	Need	Action
Surveys	Sample under-represented vegetation community types.	Sample communities in data-poor areas.
	Ground truth maps.	Once areal extent has been estimated, use provisional maps to check accuracy on the ground and to revise sampling priorities.
	Sample vegetation communities within the home ranges of Species in Greatest Need of Conservation.	Beginning with a small number of targeted Species in Greatest Need of Conservation, work with zoologists to define and map critical habitat types for these species.
	Identify high quality stands and stands with potential for reclamation.	Using geologic maps, air photos, and species data, identify and sample potentially high quality stands and make recommendations (as appropriate) for conservation or reclamation of these areas.

Category	Need	Action
Research	Identify Species in Greatest Need of Conservation that rely on the system for portions of their life-cycles.	Work with researchers to match wildlife species data with habitat data via GIS overlays and field surveys.
	Determine stand attributes that are most important for Species in Greatest Need of Conservation.	Work with researchers to connect wildlife species behavioral data with specific habitat attributes.

	Assess effects of browsing on regeneration of vegetation.	Establish exclosures on sampled stands and monitor effects on vegetation composition and regeneration of palatable species.
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Category	Need	Action
Monitoring	Monitor status of identified threats to habitat.	Connect vegetation ecology database/GIS layers efficiently with WVDNR geodatabases (as they are developed) that track threats such as invasive species, land use changes, spread of pathogens, or other threats. Regularly assess overlays of threats on mapped systems.
	Monitor rarity and ecological integrity of habitat.	Continue to sample and/or re-visit sampling sites periodically to monitor size, environmental condition, and landscape context of mapped habitat. Obtain most recent aerial photography to assess major trends in areal extent of each system.
	Monitor use of habitat by Species in Greatest Need of Conservation.	Develop efficient database connections between vegetation ecology data and incoming data on populations of Species in Greatest Need of Conservation.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are several conservation issues associated with the Sandstone Glade habitat system. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition
Forest Health	Coordination, Education, Management
Water Quantity and Quality	Coordination, Management
Over Collection	Coordination, Education, Management
Management Conflicts	Coordination
Invasive Species	Education, Management

SELECTED ACTIONS FOR THE CONSERVATION OF SANDSTONE GLADES IN WEST VIRGINIA

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this habitat system in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the habitat. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the habitat.

Data:

- Compile existing plot data; identify environmental parameters.
- Classify plot data into vegetation communities, using multivariate analysis and ordination. Vegetation will be classified according to the National Vegetation Classification.
- Use aerial photography, geologic maps, and known vegetation communities to estimate the areal extent of the system.
- Compare existing plot coverage with estimated extent of the system to determine high-priority sampling needs.

Surveys:

- Sample communities in data-poor areas.

Coordination:

- Coordinate management with willing landowners and land managers on lands that have this habitat type.

Management:

- Work with landowners to develop management plans for their land that conserves these habitats over the long run.
- Manage glades and surrounding buffer to minimize encroachment of invasive plants.

Education:

- Educate the public in general and landowners with these habitats on their lands about the uniqueness of these systems.
- Educate the public and landowners about the negative effects of invasive plants on natural habitats.

Acquisition:

- Acquire or obtain non-development easements on these habitats from willing landowners.

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Habitat System: Hemlock Forest

DESCRIPTION

Hemlock Forests are upland evergreen forests found in cool aspects such as ravines and north slopes throughout much of the state, and as an extensive type on the plateaus near the Gauley River. These forests are dominated by Hemlock, but are often mixed with the deciduous trees of the Northern Hardwoods forest type. Giant Rhododendron is a common tall shrub species in many stands. Herb layers are typically sparse.

SPECIES IN GREATEST NEED OF CONSERVATION

The Hemlock Forest system harbors several species that are dependent on this type and essentially restricted to it within the state. Additional research is needed to determine the faunal use of Hemlock Forests.

SPECIES IN GREATEST NEED OF CONSERVATION HEMLOCK FOREST	
Scientific Name	Common Name
<i>Glaucomys sabrinus fuscus</i>	West Virginia Northern Flying Squirrel
<i>Myotis sodalis</i>	Indiana Bat
<i>Microtus chrotorrhinus carolinensis</i>	Southern Rock Vole
<i>Neotoma magister</i>	Allegheny Woodrat
<i>Sorex palustris punctulatus</i>	Southern Water Shrew
<i>Empidonax virescens</i>	Acadian Flycatcher
<i>Hylocichla mustelina</i>	Wood Thrush
<i>Seiurus motacilla</i>	Louisiana Waterthrush
<i>Aneides aeneus</i>	Green Salamander
<i>Plethodon punctatus</i>	Cow Knob Salamander
<i>Plethodon virginia</i>	Shenandoah Mountain Salamander
<i>Plethodon nettingi</i>	Cheat Mountain Salamander
<i>Triodopsis platysayoides</i>	Flat-Spired Three-toothed Landsnail
<i>Sorex dispar</i>	Long-Tailed Shrew
<i>Sorex hoyi winnemana</i>	Southern Pygmy Shrew
<i>Accipiter cooperii</i>	Cooper's Hawk
<i>Accipiter striatus</i>	Sharp-Shinned Hawk
<i>Ambystoma jeffersonianum</i>	Jefferson Salamander
<i>Cambarus monongalensis</i>	A Crayfish

LOCATION AND STATUS

Hemlock Forest habitat occurs statewide. Hemlock is under extreme threat from the Hemlock Woolly Adelgid, a small sap sucking insect that can kill the trees. Significant losses have already occurred in the Eastern Panhandle of the state and evidence of damage is moving south and west.

DECISION MAKING PROCESS – NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Hemlock Forest in West Virginia. Needs and actions for each category are outlined below. **Bolded** text indicates initial actions required to identify conservation needs of this habitat type in the state.

Category	Need	Action
Data	Develop working definition of system.	Compile existing plot data; identify environmental parameters.
	Determine vegetation communities.	Classify plot data into vegetation communities, using multivariate analysis and ordination. Vegetation will be classified according to the National Vegetation Classification.
	Map extent.	Use aerial photography and known vegetation communities to estimate the areal extent of the system. Determine environmental and geographic patterns related to species composition and habitat suitability.
	Assess plot sampling coverage and needs.	Compare existing plot coverage with estimated extent of the system to determine high-priority sampling needs. The upcoming Gauley project will add a number of additional sample plots to the DNR's existing data.
	Assess rarity.	Based on existing data, estimate rarity of the system at the state and global level. Historic data, where available, will be used to assess trends in rarity and/or comparisons with the pre-settlement extent of the system.
	Assess environmental integrity.	Document size, patch dynamics, environmental condition (status of Hemlock Woolly Adelgid infestation, age, successional state, composition, structure, land use history, disturbance) and landscape context (fragmentation, natural disturbance regime, landscape dynamics, surrounding land use) of each system. Describe the ecological processes that maintain the habitat.

Category	Need	Action
Data (con't)	Maintain and improve plot sampling methodology and geodatabase.	Continue to maintain and improve plot sampling methodology in accordance with national standards. Continue to maintain and update the Plots2-WV database, including interface with WVDNR geodatabases, Biotics and national standards for ecological data storage.
	Identify threats.	Identify threats including decline due to Hemlock Woolly Adelgid infestation, human disturbance, invasive species, other pathogens, or alterations in natural processes.
	Identify management opportunities to increase quality of habitat.	Match identified threats and critical ecological processes with possible management interventions (including a prescription for non-intervention) to increase quality of habitat. Identify high quality stands that might be candidates for interventions to protect from Hemlock Woolly Adelgid infestation.
	Identify SGNC that rely on this system.	Working with researchers, compile existing data on wildlife use of the system to identify a more complete listing of species that rely on it.

Category	Need	Action
Surveys	Sample under-represented vegetation community types.	Sample communities in data-poor areas.
	Ground truth maps.	Once areal extent has been estimated, use provisional maps to check accuracy on the ground and to revise sampling priorities.
	Sample vegetation communities within the home ranges of Species in Greatest Need of Conservation.	Beginning with a small number of targeted Species in Greatest Need of Conservation, work with zoologists to define and map critical habitat types for these species.
	Identify high quality stands.	Using geologic maps, air photos, and species data, identify and sample potentially high quality stands and make recommendations (as appropriate) for potential interventions to protect against Hemlock Woolly Adelgid infestation.

Category	Need	Action
Research	Identify Species in Greatest Need of Conservation that rely on the system for portions of their life-cycles.	Work with researchers to match wildlife species data with habitat data via GIS overlays and field surveys.
	Determine stand attributes that are most important for Species in Greatest Need of Conservation.	Work with researchers to connect wildlife species behavioral data with specific habitat attributes.
	Assess resilience of stands within various vegetation communities in the face of Hemlock Woolly Adelgid infestation.	Sample stands within different vegetation communities to determine whether resistance to Hemlock Woolly Adelgid might be stronger within certain communities.

Category	Need	Action
Monitoring	Monitor status of identified threats to habitat.	Connect vegetation ecology database/GIS layers efficiently with WVDNR geodatabases (as they are developed) that track threats such as invasive species, land use changes, spread of pathogens or other threats. Regularly assess overlays of threats on mapped systems.
	Monitor rarity and ecological integrity of habitat.	Continue to sample and/or re-visit sampling sites periodically to monitor size, environmental condition, and landscape context of mapped habitat. Obtain most recent aerial photography to assess major trends in areal extent of each system.
	Monitor use of habitat by SGNC.	Develop efficient database connections between vegetation ecology data and incoming data on populations of SGNC.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are several conservation issues associated with the Hemlock Forest habitat system. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition
Forest Health	Coordination, Education, Management
Acid Deposition	Coordination, Management
Harvest	Coordination, Education, Management
Management Conflicts	Coordination
Invasive Species	Education, Management
Damaging Recreation	Education

SELECTED ACTIONS FOR THE CONSERVATION OF HEMLOCK FORESTS IN WEST VIRGINIA

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this habitat system in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the habitat. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the habitat.

Data:

- Compile existing plot data; identify environmental parameters.
- Classify plot data into vegetation communities, using multivariate analysis and ordination. Vegetation will be classified according to the National Vegetation Classification.
- Use aerial photography and known vegetation communities to estimate the areal extent of the system. Determine environmental and geographic patterns related to species composition and habitat suitability.
- Compare existing plot coverage with estimated extent of the system to determine high-priority sampling needs. The upcoming Gauley project will add a number of additional sample plots to the DNR's existing data.

Surveys:

- Sample communities in data-poor areas.

Monitoring:

- Connect vegetation ecology database/GIS layers efficiently with WVDNR geodatabases (as they are developed) that track threats such as invasive species, land use changes, spread of pathogens, or other threats. Regularly assess overlays of threats on mapped systems.
- Continue to sample and/or re-visit sampling sites periodically to monitor size, environmental condition, and landscape context of mapped habitat. Obtain most recent aerial photography to assess major trends in areal extent of each system.

Coordination:

- Maintain close contact with researchers studying the Hemlock Woolly Adelgid and enact any control measures that are practical to important stands on both public and private lands.
- Coordinate management with willing landowners and land managers on lands that have this habitat type.
- Continue to encourage the Monongahela National Forest to incorporate conservation and restoration of this habitat in their operational plans.

Management:

- Work with forest landowners to develop management plans for their land that conserves Hemlock over the long run.
- Plan timber harvests to maintain the health of Hemlock Forest habitat in the state.

Education:

- Educate the public about the importance of maintaining Hemlock Forests.
- Educate the public and landowners about the negative effects of invasive plants on natural habitats.

Acquisition:

- Encourage owners of Hemlock Forests to enroll their land in the Forest Legacy or similar Program.

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Habitat System: Wetlands

DESCRIPTION

This category includes all Wetland types found in the state except floodplain swamps, which are treated separately. Various types of wetland habitat include: swamps, bogs and fens, forest seeps, vernal pools, marshes and wet meadows. Wetlands are rich in both floral and faunal diversity, and provide critical ecosystem services to benefit all life. While wetlands make up less than one-half of one percent of West Virginia's land area, they are home to 23% of its plant species, and thus provide one of our most critically important habitat types.

SPECIES IN GREATEST NEED OF CONSERVATION

Wetlands harbor many Species in Greatest Need of Conservation that are dependent on this habitat type within the state.

SPECIES IN GREATEST NEED OF CONSERVATION WETLANDS	
Scientific Name	Common Name
<i>Acris crepitans blanchardi</i>	Blanchard's Cricket Frog
<i>Aegolius acadicus</i>	Northern Saw-whet Owl
<i>Aeshna mutata</i>	Spatterdock Darner
<i>Ambystoma barbouri</i>	Streamside Salamander
<i>Ambystoma jeffersonianum</i>	Jefferson Salamander
<i>Ambystoma texanum</i>	Smallmouth Salamander
<i>Asio flammeus</i>	Short-eared Owl
<i>Asio otus</i>	Long-eared Owl
<i>Boloria selene myrina</i>	Myrina Fritillary
<i>Botaurus lentiginosus</i>	American Bittern
<i>Chlosyne harrisii</i>	Harris's Checkerspot
<i>Circus cyaneus</i>	Northern Harrier
<i>Cistothorus palustris</i>	Marsh Wren
<i>Cistothorus platensis</i>	Sedge Wren
<i>Clemmys guttata</i>	Spotted Turtle
<i>Colias interior pop 1</i>	Pink-edged Sulphur (high elevation)
<i>Contopus cooperi</i>	Olive-sided Flycatcher
<i>Corynorhinus townsendii virginianus</i>	Virginia Big-eared Bat
<i>Empidonax alorum</i>	Alder Flycatcher
<i>Empidonax flaviventris</i>	Yellow-bellied Flycatcher
<i>Euphyes bimacula</i>	Two-spotted Skipper
<i>Euphyes conspicua</i>	Black Dash
<i>Fulica americana</i>	American Coot
<i>Gallinago delicata</i>	Wilson's Snipe
<i>Ixobrychus exilis</i>	Least Bittern
<i>Lasiurus borealis</i>	Eastern Red Bat
<i>Lycaena epixanthe</i>	Bog Copper

<i>Lycaena hyllus</i>	Bronze Copper
<i>Microtus ochrogaster</i>	Prairie Vole
<i>Myotis leibii</i>	Eastern Small-footed Bat
<i>Nycticorax nycticorax</i>	Black-crowned Night-heron
<i>Porzana carolina</i>	Sora
<i>Pseudacris triseriata feriarum</i>	Upland Chorus Frog
<i>Pseudotriton montanus diastictus</i>	Midland Mud Salamander
<i>Pseudotriton ruber</i>	Northern Red Salamander
<i>Rallus elegans</i>	King Rail
<i>Rallus limicola</i>	Virginia Rail
<i>Rana pipiens</i>	Northern Leopard Frog
<i>Reithrodontomys humulis</i>	Eastern Harvest Mouse
<i>Scaphiopus holbrookii</i>	Eastern Spadefoot
<i>Seiurus noveboracensis</i>	Northern Waterthrush
<i>Sorex palustris punctulatus</i>	Southern Water Shrew
<i>Speyeria atlantis</i>	Atlantis Fritillary
<i>Synaptomys cooperi</i>	Southern Bog Lemming
<i>Vermivora chrysoptera</i>	Golden-winged Warbler
<i>Vermivora ruficapilla</i>	Nashville Warbler

LOCATION AND STATUS

Wetlands are found statewide.

DECISION MAKING PROCESS – NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of Wetlands in West Virginia. Needs and actions for each category are outlined below. **Bolded** text indicates initial actions required to identify conservation needs of this habitat type in the state.

Category	Need	Action
Data	Develop working definition of wetland habitat systems (High Allegheny swamps, High Allegheny bogs and fens, Forest seeps and vernal pools, Marshes and wet meadows).	Compile and identify plot data within each system; identify environmental parameters. For high elevation wetlands which have been well-sampled, compile existing vegetation community descriptions into broader system descriptions.
	Determine vegetation communities within each system.	Classify plot data into vegetation communities within each system, using multivariate analysis and ordination. Vegetation will be classified according to the National Vegetation Classification.
	Map extent.	Use infrared aerial photography and known vegetation communities to estimate the areal extent of each wetland system.

Category	Need	Action
Data (con't)	Assess plot sampling coverage and needs.	Compare existing plot coverage with estimated extent of each system to determine high-priority sampling needs. For Wetlands, these are the Ridge and Valley, Western Allegheny Plateau, and Cumberland/Southern Ridge and Valley regions.
	Assess rarity.	Based on existing data, estimate rarity of each system at the state and global level. Historic data, where available, will be used to assess trends in rarity and/or comparisons with the pre-settlement extent of each system.
	Assess environmental integrity.	Document size, patch dynamics, environmental condition (age, successional state, composition, structure, land use history, disturbance), and landscape context (fragmentation, natural disturbance regime, landscape dynamics, surrounding land use) of each system. Describe the ecological processes that maintain the habitat.
	Maintain and improve plot sampling methodology and geodatabase.	Continue to maintain and improve plot sampling methodology in accordance with national standards. Continue to maintain and update the Plots2-WV database, including interface with WVDNR geodatabases, Biotics, and national standards for ecological data storage.
	Identify threats.	Identify threats including human disturbance, hydrologic alteration, invasive species, pathogens, or alterations in natural processes.
	Identify management opportunities to increase quality of habitat.	Match identified threats and critical ecological processes with possible management interventions (including a prescription for non-intervention).to increase quality of habitat. Where possible, identify land ownership of large, intact occurrences, for referral to partners who may wish to initiate a dialog concerning opportunities for management or conservation.
	Identify SGNC that rely on wetland systems.	Working with researchers, compile existing data on wildlife use of Wetlands to identify an expanded list of species that rely on these systems.

Category	Need	Action
Surveys	Sample under-represented vegetation community types.	Sample wetland communities in the Ridge and Valley, Western Allegheny Plateau and CSRV regions.
	Ground truth maps.	Once areal extent of each system has been estimated, use provisional maps to check accuracy on the ground and to revise sampling priorities.
	Sample vegetation communities within the home ranges of Species in Greatest Need of Conservation.	Beginning with a small number of targeted Species in Greatest Need of Conservation, work with zoologists to define and map critical habitat types for these species.
	Identify high quality stands and stands with potential for reclamation.	Using geologic maps, air photos, and species data, identify and sample potentially high quality stands and make recommendations (as appropriate) for conservation or reclamation of these areas.

Category	Need	Action
Research	An effective Wetland monitoring strategy and methodology.	Develop a Wetland monitoring methodology and process.
	Identify Species in Greatest Need of Conservation that rely on Wetland systems for portions of their life-cycles.	Work with researchers to match wildlife species data with habitat data via GIS overlays and field surveys.
	Determine stand attributes in each system that are most important for Species in Greatest Need of Conservation.	Work with researchers to connect wildlife species behavioral data with specific habitat attributes.
	Determine successional sequences within each system.	Sample multiple age classes and disturbance regimes within each system and relate to classification of habitats and the species that use them.
	Assess effects of acid deposition on vegetation composition, structure and viability.	Sample stands exposed to varying amounts of acid rain and relate to ecological integrity of the stand.
	Assess effects of browsing on regeneration of vegetation.	Establish exclosures on sampled stands and monitor effects on vegetation composition and regeneration of palatable species.

Category	Need	Action
Monitoring	Monitor status of identified threats to habitat.	Connect vegetation ecology database/GIS layers efficiently with WVDNR geodatabases (as they are developed) that track threats such as invasive species, land use changes, spread of pathogens, or other threats. Regularly assess overlays of threats on mapped wetland systems.
	Monitor status of Wetland systems across the state.	Implement Wetland monitoring program as the methodology is developed.
	Monitor rarity and ecological integrity of habitat.	Continue to sample and/or re-visit sampling sites periodically to monitor size, environmental condition, and landscape context of mapped habitat. Obtain most recent aerial photography to assess major trends in areal extent of each system.
	Monitor use of habitat by Species in Greatest Need of Conservation.	Develop efficient database connections between vegetation ecology data and incoming data on populations of Species in Greatest Need of Conservation.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are several conservation issues associated with Wetlands. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Action
Habitat Loss	Coordination, Education, Management, Acquisition
Forest Health	Coordination, Education, Management
Acid Deposition	Coordination, Management
Harvest	Coordination, Education, Management
Management Conflicts	Coordination
Invasive Species	Education, Management

SELECTED ACTIONS FOR THE CONSERVATION OF WETLANDS IN WEST VIRGINIA

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve Wetlands in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the habitat. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the habitat.

Data:

- Compile and identify plot data within each system; identify environmental parameters. For high elevation wetlands which have been well-sampled, compile existing vegetation community descriptions into broader system descriptions.
- Classify plot data into vegetation communities within each system, using multivariate analysis and ordination. Vegetation will be classified according to the National Vegetation Classification.
- Use infrared aerial photography and known vegetation communities to estimate the areal extent of each wetland system.
- Compare existing plot coverage with estimated extent of each system to determine high-priority sampling needs. For wetlands, these are the Ridge and Valley, Western Allegheny Plateau and Cumberland/Southern Ridge and Valley regions.

Surveys:

- Sample wetland communities in the Ridge and Valley, Western Allegheny Plateau and CSRV regions.

Monitoring:

- Implement wetland monitoring program as the methodology is developed.

Research:

- Develop a wetland monitoring methodology and process.

Coordination:

- Coordinate management with willing landowners and land managers on lands that have this habitat type.
- Continue to encourage the Monongahela National Forest to incorporate conservation and restoration of this habitat in their operational plans.

Management:

- Work with landowners to develop management plans for their land that conserves Wetlands over the long run.

Education:

- Educate the public about the importance of maintaining Wetlands.

- Educate the public and landowners about the negative effects of invasive plants on natural habitats.

Acquisition:

- Encourage willing owners of Wetlands to conserve Wetlands on their property through management agreements, easements, or other appropriate avenues.

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Habitat System: Floodplain Forests and Swamps

DESCRIPTION

Floodplain Forests and Swamps are forests, forested swamps and shrub swamps on depositional floodplains of rivers and large tributaries in all parts of the state. Wetlands include Pin Oak swamps and Buttonbush swamps. The characteristic trees of Floodplain Forests include Silver Maple, Box-Elder, Sycamore, Green Ash and American Elm. These floodplain systems are dynamic but are more stable than riverscour communities which may occur in adjacent positions closer to the stream channel.

SPECIES IN GREATEST NEED OF CONSERVATION

The Floodplain Forest and Swamp system harbors several species that are dependent on this type and essentially restricted to it within the state.

SPECIES IN GREATEST NEED OF CONSERVATION FLOODPLAIN FOREST AND SWAMP	
Scientific Name	Common Name
<i>Corynorhinus townsendii virginianus</i>	Virginia Big-Eared Bat
<i>Myotis leibii</i>	Eastern Small-footed Bat
<i>Reithrodontomys humulis</i>	Eastern Harvest Mouse
<i>Sorex palustris punctulatus</i>	Southern Water Shrew
<i>Botaurus lentiginosus</i>	American Bittern
<i>Cistothorus palustris</i>	Marsh Wren
<i>Gallinula chloropus</i>	Common Moorhen
<i>Haliaeetus leucocephalus</i>	Bald Eagle
<i>Ixobrychus exilis</i>	Least Bittern
<i>Nycticorax nycticorax</i>	Black-Crowned Night-Heron
<i>Porzana carolina</i>	Sora
<i>Rallus elegans</i>	King Rail
<i>Rallus limicola</i>	Virginia Rail
<i>Seiurus motacilla</i>	Louisiana Waterthrush
<i>Ambystoma barbouri</i>	Streamside Salamander
<i>Ambystoma texanum</i>	Smallmouth Salamander
<i>Scaphiopus holbrookii</i>	Eastern Spadefoot
<i>Scaphiopus holbrookii</i>	Eastern Spadefoot
<i>Clemmys insculpta</i>	Wood Turtle
<i>Aeshna mutata</i>	Spatterdock Darner
<i>Lasiurus borealis</i>	Eastern Red Bat
<i>Ochrotomys nuttalli</i>	Golden Mouse
<i>Synaptomys cooperi</i>	Southern Bog Lemming
<i>Zapus hudsonius</i>	Meadow Jumping Mouse
<i>Ardea herodias</i>	Great Blue Heron
<i>Protonotaria citrea</i>	Prothonotary Warbler
<i>Ambystoma jeffersonianum</i>	Jefferson Salamander
<i>Rana pipiens</i>	Northern Leopard Frog

LOCATION AND STATUS

Floodplain Forests and Swamps are found statewide. The number and acreage of these systems have been severely diminished in West Virginia. Few intact Floodplain Forests exist along the state's large rivers and many wetlands on these floodplains have been drained or filled for development or agriculture.

DECISION MAKING PROCESS – NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Floodplain Forests and Swamps in West Virginia. Needs and actions for each category are outlined below. **Bolded** text indicates initial actions required to identify conservation needs of this habitat type in the state.

Category	Need	Action
Data	Develop working definition of system.	Compile existing plot data; identify environmental parameters.
	Determine vegetation communities.	Classify plot data into vegetation communities, using multivariate analysis and ordination. Vegetation will be classified according to the National Vegetation Classification.
	Map extent.	Use aerial photography and known vegetation communities to estimate the areal extent of the system.
	Assess plot sampling coverage and needs.	Compare existing plot coverage with estimated extent of the system to determine high-priority sampling needs. Data exist from the New River, Harper's Ferry, Bluestone, Tygart, Ohio River and some mountain locations, but many parts of the state remain unsampled.
	Assess rarity.	Based on existing data, estimate rarity of the system at the state and global level. Historic data, where available, will be used to assess trends in rarity and/or comparisons with the pre-settlement extent of the system.

Category	Need	Action
Data (con't)	Assess environmental integrity.	Document size, patch dynamics, environmental condition (age, successional state, composition, structure, land use history, disturbance) and landscape context (fragmentation, natural disturbance regime, landscape dynamics, surrounding land use) of each system. Describe the ecological processes that maintain the habitat. Because human influence is particularly strong in floodplain areas, many examples of this system are disturbed.
	Maintain and improve plot sampling methodology and geodatabase.	Continue to maintain and improve plot sampling methodology in accordance with national standards. Maintain and update the Plots2-WV database, including interface with WVDNR geodatabases, Biotics and national standards for ecological data storage.
	Identify threats.	Identify threats including hydrologic alteration, polluted flows, human disturbance, invasive species, pathogens, or alterations in natural processes.
	Identify management opportunities to increase quality of habitat.	Match identified threats and critical ecological processes with possible management interventions (including a prescription for non-intervention) to increase quality of habitat.
	Identify Species in Greatest Need of Conservation that rely on Floodplain Forests and Swamps.	Working with wildlife staff, compile existing data on wildlife use of the system to identify a preliminary list of species that rely on floodplain forests and swamps.

Category	Need	Action
Surveys	Sample under-represented vegetation community types.	Sample communities in data-poor areas.
	Ground truth maps.	Once areal extent has been estimated, use provisional maps to check accuracy on the ground and to revise sampling priorities.
	Sample vegetation communities within the home ranges of Species in Greatest Need of Conservation.	Beginning with a small number of targeted Species in Greatest Need of Conservation, work with zoologists to define and map critical habitat types for these species.

Surveys (con't)	Identify large, high quality stands and stands with potential for reclamation.	Using geologic maps, air photos, and species data, identify and sample potentially high quality stands and make recommendations (as appropriate) for conservation or reclamation of these areas.
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Category	Need	Action
Research	Identify Species in Greatest Need of Conservation that rely on Floodplain Forests and Swamps for portions of their life-cycles.	Work with researchers to match wildlife species data with habitat data via GIS overlays and field surveys.
	Determine stand attributes that are most important for Species in Greatest Need of Conservation.	Work with researchers to connect wildlife species behavioral data with specific habitat attributes.
	Determine successional sequences within the system.	Sample multiple age classes and disturbance regimes within the system and relate to classification of habitats and the species that use them.
	Assess effects of historic and altered flow regimes, including water pollution, on community composition and viability.	Gather historic records and sample stands exposed to varying flow regimes and pollution inputs. Relate to ecological integrity of the stand.
	Assess effects of browsing on regeneration of vegetation.	Establish exclosures on sampled stands and compare effects of browsing on vegetation composition.

Category	Need	Action
Monitoring	Monitor status of identified threats to habitat.	Connect vegetation ecology database/GIS layers efficiently with WVDNR geodatabases (as they are developed) that track threats such as invasive species, land use changes, spread of pathogens, or other threats. Regularly assess overlays of threats on mapped systems.
	Monitor rarity and ecological integrity of habitat.	Continue to sample and/or re-visit sampling sites periodically to monitor size, environmental condition, and landscape context of mapped habitat. Obtain most recent aerial photography to assess major trends in areal extent of each system.
	Monitor use of habitat by SGNC.	Develop efficient database connections between vegetation ecology data and incoming data on populations of SGNC.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are several conservation issues associated with the Floodplain Forest and Swamp habitat system. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition
Forest Health	Coordination, Education, Management
Acid Deposition	Coordination, Management
Over Collection	Coordination, Education, Management
Management Conflicts	Coordination
Invasive Species	Education, Management
Damaging Recreation	Education

SELECTED ACTIONS FOR THE CONSERVATION OF FLOODPLAIN FOREST AND SWAMP HABITATS IN WEST VIRGINIA

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this habitat system in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the habitat. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the habitat.

Data:

- Compile existing plot data; identify environmental parameters.
- Classify plot data into vegetation communities, using multivariate analysis and ordination. Vegetation will be classified according to the National Vegetation Classification.
- Use aerial photography and known vegetation communities to estimate the areal extent of the system.
- Compare existing plot coverage with estimated extent of the system to determine high-priority sampling needs. Data exist from the New River, Harper's Ferry, Bluestone, Tygart, Ohio River and some mountain locations, but many parts of the state remain unsampled.

Surveys:

- Sample communities in data-poor areas.

Coordination:

- Coordinate management with willing landowners and land managers on lands that have this habitat type.

Management:

- Work with landowners to develop management plans for their land that conserves Floodplain Forest and Swamp habitat over the long run.

Education:

- Educate the public about the importance of maintaining Floodplain Forests and Swamps.
- Educate the public and landowners about the negative effects of invasive plants on natural habitats.

Acquisition:

- Encourage willing owners of these habitats to conserve their property through management agreements, easements, or other appropriate avenues.

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Habitat System: Cliff/Rock Outcrop/Talus

DESCRIPTION

Cliffs, Rock Outcrops and Talus all represent sparsely vegetated rock exposures throughout the state. Many examples have all three components with a horizontal rock outcrop (or "pavement") above a cliff, above talus. These communities occur in all vegetation zones and are more characterized by their topographical structure than by vegetation. Subtypes may be broken out based on rock type and aspect.

SPECIES IN GREATEST NEED OF CONSERVATION

These systems harbor many species that are dependent on this type for all or a portion of their life cycle. In general, the fauna utilizing or dependent on these systems is poorly known.

SPECIES IN GREATEST NEED OF CONSERVATION CLIFF/ROCK OUTCROP/TALUS	
Scientific Name	Common Name
<i>Corynorhinus townsendii virginianus</i>	Virginia Big-Eared Bat
<i>Microtus chrotorrhinus carolinensis</i>	Southern Rock Vole
<i>Myotis leibii</i>	Eastern Small-footed Bat
<i>Neotoma magister</i>	Allegheny Woodrat
<i>Spilogale putorius</i>	Eastern Spotted Skunk
<i>Falco peregrinus</i>	Peregrine Falcon
<i>Aneides aeneus</i>	Green Salamander
<i>Cnemidophorus sexlineatus</i>	Eastern Six-Lined Racerunner
<i>Crotalus horridus</i>	Timber Rattlesnake
<i>Elaphe guttata guttata</i>	Cornsnake
<i>Virginia valeriae pulchra</i>	Mountain Earthsnake
<i>Triodopsis platysayoides</i>	Flat-Spired Three-toothed Landsnail
<i>Sorex dispar</i>	Long-Tailed Shrew
<i>Coragyps atratus</i>	Black Vulture
<i>Petrochelidon pyrrhonota</i>	Cliff Swallow
<i>Eurycea lucifuga</i>	Cave Salamander
<i>Carphophis amoenus</i>	Wormsnake
<i>Eumeces anthracinus anthracinus</i>	Northern Coal Skink
<i>Eumeces laticeps</i>	Broad-Headed Skink
<i>Scincella lateralis</i>	Little Brown Skink
<i>Virginia valeriae valeriae</i>	Eastern Earthsnake
<i>Erynnis lucilius</i>	Columbine Duskywing

LOCATION AND STATUS

Cliff/Rock Outcrop/Talus systems are found statewide with the most dramatic examples along the Cheat River Gorge, North Fork Mountain, and the New, Bluestone and Gauley River Gorges.

Watersheds with Major Cliff/Rock Outcrop/Talus Habitat
New
Bluestone
Gauley
Cheat
North Branch Potomac
South Branch Potomac
Cacapon

DECISION MAKING PROCESS – NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of the Cliff/Rock Outcrop/Talus in West Virginia. Needs and actions for each category are outlined below. **Bolded** text indicates initial actions required to identify conservation needs of this habitat type in the state.

Category	Need	Action
Data	Develop working definition of system.	Compile existing plot data; identify environmental parameters.
	Determine vegetation communities.	Classify plot data into vegetation communities, using multivariate analysis and ordination. Vegetation will be classified according to the National Vegetation Classification.
	Map extent.	Use aerial photography, geologic maps, and known vegetation communities to estimate the areal extent of the system.
	Assess plot sampling coverage and needs.	Compare existing plot coverage with estimated extent of the system to determine high-priority sampling needs.
	Assess rarity.	Based on existing data, estimate rarity of the different types of systems at the state and global level.

Category	Need	Action
Data (con't)	Assess environmental integrity.	Document size, patch dynamics, environmental condition (age, successional state, composition, structure, land use history, disturbance) and landscape context (fragmentation, natural disturbance regime, landscape dynamics, surrounding land use) of each system. Describe the ecological processes (e.g. drought stress) that maintain the habitat.
	Maintain and improve plot sampling methodology and geodatabase.	Continue to maintain and improve plot sampling methodology in accordance with national standards. Continue to maintain and update the Plots2-WV database, including interface with WVDNR geodatabases, Biotics and national standards for ecological data storage.
	Identify threats.	Identify threats including human disturbance, invasive species, pathogens or alterations in natural processes.
	Identify management opportunities to increase quality of habitat.	Match identified threats and critical ecological processes with possible management interventions (including a prescription for non-intervention) to increase quality of habitat. Where possible, identify land ownership of high quality examples with potential for reclamation, for referral to partners who may wish to initiate a dialog concerning opportunities for management or conservation.
	Identify SGNC that rely on this system.	Working with researchers, compile existing data on wildlife use of the system to identify an expanded list of species that rely on it.

Category	Need	Action
Surveys	Sample under-represented vegetation community types.	Sample communities in data-poor areas.
	Ground truth maps.	Once areal extent has been estimated, use provisional maps to check accuracy on the ground and to revise sampling priorities.

Category	Need	Action
Surveys (con't)	Sample vegetation communities within the home ranges of Species in Greatest Need of Conservation.	Beginning with a small number of targeted Species in Greatest Need of Conservation, work with zoologists to define and map critical habitat types for these species.
	Identify high quality examples with potential for reclamation.	Using geologic maps, air photos and species data, identify and sample potentially high quality examples and make recommendations (as appropriate) for conservation or reclamation of these areas.

Category	Need	Action
Research	Identify Species in Greatest Need of Conservation that rely on the system for portions of their life-cycles.	Work with researchers to match wildlife species data with habitat data via GIS overlays and field surveys.
	Determine system attributes that are most important for Species in Greatest Need of Conservation.	Work with researchers to connect wildlife species behavioral data with specific habitat attributes.
	Assess effects of browsing on regeneration of vegetation.	Establish exclosures on sampled communities (primarily cliff tops) and monitor effects on vegetation composition and regeneration of palatable species.

Category	Need	Action
Monitoring	Monitor status of identified threats to habitat.	Connect vegetation ecology database/GIS layers efficiently with WVDNR geodatabases (as they are developed) that track threats such as invasive species, land use changes, spread of pathogens, or other threats. Regularly assess overlays of threats on mapped systems.
	Monitor rarity and ecological integrity of habitat.	Continue to sample and/or re-visit sampling sites periodically to monitor size, environmental condition and landscape context of mapped habitat.
	Monitor use of habitat by Species in Greatest Need of Conservation.	Develop efficient database connections between vegetation ecology data and incoming data on populations of SGNC.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are several conservation issues associated with the Cliff/Rock Outcrop/Talus habitat systems. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition
Forest Health	Coordination, Education, Management
Management Conflicts	Coordination
Invasive Species	Education, Management
Damaging Recreation	Education, Management

**SELECTED ACTIONS FOR THE CONSERVATION OF CLIFF/ROCK
OUTCROP/TALUS IN WEST VIRGINIA**

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this habitat system in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the habitat. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the habitat.

Data:

- Compile existing plot data; identify environmental parameters.
- Classify plot data into vegetation communities, using multivariate analysis and ordination. Vegetation will be classified according to the National Vegetation Classification.
- Use aerial photography, geologic maps, and known vegetation communities to estimate the areal extent of the system.
- Compare existing plot coverage with estimated extent of the system to determine high-priority sampling needs.

Surveys:

- Sample communities in data-poor areas.

Coordination:

- Coordinate management with willing landowners and land managers on lands that have these habitat types.

Management:

- Work with landowners to develop management plans for their land that conserves these habitats over the long run.
- Manage these systems and surrounding buffer to minimize encroachment of invasive plants.
- Work with National Park Service to continue to develop recreation (primarily climbing) plans for use of these areas on Park Service lands.

Education:

- Educate the public in general and landowners with these habitats on their lands about the uniqueness of these systems.
- Educate the public and landowners about the negative effects of invasive plants on natural habitats.

Acquisition:

- Acquire or obtain non-development easements on these habitats from willing landowners.

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Habitat System: Caves and Karst

DESCRIPTION

Limestone caves are voids within limestone bedrock resulting from dissolution of the rock over long periods of time. Karst refers to a limestone bedrock region that incorporates the sinks (depressions in the land surface resulting from dissolving the limestone underneath the spot), caves and underground streams which may be found there. Sandstone bedrock may develop voids from erosion and/or the consequent breakdown of the strata. These habitats are markedly different from limestone caves because of the general propensity of sandstone to be acidic rather than alkaline like limestone. Sandstone caves rarely have flowing water associated with them and the habitat they supply is more for shelter or dens.

SPECIES IN GREATEST NEED OF CONSERVATION

Caves and Karst harbor many species that are dependent on these subterranean habitats and essentially restricted to them within the state. Many species are endemic to one or at most a small number of caves. Surface habitats are also important to several cave-dwelling species, although much more research is needed to determine interactions between surface and subterranean environments. In many cases, the watershed of caves streams is poorly understood and may not coincide with surface watersheds.

SPECIES IN GREATEST NEED OF CONSERVATION LIMESTONE AND SANDSTONE CAVES AND KARST	
Scientific Name	Common Name
<i>Myotis sodalis</i>	Virginia Big-Eared Bat
<i>Neotoma magister</i>	Indiana Bat
<i>Spilogale putorius</i>	Allegheny Woodrat
<i>Gyrinophilus subterraneus</i>	Eastern Spotted Skunk
<i>Eurycea lucifuga</i>	West Virginia Spring Salamander
<i>Antrolana lira</i>	Cave Salamander
<i>Myotis sodalis</i>	Madison Cave Isopod
<i>Anthrobia monmouthia</i>	Spider
<i>Apochthonius paucispinosus</i>	Dry Fork Valley Cave Pseudoscorpion
<i>Arrhopalites sp 2</i>	A Collembola
<i>Arrhopalites sp 3</i>	A Collembola
<i>Bathyphantes weyeri</i>	A Cave Spider
<i>Caecidotea cannula</i>	An Isopod
<i>Caecidotea franzi</i>	Franz's Cave Isopod
<i>Caecidotea holsingeri</i>	Greenbrier Valley Cave Isopod
<i>Caecidotea pricei</i>	Price's Cave Isopod

Scientific Name	Common Name
<i>Caecidotea simonini</i>	An Isopod
<i>Caecidotea sinuncus</i>	An Isopod
<i>Chitrella regina</i>	Royal Syarinid Pseudoscorpion
<i>Conotyla vista</i>	A Cave Millipede
<i>Crangonyx sp 2</i>	An Amphipod
<i>Fontigens sp 1</i>	McClung Cavesnail
<i>Fontigens tartarea</i>	Organ Cavesnail
<i>Fontigens turritella</i>	Greenbrier Cavesnail
<i>Geocentrophora cavernicola</i>	Cave Flatworm
<i>Haplotaxis brinkhursti</i>	An Oligochaete
<i>Horologion speokites</i>	Arbuckle Cave Ground Beetle
<i>Islandiana sp 1</i>	A Spider
<i>Islandiana speophila</i>	Cavern Sheet-Web Spider
<i>Kleptochthonius henroti</i>	Greenbrier Valley Cave Pseudoscorpion
<i>Kleptochthonius hetricki</i>	Organ Cave Pseudoscorpion
<i>Kleptochthonius orpheus</i>	Orpheus Cave Pseudoscorpion
<i>Kleptochthonius proserpinae</i>	Proserpina Cave Pseudoscorpion
<i>Litocampa fieldingi</i>	Diplura
<i>Litocampa sp 1</i>	Diplura
<i>Macrocotyla hoffmasteri</i>	Hoffmaster's Cave Flatworm
<i>Nesticus tennesseensis</i>	A Cave Spider
<i>Phagocata angusta</i>	A Cave Planarian
<i>Phanetta subterranea</i>	A Spider
<i>Poecilophysis wolmsdorfensis</i>	A Cave Mite
<i>Porrhomma cavernicola</i>	Appalachian Cave Spider
<i>Pseudanophthalmus fuscus</i>	A Cave Beetle
<i>Pseudanophthalmus grandis elevatus</i>	A Cave Beetle
<i>Pseudanophthalmus grandis grandis</i>	A Cave Beetle
<i>Pseudanophthalmus grandis orthosulc</i>	A Cave Beetle
<i>Pseudanophthalmus grandis ssp 1</i>	A Cave Beetle
<i>Pseudanophthalmus hadenoecus</i>	Timber Ridge Cave Beetle
<i>Pseudanophthalmus higinbothami</i>	A Cave Beetle
<i>Pseudanophthalmus hypertrichosis</i>	A Cave Beetle
<i>Pseudanophthalmus krekeri</i>	Rich Mountain Cave Beetle
<i>Pseudanophthalmus lallemanti</i>	Lallemant's Cave Beetle
<i>Pseudanophthalmus montanus</i>	Dry Fork Valley Cave Beetle
<i>Pseudanophthalmus potomaca potomaca</i>	South Branch Valley Cave Beetle
<i>Pseudanophthalmus potomaca senecae</i>	Seneca Cave Beetle

Scientific Name	Common Name
<i>Pseudanophthalmus sp 1</i>	A Beetle
<i>Pseudanophthalmus sp 2</i>	A Beetle
<i>Pseudanophthalmus sp 3</i>	A Beetle
<i>Pseudanophthalmus subaequalis</i>	Greenbrier Valley Cave Beetle
<i>Pseudosinella certa</i>	Gandy Creek Cave Springtail
<i>Pseudosinella gisini</i>	A Springtail
<i>Pseudosinella orba</i>	A Cave Springtail
<i>Pseudosinella sp 1</i>	A Springtail
<i>Pseudosinella testa</i>	Shelled Cave Springtail
<i>Pseudotremia fulgida</i>	Greenbrier Valley Cave Millipede
<i>Pseudotremia lusciosa</i>	Germany Valley Cave Millipede
<i>Pseudotremia princeps</i>	South Branch Valley Cave Millipede
<i>Pseudotremia sp 1</i>	General Davis Cave Millipede
<i>Rhagidia varia</i>	A Cave Mite
<i>Sinella agna</i>	A Springtail
<i>Sphalloplana culveri</i>	Culver's Planarian
<i>Stygobromus allegheniensis</i>	Allegheny Cave Amphipod
<i>Stygobromus biggersi</i>	Biggers' Cave Amphipod
<i>Stygobromus cooperi</i>	Cooper's Cave Amphipod
<i>Stygobromus culveri</i>	Culver's Cave Amphipod
<i>Stygobromus emarginatus</i>	Greenbrier Cave Amphipod
<i>Stygobromus franzi</i>	Franz's Cave Amphipod
<i>Stygobromus gracilipes</i>	Shenandoah Valley Cave Amphipod
<i>Stygobromus morrisoni</i>	Morrison's Cave Amphipod
<i>Stygobromus nanus</i>	Pocahontas Cave Amphipod
<i>Stygobromus parvus</i>	Minute Cave Amphipod
<i>Stygobromus pollostus</i>	An Amphipod
<i>Stygobromus redactus</i>	An Amphipod
<i>Stygobromus sp 1</i>	An Amphipod
<i>Stygobromus sp 2</i>	Coburn Cave Amphipod
<i>Stygobromus sp 3</i>	Dyers Cave Amphipod
<i>Stygobromus spinatus</i>	Spring Cave Amphipod
<i>Stygobromus tenuis potomacus</i>	Potomac Groundwater Amphipod
<i>Stylodrilus beattiei</i>	An Oligochaete
<i>Trichodrilus culveri</i>	An Oligochaete
<i>Trichopetalum krekeleri</i>	West Virginia Blind Cave Millipede
<i>Trichopetalum packardi</i>	Packard's Blind Cave Millipede
<i>Trichopetalum weyeriense</i>	Grand Caverns Blind Cave Millipede
<i>Trichopetalum whitei</i>	Luray Caverns Blind Cave Millipede

LOCATION AND STATUS

Limestone caves are known from Barbour, Berkeley, Grant, Greenbrier, Hampshire, Hardy, Jefferson, Mercer, Mineral, Monongalia, Monroe, Morgan, Nicholas, Ohio, Pendleton, Pocahontas, Preston, Randolph and Tucker counties. Sandstone breakdown or overhang caves are scattered around the state wherever there are sandstone outcrops. Watersheds with limestone caves are listed below.

Watersheds with Limestone Cave/Karst Habitat
Shenandoah
Cacapon
North Branch Potomac
South Branch Potomac
Potomac
Gauley
Cheat
Tygart Valley
Greenbrier
Upper New
Elk

DECISION MAKING PROCESS – NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of Caves and Karst Habitats in West Virginia. Needs and actions for each category are outlined below. **Bolded** text indicates initial actions required to identify conservation needs of this habitat type in the state.

Category	Need	Action
Data	Develop a database of Cave and Karst habitats.	Compile existing Cave/Karst location data; work with caving groups to share data useful in protecting Caves and Karst; obtaining existing data on physical characteristics of Caves (cave length and depth, presence of streams, drip pools, etc.).
	Develop a database of known records of Cave/Karst Species in Greatest Need of Conservation.	Compile existing data; contact experts to obtain data not in the literature or in existing databases.
	Assess rarity and quality of Cave/Karst communities.	Based on data compiled in above activities, identify Caves and Karst regions with state and globally rare species and significant multi-species assemblages.

	Habitat classification.	Work with experts to develop a classification system for terrestrial and aquatic cave ecosystems.
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Category	Need	Action
Surveys	Additional information on the distribution and status of Species in Greatest Need of Conservation in Caves/Karst.	Survey additional sites that are likely to have rare species based on physical conditions of the Cave and the distribution of Karst species; identify and sample Karst areas that have been poorly sampled in the past; identify and sample in areas where threats are high. More data are needed to make informed decisions.
	Map Caves.	Map the extent of biologically significant Caves if adequate maps do not exist and create GIS layers of Cave maps.
	Identify threats and management opportunities.	Site visits may be required to identify threats to Cave/Karst ecosystems; match threats with possible management interventions (i.e., gate caves, clean up dumps in cave entrances, etc.); work with partners to accomplish management activities.

Category	Need	Action
Research	Cave hydrology.	Dye tracing and other methods should be used to determine the watershed and flow patterns in Karst systems containing aquatic species of concern.
	Importance of surface habitats.	Conduct studies to determine the importance of surface habitat to Cave/Karst species. This should include areas used outside of the cave (i.e., foraging areas for cave-dwelling bats) and areas that provide nutrient inputs to subterranean ecosystems.
	Map surface habitats.	Based on the research above, map surface habitats over and around caves that are important to the Cave/Karst species of interest.
	Human disturbance.	Assess the impacts of recreational caving on Species in Greatest Need of Conservation in Caves.

	Summer habitat for bats.	Many bats that hibernate in Caves are migratory and do not live in Caves in the summer. Studies need to be conducted to determine where these bats spend the summer. This will assist in managing these species and may provide data that will help explain trends observed in Cave populations.
Research (con't)	Life history data.	Little is known of the life history of many Cave/Karst-dwelling species, especially invertebrates. Studies should be conducted to provide life history information when it is likely to help guide conservation efforts.

Category	Need	Action
Monitoring	Monitor populations of Species In Greatest Need of Conservation.	Develop and implement monitoring plans to assess the quality of Species in Greatest Need of Conservation populations over time; assess impact of management activities to determine if they have been effective.
	Monitor threats.	Identify existing and potential threats to Cave/Karst ecosystems and monitor threats to determine when appropriate conservation actions should be taken.
	Monitor gates, fences and signs.	Where physical structures and signs have been used to restrict human entry into caves, these should be monitored to determine when repairs are needed.
	Monitor water quality.	Monitor water quality in areas where there are aquatic Karst Species in Greatest Need of Conservation; this should include water in Caves and ground water as appropriate for the Species in Greatest Need of Conservation.
	Monitor Cave microclimates.	Monitor Cave conditions that are important for the species present (i.e., temperature and humidity for hibernating bats) especially where there are reasons to believe activities may result in microclimate changes (i.e., modification of Cave entrances or passages).

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are several conservation issues associated with Cave and Karst habitat systems. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition
Forest Health	Coordination, Education, Management
Acid Deposition	Coordination, Management
Over Collection	Coordination, Education, Management
Management Conflicts	Coordination
Invasive Species	Education, Management
Damaging Recreation	Education

SELECTED ACTIONS FOR THE CONSERVATION OF CAVE AND KARST HABITATS IN WEST VIRGINIA

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed in a sequential process to conserve this habitat system in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the habitat. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the habitat.

Data:

- Compile existing Cave/Karst location data; work with caving groups to share data useful in protecting caves and karst; obtaining existing data on physical characteristics of caves (cave length and depth, presence of streams, drip pools, etc.).
- Compile existing data; contact experts to obtain data not in the literature or in existing databases.
- Based on data compiled in above activities, identify Cave and Karst regions with state and globally rare species and significant multi-species assemblages.

Surveys:

- Survey additional sites that are likely to have rare species based on physical conditions of the cave and the distribution of Karst species; identify and sample Karst areas that have been poorly sampled in the past; identify and sample in areas where threats are high. More data are needed to make informed decisions.

Research:

- Conduct studies to determine the importance of surface habitat to Cave/Karst species. This should include areas used out side of the cave (i.e., foraging areas for cave-dwelling bats) and areas that provide nutrient inputs to subterranean ecosystems.

Monitoring:

- Develop and implement monitoring plans to assess the quality of populations of species of concern over time; assess impact of management activities to determine if they have been effective.

- Identify existing and potential threats to Cave/Karst ecosystems and monitor threats to determine when appropriate conservation actions should be taken.
- Where physical structures and signs have been used to restrict human entry into caves, these should be monitored to determine when repairs are needed.
- Monitor water quality in areas where there are aquatic Karst species of concern; this should include water in caves and ground water as appropriate for the species of concern.
- Monitor Cave conditions that are important for the species present (i.e., temperature and humidity for hibernating bats) especially where there are reasons to believe activities may result in microclimate changes (i.e., modification of cave entrances or passages).

Coordination:

- Coordinate management with willing landowners and land managers on lands that have these habitat types.

Management:

- Work with landowners to develop management plans for their land that conserves these habitats over the long run. Enter into management agreements with landowners when possible and practical.
- Manage these systems and surrounding buffer to minimize encroachment of invasive species if they become an issue.

Education:

- Educate the public in general and landowners with these habitats on their lands about the uniqueness of these systems.
- Educate the public and landowners about the negative effects of dumping debris into these habitats and the effects of pollution on the aquatic systems that feed into these habitats.

Acquisition:

- Acquire or obtain non-development easements on these habitats from willing landowners.

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Stihler, Craig. 2005. Personal Communication. WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Program.

West Virginia Division of Natural Resources, Wildlife Resources Section, Natural Heritage Program. 2005. Biological Conservation Database. Elkins, West Virginia.

Habitat System: Aquatic Systems

DESCRIPTION

Aquatic Systems comprise all streams and natural ponds/lakes in the state.

SPECIES IN GREATEST NEED OF CONSERVATION

Aquatic Systems harbor many species that are restricted to the state's waterways. The aquatic species are listed below. In addition, many SGNC utilize habitat that is associated with and maintained by the state's Aquatic Systems.

Species in Greatest Need of Conservation Aquatic Systems	
Scientific Name	Common Name
Fish	
<i>Ameiurus melas</i>	Black Bullhead
<i>Noturus eleutherus</i>	Mountain Madtom
<i>Noturus stigmosus</i>	Northern Madtom
<i>Anguilla rostrata</i>	American Eel
<i>Cottus carolinae</i>	Banded Sculpin
<i>Cottus cognatus</i>	Slimy Sculpin
<i>Cottus sp 1</i>	Bluestone Sculpin
<i>Cottus girardi</i>	Potomac Sculpin
<i>Esox americanus vermiculatus</i>	Grass Pickerel
<i>Fundulus diaphanus</i>	Banded Killifish
<i>Polyodon spathula</i>	Paddlefish
<i>Umbra limi</i>	Central Mudminnow
<i>Ichthyomyzon greeleyi</i>	Mountain Brook Lamprey
<i>Ichthyomyzon fossor</i>	Northern Brook Lamprey
<i>Lampetra aepyptera</i>	Least Brook Lamprey
<i>Ichthyomyzon bdellium</i>	Ohio Lamprey
<i>Ichthyomyzon unicuspis</i>	Silver Lamprey
<i>Lampetra appendix</i>	American Brook Lamprey
<i>Lepomis gulosus</i>	Warmouth
<i>Lepomis humilis</i>	Orangespotted Sunfish
<i>Macrhybopsis hyostoma</i>	Speckled Chub
<i>Macrhybopsis storeriana</i>	Silver Chub
<i>Nocomis leptocephalus</i>	Bluehead Chub
<i>Pararhinichthys bowersi</i>	Cheat Minnow
<i>Pimephales vigilax</i>	Bullhead Minnow
<i>Phenacobius teretulus</i>	Kanawha Minnow
<i>Hybognathus regius</i>	Eastern Silvery Minnow
<i>Exoglossum laurae</i>	Tonguetied Minnow
<i>Clinostomus elongatus</i>	Redside Dace
<i>Phoxinus erythrogaster</i>	Southern Redbelly Dace
<i>Phoxinus oreas</i>	Mountain Redbelly Dace
<i>Margariscus margarita</i>	Pearl Dace

<i>Cyprinella analostana</i>	Satinfin Shiner
<i>Notropis blennioides</i>	River Shiner
<i>Notropis boops</i>	Bigeye Shiner
<i>Notropis scabriceps</i>	New River Shiner
<i>Notropis procne</i>	Swallowtail Shiner
<i>Lythrurus ardens</i>	Blueside Shiner
<i>Luxilus cornutus</i>	Common Shiner
<i>Lythrurus umbratilis</i>	Redfin Shiner
<i>Notropis amoenus</i>	Comely Shiner
<i>Notropis ariommus</i>	Popeye Shiner
<i>Notropis buechanani</i>	Ghost Shiner
<i>Crystallaria asprella</i>	Crystal Darter
<i>Percina notogramma</i>	Stripeback Darter
<i>Etheostoma tippecanoe</i>	Tippecanoe Darter
<i>Percina gymnocephala</i>	Appalachia Darter
<i>Percina peltata</i>	Shield Darter
<i>Percina phoxocephala</i>	Slenderhead Darter
<i>Percina shumardi</i>	River Darter
<i>Etheostoma longimanum</i>	Longfin Darter
<i>Percina copelandi</i>	Channel Darter
<i>Percina evides</i>	Gilt Darter
<i>Percina macrocephala</i>	Longhead Darter
<i>Percina sciera</i>	Dusky Darter
<i>Etheostoma pellucidum</i>	Eastern Sand Darter
<i>Etheostoma camurum</i>	Bluebreast Darter
<i>Etheostoma maculatum</i>	Spotted Darter
<i>Etheostoma olmstedi</i>	Tessellated Darter
<i>Etheostoma osburni</i>	Candy Darter
<i>Erimyzon oblongus</i>	Creek Chubsucker
<i>Cycleptus elongatus</i>	Blue Sucker
<i>Thoburnia rathoeca</i>	Torrent Sucker
<i>Ictiobus cyprinellus</i>	Bigmouth Buffalo
<i>Ictiobus niger</i>	Black Buffalo
<i>Carpionodes carpio</i>	River Carpsucker
<i>Carpionodes velifer</i>	Highfin Carpsucker
<i>Moxostoma carinatum</i>	River Redhorse
<i>Hiodon tergisus</i>	Mooneye
<i>Hiodon alosoides</i>	Goldeye
<i>Salvelinus fontinalis</i>	Brook Trout
Crayfish	
<i>Cambarus elkensis</i>	Elk River Crayfish
<i>Cambarus nerterius</i>	An Underground Crayfish
<i>Cambarus veteranus</i>	A Crayfish
<i>Cambarus chasmodactylus</i>	New River Crayfish
<i>Cambarus longulus</i>	A Crayfish
<i>Cambarus monongalensis</i>	A Crayfish
<i>Fallicambarus fodiens</i>	A Crayfish
<i>Orconectes limosus</i>	Spinycheek Crayfish
<i>Procambarus acutus</i>	White River Crayfish

LOCATION AND STATUS

Aquatic Systems are found statewide.

DECISION MAKING PROCESS – NEEDS AND ACTIONS

Each category discussed in this section is important to the conservation of Aquatic Systems in West Virginia. Needs and actions for each category are outlined below. **Bolded** text indicates initial actions required to identify conservation needs of this habitat type in the state.

Category	Need	Action
Data	Future data will be collected using standardized procedures.	All surveys will collect standardized site, habitat and species data.
	Obtain historic fish occurrence data and enter into agency databases.	Visit museums to gather and database fish information.

Category	Need	Action
Surveys	Determine the distribution and status of Fishes, Crayfishes and certain Benthic Macroinvertebrates.	Conduct 40-70 stream surveys annually in wadeable streams and rivers.
	Obtain Fish distribution for WVDEP monitoring stations.	Conduct surveys at WVDEP monitoring sites.

Category	Need	Action
Research	Create a statewide stream classification system.	A plan for this activity has been drafted and data collection is underway and will continue. (Copy available at WVDNR – Elkins Office).
	Describe stream reaches that harbor SGNC and assess the potential distribution of the habitat statewide.	Conduct analysis of the physical attributes of reaches harboring specific SGNC to determine similarities within the reaches and to develop a system to categorize them.
	Assessment of conservation issues in the state's watersheds.	Work with a variety of partners to analyze major conservation issues in the state's watersheds, starting with those that harbor SGNC and are thought to be most threatened.

Category	Need	Action
Monitoring	Long term monitoring of various stream reaches that harbor SGNC.	As the stream classification system is developed, determine which habitats and stream reaches should be monitored to cover the range of habitat types harboring SGNC.
	Monitor status of large river SGNC fish populations.	Assist researchers that monitor the state's fish populations in large rivers through electro-shocking and lock rotenone surveys.

CONSERVATION PROCESS – ISSUES AND ACTIONS

There are several conservation issues associated with the Aquatic Systems habitat system. This section outlines the issues and the appropriate actions required to address the issues. **Bolded** actions are actions for initial implementation. Habitat loss includes effects from housing and commercial development, dam construction, road construction, mining and quarry activities, acid precipitation, utility corridors and sites, and oil and gas drilling. Water quantity and quality issues include stream channel modification, dam construction, wetland draining and filling activities, water use, acid precipitation, acid mine drainage, erosion and sedimentation, chemical pollution, nutrient loads and solid waste.

Issues	Actions
Habitat Loss	Coordination, Education, Management, Acquisition
Forest Health	Coordination, Education, Management
Acid Deposition	Coordination, Management
Management Conflicts	Coordination, Education, Legislation/Regulation
Invasive Species	Education, Management
Damaging Recreation	Education, Coordination, Legislation/Regulation

SELECTED ACTIONS FOR THE CONSERVATION OF AQUATIC SYSTEMS IN WEST VIRGINIA

These actions were selected, through a consensus of expert opinion, to be the initial and ongoing actions needed to conserve the Aquatic Habitat system in West Virginia and are derived from the tables above. The selection of actions was made by assessing the current knowledge on the distribution, status and conservation needs of the habitat. Other actions may be undertaken on an opportunistic basis when a lack of action could result in a lost opportunity regarding conservation of the habitat.

Data:

- All surveys will have standardized site, habitat and species data collected.
- Visit museums to gather and database fish information..

Surveys:

- Conduct 40-70 stream surveys annually in wadeable streams and rivers.
- Conduct surveys at WVDEP monitoring sites.

Research:

- A plan for a stream classification system has been drafted and data collection is underway and will continue. (Copy available at WVDNR – Elkins Office).
- Work with a variety of partners to analyze major conservation issues in the state's watersheds, starting with those that harbor SGNC and are thought to be most threatened.

Monitoring:

- Assist researchers that monitor the state's fish populations in large rivers through electro-shocking and lock rotenone surveys.

Coordination:

- Work with landowners to reduce or eliminate activities that may be detrimental to water quality (sedimentation, nutrient loading, pollution, mining practices, etc.).
- Work with landowners to allow surveying/monitoring of Aquatic Systems that their land borders.
- Assess effects of stream modifications, such as dam construction, re-channelization, valley fills and bank stabilization on rivers and streams as projects may arise.
- Mitigate against impacts of mining, chemical pollution, nutrient loading, etc. in streams.

Education:

- Educate the public as to the effects of various land use activities that might impact water quality (including erosion, nutrient loading, pollution, etc) in West Virginia streams.
- Educate the public as to the problems related to moving species from one watershed to another, as well as the problems with non-native aquatic species that may out-compete our native species.

Legislation/Regulation:

- Enforce laws related to degradation of water quality.

Restoration:

- Restore habitat in Huff Creek by replacing larger substrate within the stream that was removed during flood recovery.
- If *Cambarus veteranus* cannot be re-located, explore the possibility of a reintroduction project through propagation from Kentucky or Virginia populations.

REFERENCES

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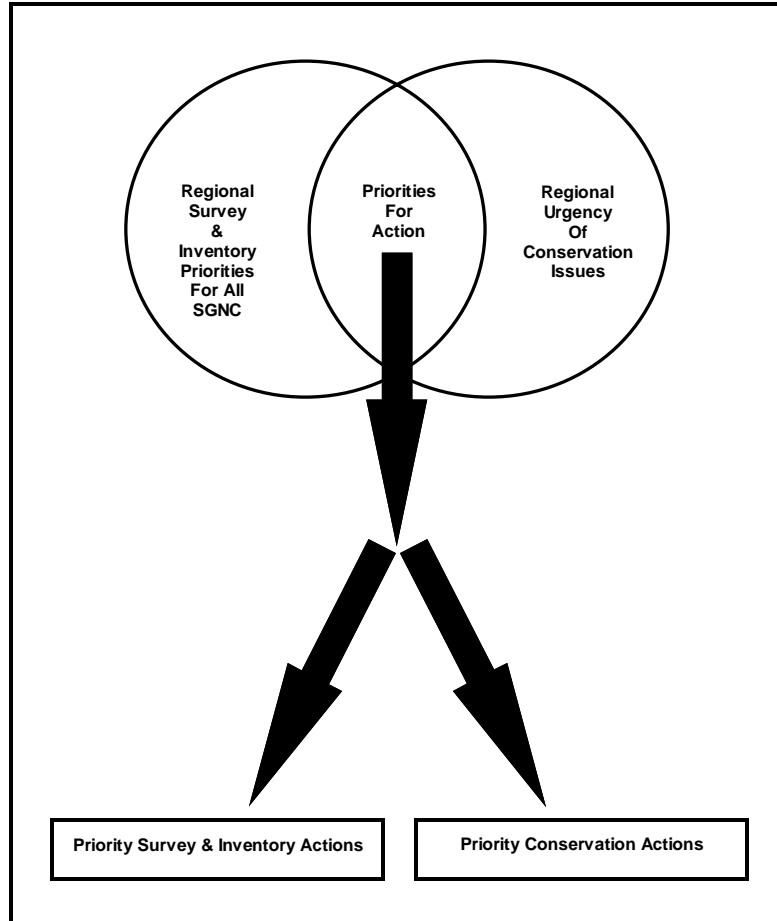
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Section 6. How Will the Plan Be Implemented?

Approach

The WVDNR is the state agency with the principal statutory authority for the conservation of fish and wildlife species in West Virginia. As such, the WVDNR will utilize *The West Virginia Wildlife Conservation Action Plan* to prioritize its conservation and survey actions for species in greatest need of conservation (SGNC).

The plan brings together identification of SGNC, their key habitats and the issues that confront their conservation. The plan thus facilitates prioritization of future actions to inventory and conserve SGNC. Significant factors influence that prioritization, however. They include (1) the fact that current knowledge of the distribution and status of most SGNC is very limited and (2) the threat that some conservation issues, e.g., habitat loss from commercial/residential development, are so urgent that they threaten to overwhelm SGNC and their habitats before adequate inventory data can be obtained. The WVDNR concludes that the most prudent course is to regionally prioritize and elevate those inventory and conservation actions for SGNC potentially facing the most urgent conservation issues. The approach to regionally prioritize these actions may be graphically depicted as follows.



For the WVDNR, these regional priorities will be addressed through projects grouped into (1) survey and inventory, and (2) conservation actions. These programs will have a structural and budgetary identity within the WVDNR.

Survey and Inventory Action Program

Regional prioritization will increase operational efficiency through implementation of planned, multi-species inventories in regions and in habitats facing urgent conservation issues. Inventory efforts focused statewide on single-species targets will receive less emphasis than will multi-species inventories. Multi-species inventories can provide data to more rapidly and more cost-effectively address urgent issues facing SGNC and their habitats. An additional benefit of regional prioritization will be the ability to quickly marshal staff for inventories of target SGNC at candidate sites for conservation action. Inventory data for SGNC will be collected and managed according to protocols being developed for the WVDNR's data management plan.

Conservation Action Program

The conservation action program will incorporate all actions listed in Section 5A of this plan. Prominent among those actions will be the development of a private land conservation initiative within the WVDNR. The land conservation initiative will seek to conserve, enhance and/or restore high-value fish and wildlife habitats confronted by urgent conservation issues, e.g., through voluntary public acquisition and subsequent stewardship of conservation easements on private lands or other management actions. Candidate projects for conservation action will emerge opportunistically, but their emergence will undoubtedly be accelerated through publication of the regional conservation priorities identified in Section 4-E of this plan.

Infrastructure development for a land conservation program was initiated in 2003 and is continuing largely under Landowner Incentive Program funding. Key to this development will be staffing a land conservation coordinator position, assembling an advisory council, developing a public awareness program, constructing a project prioritization process and writing a project assessment protocol and a prototypical stewardship plan.

Projects for consideration are expected to include conservation easements, fee-simple purchases of habitat, habitat restoration, habitat protection actions, habitat enhancements and, eventually, propagation and re-introduction. Funding sources for conservation actions include federal funding through the State Wildlife Grants and Landowner Incentive Programs, other federal and state funds, and funding available through land trusts and other non-profit and philanthropic groups.

Annual Workplanning

Regional and species priorities will provide significant guidance for annual workplanning by the WVDNR and its partners as well as for grant applications for federal funding under the State Wildlife Grants and Landowner Incentive programs. Annual grant applications will apportion grant funding to the following programmatic areas:

- Survey and Inventory
- Research
- Data Management
- Monitoring
- Conservation Action

As discussed in Sections 5-C and 5-D, two additional key conservation strategies, Education and Recreation, are not currently eligible for funding under the State Wildlife Grants or Landowner Incentive programs. Apportionment of significant staff time to actions under these strategies will not occur until funding becomes available under existing or new federal programs.

Collaborative Implementation

Many actions undertaken by the WVDNR under this plan will involve the participation of partner agencies, organizations, and individuals. Collaborative action will be a hallmark of plan implementation. Beyond that, it is anticipated that partners will autonomously initiate projects reflecting the plan's priorities. The plan will be used to support proposals submitted by partners to the WVDNR and others for conservation project funding.

It is anticipated that local conservation organizations, e.g., watershed groups and land trusts, will be among the most energetic and effective non-governmental partners for plan implementation. To facilitate their involvement, the plan is spatially referenced at the watershed and county level.

Among the most significant opportunities for collaborative implementation of the plan will be existing partnerships between the WVDNR and other state and federal agencies that manage extensive lands and waters in the state. The WVDNR has cooperative agreements with most, if not all of these agencies, including the U.S. Forest Service, the U.S. Army Corps of Engineers (COE), the U.S. Fish and Wildlife Service, the National Park Service, the U.S. Department of Defense, the West Virginia National Guard, the West Virginia Department of Agriculture and the West Virginia Department of Environmental Protection (WVDEP). The West Virginia State Parks Section is an agency within the WVDNR and the West Virginia Division of Forestry is a sister agency to the WVDNR with the state Department of Commerce. The WVDNR has a long

history of cooperation with these agencies. WVDNR personnel perform hands-on management of fish and wildlife on the three National Forests, ten COE-owned areas, nine State Forests, one National Guard base, one state prison farm and its own Wildlife Management Areas encompassing in total about 10 percent of the state's land area. Communication, review and revision of plan activities on these lands and waters will be incorporated into existing cooperative agreements and accomplished through normal channels with these cooperating agencies.

Biennial Coordination Symposium

Over the last several decades the gathering of information and implementation of conservation actions has been opportunistic for most SGNC. With the implementation of this plan there will be, for the first time, a concentrated collaborative and directed approach to conservation action in the state. The initiation of a biennial coordination symposium that will include individuals, groups and agency personnel to share information and prioritize activities that will best further the conservation of SGNC over the ensuing two years, is a landmark change in the approach to the conservation of SGNC in West Virginia. This collaborative effort may well be one of the most important elements of the planning process.

As the coordinator of the plan, the WVDNR will facilitate the coordination symposium. Well-publicized and held at a central location in the state, the symposium will serve as a forum for the WVDNR and plan partners to exchange and update information on SGNC and to collaboratively report on conservation projects and activities undertaken. It will also serve as an input mechanism for annual work planning by the WVDNR and partners. While the WVDNR will be working collaboratively throughout each two-year period with a variety of partners, it is felt that the symposium will be an opportunity for all collaborators to be brought up to speed on the actions of all involved parties. This approach will help focus the collaborative implementation of the plan.

Finally, and perhaps most importantly, the symposium will provide a venue to consolidate monitoring data for SGNC and subsequent revisions to both the list of SGNC and the plan itself.

Section 7. How Will We Know If We Are Making Progress?

The Conservation Decision Support System

Monitoring progress achieved through the WVWCAP will require the development of strategies at three levels. At the most fundamental level, we must develop better strategies for assessing the status of SGNC and their habitats. Then, we must develop performance measures to evaluate the effectiveness of conservation actions designed to improve the status of SGNC and key habitats. Finally, we must incorporate feedback mechanisms into the planning process to allow our management efforts to improve by retaining strategies that work and discarding those that do not.

Strategies at all three levels comprise the necessary components of a new system to make good decisions about fish and wildlife conservation in the state. That system, the *Conservation Decision Support System (CDSS)*, will systematically improve our ability to achieve and assess conservation progress for SGNC, both inside and outside West Virginia.

This section addresses strategies for the CDSS at all three of those levels. Many of the specific measures that will form the backbone of the CDSS remain to be developed. The purpose of this section of the plan is to describe the strategic approaches that will be used to develop those measures.

Strategic Approach to Species and Habitat Monitoring

Key Strategies for Species Monitoring

Monitoring the status of the 128 species and species groups in greatest need of conservation will require an array of strategies to survey and inventory their distribution, abundance and condition. In the process of developing the WVWCAP, we have characterized the current state of knowledge regarding species in the state, but both a continuation of existing surveys and the development of better strategies will be required to fully assess even the present status of SGNC, much less to assess trends in their status over time. Many of these strategies are described both generally and with limited specificity in the Species Fact Sheets presented in Section 5 of this plan.

Several key strategies are worthy of emphasis here. For some time, many broad, multi-species surveys, e.g., Breeding Bird Surveys, have been conducted on a regular basis in the state. Many of these surveys are implemented independently or collaboratively by both governmental and non-governmental partners, such as the USFWS, USFS, USEPA, WV Department of Environmental Protection, NRCS, Partners in Flight, Marshall University, West Virginia University, WV Division of Forestry, the Eastern Brook Trout Joint Venture, and

others. Appendix 7 provides a more complete listing of ongoing survey efforts. To optimize the use of its own limited funding and manpower, a key strategy for the WVDNR's monitoring of SGNC will be to continue and support these regular, multi-species surveys with plan partners.

A second key strategy is that survey and inventory strategies, and ultimately conservation strategies, will be prioritized in response to threat, such as commercial and residential development. The regional nature of many threats, e.g., rapid development in the state's eastern panhandle, will yield regionally focused survey, inventory, conservation, and monitoring strategies. In essence, we must prioritize what must be assessed and then implement appropriate conservation and monitoring actions, before it is too late to do so. The approach is discussed in greater detail in Section 6 of the plan.

The third key strategy relates to the role of data management in the monitoring effort. Data that is obtained from implementation of survey and inventory strategies will continue to be archived in the Wildlife Resources Section's Biotics Database. That database was a principal source used to identify candidate SGNC for this plan. It is appropriate that it will continue to support periodic assessments by internal and external experts of the status of SGNC in the state. Strategically, the Biotics Database will be a keystone decision-making tool for prioritization of monitoring and conservation strategies for SGNC. A number of specific strategies are identified in the Data Management Section 5B of the WVWCAP to improve the collection, archiving, accessibility of species data by experts both inside and outside the WVDNR.

Finally, the cost of the monitoring and conservation actions associated with managing the SGNC identified in this plan will exceed the human and financial resources currently available to do so. In fact, given the large number of SGNC, monitoring costs alone would well consume all available resources, leaving few or no resources available for conservation. To implement effective conservation, we will have to make intelligent, and difficult, decisions regarding the allocation of resources both among expenditure categories, i.e., monitoring versus conservation, and within those categories, i.e., prioritization in response to threat. Combining key monitoring strategies with annual and biennial workplanning, the WVDNR will allocate its own human and financial resources to concurrent implementation of both species-monitoring and conservation strategies. Key features of that strategic approach will be:

- Biennial, *a priori* apportionment of human and financial resources to parallel implementation of conservation and monitoring activities
- Continuation of regular, multi-species surveys to provide broad resolution monitoring data for all SGNC
- Positioning the Biotics Database as a keystone decision-making hub for both conservation and monitoring

- Implementation of the Data Management strategies identified in Section 5B of the WVWCAP
- Allocation of human and financial resources to field surveys generated from analyses of the Biotics Database, with the goal of reducing the number of inappropriately classified SGNC by documenting additional occurrences of species for which little data currently exists
- Using the Biotics Database for biennial prioritization and annual implementation of site-based monitoring and conservation activities for SGNC identified as being under greatest threat
- Partnerships with other agencies and entities that can bring additional resources to bear on species-monitoring priorities

In the aggregate, these strategies form the key species-monitoring component of the CDSS.

Key Strategies for Habitat Monitoring

The strategic approach for monitoring habitats associated with SGNC will share some characteristics with the approach to monitoring species. As with species monitoring, there will be:

- A commitment to parallel implementation of monitoring and conservation activities and apportionment of human and financial resources to those categories
- Using a database as the keystone decision-making tool
- Implementation of both broad and site-based habitat monitoring components
- Prioritization of site-based monitoring activities with respect to threat
- Partnerships with other agencies and entities

However, the strategic approach to habitat monitoring must also recognize some key differences. The first of these relates to methodology. West Virginia is a relatively small state in land area, but it possesses a great diversity of habitats that support its exceptional biological diversity. Given that diversity and limited access due to terrain and land ownership, it is the view of the WVDNR that remote sensing methodologies are the only practical approach to broad-scale monitoring of habitats in the state.

Secondly, as with multi-species surveys, there have been some broad-scale efforts implemented in the past, e.g., the U.S.G.S. National Land Cover Dataset (NLCD) and original Gap Analysis Program (GAP). However, both products are of only limited utility in assessing the current status of habitats in the state. The NLCD is sorely out of date and the original GAP mapped vegetative communities at a level that did not adequately correspond to true wildlife habitat.

Finally, the work necessary to document the importance of specific habitats to SGNC simply has not been done for more than a few species. Effective monitoring of habitats must factor these relationships into the implementation of a meaningful habitat classification system that also permits mapping by remote sensing methodologies.

As a result, there is much less information currently available regarding habitat distribution, quality and importance than exists for the SGNC themselves. In sum, habitat monitoring strategies start from a position “farther down the curve” than is the case for species monitoring.

Many states, including West Virginia, have recognized the need for better habitat mapping, both within the states and at a regional level. Several key strategies are emerging as a result of this recognition. They include the following:

- An updated version of the NLCD is scheduled to be released in December 2006. This revision will provide a current landscape-level view of land cover in West Virginia that will (1) serve as a base for further habitat classification and (2) permit some analysis of changes in land cover over the past decade.
- The most recent iteration of GAP uses NatureServe’s Ecological Systems classification system. This system more closely approximates true wildlife habitat, yet it is still lacking in some respects, such as mapping of managed or human-altered habitats, e.g., old field habitats that are important to declining species such as the loggerhead shrike.
- The USDA Forest Service is leading a consortium of other agencies in the development of another vegetation mapping system, LANDFIRE. LANDFIRE is being designed to map and assess forest fire risk. It will also incorporate mapping of Ecological Systems.
- GIS-based aquatic habitat mapping is a priority for the National Fish Habitat Initiative, a broad coalition of state and federal agencies and other organizations whose goal is to assess and improve fish habitat across the nation.
- The WVDNR is leading two important projects in the state. The first seeks to quantify and map Ecological Systems, including those that correlate most closely with key habitats identified in this plan as being at-risk. The second project is a major one to classify and ultimately map aquatic habitats in the state.
- The WVDNR is coordinating with the Trust for Public Land and The Nature Conservancy to develop better mapping of conservation issues, e.g., commercial and residential development, that can threaten habitats important to SGNC.

- There is a project under development by the Northeast Association of Fish and Wildlife Agencies (NEAFWA), of which West Virginia is a member, to coordinate with all of these initiatives to produce (1) a standardized terrestrial and aquatic habitat classification system and (2) a GIS habitat dataset at the state and regional levels of resolution. Regional, or even national, standardization is an especially important goal for monitoring habitats of importance for the large number of SGNC that cross state boundaries.

A major strategy for the WVDNR will be to actively participate in these state, regional and national initiatives and to continuously aggregate their results into a new fish and wildlife habitat database for the state. That planned database, HABMAP, will bring all of these components into juxtaposition in a GIS environment, forming the key habitat-monitoring component of the CDSS.

Strategic Approach for Evaluating the Effectiveness of Conservation Actions

Key Strategies for Developing Performance Measures

As decisions are made to take conservation actions for SGNC and their habitats, it will be important to measure the effectiveness of those actions with the twin goals of (1) improving future conservation decisions and (2) documenting and communicating conservation successes. Measuring effectiveness will require the development of performance measures for actions taken. These measures will form the evaluation component of the CDSS.

Measures of performance will be developed and applied at three levels. They are:

1. Implementation Measure - Was the action taken as planned?
2. Effectiveness Measure - Did the action taken achieve the desired result?
3. Validation Measure – Is there a better way to achieve the desired result?

This multi-level approach is used by several agencies, including the U.S. Forest Service, to monitor and evaluate management actions. Examples of multi-level performance measures that have been identified for management action categories are shown in the following table.

Action Category	Implementation Measure	Effectiveness Measure	Validation Measure
Environmental coordination	# permit applications reviewed and commented upon	Were WVDNR comments incorporated in permit?	Did permit conditions adequately mitigate impact to SGNC? If not, then what additional conditions should be required in the future?
Private land management	# landowner contacts made	# acres/miles under landowner cooperative agreements	Did the # acres/miles under landowner cooperative agreements adequately reduce habitat loss and/or increase populations of SGNC? If not, then what other actions should be taken?
Public land management	# projects implemented	# acres/miles of habitat restored or enhanced	Did the # acres of restored or enhanced habitat adequately reduce habitat loss and/or increase populations of SGNC? If not, then what other actions should be taken?
Education	# educational campaigns developed	Were the education materials received by the targeted publics?	Did public opinion or public behavior adequately change as a result of the education campaign? If not, what additional campaigns should be initiated?

Legislation	Was legislation developed and submitted?	Was legislation passed?	Did legislation adequately reduce the frequency of the targeted activity? Do we need additional legislation, better enforcement or other actions?
Land conservation	# projects initiated	# acres purchased or under conservation easement	Did the # acres purchased or under conservation easement adequately reduce habitat loss for SGNC? If not, what other actions should be taken?

These and other performance measures will be applied at both the project and program levels and periodically rolled-up to assess the overall effectiveness of the plan itself. Those evaluations will, in turn, feed the third level of the CDSS, *Adaptive Management*.

The Process of Adaptive Management

The process of adapting conservation actions to increase their effectiveness is called *adaptive management*. It is a continuous process at the project, program and plan levels. Fundamentally, it is a process of retaining and improving strategies that work and discontinuing those that do not. The process is an essential response to, or anticipation of, new information or changing conditions. It is the other major component of the CDSS.

Species- and habitat-monitoring strategies combined with performance evaluations of conservation actions provide essential information for the adaptive management process. Validation measures (*Is there a better way to achieve results?*) really set the stage for adaptive management. All that remains to be done after those evaluations is to act on them, i.e., to change.

The greatest impediment to change is inertia. Projects, programs and plans naturally tend to take on a life of their own, becoming increasingly resistant to change. That is because a substantial amount of effort is required to develop and implement them, effort that most of us are loathe to begin anew. In addition, careers, reputations and relationships are built on those projects and programs. All of this makes adaptive management easy to advocate, but difficult to do.

The very structure of this plan and the process for changing it are strategies to overcome those impediments. Each species and habitat fact sheet is designed as a mini-plan. Each can stand on its own and, more importantly, can change without necessitating a major change to the plan itself. In hard-copy form, the plan is a loose-leaf binder, each section of which can be independently removed, revised and replaced as necessary. Those revisions will be catalyzed by the virtually continuous, and very public, process of revisiting the plan that is described in Section 8.

Examples of the CDSS in Action

The following examples illustrate how the CDSS will be applied to conserve SGNC and their habitats.

Example #1 – Brook Trout

<u>Conservation Issues:</u>	Atmospheric Acid Deposition (High Threat – Allegheny Highlands)	
	Instream, Wetland and Riparian Habitat Loss (High Threat – Eastern Panhandle)	
<u>Conservation Actions:</u>	Instream limestone sand application	
	Riparian habitat fencing and restoration through USFWS’s Partners for Fish and Wildlife Program	
	Restocking of suitable strains in restored waters	
<u>Monitoring Program:</u>	<u>Species:</u>	Fish surveys
	<u>Habitat:</u>	Water quality surveys
		HABMAP aquatic habitat data, e.g., from Eastern Brook Trout Joint Venture (EBTJV)
<u>Performance Measures:</u>	<u>Implementation:</u>	# projects implemented
	<u>Effectiveness:</u>	# miles stream restored

Validation:

Species status from
EBTJV

How do we restore
acidified waters that
cannot be limed?

Example #2 – Barn Owl

Conservation Issues: Habitat Loss from Commercial and Residential Development
(High Threat - Eastern Panhandle)

Conservation Actions: Coordination with landowners to maintain nesting sites

Continue to assist landowners with Barn Owl relocation efforts

Support and coordinate with farmland protection programs

Coordinate with NRCS to develop nest box practices

Educate the public regarding Barn Owls and their benefits

Monitoring Program:

Species: Breeding bird surveys

Landowner reports

Site monitoring at known breeding locations

Habitat: HABMAP data for farmland

Performance Measures:

Implementation: # landowners contacted

counties with farmland protection programs

education programs implemented

Was NRCS practice developed?

Effectiveness: # landowner agreements
farmland acres under
easement
brochures distributed
farmers adopting NRCS
practice

Validation: Species status from PIF
What else could be done?

Example #3 – Elktoe Mussel

Conservation Issues: Habitat Loss from Commercial and Residential Development
(High Threat – Greenbrier, New and Elk)

Water Quantity and Quality

Conservation Actions: Riparian habitat fencing and restoration through USFWS's Partners for Fish and Wildlife Program

Environmental coordination with agencies and the private sector

Monitoring Program:

Species: Survey historic sites

Survey new sites

Establish long-term monitoring sites

Habitat:

Water quality surveys

Stream stability surveys at long-term monitoring sites

HABMAP aquatic habitat data, e.g., from Eastern Brook Trout Joint Venture (EBTJV)

Performance Measures:

Implementation:

projects implemented

permits reviewed

Effectiveness:

miles riparian habitat protected/restored

Were WVDNR comments incorporated in permits?

Validation:

Species status review

What else could be done?

Section 8. When Will We Revisit The Plan?

Although the plan covers a ten-year span, it is actually only the first step in a continuous, dynamic management process for collaborative conservation of the state's fish and wildlife resources and the habitats that sustain them. As indicated in Section 7, the state's new CDSS will (1) guide efforts to monitor SGNC and their habitats, (2) apply performance measures to conservation actions and (3) catalyze an adaptive management process to improve both monitoring and conservation actions.

The result will be a continuous process of change, in projects, programs and plans. Those changes will be reflected in annual revisions to work plans and biennial revisions to the plan itself. The biennial plan coordination symposium (described in Section 6), coordinated by the WVDNR and attended by plan partners, will be an important and innovative public and partner input mechanism and will initiate the formal process for biennial plan revisions. Specifically, the symposium will provide a venue for (1) sharing monitoring data for SGNC and their habitats, (2) reporting the results of conservation actions taken in the previous two years, (3) revisiting expert review of the list of SGNC and (4) prioritizing goals and objectives for the next two years. The results of each symposium will be incorporated in revisions to the list of SGNC and to the plan itself. In sum, there will be a new plan released every two years.

The biennial frequency of plan revisions may seem an ambitious commitment. However, we believe that more frequent revisions to the plan will mean smaller revisions to it. By contrast, a ten-year revision is as mammoth an undertaking as the first generation of the plan. Moreover, as indicated in Section 7, this plan is structured to facilitate regular changes to it. Its modular, loose-leaf design will make plan changes less difficult and, of equal importance, will make those changes easier to distribute to plan partners and other publics. In the final analysis, we believe that the proposed revision process will be not only a manageable one, but one that makes the plan a living, breathing process, rather than another binder merely occupying space on office shelves.

Section 9. Summary of Strategic Priorities

Introduction

The *West Virginia Wildlife Conservation Action Plan* identifies issues and proposed actions designed to conserve fish and wildlife species, and their habitats, in greatest need of conservation. The individual Species and Habitat Fact Sheets in the plan identify specific actions to conserve those species and key habitats. The purpose of this summary is to aggregate those specific actions into long-range, strategic priorities. Each of the strategic actions listed below is a priority supported by public and expert input.

For the WVDNR, these priorities will shape significant decisions about the development or revision of agency programs. Projects subsequently developed under those programs will implement specific actions identified in the Species and Habitat Fact Sheets. Expert consensus via biennial symposia and annual workplanning will prioritize projects and actions for implementation.

Investment Priorities

Funding currently available to the WVDNR for plan implementation is derived from:

- Federal funding under the State Wildlife Grants Program
- Federal funding under the Landowner Incentive Program
- State funding from general revenue
- State funding from sale of wildlife license plates

In the aggregate, the WVDNR estimates the currently available funding from these sources to be approximately \$1.6 million annually. It should be noted that each of these funding sources is subject to annual appropriation at the federal or state level; annual appropriations cannot be guaranteed. At current aggregate funding levels, the annual investment of these funds on plan-related activities is projected to be as follows.

- 60 percent for conservation actions (including 9 percent for education and 1 percent for recreation)
- 40 percent for research, surveys, monitoring and data management

Conservation Action Priorities

Priority actions to address both statewide and regional issues are as follows.

Issue: Mining

- Coordinate with owners of lands being mined to implement reclamation practices that benefit species in greatest need of conservation
- Coordinate with the WV Department of Environmental Protection and other entities to ensure protection of water quality during and following mining activity
- Secure sound mitigation for unavoidable impacts

Issue: Commercial and Residential Development

- Prioritize and promote land conservation as a means to protect key habitats on private lands in the path of commercial and residential development
- Implement a land conservation initiative within the WVDNR
- Initial county priorities for land conservation action include:
 - Berkeley
 - Braxton
 - Grant
 - Greenbrier
 - Hampshire
 - Hardy
 - Jackson
 - Jefferson
 - Lincoln
 - Monongalia
 - Monroe
 - Morgan
 - Pocahontas
 - Putnam
 - Tucker
- Priority habitats for conservation action include:
 - Red Spruce Forests
 - Calcareous Forests and Woodlands
 - Shale Barrens
 - Limestone Barrens and Glades
 - Sandstone Glades
 - Hemlock Forests
 - Wetlands
 - Floodplain Forests and Swamps

- Caves and Karst
- Cliffs, Rock Outcrops and Talus
- All aquatic and riparian habitats
- Generate a more detailed conservation priority map as the data are available to do so
- Identify and secure additional sources of federal, state and private funding for land conservation
- Facilitate donation of conservation easements by providing WVDNR stewardship for high-priority donated easements
- Support efforts to protect farmland through conservation easements by coordinating with the WV Department of Agriculture, county farmland protection boards and others
- Actively partner with the U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program
- Coordinate with the WV Division of Forestry to protect the state's working forests through the Forest Legacy program
- Coordinate with county planning agencies to provide information and planning assistance regarding key habitats for species in greatest need of conservation

Issue: Atmospheric Acid Deposition

- Support efforts to effect further source reductions of sulfur and nitrogen pollution
- Expand application of limestone sand to additional streams degraded by atmospheric acid deposition
- Collaborate with the U.S. Forest Service and others to develop and implement management strategies for watershed-level mitigation of atmospheric acid deposition

Issue: Stream Sedimentation

- Promote efforts to develop and incentivize better management practices for all activities that disturb the land, including:
 - Road maintenance
 - Unpaved secondary roads
 - Construction activities
 - Poor agricultural practices
 - Poor logging practices
 - Mining activities
 - Failing streambanks
 - Other activities that expose unvegetated soils
- Collaborate with state and federal agencies, industry groups, landowners and other private individuals to effect better implementation of sediment control practices

- Actively partner with the U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program and others to implement riparian habitat restoration projects

Issue: Forest Health

- Promote and support professional forest management of private forestland
- Collaborate with state and federal agencies, industry groups, and major forestland owners to minimize excessive fragmentation of forest habitats
- Ensure that best management practices are employed to protect water quality
- Support efforts to control major threats to forest health, such as the Hemlock Woolly Adelgid

Issue: Invasive Species

- Coordinate with state and federal agencies and non-governmental organizations to better educate publics about invasive species for the purpose of facilitating early detection of problem areas
- Collaborate with state and federal agencies and non-governmental organizations to implement early intervention programs to control invasive species

Issue: Water Pollution

- Continue coordination with the WV Department of Environmental Protection to monitor toxins and the implementation of restoration programs for resources impacted by spill events
- Continue coordination with the WV Department of Environmental Protection to effectively implement all provisions of the Clean Water Act
- Support efforts to secure additional funding for implementation of wastewater treatment systems

Issue: Instream, Wetland and Riparian Habitat Loss

- Increase public awareness of the value and condition of these habitats and the need to conserve them
- Actively partner with the U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program and others to implement instream, wetland and riparian habitat restoration projects
- Utilize mitigation opportunities to protect these habitats
- Prioritize land conservation projects featuring wetland and riparian habitats

Monitoring Priorities

- Implement the *Conservation Decision Support System* (CDSS) to drive conservation decisions through efficient monitoring and evaluation of species, habitats and conservation progress

Species Monitoring

- Continue and support regular, multi-species surveys with plan partners
- Complete statewide surveys to develop atlases for the following species groups:
 - Reptiles and amphibians
 - Fishes
 - Dragon and damselflies
 - Mussels
 - Bats
 - Mammals
- Annually conduct point counts for birds
- Update the breeding bird survey
- Continue an inventory of cave invertebrates
- Develop a survey prioritization protocol that:
 - Responds to regional conservation issues and threats
 - Employs a multi-species approach for logistical efficiency
 - Provides site-specific information for possible conservation action
- Implement a Data Management Plan that features the Biotics Database to improve the collection, archiving and accessibility of species data

Habitat Monitoring

- Complete a classification system for aquatic habitats
- Map aquatic habitats using the aquatic habitat classification system
- Identify species associations with aquatic habitat types
- Complete a terrestrial habitat classification system
- Map habitats using the terrestrial habitat classification system
- Identify species associations with terrestrial habitat types
- Actively coordinate with the NEAFWA, TPL, TNC, USFS, NFHI and others to develop and implement better habitat mapping and monitoring capabilities
- Implement a habitat database (HABMAP) to aggregate and improve access to habitat data

Effectiveness Monitoring

- Develop and apply performance measures to measure the implementation, effectiveness and validity of conservation actions taken
- Adjust conservation and monitoring strategies as indicated by performance measures

Appendix 1. Explanation of the Rank designations used by various organizations in the Status table of the Species and Group Fact Sheets located in Section 5-F of the Comprehensive Wildlife Action Plan

Natural Heritage Program Network (NatureServe) Global Rank:

- G1** Five or fewer documented occurrences, or very few remaining individuals globally. Extremely rare and critically imperiled.
- G2** Six to 20 documented occurrences, or few remaining individuals globally. Very rare and imperiled.
- G3** Twenty-one to 100 documented occurrences. Either very rare and local throughout its range or found locally in a restricted range.
- G4** Common and apparently secure globally, though it may be rare in parts of its range, especially at the periphery.
- G5** Very common and demonstrably secure, though it may be rare in parts of its range, especially at the periphery.
- GH** Historical. May be rediscovered.
- GX** Believed extirpated. Little likelihood of rediscovery.
- T#** Rank of subspecies or variety.

Natural Heritage Program Network (NatureServe) West Virginia State Rank:

- S1** Five or fewer documented occurrences, or very few remaining individuals within the state. Extremely rare and critically imperiled.
- S2** Six to 20 documented occurrences, or few remaining individuals within the state. Very rare and imperiled.
- S3** Twenty-one to 100 documented occurrences.
- S4** Common and apparently secure with more than 100 occurrences.
- S5** Very common and demonstrably secure.
- SH** Historical. Species which have not been documented in the state within the last 20 years. May be rediscovered.
- SX** Believed extirpated. Little likelihood of rediscovery.
- B** Bird breeding populations; rank reflects species status in WV during breeding season
- N** Non-breeding populations; rank reflects species status in WV outside the breeding season; mainly refers to species status in the winter; doesn't apply for regular non-breeding migrants.

AFS- American Fisheries Society:

E = Endangered
T = Threatened
SC = Special Concern

Mon Forest- Monongahela National Forest:

X = Species is listed on Monongahela National Forest Sensitive Species list

Jeff Forest- Jefferson and / or George Washington National Forest(s):

X = Species is listed on the Jefferson and / or George Washington National Forest(s) Sensitive Species list(s)

NE Tech Comm. - Northeast Wildlife Diversity Technical Committee:

X = Species is listed on Northeast Wildlife Diversity Technical Committee Sensitive Species list

USFWS – United States Fish & Wildlife Service:

E = Endangered
T = Threatened
Cat 1 = Category 1 Species (candidate for listing)
SC = Species of Concern (formally C2 species)

WV PIF – West Virginia Partners in Flight:

IA = Species tracked by Wildlife Diversity program with all records and sightings to be reported.

IB = Species tracked by Wildlife Diversity program with all confirmed (observation of distraction display, nest building, recently fledged young, adult bird carrying food or fecal sac, occupied nest, nest with eggs, nest with young and/ or a used nest) and most probable (a record of 5 or more singing males in suitable breeding habitat within safe dates, agitated behavior or anxiety calls from adults, or copulation observed) breeding records to be reported.

IC = Species tracked by Wildlife Diversity program with all confirmed breeding records (except nest building behavior and used nest sightings) to be reported.

II = Species are of conservation concern and were chosen as foci for research due to population declines as well as the large proportions of their total breeding populations occurring in West Virginia.

III = Indicator species that were chosen to monitor population trends due to the fact that their populations are currently stable (declines would be easily noticed), they represent each major habitat type and each as a high proportion of their total breeding population in West Virginia.

Audubon- National Audubon Society:

X = Species is present on Audubon's watchlist for West Virginia

CITES- Convention on International Trade in Endangered Species of Wild Fauna and Flora:

App I = Includes species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances.

App II = Includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival.

App III = Contains species that are protected in at least one country, which has asked other CITES Parties for assistance in controlling the trade.

IUCN – International Union for the Conservation of Nature:

CR = Critically Endangered- A taxon is Critically Endangered when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing an extremely high risk of extinction in the wild:

A. Reduction in population size based on any of the following:

1. An observed, estimated, inferred or suspected population size reduction of $\geq 90\%$ over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) any of the following:

- (a) direct observation
- (b) an index of abundance appropriate to the taxon
- (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat
- (d) actual or potential levels of exploitation
- (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

2. An observed, estimated, inferred or suspected population size reduction of $\geq 80\%$ over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

3. A population size reduction of $\geq 80\%$, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.

4. An observed, estimated, inferred, projected or suspected population size reduction of $\geq 80\%$ over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

B. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:

1. Extent of occurrence estimated to be less than 100 km², and estimates indicating at least two of a-c:

(a) Severely fragmented or known to exist at only a single location.

(b) Continuing decline, observed, inferred or projected, in any of the following:

- (i) extent of occurrence
- (ii) area of occupancy
- (iii) area, extent and/or quality of habitat
- (iv) number of locations or subpopulations
- (v) number of mature individuals.

(c) Extreme fluctuations in any of the following:

- (i) extent of occurrence
- (ii) area of occupancy
- (iii) number of locations or subpopulations
- (iv) number of mature individuals.

2. Area of occupancy estimated to be less than 10 km², and estimates indicating at least two of a-c:

(a) Severely fragmented or known to exist at only a single location.

(b) Continuing decline, observed, inferred or projected, in any of the following:

- (i) extent of occurrence
- (ii) area of occupancy
- (iii) area, extent and/or quality of habitat
- (iv) number of locations or subpopulations
- (v) number of mature individuals.

(c) Extreme fluctuations in any of the following:

- (i) extent of occurrence
- (ii) area of occupancy
- (iii) number of locations or subpopulations
- (iv) number of mature individuals.

C. Population size estimated to number fewer than 250 mature individuals and either:

1. An estimated continuing decline of at least 25% within three years or one generation, whichever is longer, (up to a maximum of 100 years in the future) OR

2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a-b):

(a) Population structure in the form of one of the following:

- (i) no subpopulation estimated to contain more than 50 mature individuals, OR
- (ii) at least 90% of mature individuals in one subpopulation.

(b) Extreme fluctuations in number of mature individuals.

D. Population size estimated to number fewer than 50 mature individuals.

E. Quantitative analysis showing the probability of extinction in the wild is at least 50% within 10 years or three generations, whichever is the longer (up to a maximum of 100 years).

EN = Endangered- A taxon is Endangered when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing a very high risk of extinction in the wild:

A. Reduction in population size based on any of the following:

1. An observed, estimated, inferred or suspected population size reduction of $\geq 70\%$ over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) any of the following:

- (a) direct observation
- (b) an index of abundance appropriate to the taxon
- (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat

- (d) actual or potential levels of exploitation
- (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

2. An observed, estimated, inferred or suspected population size reduction of $\geq 50\%$ over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

3. A population size reduction of $\geq 50\%$, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.

4. An observed, estimated, inferred, projected or suspected population size reduction of $\geq 50\%$ over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

B. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:

1. Extent of occurrence estimated to be less than 5000 km², and estimates indicating at least two of a-c:

(a) Severely fragmented or known to exist at no more than five locations.

(b) Continuing decline, observed, inferred or projected, in any of the following:

- (i) extent of occurrence
- (ii) area of occupancy
- (iii) area, extent and/or quality of habitat
- (iv) number of locations or subpopulations
- (v) number of mature individuals.

(c) Extreme fluctuations in any of the following:

- (i) extent of occurrence
- (ii) area of occupancy
- (iii) number of locations or subpopulations
- (iv) number of mature individuals.

2. Area of occupancy estimated to be less than 500 km², and estimates indicating at least two of a-c:

(a) Severely fragmented or known to exist at no more than five locations.

(b) Continuing decline, observed, inferred or projected, in any of the following:

- (i) extent of occurrence
- (ii) area of occupancy
- (iii) area, extent and/or quality of habitat
- (iv) number of locations or subpopulations
- (v) number of mature individuals.

(c) Extreme fluctuations in any of the following:

- (i) extent of occurrence
- (ii) area of occupancy
- (iii) number of locations or subpopulations
- (iv) number of mature individuals.

C. Population size estimated to number fewer than 2500 mature individuals and either:

1. An estimated continuing decline of at least 20% within five years or two generations, whichever is longer, (up to a maximum of 100 years in the future) OR

2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a-b):

(a) Population structure in the form of one of the following:

- (i) no subpopulation estimated to contain more than 250 mature individuals, OR
- (ii) at least 95% of mature individuals in one subpopulation.

(b) Extreme fluctuations in number of mature individuals.

D. Population size estimated to number fewer than 250 mature individuals.

E. Quantitative analysis showing the probability of extinction in the wild is at least 20% within 20 years or five generations, whichever is the longer (up to a maximum of 100 years).

VU = Vulnerable- A taxon is Vulnerable when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing a high risk of extinction in the wild:

A. Reduction in population size based on any of the following:

1. An observed, estimated, inferred or suspected population size reduction of $\geq 50\%$ over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are: clearly reversible

AND understood AND ceased, based on (and specifying) any of the following:

- (a) direct observation
- (b) an index of abundance appropriate to the taxon
- (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat
- (d) actual or potential levels of exploitation
- (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

2. An observed, estimated, inferred or suspected population size reduction of $\geq 30\%$ over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

3. A population size reduction of $\geq 30\%$, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.

4. An observed, estimated, inferred, projected or suspected population size reduction of $\geq 30\%$ over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

B. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:

1. Extent of occurrence estimated to be less than 20,000 km², and estimates indicating at least two of a-c:

(a) Severely fragmented or known to exist at no more than 10 locations.

(b) Continuing decline, observed, inferred or projected, in any of the following:

- (i) extent of occurrence
- (ii) area of occupancy
- (iii) area, extent and/or quality of habitat
- (iv) number of locations or subpopulations
- (v) number of mature individuals.

- (c) Extreme fluctuations in any of the following:
 - (i) extent of occurrence
 - (ii) area of occupancy
 - (iii) number of locations or subpopulations
 - (iv) number of mature individuals.

2. Area of occupancy estimated to be less than 2000 km², and estimates indicating at least two of a-c:

(a) Severely fragmented or known to exist at no more than 10 locations.

(b) Continuing decline, observed, inferred or projected, in any of the following:

- (i) extent of occurrence
- (ii) area of occupancy
- (iii) area, extent and/or quality of habitat
- (iv) number of locations or subpopulations
- (v) number of mature individuals.

(c) Extreme fluctuations in any of the following:

- (i) extent of occurrence
- (ii) area of occupancy
- (iii) number of locations or subpopulations
- (iv) number of mature individuals.

C. Population size estimated to number fewer than 10,000 mature individuals and either:

1. An estimated continuing decline of at least 10% within 10 years or three generations, whichever is longer, (up to a maximum of 100 years in the future) OR

2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a-b):

(a) Population structure in the form of one of the following:

- (i) no subpopulation estimated to contain more than 1000 mature individuals, OR
- (ii) all mature individuals are in one subpopulation.

(b) Extreme fluctuations in number of mature individuals.

D. Population very small or restricted in the form of either of the following:

1. Population size estimated to number fewer than 1000 mature individuals.

2. Population with a very restricted area of occupancy (typically less than 20 km²) or number of locations (typically five or fewer) such that it is prone to the effects of human activities or stochastic events within a very short time period in an uncertain future, and is thus capable of becoming Critically Endangered or even Extinct in a very short time period.

E. Quantitative analysis showing the probability of extinction in the wild is at least 10% within 100 years.

NT = Near Threatened- A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

DD = Data Deficient- A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution is lacking. Data Deficient is therefore not a category of threat or Lower Risk. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and threatened status. If the range of a taxon is suspected to be relatively circumscribed, if a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.

LR = Lower Risk- A taxon is Lower Risk when it has been evaluated, does not satisfy the criteria for any of the categories Critically Endangered, Endangered or Vulnerable. Taxa included in the Lower Risk category can be separated into three subcategories:

1. Conservation Dependent (cd). Taxa which are the focus of a continuing taxon-specific or habitat-specific conservation program targeted towards the taxon in question, the cessation of which would result in the taxon qualifying for one of the threatened categories above within a period of five years.

2. Near Threatened (nt). Taxa which do not qualify for Conservation Dependent, but which are close to qualifying for Vulnerable.

3. Least Concern (lc). Taxa which do not qualify for Conservation Dependent or Near Threatened.

LC = Least Concern- A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.

Trend

This is an indication of the overall West Virginia population trend for a species. The trend was determined by the expert for the particular species. It is a general indicator of the status of the species population. Bird trends were based on West Virginia Breeding Bird Survey data.

Priority groups

Priority 1: Vertebrate criteria

- All species with a NatureServe Global rank of G1-G3G4 and a state rank of SH, S1, S1S2
- Experts were consulted and some species not meeting these criteria were added to Priority List 1. Most birds added to the list were identified by Partner's in Flight as foci for research due to population declines as well as the large proportions of their total breeding populations occurring in West Virginia. These and other species added included:

Species	Global Rank	State Rank
Eastern Hellbender	G4	S2
Upland Chorus Frog	G5T5	S2
Wood Turtle	G4	S2
Timber Rattlesnake	G4	S3
Eastern Spotted Skunk	G5	S2S3
Cerulean Warbler	G4	S4B
Bald Eagle	G4	S2B, S3N
Golden-winged Warbler	G4	S2B
Saw-whet Owl	G5	S2B, S3N
American Woodcock	G5	S4B, S4N
Blue-winged Warbler		
Worm-eating Warbler		
Louisiana Waterthrush		
Wood Thrush		
Prairie Warbler		
Acadian Flycatcher		
Kentucky Warbler		
Eastern Wood Peewee		
Whip-Poor-Will		
Field Sparrow		

Priority 1: Invertebrate criteria

- All species with a NatureServe Global rank of G1-G3G4

Many invertebrate species are lacking data and even though they have a high Global rank, they can not be placed in a Priority 1 category. Species *excluded* from Priority group 1 are:

Common Name	Global Rank	State Rank
Stoneflies:		
Monongahela Snowfly	G2	S2
Aracoma Sallfly	G3	S1
Dusky Sallfly	G3	S1
Little Kanawha Perlodid Stonefly	G3	S1
Hanson's Appalachian Stonefly	G3	S2
Splendid Stonefly	G2	S1
Shenandoah Stonefly	G2	S1
Notched Forestfly	G4	S1
Bent Forestfly	G3	S1
Spiny Salmonfly	G3	S2
Pocahontas Sallfly	G2	S2
Gaspe Sallfly	G3	S1
Emerton's Grass Spider	G?	S1
Reddish Arctosa	G?	S1
West Virginia Calymmaria	G1	S1
Diverse Ant Mimic	G?	S1
Jenning's Comb-foot	G1	S1
Fierce Wolf Spider	G?	S1
Carolina Wolf Spider	G?	S1
Vegetable Leaf Wolf Spider	G?	S1

Barred Neriene	G?	S1
Shy Toad Spider	G?	S1
Adorned Leopard-Wolf Spider	G?	S1
Island Pirate Spider	G?	S1
Sedentary Pirate	G?	S1
Seminole Swamp Pirate	G?	S1
Eager Swamp Pirate	G?	S1
Backward Schizocosa	G?	S1
Garden Rug Merchant	G?	S1
Hentz's Zelotes	G?	S1
Moths:		
<i>Catocala dulciola</i>	G3	SU
<i>Catocala herodias gerhardi</i>	G3T3	SU
<i>Chaetagnlaea cerata</i>	G3G4	S1
<i>Euchlaena milnei</i>	G2G4	S2
<i>Hadena ectypa</i>	G3G4	S1
<i>Merolonche dolli</i>	G3G4	SH
Landsnails:		
Maryland Glyph Snail	G2	S2
Tallus Coil	G2	SH
Seep Mudalia	G2?	SU
Round Supercoil	G3	S1
Barred Supercoil	G3	SH
Shale Pebblesnail	G3	SU

Priority 2: Vertebrate criteria:

- All species with a NatureServe State rank of S2, S2S3, S3S4 (all of the rest of the SGNC not included in Group 1)
- Experts were consulted and one species fitting the Group 1 criteria was demoted to Group 2:

Species	Global Rank	State Rank
Evening Bat	G5	S1

Priority 2: Invertebrate criteria:

- All species with a NatureServe Global rank of G4 and G5 (and all of the invertebrates *excluded* from Group 1 listed above).

Appendix 2. Initial List Reviewed for Species In Greatest Need Of Conservation

This list of species, compiled from various organizations that maintain lists of species of concern in West Virginia, is the initial list reviewed to determine which of the species should be included on the list of Species of Greatest Need for Conservation for the first planning period (2 years) of the *West Virginia Wildlife Conservation Action Plan*.

Group	Species	Common Name	Global Rank	State Rank
Amphibian	<i>Plethodon nettingi</i>	Cheat Mountain Salamander	G2	S2
Amphibian	<i>Gyrinophilus subterraneus</i>	West Virginia Spring Salamander	G1Q	S1
Amphibian	<i>Plethodon punctatus</i>	Cow Knob Salamander	G3	S1
Amphibian	<i>Cryptobranchus alleganiensis</i>	Eastern Hellbender	G4	S2
Amphibian	<i>Aneides aeneus</i>	Green Salamander	G3G4	S3
Amphibian	<i>Plethodon virginia</i>	Shenandoah Mountain Salamander	G2G3Q	S2
Amphibian	<i>Scaphiopus holbrookii</i>	Eastern Spadefoot	G5	S1
Amphibian	<i>Ambystoma barbouri</i>	Streamside Salamander	G4	S1
Amphibian	<i>Rana pipiens</i>	Northern Leopard Frog	G5	S2
Amphibian	<i>Ambystoma jeffersonianum</i>	Jefferson Salamander	G5	S3
Amphibian	<i>Acris crepitans blanchardi</i>	Blanchard's Cricket Frog	G5T5	SH
Amphibian	<i>Ambystoma texanum</i>	Smallmouth Salamander	G5	S1
Amphibian	<i>Desmognathus welteri</i>	Black Mountain Salamander	G4	S1
Amphibian	<i>Pseudotriton montanus diastictus</i>	Midland Mud Salamander	G5T5	S1
Amphibian	<i>Acris crepitans crepitans</i>	Eastern Cricket Frog	G5T5	S2
Amphibian	<i>Eurycea longicauda</i>	Longtail Salamander	G5	S5
Amphibian	<i>Pseudacris triseriata feriarum</i>	Upland Chorus Frog	G5T5	S2
Amphibian	<i>Pseudacris brachyphona</i>	Mountain Chorus Frog	G5	S4
Amphibian	<i>Eurycea lucifuga</i>	Cave Salamander	G5	S3
Amphibian	<i>Desmognathus quadramaculatus</i>	Black-Bellied Salamander	G5	S3
Amphibian	<i>Pseudotriton ruber</i>	Northern Red Salamander	G5	S3
Beetle	<i>Cicindela marginipennis</i>	Cobblestone Tiger Beetle	G2G3	S1
Beetle	<i>Batrasyemmododes parki</i>	An Antloving Beetle	G1G2	SH
Beetle	<i>Dryobius sexnotatus</i>	Six-Banded Longhorn Beetle	G?	S1
Beetle	<i>Cicindela patruela</i>	A Tiger Beetle	G3	S2S3
Beetle	<i>Cicindela ancocisconensis</i>	A Tiger Beetle	G3	S3
Beetle	<i>Cicindela cuprascens</i>	A Tiger Beetle	G5	S1
Beetle	<i>Cicindela cursitans</i>	A Tiger Beetle	G5	S1
Beetle	<i>Cicindela formosa generosa</i>	A Tiger Beetle	G5T5	S1
Beetle	<i>Cicindela hirticollis</i>	Beach-Dune Tiger Beetle	G5	S1
Beetle	<i>Cicindela scutellaris</i>	A Tiger Beetle	G5	S1
Beetle	<i>Cicindela splendida</i>	A Tiger Beetle	G5	S1
Beetle	<i>Lordithon niger</i>	Black Lordithon Rove Beetle	GU	SH
Beetle	<i>Megacephala virginica</i>	Virginia Big-Headed Tiger Beetle	G5	S3
Beetle	<i>Cicindela purpurea</i>	A Tiger Beetle	G5	S3
Beetle	<i>Cicindela unipunctata</i>	A Tiger Beetle	G4	S3

Bird	<i>Lanius ludovicianus migrans</i>	Migrant Loggerhead Shrike	G4T3Q	S1B,S2 N
Bird	<i>Thryomanes bewickii altus</i>	Appalachian Bewick's Wren	G5T2Q	S1B,S1 N
Bird	<i>Haliaeetus leucocephalus</i>	Bald Eagle	G4	S2B,S3 N
Bird	<i>Aimophila aestivalis</i>	Bachman's Sparrow	G3	SHB
Bird	<i>Falco peregrinus</i>	Peregrine Falcon	G4	S1B,S2 N
Bird	<i>Vermivora chrysoptera</i>	Golden-Winged Warbler	G4	S2B
Bird	<i>Ammodramus henslowii</i>	Henslow's Sparrow	G4	S1B
Bird	<i>Dendroica cerulea</i>	Cerulean Warbler	G4	S4B
Bird	<i>Caprimulgus vociferus</i>	Whip-Poor-Will	G5	S3B
Bird	<i>Asio otus</i>	Long-Eared Owl	G5	S1B,S1 N
Bird	<i>Bartramia longicauda</i>	Upland Sandpiper	G5	SHB,S 1N
Bird	<i>Tyto alba</i>	Barn Owl	G5	S1B,S1 N
Bird	<i>Botaurus lentiginosus</i>	American Bittern	G4	S1B,S1 N
Bird	<i>Cistothorus platensis</i>	Sedge Wren	G5	S1B
Bird	<i>Asio flammeus</i>	Short-Eared Owl	G5	S1B,S2 N
Bird	<i>Colinus virginianus</i>	Northern Bobwhite	G5	S3B,S3 N
Bird	<i>Contopus cooperi</i>	Olive-Sided Flycatcher	G4	S1B
Bird	<i>Accipiter gentilis</i>	Northern Goshawk	G5	S1B,S1 N
Bird	<i>Circus cyaneus</i>	Northern Harrier	G5	S1B,S3 N
Bird	<i>Limnothlypis swainsonii</i>	Swainson's Warbler	G4	S2B
Bird	<i>Anas rubripes</i>	American Black Duck	G5	S2B,S4 N
Bird	<i>Melanerpes erythrocephalus</i>	Red-Headed Woodpecker	G5	S2B,S3 N
Bird	<i>Caprimulgus carolinensis</i>	Chuck-Will's-Widow	G5	S1B
Bird	<i>Chondestes grammacus</i>	Lark Sparrow	G5	S1B
Bird	<i>Cistothorus palustris</i>	Marsh Wren	G5	S1B
Bird	<i>Gallinula chloropus</i>	Common Moorhen	G5	S1B
Bird	<i>Ixobrychus exilis</i>	Least Bittern	G5	S1B
Bird	<i>Nycticorax nycticorax</i>	Black-Crowned Night-Heron	G5	SHB
Bird	<i>Rallus elegans</i>	King Rail	G4G5	S1B
Bird	<i>Rallus limicola</i>	Virginia Rail	G5	S1B,S1 N
Bird	<i>Catharus ustulatus</i>	Swainson's Thrush	G5	S1B
Bird	<i>Empidonax flaviventris</i>	Yellow-Bellied Flycatcher	G5	S1B
Bird	<i>Porzana carolina</i>	Sora	G5	S1B,S1 N
Bird	<i>Vermivora ruficapilla</i>	Nashville Warbler	G5	S1B
Bird	<i>Anas crecca</i>	Green-Winged Teal	G5	SHB,S 2N

Bird	<i>Dendroica discolor</i>	Prairie Warbler	G5	S4B
Bird	<i>Fulica americana</i>	American Coot	G5	S1B,S3 N
Bird	<i>Helmitheros vermivorus</i>	Worm-Eating Warbler	G5	S5B
Bird	<i>Hylocichla mustelina</i>	Wood Thrush	G5	S5B
Bird	<i>Poocetes gramineus</i>	Vesper Sparrow	G5	S3B,S3 N
Bird	<i>Spizella pusilla</i>	Field Sparrow	G5	S4B,S4 N
Bird	<i>Carduelis pinus</i>	Pine Siskin	G5	S1B,S4 N
Bird	<i>Lophodytes cucullatus</i>	Hooded Merganser	G5	S1B,S4 N
Bird	<i>Sphyrapicus varius</i>	Yellow-Bellied Sapsucker	G5	S1B,S3 N
Bird	<i>Ammodramus savannarum</i>	Grasshopper Sparrow	G5	S3B
Bird	<i>Eremophila alpestris</i>	Horned Lark	G5	S2B,S3 N
Bird	<i>Pandion haliaetus</i>	Osprey	G5	S2B,S2 N
Bird	<i>Protonotaria citrea</i>	Prothonotary Warbler	G5	S2B
Bird	<i>Spiza americana</i>	Dickcissel	G5	S2B
Bird	<i>Passerculus sandwichensis</i>	Savannah Sparrow	G5	S1N,S 4B
Bird	<i>Aegolius acadicus</i>	Northern Saw-Whet Owl	G5	S2B,S3 N
Bird	<i>Ardea herodias</i>	Great Blue Heron	G5	S2B,S4 N
Bird	<i>Dolichonyx oryzivorus</i>	Bobolink	G5	S2B
Bird	<i>Podilymbus podiceps</i>	Pied-Billed Grebe	G5	S2B,S4 N
Bird	<i>Riparia riparia</i>	Bank Swallow	G5	S2B
Bird	<i>Seiurus noveboracensis</i>	Northern Waterthrush	G5	S2B
Bird	<i>Empidonax alnorum</i>	Alder Flycatcher	G5	S3B,S4 N
Bird	<i>Actitis macularia</i>	Spotted Sandpiper	G5	S3B
Bird	<i>Chordeiles minor</i>	Common Nighthawk	G5	S3B
Bird	<i>Seiurus motacilla</i>	Louisiana Waterthrush	G5	S5B
Bird	<i>Certhia americana</i>	Brown Creeper	G5	S3B,S4 N
Bird	<i>Dendroica coronata</i>	Yellow-Rumped Warbler	G5	S3B,S3 N
Bird	<i>Empidonax virescens</i>	Acadian Flycatcher	G5	S5B
Bird	<i>Oporornis formosus</i>	Kentucky Warbler	G5	S4B
Bird	<i>Accipiter cooperii</i>	Cooper's Hawk	G5	S3B,S4 N
Bird	<i>Accipiter striatus</i>	Sharp-Shinned Hawk	G5	S3B,S4 N
Bird	<i>Coccyzus erythrophthalmus</i>	Black-Billed Cuckoo	G5	S3B
Bird	<i>Coragyps atratus</i>	Black Vulture	G5	S3B,S4 N
Bird	<i>Dendroica fusca</i>	Blackburnian Warbler	G5	S3B

Bird	<i>Icteria virens</i>	Yellow-Breasted Chat	G5	S4B
Bird	<i>Petrochelidon pyrrhonota</i>	Cliff Swallow	G5	S3B
Bird	<i>Sturnella magna</i>	Eastern Meadowlark	G5	S4N,S 5B
Bird	<i>Dendroica caerulescens</i>	Black-Throated Blue Warbler	G5	S4B
Bird	<i>Gallinago delicata</i>	Wilson's Snipe	G5	S1B,S1 N
Bird	<i>Contopus virens</i>	Eastern Wood Peewee	G5	S5B
Bird	<i>Scolopax minor</i>	American Woodcock	G5	S4N,S 4B
Bird	<i>Toxostoma rufum</i>	Brown Thrasher	G5	S3N,S 5B
Bird	<i>Wilsonia canadensis</i>	Canada Warbler	G5	S4B
Bird	<i>Parula americana</i>	Northern Parula	G5	S5B
Bird	<i>Vireo flavifrons</i>	Yellow-Throated Vireo	G5	S5B
Bird	<i>Wilsonia citrina</i>	Hooded Warbler	G5	S5B
Bird	<i>Ceryle alcyon</i>	Belted Kingfisher	G5	S4N,S 4B
Bird	<i>Dendroica dominica</i>	Yellow-Throated Warbler	G5	S4B
Bird	<i>Passerina cyanea</i>	Indigo Bunting	G5	S5B
Bird	<i>Piranga olivacea</i>	Scarlet Tanager	G5	S5B
Bird	<i>Vireo olivaceus</i>	Red-Eyed Vireo	G5	S5B
Bird	<i>Vermivora pinus</i>	Blue-Winged Warbler	G5	S4B
Bird	<i>Aquila chrysaetos</i>	Golden Eagle	G5	S2N
Bird	<i>Aythya marila</i>	Greater Scaup	G5	S3N
Bird	<i>Catharus bicknelli</i>	Bicknell's Thrush	G4	SA
Bird	<i>Charadrius melodus</i>	Piping Plover	G3	SA
Bird	<i>Chlidonias niger</i>	Black Tern	G4	SZM
Bird	<i>Conuropsis carolinensis</i>	Carolina Parakeet	GX	SX
Bird	<i>Dendroica kirtlandii</i>	Kirtland's Warbler	G1	SR
Bird	<i>Ectopistes migratorius</i>	Passenger Pigeon	GX	SX
Bird	<i>Histrionicus histrionicus</i>	Harlequin Duck	G4	SR
Bird	<i>Laterallus jamaicensis</i>	Black Rail	G4	SR
Bird	<i>Nycticorax violaceus</i>	Yellow-Crowned Night-Heron	G5	SPB,S 1N
Bird	<i>Sterna hirundo</i>	Common Tern	G5	SZM
Butterfly	<i>Pyrgus wyandot</i>	Grizzled Skipper	G2	S1
Butterfly	<i>Speyeria diana</i>	Diana	G3	S2S3
Butterfly	<i>Phyciodes batesii</i>	Tawny Crescent	G4	SH
Butterfly	<i>Callophrys irus</i>	Frosted Elfin	G3	S1
Butterfly	<i>Speyeria idalia</i>	Regal Fritillary	G3	S1
Butterfly	<i>Colias interior pop 1</i>	Pink-Edged Sulphur (High Elev Pop.)	G5T1T2	S1
Butterfly	<i>Polygonia faunus smythi</i>	Green Comma	G5T3T4	S1
Butterfly	<i>Calephelis borealis</i>	Northern Metalmark	G3G4	S2
Butterfly	<i>Erynnis martialis</i>	Mottled Duskywing	G3G4	S3
Butterfly	<i>Atrytonopsis hianna</i>	Dusted Skipper	G4G5	S1
Butterfly	<i>Autochton cellus</i>	Golden-Banded Skipper	G4	S1S2
Butterfly	<i>Callophrys polios</i>	Hoary Elfin	G5	SH
Butterfly	<i>Euphyes conspicua</i>	Black Dash	G4	S1
Butterfly	<i>Fixsenia favonius ontario</i>	Northern Hairstreak	G4T4	S1S2

Butterfly	<i>Lycaena epixanthe</i>	Bog Copper	G4G5	S1
Butterfly	<i>Staphylus hayhurstii</i>	Hayhurst's Scallopwing	G5	S1
Butterfly	<i>Euphyes bimacula</i>	Two-Spotted Skipper	G4	S1
Butterfly	<i>Cyllopsis gemma</i>	Gemmed Satyr	G5	S2S3
Butterfly	<i>Satyrrium caryaevorum</i>	Hickory Hairstreak	G4	S2
Butterfly	<i>Chlosyne harrisii</i>	Harris's Checkerspot	G4	S2
Butterfly	<i>Erora laeta</i>	Early Hairstreak	G4	S2
Butterfly	<i>Erynnis lucilius</i>	Columbine Duskywing	G4	S2
Butterfly	<i>Euchloe olympia</i>	Olympia Marble	G4G5	S2S3
Butterfly	<i>Hesperia metea</i>	Cobweb Skipper	G4G5	S2S3
Butterfly	<i>Lycaena hyllus</i>	Bronze Copper	G5	S2
Butterfly	<i>Parrhasius malbum</i>	White-M Hairstreak	G5	S2
Butterfly	<i>Phyciodes cocyta</i>	Northern Crescent	G5	S2
Butterfly	<i>Satyrrium edwardsii</i>	Edwards' Hairstreak	G4	S2
Butterfly	<i>Boloria selene myrina</i>	Myrina Fritillary	G5T5	S3
Butterfly	<i>Polygonia progne</i>	Gray Comma	G5	S3
Butterfly	<i>Speyeria atlantis</i>	Atlantis Fritillary	G5	S3
Cave invertebrate (invert)	<i>Antrolana lira</i>	Madison Cave Isopod	G2G4	S1
Cave invert	<i>Stygobromus parvus</i>	Minute Cave Amphipod	G1G2	S1
Cave invert	<i>Stygobromus cooperi</i>	Cooper's Cave Amphipod	G1	S1
Cave invert	<i>Stygobromus morrisoni</i>	Morrison's Cave Amphipod	G2G3	S1
Cave invert	<i>Apochthonius paucispinosus</i>	Dry Fork Valley Cave Pseudoscorpion	G1	S1
Cave invert	<i>Fontigens turritella</i>	Greenbrier Cavesnail	G1	S1
Cave invert	<i>Kleptochthonius orpheus</i>	Orpheus Cave Pseudoscorpion	G1	S1
Cave invert	<i>Pseudanophthalmus hadenoecus</i>	Timber Ridge Cave Beetle	G1	S1
Cave invert	<i>Pseudanophthalmus montanus</i>	Dry Fork Valley Cave Beetle	G1	S1
Cave invert	<i>Sphalloplana culveri</i>	Culver's Planarian	G1	S1
Cave invert	<i>Stygobromus culveri</i>	Culver's Cave Amphipod	G1G2	S1
Cave invert	<i>Stygobromus nanus</i>	Pocahontas Cave Amphipod	G1	S1
Cave invert	<i>Chitrella regina</i>	Royal Syarinid Pseudoscorpion	G1	S1
Cave invert	<i>Horologion speokites</i>	Arbuckle Cave Ground Beetle	GH	SH
Cave invert	<i>Islandiana speophila</i>	Cavern Sheet-Web Spider	G1	S1
Cave invert	<i>Kleptochthonius henroti</i>	Greenbrier Valley Cave Pseudoscorpion	G1G2	S1
Cave invert	<i>Kleptochthonius hetricki</i>	Organ Cave Pseudoscorpion	G1	S1
Cave invert	<i>Kleptochthonius proserpinae</i>	Proserpina Cave Pseudoscorpion	G1	S1
Cave invert	<i>Pseudanophthalmus krekeleri</i>	Rich Mountain Cave Beetle	G1	SX
Cave invert	<i>Pseudanophthalmus lallemanti</i>	Lallemant's Cave Beetle	G1	S1
Cave invert	<i>Pseudanophthalmus potomaca senecae</i>	Seneca Cave Beetle	G2T1	S1
Cave invert	<i>Pseudanophthalmus subaequalis</i>	Greenbrier Valley Cave Beetle	G1	S1
Cave invert	<i>Stygobromus redactus</i>	An Amphipod	G1	S1
Cave invert	<i>Stygobromus spinatus</i>	Spring Cave Amphipod	G3	S3
Cave invert	<i>Pseudanophthalmus potomaca potomaca</i>	South Branch Valley Cave Beetle	G2T2	S1
Cave invert	<i>Stygobromus biggersi</i>	Biggers' Cave Amphipod	G2G4	S1
Cave invert	<i>Caecidotea simonini</i>	An Isopod	G1	S1

Cave invert	<i>Caecidotea sinuncus</i>	An Isopod	G1	S1
Cave invert	<i>Pseudosinella certa</i>	Gandy Creek Cave Springtail	G1	S1
Cave invert	<i>Pseudotremia lusciosa</i>	Germany Valley Cave Millipede	G1	S1
Cave invert	<i>Pseudotremia princeps</i>	South Branch Valley Cave Millipede	G1	S1
Cave invert	<i>Stygobromus emarginatus</i>	Greenbrier Cave Amphipod	G3	S3
Cave invert	<i>Trichopetalum krekeleri</i>	West Virginia Blind Cave Millipede	G1	S1
Cave invert	<i>Sinella agna</i>	A Springtail	G2G3	S1
Cave invert	<i>Stygobromus gracilipes</i>	Shenandoah Valley Cave Amphipod	G2G4	S1
Cave invert	<i>Trichopetalum whitei</i>	Luray Caverns Blind Cave Millipede	G2G3Q	S1
Cave invert	<i>Arrhopalites sp 2</i>	A Collembola	G1	S1
Cave invert	<i>Arrhopalites sp 3</i>	A Collembola	G1	S1
Cave invert	<i>Fontigens sp 1</i>	Mcclung Cavesnail	G1	S1
Cave invert	<i>Islandiana sp 1</i>	A Spider	G1	S1
Cave invert	<i>Litocampa sp 1</i>	Diplura	G1	S1
Cave invert	<i>Pseudanopthalmus grandis orthosulc</i>	A Cave Beetle	G3T1	S1
Cave invert	<i>Pseudanopthalmus sp 1</i>	A Beetle	G1	S1
Cave invert	<i>Pseudanopthalmus sp 2</i>	A Beetle	G1	S1
Cave invert	<i>Pseudanopthalmus sp 3</i>	A Beetle	G1	S1
Cave invert	<i>Pseudosinella sp 1</i>	A Springtail	G1	S1
Cave invert	<i>Pseudosinella testa</i>	Shelled Cave Springtail	G1G2	S1
Cave invert	<i>Pseudotremia sp 1</i>	General Davis Cave Millipede	G1?	S1
Cave invert	<i>Stygobromus sp 2</i>	Coburn Cave Amphipod	G1	S1
Cave invert	<i>Stygobromus sp 3</i>	Dyers Cave Amphipod	G1	S1
Cave invert	<i>Trichodrilus culveri</i>	An Oligochaete	G1G2	S1
Cave invert	<i>Caecidotea cannula</i>	An Isopod	G3	S1
Cave invert	<i>Fontigens tartarea</i>	Organ Cavesnail	G2	S2
Cave invert	<i>Pseudanopthalmus fuscus</i>	A Cave Beetle	G2G3	S2
Cave invert	<i>Pseudotremia fulgida</i>	Greenbrier Valley Cave Millipede	G2G3	S2
Cave invert	<i>Caecidotea franzi</i>	Franz's Cave Isopod	G2G3	S1
Cave invert	<i>Pseudanopthalmus grandis elevatus</i>	A Cave Beetle	G3T2	S1
Cave invert	<i>Stygobromus pollostus</i>	An Amphipod	G2G3	S1
Cave invert	<i>Stygobromus sp 1</i>	An Amphipod	G2	S1S2
Cave invert	<i>Stylodrilus beattiei</i>	An Oligochaete	G2G3	S1
Cave invert	<i>Macrocotyla hoffmasteri</i>	Hoffmaster's Cave Flatworm	G2G3	S3
Cave invert	<i>Phagocata angusta</i>	A Cave Planarian	G1G2	SU
Cave invert	<i>Trichopetalum weyeriensis</i>	Grand Caverns Blind Cave Millipe	G3Q	S2
Cave invert	<i>Bathyphantès weyeri</i>	A Cave Spider	G3G4	S1
Cave invert	<i>Caecidotea pricei</i>	Price's Cave Isopod	G3G4	S1
Cave invert	<i>Geocentrophora cavernicola</i>	Cave Flatworm	G3G4	SH
Cave invert	<i>Litocampa fieldingi</i>	Diplura	G2G3	S2
Cave invert	<i>Pseudanopthalmus higinbothami</i>	A Cave Beetle	G2G3	S2
Cave invert	<i>Pseudosinella orba</i>	A Cave Springtail	G3G4	S1
Cave invert	<i>Stygobromus tenuis potomacus</i>	Potomac Groundwater Amphipod	G4T3T4	S1
Cave invert	<i>Caecidotea holsingeri</i>	Greenbrier Valley Cave Isopod	G3	S3
Cave invert	<i>Pseudanopthalmus hypertrichosis</i>	A Cave Beetle	G3	S3

Cave invert	<i>Pseudosinella gisini</i>	A Springtail	G3	S3
Cave invert	<i>Anthrobia monmouthia</i>	Spider	G3G4	S2
Cave invert	<i>Conotyla vista</i>	A Cave Millipede	G1G2	SU
Cave invert	<i>Haplotaxis brinkhursti</i>	An Oligochaete	G1G2	SU
Cave invert	<i>Pseudanophthalmus grandis</i> ssp 1	A Cave Beetle	G3T?	S1
Cave invert	<i>Trichopetalum packardi</i>	Packard's Blind Cave Millepede	G3Q	S2
Cave invert	<i>Crangonyx</i> sp 2	An Amphipod	G2	SU
Cave invert	<i>Nesticus tennesseensis</i>	A Cave Spider	G2G4	SU
Cave invert	<i>Pseudanophthalmus grandis grandis</i>	A Cave Beetle	G3T3	S3
Cave invert	<i>Stygobromus franzi</i>	Franz's Cave Amphipod	G2G3	SU
Cave invert	<i>Poecilophysis wolmsdorfensis</i>	A Cave Mite	G3	SU
Cave invert	<i>Rhagidia varia</i>	A Cave Mite	G3	SU
Cave invert	<i>Stygobromus allegheniensis</i>	Allegheny Cave Amphipod	G4	S1
Cave invert	<i>Porrhomma cavernicola</i>	Appalachian Cave Spider	G4G5	S2
Cave invert	<i>Phanetta subterranea</i>	A Spider	G4	S3
Crayfish	<i>Cambarus nerterius</i>	An Underground Crayfish	G2G3	S1
Crayfish	<i>Cambarus veteranus</i>	A Crayfish	G3G4	S1
Crayfish	<i>Cambarus elkensis</i>	Elk River Crayfish	G2	S1
Crayfish	<i>Fallicambarus fodiens</i>	A Crayfish	G5	S1
Crayfish	<i>Orconectes limosus</i>	Spinycheek Crayfish	G4G5	S1
Crayfish	<i>Cambarus longulus</i>	A Crayfish	G5	S1
Crayfish	<i>Cambarus chasmodactylus</i>	New River Crayfish	G4	S3
Crayfish	<i>Cambarus monongalensis</i>	A Crayfish	G5	S3
Fish	<i>Etheostoma pellucidum</i>	Eastern Sand Darter	G3	S2S3
Fish	<i>Percina macrocephala</i>	Longhead Darter	G3	S2
Fish	<i>Etheostoma maculatum</i>	Spotted Darter	G2	S1
Fish	<i>Etheostoma osburni</i>	Candy Darter	G3	S2
Fish	<i>Phenacobius teretulus</i>	Kanawha Minnow	G3G4	S1
Fish	<i>Cycleptus elongatus</i>	Blue Sucker	G3G4	S1
Fish	<i>Acipenser fulvescens</i>	Lake Sturgeon	G3G4	SX
Fish	<i>Crystallaria asprella</i>	Crystal Darter	G3G4	S1
Fish	<i>Polyodon spathula</i>	Paddlefish	G4	S1
Fish	<i>Pararhinichthys bowersi</i>	Cheat Minnow	G1G2Q	S1S2
Fish	<i>Ichthyomyzon greeleyi</i>	Mountain Brook Lamprey	G3G4	S1
Fish	<i>Etheostoma tippecanoe</i>	Tippecanoe Darter	G3G4	S2
Fish	<i>Ichthyomyzon bdellium</i>	Ohio Lamprey	G3G4	S2
Fish	<i>Cottus</i> sp 1	Bluestone Sculpin	G2	S1
Fish	<i>Scaphirhynchus platyrhynchus</i>	Shovelnose Sturgeon	G4	SX
Fish	<i>Notropis ariommus</i>	Popeye Shiner	G3	S2
Fish	<i>Erimystax x-punctatus</i>	Gravel Chub	G4	S1
Fish	<i>Ichthyomyzon fossor</i>	Northern Brook Lamprey	G4	S1
Fish	<i>Noturus stigmosus</i>	Northern Madtom	G3	S1
Fish	<i>Clinostomus elongatus</i>	Redside Dace	G4	S1S2
Fish	<i>Ichthyomyzon unicuspis</i>	Silver Lamprey	G5	S2S3
Fish	<i>Lampetra appendix</i>	American Brook Lamprey	G4	S2
Fish	<i>Percina copelandi</i>	Channel Darter	G4	S2S3
Fish	<i>Percina evides</i>	Gilt Darter	G4	S2

Fish	<i>Percina gymnocephala</i>	Appalachia Darter	G4	S3
Fish	<i>Hiodon tergisus</i>	Mooneye	G5	S3
Fish	<i>Macrhybopsis storeriana</i>	Silver Chub	G5	S3S4
Fish	<i>Moxostoma carinatum</i>	River Redhorse	G4	S3
Fish	<i>Etheostoma camurum</i>	Bluebreast Darter	G4	S3
Fish	<i>Notropis scabriceps</i>	New River Shiner	G4	S2
Fish	<i>Margariscus margarita</i>	Pearl Dace	G5	S3S4
Fish	<i>Carpiodes velifer</i>	Highfin Carpsucker	G4G5	S1
Fish	<i>Cottus cognatus</i>	Slimy Sculpin	G5	S1
Fish	<i>Hiodon alosoides</i>	Goldeye	G5	S1S2
Fish	<i>Hybognathus regius</i>	Eastern Silvery Minnow	G5	S1
Fish	<i>Ictiobus cyprinellus</i>	Bigmouth Buffalo	G5	S1
Fish	<i>Notropis boops</i>	Bigeye Shiner	G5	S1
Fish	<i>Noturus eleutherus</i>	Mountain Madtom	G4	S1
Fish	<i>Percina peltata</i>	Shield Darter	G5	S1
Fish	<i>Percina phoxocephala</i>	Slenderhead Darter	G5	S1
Fish	<i>Percina shumardi</i>	River Darter	G5	S1
Fish	<i>Umbra limi</i>	Central Mudminnow	G5	S1
Fish	<i>Etheostoma longimanum</i>	Longfin Darter	G4	S1
Fish	<i>Lythrurus ardens</i>	Blueside Shiner	G5	S1
Fish	<i>Percina notogramma</i>	Stripeback Darter	G4	S1
Fish	<i>Carpiodes carpio</i>	River Carpsucker	G5	S2S3
Fish	<i>Esox americanus vermiculatus</i>	Grass Pickerel	G5T5	S2
Fish	<i>Fundulus diaphanus</i>	Banded Killifish	G5	S2
Fish	<i>Ictiobus niger</i>	Black Buffalo	G5	S2
Fish	<i>Lampetra aepyptera</i>	Least Brook Lamprey	G5	S2S3
Fish	<i>Lepomis gulosus</i>	Warmouth	G5	S2
Fish	<i>Lepomis humilis</i>	Orangespotted Sunfish	G5	S2
Fish	<i>Notropis blennioides</i>	River Shiner	G5	S2
Fish	<i>Notropis procne</i>	Swallowtail Shiner	G5	S2
Fish	<i>Phoxinus erythrogaster</i>	Southern Redbelly Dace	G5	S2S3
Fish	<i>Pimephales vigilax</i>	Bullhead Minnow	G5	S2
Fish	<i>Anguilla rostrata</i>	American Eel	G5	S2
Fish	<i>Cottus caroliniae</i>	Banded Sculpin	G5	S2
Fish	<i>Cyprinella analostana</i>	Satinfin Shiner	G5	S2
Fish	<i>Etheostoma olmstedii</i>	Tessellated Darter	G5	S2
Fish	<i>Ameiurus melas</i>	Black Bullhead	G5	S3S4
Fish	<i>Cottus girardi</i>	Potomac Sculpin	G4	S3
Fish	<i>Erimyzon oblongus</i>	Creek Chubsucker	G5	S3
Fish	<i>Lythrurus umbratilis</i>	Redfin Shiner	G5	S3
Fish	<i>Macrhybopsis hyostoma</i>	Speckled Chub	G5	S3
Fish	<i>Notropis amoenus</i>	Comely Shiner	G5	S3S4
Fish	<i>Notropis buechanani</i>	Ghost Shiner	G5	S3S4
Fish	<i>Percina sciera</i>	Dusky Darter	G5	S3
Fish	<i>Exoglossum laurae</i>	Tonguetied Minnow	G4	S3
Fish	<i>Luxilus cornutus</i>	Common Shiner	G5	S3
Fish	<i>Nocomis leptoccephalus</i>	Bluehead Chub	G5	S3
Fish	<i>Nocomis platyrhynchus</i>	Bigmouth Chub	G4Q	S3S4

Fish	<i>Phoxinus oreas</i>	Mountain Redbelly Dace	G5	S3
Fish	<i>Thoburnia rhothoeca</i>	Torrent Sucker	G4	S3
Land snail	<i>Triodopsis platysayoides</i>	Flat-Spired Three-Toothed Landsnail	G1	S1
Land snail	<i>Glyphyalinia raderi</i>	Maryland Glyph Snail	G2	S2
Land snail	<i>Helicodiscus triodus</i>	Tallus Coil	G2	SH
Land snail	<i>Paravitrea reesi</i>	Round Supercoil	G3	S1
Land snail	<i>Paravitrea seradens</i>	Barred Supercoil	G3	SH
Land snail	<i>Paravitrea ceres</i>	Sidelong Supercoil	G?	S1
Land snail	<i>Webbhelix multilineata</i>	Striped Whitelip	G?	S1
Land snail	<i>Leptoxis dilatata</i>	Seep Mudalia	G2?	SU
Land snail	<i>Carychium clappi</i>	Appalachian Thorn	G4G5	SH
Land snail	<i>Somatogyrus pennsylvanicus</i>	Shale Pebblesnail	G3	SU
Land snail	<i>Hendersonia occulta</i>	Cherrystone Drop	G4	S1S2
Mammal	<i>Puma concolor cougar</i>	Eastern Cougar	G5THQ	SH
Mammal	<i>Myotis sodalis</i>	Indiana Bat	G2	S1
Mammal	<i>Myotis leibii</i>	Eastern Small-Footed Bat	G3	S1
Mammal	<i>Corynorhinus townsendii virginianus</i>	Virginia Big-Eared Bat	G4T2	S2
Mammal	<i>Glaucomys sabrinus fuscus</i>	West Virginia Northern Flying Squirrel	G5T2	S2
Mammal	<i>Sorex palustris punctulatus</i>	Southern Water Shrew	G5T3	S1
Mammal	<i>Microtus chrotorrhinus carolinensis</i>	Southern Rock Vole	G4T3	S2
Mammal	<i>Corynorhinus rafinesquii</i>	Eastern Big-Eared Bat	G3G4	S1
Mammal	<i>Neotoma magister</i>	Allegheny Woodrat	G3G4	S3
Mammal	<i>Sylvilagus obscurus</i>	Appalachian Cottontail	G4	S3
Mammal	<i>Cryptotis parva</i>	Least Shrew	G5	S2
Mammal	<i>Lasionycteris noctivagans</i>	Silver-Haired Bat	G5	S2
Mammal	<i>Lasiurus cinereus</i>	Hoary Bat	G5	S3
Mammal	<i>Nycticeius humeralis</i>	Evening Bat	G5	SH
Mammal	<i>Reithrodontomys humulis</i>	Eastern Harvest Mouse	G5	S1
Mammal	<i>Ochrotomys nuttalli</i>	Golden Mouse	G5	S2
Mammal	<i>Condylura cristata</i>	Star-Nosed Mole	G5	S2
Mammal	<i>Sorex dispar</i>	Long-Tailed Shrew	G4	S2S3
Mammal	<i>Sorex hoyi winnemana</i>	Southern Pygmy Shrew	G5T4	S2S3
Mammal	<i>Spilogale putorius</i>	Eastern Spotted Skunk	G5	S2S3
Mammal	<i>Lasiurus borealis</i>	Eastern Red Bat	G5	S4
Mammal	<i>Synaptomys cooperi</i>	Southern Bog Lemming	G5	S2
Mammal	<i>Microtus ochrogaster</i>	Prairie Vole	G5	S3
Mammal	<i>Scalopus aquaticus</i>	Eastern Mole	G5	S3
Mammal	<i>Zapus hudsonius</i>	Meadow Jumping Mouse	G5	S3
Mammal	<i>Bison bison</i>	American Bison	G4	SX
Mammal	<i>Myotis grisescens</i>	Grey Bat	G3	SA
Mayfly	<i>Ephemera triplex</i>	West Virginia Burrowing Mayfly	GHQ	SH
Moth	<i>Euchlaena milnei</i>	A Looper Moth	G2G4	S2
Moth	<i>Catocala herodias gerhardi</i>	Herodias Underwing	G3T3	SU
Moth	<i>Chaetagnaea cerata</i>	A Noctuid Moth	G3G4	S1
Moth	<i>Merolonche doli</i>	Doll's Merolonche	G3G4	SH
Moth	<i>Hadena ectypa</i>	A Noctuid Moth	G3G4	S1
Moth	<i>Aplectoides condita</i>	A Noctuid Moth	G4	S1

Moth	<i>Catocala dulciola</i>	Sweet Underwing	G3	SU
Moth	<i>Euchlaena effecta</i>	A Looper Moth	G5	S1
Moth	<i>Melanchra assimilis</i>	A Moth	G5	S1
Moth	<i>Metalepsis salicarum</i>	A Moth	G5	S1
Moth	<i>Syngrapha rectangula</i>	Salt And Pepper Looper Moth	G5	S1
Moth	<i>Xestia tenuicula</i>	A Moth	G4	S1
Moth	<i>Brachionycha borealis</i>	Boreal Fan Moth	G4	S1
Moth	<i>Eilema bicolor</i>	Bicolor Moth	G5	S1
Moth	<i>Lithophane oriunda</i>	A Noctuid Moth	G4	S1
Moth	<i>Lophocampa maculata</i>	Spotted Tussock Moth	G5	S1
Moth	<i>Zale calycanthata</i>	A Noctuid Moth	G4	SU
Mussel	<i>Pleurobema clava</i>	Clubshell	G2	S1
Mussel	<i>Cyrogenia stegaria</i>	Fanshell	G1	S1
Mussel	<i>Pleurobema collina</i>	James Spiny mussel	G1	S1
Mussel	<i>Plethobasus cooperianus</i>	Orangefoot Pimpleback	G1	SX
Mussel	<i>Lampsilis abrupta</i>	Pink Mucket	G2	S1
Mussel	<i>Epioblasma torulosa rangiana</i>	Northern Riffleshell	G2T2	S1
Mussel	<i>Plethobasus cicatricosus</i>	White Wartback Mussel	G1	SX
Mussel	<i>Obovaria retusa</i>	Ring Pink	G1	S1
Mussel	<i>Lasmigona subviridis</i>	Green Floater	G3	S2
Mussel	<i>Alasmidonta varicosa</i>	Brook Floater	G3	S1
Mussel	<i>Simpsonaias ambigua</i>	Salamander Mussel	G3	S1
Mussel	<i>Villosa fabalis</i>	Rayed Bean	G1G2	SH
Mussel	<i>Lampsilis cariosa</i>	Yellow Lampmussel	G3G4	S1
Mussel	<i>Pleurobema plenum</i>	Rough Pigtoe	G1	SX
Mussel	<i>Epioblasma triquetra</i>	Snuffbox	G3	S2
Mussel	<i>Plethobasus cyphus</i>	Sheepnose	G3	S1
Mussel	<i>Cumberlandia monodonta</i>	Spectaclecase	G2G3	S1
Mussel	<i>Fusconaia subrotunda</i>	Long-Solid	G3	S2
Mussel	<i>Quadrula cylindrica</i>	Rabbitsfoot	G3	SX
Mussel	<i>Pleurobema cordatum</i>	Ohio Pigtoe	G3	S2
Mussel	<i>Alasmidonta marginata</i>	Elktoe	G4	S2
Mussel	<i>Ligumia recta</i>	Black Sandshell	G5	S2
Mussel	<i>Obovaria subrotunda</i>	Round Hickorynut	G4	S3
Mussel	<i>Cyclonaias tuberculata</i>	Purple Wartback	G5	S1
Mussel	<i>Ellipsaria lineolata</i>	Butterfly	G4	S1
Mussel	<i>Lampsilis ovata</i>	Pocketbook	G5	S1
Mussel	<i>Lampsilis cardium</i>	Plain Pocketbook	G5	S2
Mussel	<i>Lampsilis teres teres</i>	Yellow Sandshell	G5T1Q	S1
Mussel	<i>Elliptio fisheriana</i>	Northern Lance	G4	S1
Mussel	<i>Alasmidonta undulata</i>	Triangle Floater	G4	S1
Mussel	<i>Anodonta suborbiculata</i>	Flat Floater	G5	S1
Mussel	<i>Fusconaia ebena</i>	Ebonys shell	G4G5	S1
Mussel	<i>Lasmigona compressa</i>	Creek Heelsplitter	G5	S1
Mussel	<i>Megaloniais nervosa</i>	Washboard	G5	S1
Mussel	<i>Potamilus ohioensis</i>	Pink Papershell	G5	S1
Mussel	<i>Quadrula metanevra</i>	Monkeyface	G4	S1
Mussel	<i>Truncilla donaciformis</i>	Fawnsfoot	G5	S1

Mussel	<i>Truncilla truncata</i>	Deertoe	G5	S1
Mussel	<i>Unio merus tetralasmus</i>	Pondhorn	G4	S1
Mussel	<i>Villosa lienosa</i>	Little Spectaclecase	G5	S1
Mussel	<i>Anodontoides ferussacianus</i>	Cylindrical Papershell	G5	S2
Mussel	<i>Elliptio complanata</i>	Eastern Elliptio	G5	S2
Mussel	<i>Elliptio crassidens</i>	Elephant-Ear	G5	S2
Mussel	<i>Lasmigona complanata</i>	White Heelsplitter	G5	S2
Mussel	<i>Leptodea fragilis</i>	Fragile Papershell	G5	S2
Mussel	<i>Obliquaria reflexa</i>	Threehorn Wartyback	G5	S2
Mussel	<i>Pleurobema sintoxia</i>	Round Pigtoe	G4	S2
Mussel	<i>Quadrula quadrula</i>	Mapleleaf	G5	S2
Mussel	<i>Toxolasma parvus</i>	Lilliput	G5	S2
Mussel	<i>Tritogonia verrucosa</i>	Pistolgrip	G4	S2
Mussel	<i>Villosa iris</i>	Rainbow	G5	S2
Mussel	<i>Lampsilis fasciola</i>	Wavy-Rayed Lampmussel	G4	S2
Mussel	<i>Elliptio dilatata</i>	Spike	G5	S2S3
Mussel	<i>Epioblasma torulosa torulosa</i>	Tuberculed-Blossom	G2TX	SX
Mussel	<i>Pleurobema pyramidatum</i>	Pyramid Pigtoe		
Odonate	<i>Ophiogomphus incurvatus alleghaniensis</i>	Allegheny Snaketail	G3Q	S1
Odonate	<i>Calopteryx angustipennis</i>	Appalachian Jewelwing	G4	S2
Odonate	<i>Gomphus quadricolor</i>	Rapids Clubtail	G3G4	S2S3
Odonate	<i>Gomphus abbreviatus</i>	Spine-Crowned Clubtail	G3G4	S1
Odonate	<i>Gomphus viridifrons</i>	Green-Faced Clubtail	G3G4	S2
Odonate	<i>Aeshna mutata</i>	Spatterdock Darner	G3G4	S1
Odonate	<i>Anax longipes</i>	Comet Darner	G5	S1
Odonate	<i>Enallagma vesperum</i>	Vesper Bluet	G5	SH
Odonate	<i>Erythrodiplex minuscula</i>	Little Blue Dragonlet	G5	S1
Odonate	<i>Hetaerina titia</i>	Smoky Rubyspot	G5	SH
Odonate	<i>Ischnura prognata</i>	Furtive Forktail	G4	SH
Odonate	<i>Lanthus vernalis</i>	Southern Pygmy Clubtail	G4	S1
Odonate	<i>Lestes unguiculatus</i>	Lyre-Tipped Spreadwing	G5	SH
Odonate	<i>Libellula quadrimaculata</i>	Four Spotted Skimmer	G5	SH
Odonate	<i>Nasiaeschna pentacantha</i>	Cyrano Darner	G5	SH
Odonate	<i>Somatochlora provocans</i>	Treetop Emerald	G4	S1
Odonate	<i>Stylurus notatus</i>	Elusive Clubtail	G3	S1
Odonate	<i>Stylurus plagiatus</i>	Russet-Tipped Clubtail	G5	SH
Odonate	<i>Stylurus scudleri</i>	Zebra Clubtail	G4	SH
Odonate	<i>Stylurus spiniceps</i>	Arrow Clubtail	G5	SH
Odonate	<i>Sympetrum ambiguum</i>	Blue-Faced Meadowhawk	G5	S1
Odonate	<i>Sympetrum janeae</i>	Jane's Meadowhawk	G5	S1
Odonate	<i>Telebasis byersi</i>	Duckweed Firetail	G5	S1
Odonate	<i>Aeshna canadensis</i>	Canada Darner	G5	S1
Odonate	<i>Enallagma boreale</i>	Boreal Bluet	G5	S1
Odonate	<i>Gomphus fraternus</i>	Midland Clubtail	G5	S1
Odonate	<i>Gomphus rogersi</i>	Sable Clubtail	G4	S1S2
Odonate	<i>Lestes forcipatus</i>	Sweetflag Spreadwing	G5	SH
Odonate	<i>Leucorrhinia glacialis</i>	Crimson-Ringed Whiteface	G5	S1
Odonate	<i>Leucorrhinia hudsonica</i>	Hudsonian Whiteface	G5	S1

Odonate	<i>Libellula auripennis</i>	Golden-Winged Skimmer	G5	S1
Odonate	<i>Libellula flavida</i>	Yellow-Sided Skimmer	G5	SH
Odonate	<i>Ophiogomphus carolus</i>	Riffle Snaketail	G5	S1
Odonate	<i>Somatochlora forcipata</i>	Forcipate Emerald	G5	S1
Odonate	<i>Somatochlora linearis</i>	Mocha Emerald	G5	SH
Odonate	<i>Tetragoneuria canis</i>	Beaverpond Baskettail	G5	S1S2
Odonate	<i>Cordulegaster erronea</i>	Tiger Spiketail	G4	S1
Odonate	<i>Dromogomphus spoliatus</i>	Flag-Tailed Spinyleg	G4G5	S2S3
Odonate	<i>Erpetogomphus designatus</i>	Eastern Ringtail	G5	S2
Odonate	<i>Aeshna verticalis</i>	Green-Striped Darner	G5	S2
Odonate	<i>Aeshna tuberculifera</i>	Back-Tipped Darner	G4	S2
Odonate	<i>Calopteryx amata</i>	Superb Jewelwing	G4	S2
Odonate	<i>Cordulegaster diastatops</i>	Delta-Spotted Spiketail	G5	S2
Odonate	<i>Enallagma antennatum</i>	Rainbow Bluet	G5	S2
Odonate	<i>Enallagma cyathigerum vernale</i>	Northern Bluet	G5	S2
Odonate	<i>Gomphus adelphus</i>	Moustached Clubtail	G4	S2
Odonate	<i>Gomphus lineatifrons</i>	Splendid Clubtail	G4	S2
Odonate	<i>Gomphus vastus</i>	Cobra Clubtail	G5	S2
Odonate	<i>Ladona julia</i>	Chalk-Fronted Corporal	G5	S1
Odonate	<i>Lanthus parvulus</i>	Northern Pygmy Clubtail	G4	S2
Odonate	<i>Lestes d. disjunctus</i>	Common Spreadwing	G5T5	S2S3
Odonate	<i>Lestes inaequalis</i>	Elegant Spreadwing	G5	S2
Odonate	<i>Lestes vigilax</i>	Swamp Spreadwing	G5	S2
Odonate	<i>Macromia taeniolata</i>	Royal River Cruiser	G5	S2
Odonate	<i>Nehalennia gracilis</i>	Sphagnum Sprite	G5	S2
Odonate	<i>Neurocordulia yamaskanensis</i>	Stygian Shadowdragon	G5	S2
Odonate	<i>Ophiogomphus mainensis fastigiatus</i>	Maine Snaketail	G4	S2
Odonate	<i>Somatochlora elongata</i>	Ski-Tailed Emerald	G5	S2
Odonate	<i>Sympetrum internum</i>	Cherry-Faced Meadowhawk	G5	S2
Odonate	<i>Sympetrum obtrusum</i>	White-Faced Meadowhawk	G5	S2
Odonate	<i>Tachopteryx thoreyi</i>	Gray Petaltail	G4	S2
Odonate	<i>Tramea carolina</i>	Carolina Saddlebags	G5	S2
Odonate	<i>Celithemis fasciata</i>	Banded Pennant	G5	S3
Odonate	<i>Lestes dryas</i>	Emerald Spreadwing	G5	S3
Odonate	<i>Cordulia shurtleffi</i>	American Emerald	G5	S3
Odonate	<i>Epiaeschna heros</i>	Swamp Darner	G5	S3
Odonate	<i>Gomphus descriptus</i>	Harpoon Clubtail	G4	S3
Odonate	<i>Lestes congener</i>	Spotted Spreadwing	G5	S3
Odonate	<i>Macromia alleghaniensis</i>	Allegheny River Cruiser	G4	S3
Odonate	<i>Nehalennia irene</i>	Sedge Sprite	G5	S3
Odonate	<i>Sympetrum semicinctum</i>	Band-Winged Meadowhawk	G5	S3
Odonate	<i>Aeshna interrupta interrupta</i>	Variable Darner	G5T5	SR
Odonate	<i>Dromogomphus armatus</i>	Southeastern Spinyleg	G4	SR
Odonate	<i>Leucorrhinia proxima</i>	Red-Waisted Whiteface	G5	SR
Odonate	<i>Neurocordulia obsoleta</i>	Umber Showdragon	G4	SR
Odonate	<i>Somatochlora williamsoni</i>	Williamson's Emerald	G5	SR
Odonate	<i>Sympetrum corruptum</i>	Variiegated Meadowhawk	G5	SR
Reptile	<i>Clemmys insculpta</i>	Wood Turtle	G4	S2

Reptile	<i>Clemmys guttata</i>	Spotted Turtle	G5	S1
Reptile	<i>Pituophis melanoleucus melanoleucus</i>	Northern Pinesnake	G4T4	SH
Reptile	<i>Pseudemys rubriventris</i>	Northern Red-Bellied Cooter	G5	S1
Reptile	<i>Virginia valeriae pulchra</i>	Mountain Earthsnake	G5T3T4	S1
Reptile	<i>Crotalus horridus</i>	Timber Rattlesnake	G4	S3
Reptile	<i>Terrapene carolina</i>	Eastern Box Turtle	G5	S5
Reptile	<i>Eumeces anthracinus anthracinus</i>	Northern Coal Skink	G5T5	S2
Reptile	<i>Eumeces laticeps</i>	Broad-Headed Skink	G5	S2
Reptile	<i>Thamnophis sauritus</i>	Eastern Ribbonsnake	G5	S2
Reptile	<i>Heterodon platirhinos</i>	Eastern Hog-Nosed Snake	G5	S3
Reptile	<i>Apalone mutica mutica</i>	Midland Smooth Softshell	G5T5	SH
Reptile	<i>Cnemidophorus sexlineatus</i>	Eastern Six-Lined Racerunner	G5	S1
Reptile	<i>Elaphe guttata guttata</i>	Cornsnake	G5T5	S1
Reptile	<i>Pseudemys concinna</i>	River Cooter	G5	S1S2
Reptile	<i>Gratemys geographica</i>	Northern Map Turtle	G5	S2
Reptile	<i>Lampropeltis getula getula</i>	Eastern Kingsnake	G5T5	S2
Reptile	<i>Regina septemvittata</i>	Queen Snake	G5	S4
Reptile	<i>Carphophis amoenus</i>	Wormsnake	G5	S3
Reptile	<i>Opheodrys aestivus</i>	Rough Greensnake	G5	S3
Reptile	<i>Scincella lateralis</i>	Little Brown Skink	G5	S3
Reptile	<i>Virginia valeriae valeriae</i>	Eastern Earthsnake	G5	S3
Spider	<i>Calymmaria sp. 21</i>	A Spider	G1	S1
Spider	<i>Chrosiothes jenningsi</i>	A Spider	G1	S1
Spider	<i>Agelenopsis emertoni</i>	A Grass Spider	G?	S1
Spider	<i>Arctosa rubicunda</i>	A Spider	G?	S1
Spider	<i>Castianeira variata</i>	A Spider	G?	S1
Spider	<i>Hogna aspersa</i>	A Spider	G?	S1
Spider	<i>Hogna carolinensis</i>	A Spider	G?	S1
Spider	<i>Hogna frondicola</i>	A Spider	G?	S1
Spider	<i>Neriene clathrata</i>	A Line Weaving Spider	G?	S1
Spider	<i>Ozyptila modesta</i>	A Spider	G?	S1
Spider	<i>Pardosa distincta</i>	A Thin-Legged Wolf Spider	G?	S1
Spider	<i>Pirata insularis</i>	A Wolf Spider	G?	S1
Spider	<i>Pirata sedentarius</i>	A Wolf Spider	G?	S1
Spider	<i>Pirata seminolus</i>	A Wolf Spider	G?	S1
Spider	<i>Pirata zelotes</i>	A Wolf Spider	G?	S1
Spider	<i>Schizocosa retrorsa</i>	A Spider	G?	S1
Spider	<i>Tapinocyba hortensis</i>	A Spider	G?	S1
Spider	<i>Zelotes hentzi</i>	A Spider	G?	S1
Stonefly	<i>Hansonoperla hokolesqua</i>	A Stonefly	G2	S1
Stonefly	<i>Megaleuctra flinti</i>	A Stonefly	G2	S1
Stonefly	<i>Allocapnia frumi</i>	A Stonefly	G2	S2
Stonefly	<i>Alloperla aracoma</i>	A Stonefly	G3	S1
Stonefly	<i>Alloperla biserrata</i>	A Stonefly	G3	S1
Stonefly	<i>Diploperla kanawholensis</i>	Little Kanawha Perlodid Stonefly	G3	S1
Stonefly	<i>Ostrocerca prolongata</i>	A Stonefly	G3	S1
Stonefly	<i>Sweltsa pocahontas</i>	A Stonefly	G2	S2
Stonefly	<i>Utaperla gaspesiana</i>	A Stonefly	G3	S1

Stonefly	<i>Hansonoperla appalachia</i>	Hanson's Appalachian Stonefly	G3	S2
Stonefly	<i>Pteronarcys comstocki</i>	A Stonefly	G3	S2
Stonefly	<i>Ostrocerca complexa</i>	A Stonefly	G4	S1

Appendix 3. Species in Greatest Need of Conservation

This list of species, compiled from various organizations that maintain lists of species of concern in West Virginia, is the consensus list of Species of Greatest Need for Conservation for the first planning period (2 years) of the *West Virginia Wildlife Conservation Action Plan*.

Group	Species	Common Name	Global Rank	State Rank
Amphibian	<i>Plethodon nettingi</i>	Cheat Mountain Salamander	G2	S2
Amphibian	<i>Gyrinophilus subterraneus</i>	West Virginia Spring Salamander	G1Q	S1
Amphibian	<i>Plethodon punctatus</i>	Cow Knob Salamander	G3	S1
Amphibian	<i>Cryptobranchus alleganiensis</i>	Eastern Hellbender	G4	S2
Amphibian	<i>Aneides aeneus</i>	Green Salamander	G3G4	S3
Amphibian	<i>Plethodon virginia</i>	Shenandoah Mountain Salamander	G2G3Q	S2
Amphibian	<i>Scaphiopus holbrookii</i>	Eastern Spadefoot	G5	S1
Amphibian	<i>Ambystoma barbouri</i>	Streamside Salamander	G4	S1
Amphibian	<i>Rana pipiens</i>	Northern Leopard Frog	G5	S2
Amphibian	<i>Ambystoma jeffersonianum</i>	Jefferson Salamander	G5	S3
Amphibian	<i>Acris crepitans blanchardi</i>	Blanchard's Cricket Frog	G5T5	SH
Amphibian	<i>Ambystoma texanum</i>	Smallmouth Salamander	G5	S1
Amphibian	<i>Desmognathus welteri</i>	Black Mountain Salamander	G4	S1
Amphibian	<i>Pseudotriton montanus diastictus</i>	Midland Mud Salamander	G5T5	S1
Amphibian	<i>Acris crepitans crepitans</i>	Eastern Cricket Frog	G5T5	S2
Amphibian	<i>Pseudacris triseriata feriarum</i>	Upland Chorus Frog	G5T5	S2
Amphibian	<i>Eurycea lucifuga</i>	Cave Salamander	G5	S3
Amphibian	<i>Desmognathus quadramaculatus</i>	Black-bellied Salamander	G5	S3
Amphibian	<i>Pseudotriton ruber</i>	Northern Red Salamander	G5	S3
Beetle	<i>Cicindela marginipennis</i>	Cobblestone Tiger Beetle	G2G3	S1
Beetle	<i>Cicindela limbalis</i>	Common Claybank Tiger Beetle	G5	S1
Beetle	<i>Cicindela patruela</i>	A Tiger Beetle	G3	S2S3
Beetle	<i>Cicindela ancocisconensis</i>	A Tiger Beetle	G3	S3
Beetle	<i>Cicindela cuprascens</i>	A Tiger Beetle	G5	S1
Beetle	<i>Cicindela cursitans</i>	A Tiger Beetle	G5	S1
Beetle	<i>Cicindela formosa generosa</i>	A Tiger Beetle	G5T5	S1
Beetle	<i>Cicindela hirticollis</i>	Beach-dune Tiger Beetle	G5	S1
Beetle	<i>Cicindela scutellaris</i>	A Tiger Beetle	G5	S1
Beetle	<i>Cicindela splendida</i>	A Tiger Beetle	G5	S1
Beetle	<i>Megacephala virginica</i>	Virginia Big-headed Tiger Beetle	G5	S3
Beetle	<i>Cicindela purpurea</i>	A Tiger Beetle	G5	S3
Beetle	<i>Cicindela unipunctata</i>	A Tiger Beetle	G4	S3
Bird	<i>Lanius ludovicianus migrans</i>	Migrant Loggerhead Shrike	G4T3Q	S1B,S2 N
Bird	<i>Thryomanes bewickii altus</i>	Appalachian Bewick's Wren	G5T2Q	S1B,S1 N
Bird	<i>Haliaeetus leucocephalus</i>	Bald Eagle	G4	S2B,S3 N
Bird	<i>Aimophila aestivalis</i>	Bachman's Sparrow	G3	SHB

Bird	<i>Falco peregrinus</i>	Peregrine Falcon	G4	S1B,S2 N
Bird	<i>Vermivora chrysoptera</i>	Golden-winged Warbler	G4	S2B
Bird	<i>Ammodramus henslowii</i>	Henslow's Sparrow	G4	S1B
Bird	<i>Dendroica cerulea</i>	Cerulean Warbler	G4	S4B
Bird	<i>Caprimulgus vociferus</i>	Whip-poor-will	G5	S3B
Bird	<i>Asio otus</i>	Long-eared Owl	G5	S1B,S1 N
Bird	<i>Bartramia longicauda</i>	Upland Sandpiper	G5	SHB,S 1N
Bird	<i>Tyto alba</i>	Barn Owl	G5	S1B,S1 N
Bird	<i>Botaurus lentiginosus</i>	American Bittern	G4	S1B,S1 N
Bird	<i>Cistothorus platensis</i>	Sedge Wren	G5	S1B
Bird	<i>Asio flammeus</i>	Short-Eared Owl	G5	S1B,S2 N
Bird	<i>Colinus virginianus</i>	Northern Bobwhite	G5	S3B,S3 N
Bird	<i>Contopus cooperi</i>	Olive-sided Flycatcher	G4	S1B
Bird	<i>Accipiter gentilis</i>	Northern Goshawk	G5	S1B,S1 N
Bird	<i>Circus cyaneus</i>	Northern Harrier	G5	S1B,S3 N
Bird	<i>Limnothlypis swainsonii</i>	Swainson's Warbler	G4	S2B
Bird	<i>Anas rubripes</i>	American Black Duck	G5	S2B,S4 N
Bird	<i>Melanerpes erythrocephalus</i>	Red-Headed Woodpecker	G5	S2B,S3 N
Bird	<i>Caprimulgus carolinensis</i>	Chuck-will's-widow	G5	S1B
Bird	<i>Chondestes grammacus</i>	Lark Sparrow	G5	S1B
Bird	<i>Cistothorus palustris</i>	Marsh Wren	G5	S1B
Bird	<i>Gallinula chloropus</i>	Common Moorhen	G5	S1B
Bird	<i>Ixobrychus exilis</i>	Least Bittern	G5	S1B
Bird	<i>Nycticorax nycticorax</i>	Black-crowned Night-Heron	G5	SHB
Bird	<i>Rallus elegans</i>	King Rail	G4G5	S1B
Bird	<i>Rallus limicola</i>	Virginia Rail	G5	S1B,S1 N
Bird	<i>Catharus ustulatus</i>	Swainson's Thrush	G5	S1B
Bird	<i>Empidonax flaviventris</i>	Yellow-bellied Flycatcher	G5	S1B
Bird	<i>Porzana carolina</i>	Sora	G5	S1B,S1 N
Bird	<i>Vermivora ruficapilla</i>	Nashville Warbler	G5	S1B
Bird	<i>Anas crecca</i>	Green-winged Teal	G5	SHB,S 2N
Bird	<i>Dendroica discolor</i>	Prairie Warbler	G5	S4B
Bird	<i>Fulica americana</i>	American Coot	G5	S1B,S3 N
Bird	<i>Helmitheros vermivorus</i>	Worm-eating Warbler	G5	S5B
Bird	<i>Hylocichla mustelina</i>	Wood Thrush	G5	S5B
Bird	<i>Poocetes gramineus</i>	Vesper Sparrow	G5	S3B,S3 N

Bird	<i>Spizella pusilla</i>	Field Sparrow	G5	S4B,S4 N
Bird	<i>Carduelis pinus</i>	Pine Siskin	G5	S1B,S4 N
Bird	<i>Lophodytes cucullatus</i>	Hooded Merganser	G5	S1B,S4 N
Bird	<i>Sphyrapicus varius</i>	Yellow-bellied Sapsucker	G5	S1B,S3 N
Bird	<i>Ammodramus savannarum</i>	Grasshopper Sparrow	G5	S3B
Bird	<i>Eremophila alpestris</i>	Horned Lark	G5	S2B,S3 N
Bird	<i>Pandion haliaetus</i>	Osprey	G5	S2B,S2 N
Bird	<i>Protonotaria citrea</i>	Prothonotary Warbler	G5	S2B
Bird	<i>Spiza americana</i>	Dickcissel	G5	S2B
Bird	<i>Aegolius acadicus</i>	Northern Saw-whet Owl	G5	S2B,S3 N
Bird	<i>Ardea herodias</i>	Great Blue Heron	G5	S2B,S4 N
Bird	<i>Dolichonyx oryzivorus</i>	Bobolink	G5	S2B
Bird	<i>Podilymbus podiceps</i>	Pied-billed Grebe	G5	S2B,S4 N
Bird	<i>Riparia riparia</i>	Bank Swallow	G5	S2B
Bird	<i>Seiurus noveboracensis</i>	Northern Waterthrush	G5	S2B
Bird	<i>Empidonax alnorum</i>	Alder Flycatcher	G5	S3B,S4 N
Bird	<i>Actitis macularia</i>	Spotted Sandpiper	G5	S3B
Bird	<i>Chordeiles minor</i>	Common Nighthawk	G5	S3B
Bird	<i>Seiurus motacilla</i>	Louisiana Waterthrush	G5	S5B
Bird	<i>Certhia americana</i>	Brown Creeper	G5	S3B,S4 N
Bird	<i>Dendroica coronata</i>	Yellow-rumped Warbler	G5	S3B,S3 N
Bird	<i>Empidonax virescens</i>	Acadian Flycatcher	G5	S5B
Bird	<i>Oporornis formosus</i>	Kentucky Warbler	G5	S4B
Bird	<i>Accipiter cooperii</i>	Cooper's Hawk	G5	S3B,S4 N
Bird	<i>Accipiter striatus</i>	Sharp-shinned Hawk	G5	S3B,S4 N
Bird	<i>Coccyzus erythrophthalmus</i>	Black-billed Cuckoo	G5	S3B
Bird	<i>Coragyps atratus</i>	Black Vulture	G5	S3B,S4 N
Bird	<i>Dendroica fusca</i>	Blackburnian Warbler	G5	S3B
Bird	<i>Petrochelidon pyrrhonota</i>	Cliff Swallow	G5	S3B
Bird	<i>Gallinago delicata</i>	Wilson's Snipe	G5	S1B,S1 N
Bird	<i>Contopus virens</i>	Eastern Wood Peewee	G5	S5B
Bird	<i>Scolopax minor</i>	American Woodcock	G5	S4N,S 4B
Bird	<i>Vermivora pinus</i>	Blue-winged Warbler	G5	S4B
Bird	<i>Nycticorax violaceus</i>	Yellow-crowned Night-heron	G5	SPB,S 1N

Butterfly	<i>Pyrgus wyandot</i>	Grizzled Skipper	G2	S1
Butterfly	<i>Speyeria diana</i>	Diana	G3	S2S3
Butterfly	<i>Phyciodes batesii</i>	Tawny Crescent	G4	SH
Butterfly	<i>Callophrys irus</i>	Frosted Elfin	G3	S1
Butterfly	<i>Speyeria idalia</i>	Regal Fritillary	G3	S1
Butterfly	<i>Colias interior pop 1</i>	Pink-edged Sulphur (High Elev Pop.)	G5T1T2	S1
Butterfly	<i>Polygonia faunus smythi</i>	Green Comma	G5T3T4	S1
Butterfly	<i>Calephelis borealis</i>	Northern Metalmark	G3G4	S2
Butterfly	<i>Erynnis martialis</i>	Mottled Duskywing	G3G4	S3
Butterfly	<i>Atrytonopsis hianna</i>	Dusted Skipper	G4G5	S1
Butterfly	<i>Autochton cellus</i>	Golden-banded Skipper	G4	S1S2
Butterfly	<i>Callophrys polios</i>	Hoary Elfin	G5	SH
Butterfly	<i>Euphyes conspicua</i>	Black Dash	G4	S1
Butterfly	<i>Fixsenia favonius ontario</i>	Northern Hairstreak	G4T4	S1S2
Butterfly	<i>Lycaena epixanthe</i>	Bog Copper	G4G5	S1
Butterfly	<i>Staphylus hayhurstii</i>	Hayhurst's Scallopwing	G5	S1
Butterfly	<i>Euphyes bimacula</i>	Two-spotted Skipper	G4	S1
Butterfly	<i>Cyllopsis gemma</i>	Gemmed Satyr	G5	S2S3
Butterfly	<i>Satyrium caryaevorum</i>	Hickory Hairstreak	G4	S2
Butterfly	<i>Chlosyne harrisii</i>	Harris's Checkerspot	G4	S2
Butterfly	<i>Erora laeta</i>	Early Hairstreak	G4	S2
Butterfly	<i>Erynnis lucilius</i>	Columbine Duskywing	G4	S2
Butterfly	<i>Euchloe olympia</i>	Olympia Marble	G4G5	S2S3
Butterfly	<i>Hesperia metea</i>	Cobweb Skipper	G4G5	S2S3
Butterfly	<i>Lycaena hyllus</i>	Bronze Copper	G5	S2
Butterfly	<i>Parrhasius malbum</i>	White-M Hairstreak	G5	S2
Butterfly	<i>Phyciodes cocyta</i>	Northern Crescent	G5	S2
Butterfly	<i>Satyrium edwardsii</i>	Edwards' Hairstreak	G4	S2
Butterfly	<i>Boloria selene myrina</i>	Myrina Fritillary	G5T5	S3
Butterfly	<i>Polygonia progne</i>	Gray Comma	G5	S3
Butterfly	<i>Speyeria atlantis</i>	Atlantis Fritillary	G5	S3
Cave invertebrate (invert)	<i>Antrolana lira</i>	Madison Cave Isopod	G2G4	S1
Cave invert	<i>Stygobromus parvus</i>	Minute Cave Amphipod	G1G2	S1
Cave invert	<i>Stygobromus cooperi</i>	Cooper's Cave Amphipod	G1	S1
Cave invert	<i>Stygobromus morrisoni</i>	Morrison's Cave Amphipod	G2G3	S1
Cave invert	<i>Apochthonius paucispinosus</i>	Dry Fork Valley Cave Pseudoscorpion	G1	S1
Cave invert	<i>Fontigens turritella</i>	Greenbrier Cavesnail	G1	S1
Cave invert	<i>Kleptochthonius orpheus</i>	Orpheus Cave Pseudoscorpion	G1	S1
Cave invert	<i>Pseudanophthalmus hadenoecus</i>	Timber Ridge Cave Beetle	G1	S1
Cave invert	<i>Pseudanophthalmus montanus</i>	Dry Fork Valley Cave Beetle	G1	S1
Cave invert	<i>Sphalloplana culveri</i>	Culver's Planarian	G1	S1
Cave invert	<i>Stygobromus culveri</i>	Culver's Cave Amphipod	G1G2	S1
Cave invert	<i>Stygobromus nanus</i>	Pocahontas Cave Amphipod	G1	S1
Cave invert	<i>Chitrella regina</i>	Royal Syarinid Pseudoscorpion	G1	S1
Cave invert	<i>Horologion speokites</i>	Arbuckle Cave Ground Beetle	GH	SH
Cave invert	<i>Islandiana speophila</i>	Cavern Sheet-web Spider	G1	S1

Cave invert	<i>Kleptochthonius henroti</i>	Greenbrier Valley Cave Pseudoscorpion	G1G2	S1
Cave invert	<i>Kleptochthonius hetricki</i>	Organ Cave Pseudoscorpion	G1	S1
Cave invert	<i>Kleptochthonius proserpinae</i>	Proserpina Cave Pseudoscorpion	G1	S1
Cave invert	<i>Pseudanophthalmus krekeri</i>	Rich Mountain Cave Beetle	G1	SX
Cave invert	<i>Pseudanophthalmus lallemanti</i>	Lallemant's Cave Beetle	G1	S1
Cave invert	<i>Pseudanophthalmus potomaca senecae</i>	Seneca Cave Beetle	G2T1	S1
Cave invert	<i>Pseudanophthalmus subaequalis</i>	Greenbrier Valley Cave Beetle	G1	S1
Cave invert	<i>Stygobromus redactus</i>	An Amphipod	G1	S1
Cave invert	<i>Stygobromus spinatus</i>	Spring Cave Amphipod	G3	S3
Cave invert	<i>Pseudanophthalmus potomaca potomaca</i>	South Branch Valley Cave Beetle	G2T2	S1
Cave invert	<i>Stygobromus biggersi</i>	Biggers' Cave Amphipod	G2G4	S1
Cave invert	<i>Caecidotea simonini</i>	An Isopod	G1	S1
Cave invert	<i>Caecidotea sinuncus</i>	An Isopod	G1	S1
Cave invert	<i>Pseudosinella certa</i>	Gandy Creek Cave Springtail	G1	S1
Cave invert	<i>Pseudotremia lusciosa</i>	Germany Valley Cave Millipede	G1	S1
Cave invert	<i>Pseudotremia princeps</i>	South Branch Valley Cave Millipede	G1	S1
Cave invert	<i>Stygobromus emarginatus</i>	Greenbrier Cave Amphipod	G3	S3
Cave invert	<i>Trichopetalum krekeri</i>	West Virginia Blind Cave Millipede	G1	S1
Cave invert	<i>Sinella agna</i>	A Springtail	G2G3	S1
Cave invert	<i>Stygobromus gracilipes</i>	Shenandoah Valley Cave Amphipod	G2G4	S1
Cave invert	<i>Trichopetalum whitei</i>	Luray Caverns Blind Cave Millipede	G2G3Q	S1
Cave invert	<i>Arrhopalites sp 2</i>	A Collembola	G1	S1
Cave invert	<i>Arrhopalites sp 3</i>	A Collembola	G1	S1
Cave invert	<i>Fontigens sp 1</i>	Mcclung Cavesnail	G1	S1
Cave invert	<i>Islandiana sp 1</i>	A Spider	G1	S1
Cave invert	<i>Litocampa sp 1</i>	Diplura	G1	S1
Cave invert	<i>Pseudanophthalmus grandis orthosulc</i>	A Cave Beetle	G3T1	S1
Cave invert	<i>Pseudanophthalmus sp 1</i>	A Beetle	G1	S1
Cave invert	<i>Pseudanophthalmus sp 2</i>	A Beetle	G1	S1
Cave invert	<i>Pseudanophthalmus sp 3</i>	A Beetle	G1	S1
Cave invert	<i>Pseudosinella sp 1</i>	A Springtail	G1	S1
Cave invert	<i>Pseudosinella testa</i>	Shelled Cave Springtail	G1G2	S1
Cave invert	<i>Pseudotremia sp 1</i>	General Davis Cave Millipede	G1?	S1
Cave invert	<i>Stygobromus sp 2</i>	Coburn Cave Amphipod	G1	S1
Cave invert	<i>Stygobromus sp 3</i>	Dyers Cave Amphipod	G1	S1
Cave invert	<i>Trichodrilus culveri</i>	An Oligochaete	G1G2	S1
Cave invert	<i>Caecidotea cannula</i>	An Isopod	G3	S1
Cave invert	<i>Fontigens tartarea</i>	Organ Cavesnail	G2	S2
Cave invert	<i>Pseudanophthalmus fuscus</i>	A Cave Beetle	G2G3	S2
Cave invert	<i>Pseudotremia fulgida</i>	Greenbrier Valley Cave Millipede	G2G3	S2
Cave invert	<i>Caecidotea franzi</i>	Franz's Cave Isopod	G2G3	S1
Cave invert	<i>Pseudanophthalmus grandis elevatus</i>	A Cave Beetle	G3T2	S1
Cave invert	<i>Stygobromus pollostus</i>	An Amphipod	G2G3	S1
Cave invert	<i>Stygobromus sp 1</i>	An Amphipod	G2	S1S2

Cave invert	<i>Stylodrilus beattiei</i>	An Oligochaete	G2G3	S1
Cave invert	<i>Macrocotyla hoffmasteri</i>	Hoffmaster's Cave Flatworm	G2G3	S3
Cave invert	<i>Phagocata angusta</i>	A Cave Planarian	G1G2	SU
Cave invert	<i>Trichopetalum weyeri</i>	Grand Caverns Blind Cave Millipe	G3Q	S2
Cave invert	<i>Bathyphantes weyeri</i>	A Cave Spider	G3G4	S1
Cave invert	<i>Caecidotea pricei</i>	Price's Cave Isopod	G3G4	S1
Cave invert	<i>Geocentrophora cavernicola</i>	Cave Flatworm	G3G4	SH
Cave invert	<i>Litocampa fieldingi</i>	Diplura	G2G3	S2
Cave invert	<i>Pseudanophthalmus higinbothami</i>	A Cave Beetle	G2G3	S2
Cave invert	<i>Pseudosinella orba</i>	A Cave Springtail	G3G4	S1
Cave invert	<i>Stygobromus tenuis potomacus</i>	Potomac Groundwater Amphipod	G4T3T4	S1
Cave invert	<i>Caecidotea holsingeri</i>	Greenbrier Valley Cave Isopod	G3	S3
Cave invert	<i>Pseudanophthalmus hypertrichosis</i>	A Cave Beetle	G3	S3
Cave invert	<i>Pseudosinella gisini</i>	A Springtail	G3	S3
Cave invert	<i>Anthrobia monmouthia</i>	Spider	G3G4	S2
Cave invert	<i>Conotyla vista</i>	A Cave Millipede	G1G2	SU
Cave invert	<i>Haplotaxis brinkhursti</i>	An Oligochaete	G1G2	SU
Cave invert	<i>Pseudanophthalmus grandis ssp 1</i>	A Cave Beetle	G3T?	S1
Cave invert	<i>Trichopetalum packardi</i>	Packard's Blind Cave Millepede	G3Q	S2
Cave invert	<i>Crangonyx sp 2</i>	An Amphipod	G2	SU
Cave invert	<i>Nesticus tennesseensis</i>	A Cave Spider	G2G4	SU
Cave invert	<i>Pseudanophthalmus grandis grandis</i>	A Cave Beetle	G3T3	S3
Cave invert	<i>Stygobromus franzi</i>	Franz's Cave Amphipod	G2G3	SU
Cave invert	<i>Poecilophysis wolmsdorfensis</i>	A Cave Mite	G3	SU
Cave invert	<i>Rhagidia varia</i>	A Cave Mite	G3	SU
Cave invert	<i>Stygobromus allegheniensis</i>	Allegheny Cave Amphipod	G4	S1
Cave invert	<i>Porrhomma cavernicola</i>	Appalachian Cave Spider	G4G5	S2
Cave invert	<i>Phanetta subterranea</i>	A Spider	G4	S3
Crayfish	<i>Cambarus nerterius</i>	An Underground Crayfish	G2G3	S1
Crayfish	<i>Cambarus veteranus</i>	A Crayfish	G3G4	S1
Crayfish	<i>Cambarus elkensis</i>	Elk River Crayfish	G2	S1
Crayfish	<i>Fallicambarus fodiens</i>	A Crayfish	G5	S1
Crayfish	<i>Orconectes limosus</i>	Spinycheek Crayfish	G4G5	S1
Crayfish	<i>Cambarus longulus</i>	A Crayfish	G5	S1
Crayfish	<i>Cambarus chasmodactylus</i>	New River Crayfish	G4	S3
Crayfish	<i>Cambarus monongalensis</i>	A Crayfish	G5	S3
Crayfish	<i>Procambarus acutus</i>	White River Crayfish	G5	SU
Fish	<i>Etheostoma pellucidum</i>	Eastern Sand Darter	G3	S2S3
Fish	<i>Percina macrocephala</i>	Longhead Darter	G3	S2
Fish	<i>Etheostoma maculatum</i>	Spotted Darter	G2	S1
Fish	<i>Etheostoma osburni</i>	Candy Darter	G3	S2
Fish	<i>Phenacobius teretulus</i>	Kanawha Minnow	G3G4	S1
Fish	<i>Cycleptus elongatus</i>	Blue Sucker	G3G4	S1
Fish	<i>Acipenser fulvescens</i>	Lake Sturgeon	G3G4	SX
Fish	<i>Crystallaria asprella</i>	Crystal Darter	G3G4	S1

Fish	<i>Polyodon spathula</i>	Paddlefish	G4	S1
Fish	<i>Pararhinichthys bowersi</i>	Cheat Minnow	G1G2Q	S1S2
Fish	<i>Ichthyomyzon greeleyi</i>	Mountain Brook Lamprey	G3G4	S1
Fish	<i>Etheostoma tippecanoe</i>	Tippecanoe Darter	G3G4	S2
Fish	<i>Ichthyomyzon bdellium</i>	Ohio Lamprey	G3G4	S2
Fish	<i>Cottus sp 1</i>	Bluestone Sculpin	G2	S1
Fish	<i>Scaphirhynchus platyrhynchus</i>	Shovelnose Sturgeon	G4	SX
Fish	<i>Notropis ariommus</i>	Popeye Shiner	G3	S2
Fish	<i>Erimystax x-punctatus</i>	Gravel Chub	G4	S1
Fish	<i>Ichthyomyzon fossor</i>	Northern Brook Lamprey	G4	S1
Fish	<i>Noturus stigmosus</i>	Northern Madtom	G3	S1
Fish	<i>Clinostomus elongatus</i>	Redside Dace	G4	S1S2
Fish	<i>Ichthyomyzon unicuspis</i>	Silver Lamprey	G5	S2S3
Fish	<i>Lampetra appendix</i>	American Brook Lamprey	G4	S2
Fish	<i>Percina copelandi</i>	Channel Darter	G4	S2S3
Fish	<i>Percina evides</i>	Gilt Darter	G4	S2
Fish	<i>Percina gymnocephala</i>	Appalachia Darter	G4	S3
Fish	<i>Hiodon tergisus</i>	Mooneye	G5	S3
Fish	<i>Macrhybopsis storeriana</i>	Silver Chub	G5	S3S4
Fish	<i>Moxostoma carinatum</i>	River Redhorse	G4	S3
Fish	<i>Etheostoma camurum</i>	Bluebreast Darter	G4	S3
Fish	<i>Notropis scabriceps</i>	New River Shiner	G4	S2
Fish	<i>Margariscus margarita</i>	Pearl Dace	G5	S3S4
Fish	<i>Carpiodes velifer</i>	Highfin Carpsucker	G4G5	S1
Fish	<i>Cottus cognatus</i>	Slimy Sculpin	G5	S1
Fish	<i>Hiodon alosoides</i>	Goldeye	G5	S1S2
Fish	<i>Hybognathus regius</i>	Eastern Silvery Minnow	G5	S1
Fish	<i>Ictiobus cyprinellus</i>	Bigmouth Buffalo	G5	S1
Fish	<i>Notropis boops</i>	Bigeye Shiner	G5	S1
Fish	<i>Noturus eleutherus</i>	Mountain Madtom	G4	S1
Fish	<i>Percina peltata</i>	Shield Darter	G5	S1
Fish	<i>Percina phoxocephala</i>	Slenderhead Darter	G5	S1
Fish	<i>Percina shumardi</i>	River Darter	G5	S1
Fish	<i>Umbra limi</i>	Central Mudminnow	G5	S1
Fish	<i>Etheostoma longimanum</i>	Longfin Darter	G4	S1
Fish	<i>Lythrurus ardens</i>	Blueside Shiner	G5	S1
Fish	<i>Percina notogramma</i>	Stripeback Darter	G4	S1
Fish	<i>Carpiodes carpio</i>	River Carpsucker	G5	S2S3
Fish	<i>Esox americanus vermiculatus</i>	Grass Pickerel	G5T5	S2
Fish	<i>Fundulus diaphanus</i>	Banded Killifish	G5	S2
Fish	<i>Ictiobus niger</i>	Black Buffalo	G5	S2
Fish	<i>Lampetra aepyptera</i>	Least Brook Lamprey	G5	S2S3
Fish	<i>Lepomis gulosus</i>	Warmouth	G5	S2
Fish	<i>Lepomis humilis</i>	Orangespotted Sunfish	G5	S2
Fish	<i>Notropis blennioides</i>	River Shiner	G5	S2
Fish	<i>Notropis procne</i>	Swallowtail Shiner	G5	S2
Fish	<i>Phoxinus erythrogaster</i>	Southern Redbelly Dace	G5	S2S3
Fish	<i>Pimephales vigilax</i>	Bullhead Minnow	G5	S2

Fish	<i>Anguilla rostrata</i>	American Eel	G5	S2
Fish	<i>Cottus carolinae</i>	Banded Sculpin	G5	S2
Fish	<i>Cyprinella analostana</i>	Satinfin Shiner	G5	S2
Fish	<i>Etheostoma olmstedii</i>	Tessellated Darter	G5	S2
Fish	<i>Ameiurus melas</i>	Black Bullhead	G5	S3S4
Fish	<i>Cottus girardi</i>	Potomac Sculpin	G4	S3
Fish	<i>Erimyzon oblongus</i>	Creek Chubsucker	G5	S3
Fish	<i>Lythrurus umbratilis</i>	Redfin Shiner	G5	S3
Fish	<i>Macrhybopsis hyostoma</i>	Speckled Chub	G5	S3
Fish	<i>Notropis amoenus</i>	Comely Shiner	G5	S3S4
Fish	<i>Notropis buchmanii</i>	Ghost Shiner	G5	S3S4
Fish	<i>Percina sciera</i>	Dusky Darter	G5	S3
Fish	<i>Exoglossum laurae</i>	Tonguetied Minnow	G4	S3
Fish	<i>Luxilus cornutus</i>	Common Shiner	G5	S3
Fish	<i>Nocomis leptocephalus</i>	Bluehead Chub	G5	S3
Fish	<i>Nocomis platyrhynchus</i>	Bigmouth Chub	G4Q	S3S4
Fish	<i>Phoxinus oreas</i>	Mountain Redbelly Dace	G5	S3
Fish	<i>Thoburnia rhothoeca</i>	Torrent Sucker	G4	S3
Fish	<i>Salvelinus fontinalis</i>	Brook Trout	G5	S4
Land snail	<i>Triodopsis platysayoides</i>	Flat-spined Three-toothed Landsnail	G1	S1
Land snail	<i>Glyphyalinia raderi</i>	Maryland Glyph Snail	G2	S2
Land snail	<i>Helicodiscus triodus</i>	Tallus Coil	G2	SH
Land snail	<i>Paravitrea reesi</i>	Round Supercoil	G3	S1
Land snail	<i>Paravitrea seradens</i>	Barred Supercoil	G3	SH
Land snail	<i>Paravitrea ceres</i>	Sidelong Supercoil	G?	S1
Land snail	<i>Webbhelix multilineata</i>	Striped Whitelip	G?	S1
Land snail	<i>Leptoxis dilatata</i>	Seep Mudalia	G2?	SU
Land snail	<i>Carychium clappi</i>	Appalachian Thorn	G4G5	SH
Land snail	<i>Somatogyrus pennsylvanicus</i>	Shale Pebblesnail	G3	SU
Land snail	<i>Hendersonia occulta</i>	Cherrystone Drop	G4	S1S2
Mammal	<i>Myotis sodalis</i>	Indiana Bat	G2	S1
Mammal	<i>Myotis leibii</i>	Eastern Small-footed Bat	G3	S1
Mammal	<i>Corynorhinus townsendii virginianus</i>	Virginia Big-eared Bat	G4T2	S2
Mammal	<i>Glaucomys sabrinus fuscus</i>	West Virginia Northern Flying Squirrel	G5T2	S2
Mammal	<i>Sorex palustris punctulatus</i>	Southern Water Shrew	G5T3	S1
Mammal	<i>Microtus chrotorrhinus carolinensis</i>	Southern Rock Vole	G4T3	S2
Mammal	<i>Corynorhinus rafinesquii</i>	Eastern Big-eared Bat	G3G4	S1
Mammal	<i>Neotoma magister</i>	Allegheny Woodrat	G3G4	S3
Mammal	<i>Sylvilagus obscurus</i>	Appalachian Cottontail	G4	S3
Mammal	<i>Cryptotis parva</i>	Least Shrew	G5	S2
Mammal	<i>Lasionycteris noctivagans</i>	Silver-haired Bat	G5	S2
Mammal	<i>Lasiurus cinereus</i>	Hoary Bat	G5	S3
Mammal	<i>Nycticeius humeralis</i>	Evening Bat	G5	SH
Mammal	<i>Reithrodontomys humulis</i>	Eastern Harvest Mouse	G5	S1
Mammal	<i>Ochrotomys nuttalli</i>	Golden Mouse	G5	S2
Mammal	<i>Condylura cristata</i>	Star-nosed Mole	G5	S2
Mammal	<i>Sorex dispar</i>	Long-tailed Shrew	G4	S2S3

Mammal	<i>Sorex hoyi winnemana</i>	Southern Pygmy Shrew	G5T4	S2S3
Mammal	<i>Spilogale putorius</i>	Eastern Spotted Skunk	G5	S2S3
Mammal	<i>Lasiurus borealis</i>	Eastern Red Bat	G5	S4
Mammal	<i>Synaptomys cooperi</i>	Southern Bog Lemming	G5	S2
Mammal	<i>Microtus ochrogaster</i>	Prairie Vole	G5	S3
Mammal	<i>Zapus hudsonius</i>	Meadow Jumping Mouse	G5	S3
Mammal	<i>Lutra canadensis</i>	River Otter	G5	S1
Mammal	<i>Martes pennanti</i>	Fisher	G5	S3
Moth	<i>Euchlaena milnei</i>	A Looper Moth	G2G4	S2
Moth	<i>Catocala herodias gerhardi</i>	Herodias Underwing	G3T3	SU
Moth	<i>Chaetagnaea cerata</i>	A Noctuid Moth	G3G4	S1
Moth	<i>Merolonche dolli</i>	Doll's Merolonche	G3G4	SH
Moth	<i>Hadena ectypa</i>	A Noctuid Moth	G3G4	S1
Moth	<i>Aplectoides condita</i>	A Noctuid Moth	G4	S1
Moth	<i>Catocala dulciola</i>	Sweet Underwing	G3	SU
Moth	<i>Euchlaena effecta</i>	A Looper Moth	G5	S1
Moth	<i>Melanchra assimilis</i>	A Moth	G5	S1
Moth	<i>Metalepsis salicarum</i>	A Moth	G5	S1
Moth	<i>Syngrapha rectangula</i>	Salt And Pepper Looper Moth	G5	S1
Moth	<i>Xestia tenuicula</i>	A Moth	G4	S1
Moth	<i>Brachionycha borealis</i>	Boreal Fan Moth	G4	S1
Moth	<i>Eilema bicolor</i>	Bicolor Moth	G5	S1
Moth	<i>Lithophane oriunda</i>	A Noctuid Moth	G4	S1
Moth	<i>Lophocampa maculata</i>	Spotted Tussock Moth	G5	S1
Moth	<i>Zale calycanthata</i>	A Noctuid Moth	G4	SU
Mussel	<i>Pleurobema clava</i>	Clubshell	G2	S1
Mussel	<i>Cyprogenia stegaria</i>	Fanshell	G1	S1
Mussel	<i>Pleurobema collina</i>	James Spinymussel	G1	S1
Mussel	<i>Lampsilis abrupta</i>	Pink Mucket	G2	S1
Mussel	<i>Epioblasma torulosa rangiana</i>	Northern Riffleshell	G2T2	S1
Mussel	<i>Lasmigona subviridis</i>	Green Floater	G3	S2
Mussel	<i>Alasmidonta varicosa</i>	Brook Floater	G3	S1
Mussel	<i>Simpsonaias ambigua</i>	Salamander Mussel	G3	S1
Mussel	<i>Villosa fabalis</i>	Rayed Bean	G1G2	SH
Mussel	<i>Lampsilis cariosa</i>	Yellow Lamprussel	G3G4	S1
Mussel	<i>Epioblasma triquetra</i>	Snuffbox	G3	S2
Mussel	<i>Plethobasus cyphus</i>	Sheepnose	G3	S1
Mussel	<i>Cumberlandia monodonta</i>	Spectaclecase	G2G3	S1
Mussel	<i>Fusconaia subrotunda</i>	Long-solid	G3	S2
Mussel	<i>Pleurobema cordatum</i>	Ohio Pigtoe	G3	S2
Mussel	<i>Alasmidonta marginata</i>	Elktoe	G4	S2
Mussel	<i>Ligumia recta</i>	Black Sandshell	G5	S2
Mussel	<i>Cyclonaias tuberculata</i>	Purple Wartyback	G5	S1
Mussel	<i>Ellipsaria lineolata</i>	Butterfly	G4	S1
Mussel	<i>Lampsilis ovata</i>	Pocketbook	G5	S1
Mussel	<i>Lampsilis teres teres</i>	Yellow Sandshell	G5T1Q	S1
Mussel	<i>Elliptio fisheriana</i>	Northern Lance	G4	S1
Mussel	<i>Alasmidonta undulata</i>	Triangle Floater	G4	S1

Mussel	<i>Fusconaia ebena</i>	Ebonyshell	G4G5	S1
Mussel	<i>Lasmigona compressa</i>	Creek Heelsplitter	G5	S1
Mussel	<i>Megaloniais nervosa</i>	Washboard	G5	S1
Mussel	<i>Quadrula metanevra</i>	Monkeyface	G4	S1
Mussel	<i>Truncilla donaciformis</i>	Fawnsfoot	G5	S1
Mussel	<i>Truncilla truncata</i>	Deertoe	G5	S1
Mussel	<i>Unio merus tetralasmus</i>	Pondhorn	G4	S1
Mussel	<i>Villosa lienosa</i>	Little Spectaclecase	G5	S1
Mussel	<i>Anodontoides ferussacianus</i>	Cylindrical Papershell	G5	S2
Mussel	<i>Elliptio crassidens</i>	Elephant-ear	G5	S2
Mussel	<i>Lasmigona complanata</i>	White Heelsplitter	G5	S2
Mussel	<i>Leptodea fragilis</i>	Fragile Papershell	G5	S2
Mussel	<i>Obliquaria reflexa</i>	Threehorn Wartyback	G5	S2
Mussel	<i>Pleurobema sintoxia</i>	Round Pigtoe	G4	S2
Mussel	<i>Quadrula quadrula</i>	Mapleleaf	G5	S2
Mussel	<i>Toxolasma parvus</i>	Lilliput	G5	S2
Mussel	<i>Tritogonia verrucosa</i>	Pistolgrip	G4	S2
Mussel	<i>Villosa iris</i>	Rainbow	G5	S2
Mussel	<i>Lampsilis fasciola</i>	Wavy-rayed Lampmussel	G4	S2
Odonate	<i>Ophiogomphus incurvatus alleghaniensis</i>	Allegheny Snaketail	G3Q	S1
Odonate	<i>Calopteryx angustipennis</i>	Appalachian Jewelwing	G4	S2
Odonate	<i>Gomphus quadricolor</i>	Rapids Clubtail	G3G4	S2S3
Odonate	<i>Gomphus abbreviatus</i>	Spine-crowned Clubtail	G3G4	S1
Odonate	<i>Gomphus viridifrons</i>	Green-faced Clubtail	G3G4	S2
Odonate	<i>Aeshna mutata</i>	Spatterdock Darner	G3G4	S1
Odonate	<i>Anax longipes</i>	Comet Darner	G5	S1
Odonate	<i>Enallagma vesperum</i>	Vesper Bluet	G5	SH
Odonate	<i>Erythrodiplax minuscula</i>	Little Blue Dragonlet	G5	S1
Odonate	<i>Hetaerina titia</i>	Smoky Rubyspot	G5	SH
Odonate	<i>Ischnura prognata</i>	Furtive Forktail	G4	SH
Odonate	<i>Lanthus vernalis</i>	Southern Pygmy Clubtail	G4	S1
Odonate	<i>Lestes unguiculatus</i>	Lyre-tipped Spreadwing	G5	SH
Odonate	<i>Libellula quadrimaculata</i>	Four Spotted Skimmer	G5	SH
Odonate	<i>Nasiaeschna pentacantha</i>	Cyrano Darner	G5	SH
Odonate	<i>Somatochlora provocans</i>	Treetop Emerald	G4	S1
Odonate	<i>Stylurus notatus</i>	Elusive Clubtail	G3	S1
Odonate	<i>Stylurus plagiatus</i>	Russet-tipped Clubtail	G5	SH
Odonate	<i>Stylurus scudleri</i>	Zebra Clubtail	G4	SH
Odonate	<i>Stylurus spiniceps</i>	Arrow Clubtail	G5	SH
Odonate	<i>Sympetrum ambiguum</i>	Blue-faced Meadowhawk	G5	S1
Odonate	<i>Sympetrum janeae</i>	Jane's Meadowhawk	G5	S1
Odonate	<i>Telebasis byersi</i>	Duckweed Firetail	G5	S1
Odonate	<i>Aeshna canadensis</i>	Canada Darner	G5	S1
Odonate	<i>Enallagma boreale</i>	Boreal Bluet	G5	S1
Odonate	<i>Gomphus fraternus</i>	Midland Clubtail	G5	S1
Odonate	<i>Gomphus rogersi</i>	Sable Clubtail	G4	S1S2
Odonate	<i>Lestes forcipatus</i>	Sweetflag Spreadwing	G5	SH
Odonate	<i>Leucorrhinia glacialis</i>	Crimson-ringed Whiteface	G5	S1

Odonate	<i>Leucorrhinia hudsonica</i>	Hudsonian Whiteface	G5	S1
Odonate	<i>Libellula auripennis</i>	Golden-winged Skimmer	G5	S1
Odonate	<i>Libellula flavida</i>	Yellow-sided Skimmer	G5	SH
Odonate	<i>Ophiogomphus carolus</i>	Riffle Snaketail	G5	S1
Odonate	<i>Somatochlora forcipata</i>	Forcinate Emerald	G5	S1
Odonate	<i>Somatochlora linearis</i>	Mocha Emerald	G5	SH
Odonate	<i>Tetragoneuria canis</i>	Beaverpond Baskettail	G5	S1S2
Odonate	<i>Cordulegaster erronea</i>	Tiger Spiketail	G4	S1
Odonate	<i>Dromogomphus spoliatus</i>	Flag-tailed Spinyleg	G4G5	S2S3
Odonate	<i>Erpetogomphus designatus</i>	Eastern Ringtail	G5	S2
Odonate	<i>Aeshna verticalis</i>	Green-striped Darner	G5	S2
Odonate	<i>Aeshna tuberculifera</i>	Back-tipped Darner	G4	S2
Odonate	<i>Calopteryx amata</i>	Superb Jewelwing	G4	S2
Odonate	<i>Cordulegaster diastatops</i>	Delta-spotted Spiketail	G5	S2
Odonate	<i>Enallagma antennatum</i>	Rainbow Bluet	G5	S2
Odonate	<i>Enallagma cyathigerum vernale</i>	Northern Bluet	G5	S2
Odonate	<i>Gomphus adelphus</i>	Moustached Clubtail	G4	S2
Odonate	<i>Gomphus lineatifrons</i>	Splendid Clubtail	G4	S2
Odonate	<i>Gomphus vastus</i>	Cobra Clubtail	G5	S2
Odonate	<i>Ladona julia</i>	Chalk-fronted Corporal	G5	S1
Odonate	<i>Lanthus parvulus</i>	Northern Pygmy Clubtail	G4	S2
Odonate	<i>Lestes d. disjunctus</i>	Common Spreadwing	G5T5	S2S3
Odonate	<i>Lestes inaequalis</i>	Elegant Spreadwing	G5	S2
Odonate	<i>Lestes vigilax</i>	Swamp Spreadwing	G5	S2
Odonate	<i>Macromia taeniolata</i>	Royal River Cruiser	G5	S2
Odonate	<i>Nehalennia gracilis</i>	Sphagnum Sprite	G5	S2
Odonate	<i>Neurocordulia yamaskanensis</i>	Stygian Shadowdragon	G5	S2
Odonate	<i>Ophiogomphus mainensis fastigiatus</i>	Maine Snaketail	G4	S2
Odonate	<i>Somatochlora elongata</i>	Ski-tailed Emerald	G5	S2
Odonate	<i>Sympetrum internum</i>	Cherry-faced Meadowhawk	G5	S2
Odonate	<i>Sympetrum obtrusum</i>	White-faced Meadowhawk	G5	S2
Odonate	<i>Tachopteryx thoreyi</i>	Gray Petaltail	G4	S2
Odonate	<i>Tramea carolina</i>	Carolina Saddlebags	G5	S2
Odonate	<i>Celithemis fasciata</i>	Banded Pennant	G5	S3
Odonate	<i>Lestes dryas</i>	Emerald Spreadwing	G5	S3
Odonate	<i>Cordulia shurtleffi</i>	American Emerald	G5	S3
Odonate	<i>Epiaeschna heros</i>	Swamp Darner	G5	S3
Odonate	<i>Gomphus descriptus</i>	Harpoon Clubtail	G4	S3
Odonate	<i>Lestes congener</i>	Spotted Spreadwing	G5	S3
Odonate	<i>Macromia alleghaniensis</i>	Allegheny River Cruiser	G4	S3
Odonate	<i>Nehalennia irene</i>	Sedge Sprite	G5	S3
Odonate	<i>Sympetrum semicinctum</i>	Band-winged Meadowhawk	G5	S3
Reptile	<i>Clemmys insculpta</i>	Wood Turtle	G4	S2
Reptile	<i>Clemmys guttata</i>	Spotted Turtle	G5	S1
Reptile	<i>Pseudemys rubriventris</i>	Northern Red-bellied Cooter	G5	S1
Reptile	<i>Virginia valeriae pulchra</i>	Mountain Earthsnake	G5T3T4	S1
Reptile	<i>Crotalus horridus</i>	Timber Rattlesnake	G4	S3
Reptile	<i>Eumeces anthracinus anthracinus</i>	Northern Coal Skink	G5T5	S2

Reptile	<i>Eumeces laticeps</i>	Broad-headed Skink	G5	S2
Reptile	<i>Thamnophis sauritus</i>	Eastern Ribbonsnake	G5	S2
Reptile	<i>Heterodon platirhinos</i>	Eastern Hog-Nosed Snake	G5	S3
Reptile	<i>Apalone mutica mutica</i>	Midland Smooth Softshell	G5T5	SH
Reptile	<i>Cnemidophorus sexlineatus</i>	Eastern Six-Lined Racerunner	G5	S1
Reptile	<i>Elaphe guttata guttata</i>	Cornsnake	G5T5	S1
Reptile	<i>Pseudemys concinna</i>	River Cooter	G5	S1S2
Reptile	<i>Graptemys geographica</i>	Northern Map Turtle	G5	S2
Reptile	<i>Lampropeltis getula getula</i>	Eastern Kingsnake	G5T5	S2
Reptile	<i>Carphophis amoenus</i>	Wormsnake	G5	S3
Reptile	<i>Opheodrys aestivus</i>	Rough Greensnake	G5	S3
Reptile	<i>Scincella lateralis</i>	Little Brown Skink	G5	S3
Reptile	<i>Virginia valeriae valeriae</i>	Eastern Earthsnake	G5	S3
Reptile	<i>Graptemys pseudogeographica</i>	False Map Turtle	G5	SH
Spider	<i>Calymmaria sp. 21</i>	A Spider	G1	S1
Spider	<i>Chrosiothes jenningsi</i>	A Spider	G1	S1
Spider	<i>Agelenopsis emertoni</i>	A Grass Spider	G?	S1
Spider	<i>Arctosa rubicunda</i>	A Spider	G?	S1
Spider	<i>Castianeira variata</i>	A Spider	G?	S1
Spider	<i>Hogna aspersa</i>	A Spider	G?	S1
Spider	<i>Hogna carolinensis</i>	A Spider	G?	S1
Spider	<i>Hogna frondicola</i>	A Spider	G?	S1
Spider	<i>Neriene clathrata</i>	A Line Weaving Spider	G?	S1
Spider	<i>Ozyptila modesta</i>	A Spider	G?	S1
Spider	<i>Pardosa distincta</i>	A Thin-legged Wolf Spider	G?	S1
Spider	<i>Pirata insularis</i>	A Wolf Spider	G?	S1
Spider	<i>Pirata sedentarius</i>	A Wolf Spider	G?	S1
Spider	<i>Pirata seminolus</i>	A Wolf Spider	G?	S1
Spider	<i>Pirata zelotes</i>	A Wolf Spider	G?	S1
Spider	<i>Schizocosa retrorsa</i>	A Spider	G?	S1
Spider	<i>Tapinocyba hortensis</i>	A Spider	G?	S1
Spider	<i>Zelotes hentzi</i>	A Spider	G?	S1
Stonefly	<i>Hansonoperla hokolesqua</i>	A Stonefly	G2	S1
Stonefly	<i>Megaleuctra flinti</i>	A Stonefly	G2	S1
Stonefly	<i>Allocapnia frumi</i>	A Stonefly	G2	S2
Stonefly	<i>Alloperla aracoma</i>	A Stonefly	G3	S1
Stonefly	<i>Alloperla biserrata</i>	A Stonefly	G3	S1
Stonefly	<i>Diploperla kanawholensis</i>	Little Kanawha Perlodid Stonefly	G3	S1
Stonefly	<i>Ostrocerca prolongata</i>	A Stonefly	G3	S1
Stonefly	<i>Sweltsa pocahontas</i>	A Stonefly	G2	S2
Stonefly	<i>Utaperla gaspesiana</i>	A Stonefly	G3	S1
Stonefly	<i>Hansonoperla appalachia</i>	Hanson's Appalachian Stonefly	G3	S2
Stonefly	<i>Pteronarcys comstocki</i>	A Stonefly	G3	S2
Stonefly	<i>Ostrocerca complexa</i>	A Stonefly	G4	S1

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Appendix 5. List of Acronyms Used

<u>Abbreviation</u>	<u>Full Name</u>
ACIP	American Institute of Certified Planners
AFS	American Fisheries Society
ATV	All Terrain Vehicle
BASS (Federation)	Bass Anglers Sportsman Society
BBC	Brooks Bird Club
BBS	Breeding Bird Survey
BCD	Biological and Conservation Database
BOW	Becoming an Outdoors Woman
CITES	Convention on International Trade in Endangered Species
CR	Critically Endangered
CRP	Conservation Reserve Program
CVI	Canaan Valley Institute
DD	Data Deficient
DEP	Division of Environmental Protection
DNA	Deoxyribonucleic Acid
EN	Endangered
FTE	Full Time Employee
FOIA	Freedom of Information Act
GIS	Geographic Information System
GPS	Global Positional System
IAFWA	International Association of Fish and Wildlife Agencies
ICEC	International Classification of Ecological Communities
IUCN	International Union for the Conservation of Nature
Jeff Forest	Jefferson and / or George Washington National Forest(s)
LC	Least Concern
LES	Law Enforcement Section of the West Virginia Division of Natural Resources
LIP	Landowner Incentive Program
LR	Lower Risk
Mon Forest	Monongahela National Forest
NCTC	National Conservation Training Center
NE Tech Comm.	Northeast Endangered Species & Wildlife Diversity Technical Committee
NGO's	Non-Government Organizations
NRCS	National Resources Conservation Service
NVC	National Vegetation Classification
NT	Near Threatened
OWLS	Outdoor Wildlife Learning Sites
PCS	Point Count Survey
REAP	Rehabilitation Environmental Action Plan
RTE	Rare, Threatened and Endangered
SGNC	Species in Greatest Need of Conservation

TAGIS	Temporal and Geographic Information Systems
USCOE	United States Corp of Engineers
USDA	United States Department of Agriculture
USDOI	United States Department of the Interior
USEPA MLRC	U.S. Environmental Protection Agency Multi-Resolution Land Characterization (database)
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
UTM	Universal Transverse Mercator
VU	Vulnerable
WCAP	Wildlife Conservation Action Plan
WHIP	Wildlife Habitat Incentive Program
WMA	Wildlife Management Area
WRS	Wildlife Resources Section of the West Virginia Division of Natural Resources
WVDNR	West Virginia Division of Natural Resources
WV IBA	West Virginia Important Bird Areas Program
WV PIF	West Virginia Partners in Flight
WVDNR	West Virginia Division of Natural Resources
WVPA	West Virginia Planners Association
WVU	West Virginia University
WVWCAP	West Virginia Wildlife Conservation Action Plan

Appendix 6. Plan Publicity

September 18, 2005

Changes ahead

■ DNR plan could shift agency's role

By **John McCoy**
Staff writer

Government agencies crank out action plans roughly as often as geese discharge droppings.

In other words, they do it all the time. For that reason, people tend to pay as much attention to the latest government plan as they do a dollop of goose guano.

A proposed Division of Natural Resources plan, however, stands a chance to literally change the way the agency does business. If adopted, the 990-page draft Wildlife Conservation Action Plan might convert the DNR from an agency that manages critters to an agency that manages the critters' surroundings.

"I think the biggest thing to emerge from [this plan] is a full-blown initiative from the DNR for land conservation," said Steve Brown, a senior DNR planner and one of the document's principal architects.

"In past years, we as an agency have focused primarily on managing specific species, such as deer or turkeys or bears. We figured that if we were doing the right thing for those species, other species would benefit. Under this plan, we should see a gradual shift toward managing wildlife habitat so that all species benefit."

That the state's notoriously conservative wildlife officials would consider such a drastic role change for themselves might come as a surprise to long-time DNR watchers. There is, however, at least one compelling reason for them to do so.

"The U.S. Fish and Wildlife Service's current federal funding guidelines required that we have a comprehensive wildlife management plan in place by Oct. 1, 2005," Brown said. "We didn't beat the deadline by much, but we beat it."

The draft plan will go into effect Oct. 1, only three weeks after it was released to the public. Because stakeholders won't have much of a chance to comment on the lengthy document before it becomes part of agency policy, DNR officials are considering the draft to be "a work in progress."

"As we receive comments from people, we'll incorporate them into the plan," Brown said.

The plan's overarching goal is to prevent species from becoming endangered.

"The idea is to intervene to protect any species that we feel are diminishing," Brown explained. "For that reason, the plan emphasizes those species and habitats that are in greatest need of conservation."

In compiling the list, DNR officials called on wildlife experts from academia, from conservation groups and from other governmental agencies.

"What we ended up with was 129 species, or groups of species, that made the list," Brown said.

Animals named on the list range from such familiar species as the brook trout, the peregrine falcon and the bald eagle, to species so little known they don't even have common names.

"The challenge, now that we've established the list, is to get people to focus on the actions needed to protect those species instead of arguing about who or what is on the list," Brown said. "Up to now, we in the DNR have been data archivists, compiling lists and relying on other agencies to use those lists to conserve specific species. This plan calls for action. It shifts the DNR's role to one that focuses on conservation efforts."

In past years, DNR officials preserved wildlife habitat by buying sizable tracts of land throughout the state. Brown said that practice would continue, but he added that agency administrators would also look for other, more creative ways to prevent habitat loss.

"We think, for instance, that there's a bright future in conservation easements," he said.

Conservation easements are voluntary agreements that allow landowners to limit the type or amount of development on their properties while still retaining ownership of the land.

"Land trusts and conservation trusts are writing conservation easements all the time," Brown said. "There's no reason the DNR can't get into the practice too."

The public comment period for the plan officially will end Sept. 21, but DNR officials will continue to accept comments "for as long as the public wants to make them."

"Every two years, we'll host a symposium to share information on all these species and their habitats, to reassess the species in greatest need, to set priorities for the next two years, and to revise the plan," Brown said. "So we consider it to be a work in progress."

To contact staff writer John McCoy, use e-mail or call 348-1231.

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Draft Plan Released for State Wildlife; Public Comments Invited

The West Virginia Division of Natural Resources has released a draft wildlife plan for public review. The goal of the new plan, [The West Virginia Wildlife Conservation Action Plan](#), is to conserve the diversity of the state's fish and wildlife resources by emphasizing species and habitats in greatest need of conservation. "The plan is really a roadmap for habitat conservation in West Virginia," explained DNR Director Frank Jezioro. "That's a goal shared by hunters, anglers, birdwatchers, nature photographers and everyone else who enjoys the outdoors."

DNR prepared the plan in consultation with other government agencies, academia, conservation organizations and individual experts. Since 2001, DNR's Wildlife Resources Section has been receiving funds from the federally administered State Wildlife Grants Program. The program provides matching federal dollars to every state and territory to support cost-effective conservation aimed at preventing wildlife from becoming endangered. Funds appropriated under the State Wildlife Grants Program are allocated to the states according to a formula that takes into account each state's size and population.

To maintain eligibility for future funding, Congress has charged each state with developing a comprehensive wildlife conservation plan by October, 2005. The plan must address certain criteria relating to the conservation of species at risk, including:

- information on the distribution and abundance of wildlife in the state;
- the description, location and condition of key habitat types;
- the assessment of significant problems and research priorities;
- identification of conservation actions needed to conserve wildlife and habitat, and
- plans for monitoring species and habitats to evaluate the success of these conservation actions.

DNR Wildlife Resources Section Chief Curtis Taylor said that "Developing and implementing this plan further enhances our agency's already strong program of science-driven, active conservation of the state's fish and wildlife resources."

The West Virginia Wildlife Conservation Action Plan is now ready for review on the agency's Web site: www.wvdnr.gov. Instructions for providing comments are provided on the site and any input from interested persons is welcome.

There will also be a public open house at the Elkins Operations Center at 7p.m. on Thursday, September 8th. There will be a short informational presentation about the plan, followed by a question and answer session. If you need directions to attend the open house please call Steve Brown at 304-637-0245. This will be the first of a possible series of open houses and future dates and locations will be announced.

The West Virginia Wildlife Conservation Action Plan will provide an essential foundation for the future of wildlife conservation and a stimulus to engage the states, federal agencies and other conservation partners to strategically think about their individual and coordinated roles in prioritizing and implementing wildlife conservation efforts in each state. The plan is for everyone who is involved with or interested in West Virginia's fish and wildlife. Your comments are important. Please

visit the Web site and if you have any questions or need more information, contact Steve Brown at DNR's Elkins Operations Center , 304-637-0245.

****DNR****

HOT TOPICS...

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Draft Plan Released for State Wildlife Public Comments Invited

The West Virginia Division of Natural Resources has released a draft wildlife plan for public review. The goal of the new plan, *The West Virginia Wildlife Conservation Action Plan*, is to conserve the diversity of the state's fish and wildlife resources by emphasizing species and habitats in greatest need of conservation. "The plan is really a roadmap for habitat conservation in West Virginia," explained DNR Director Frank Jezioro. "That's a goal shared by hunters, anglers, birdwatchers, nature photographers and everyone else who enjoys the outdoors."

DNR prepared the plan in consultation with other government agencies, academia, conservation organizations and individual experts. Since 2001, DNR's Wildlife Resources Section has been receiving funds from the federally administered State Wildlife Grants Program. The program provides matching federal dollars to every state and territory to support cost-effective conservation aimed at preventing wildlife from becoming endangered. Funds appropriated under the State Wildlife Grants Program are allocated to the states according to a formula that takes into account each state's size and population.

To maintain eligibility for future funding, Congress has charged each state with developing a comprehensive wildlife conservation plan by October, 2005. The plan must address certain criteria relating to the conservation of species at risk, including:

- information on the distribution and abundance of wildlife in the state;
- the description, location and condition of key habitat types;
- the assessment of significant problems and research priorities;
- identification of conservation actions needed to conserve wildlife and habitat, and
- plans for monitoring species and habitats to evaluate the success of these conservation actions.

DNR Wildlife Resources Section Chief Curtis Taylor said that "Developing and implementing this plan further enhances our agency's already strong program of science-driven, active conservation of the state's fish and wildlife resources."

The West Virginia Wildlife Conservation Action Plan is now ready for review on the agency's Web site: www.wvdnr.gov. Instructions for providing comments are provided on the site and any input from interested persons is welcome.

There will also be a public open house at the Elkins Operations Center at 7p.m. on Thursday, September 8th. There will be a short informational presentation about the plan, followed by a question and answer session. If you need directions to attend the open house please call Steve Brown at 304-637-0245. This will be the first of a possible series of open houses and future dates and locations will be announced.

The West Virginia Wildlife Conservation Action Plan will provide an essential foundation for the future of wildlife conservation and a

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CastingKids, a organization and destination to this year's West annual weekend event in County (Interstate 7

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Scheduled demonstration McNeer a.m. and of

The West Virginia Wildlife Conservation Action Plan

Wildlife Resources Section
West Virginia Division of Natural Resources

9/26/2005

Why Did We Do the Plan?

- ◆ Federal funding from excise taxes on hunting and fishing equipment has been a major factor in the conservation successes achieved by state fish and wildlife agencies



Why Did We Do the Plan?

- ◆ But until recently there was no source of federal funding for conservation of the full array of fish and wildlife species



Why Did We Do the Plan?

- ◆ However, there was broad public support for funding such conservation



Why Did We Do the Plan?

- ◆ In 2001, responding to that support, Congress acted by passing legislation for federal funding through the State Wildlife Grants Program administered by the US Fish and Wildlife Service



Why Did We Do the Plan?

- ◆ To receive federal funding under State Wildlife Grants, states must complete a comprehensive plan by October, 2005

West Virginia

*Wildlife
Conservation*

Action Plan

How Did We Do the Plan?

- ◆ The overall goal of the state plans is to prevent species from becoming endangered



Endangered
Indiana Bat

How Did We Do the Plan?

- ◆ Congress mandated that the plan must emphasize species and habitats “*in greatest need of conservation*”



Barn Owl



Brook Trout

How Did We Do the Plan?

- ◆ State fish and wildlife agencies were charged with developing the plans



How Did We Do the Plan?

- ◆ In West Virginia, we started with lists of species that we and others were concerned about



How Did We Do the Plan?

- ◆ Then we consulted experts on fish and wildlife species in West Virginia, especially those outside of our own agency



How Did We Do the Plan?

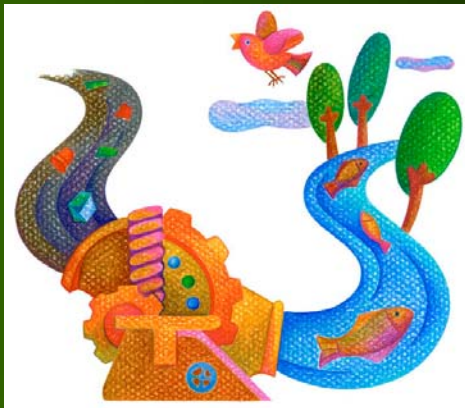
- ◆ The result was a list of “*species in greatest need of conservation*” for the West Virginia plan



Golden-winged Warbler

How Did We Do the Plan?

- ◆ Next, we looked at what was known about these species and their habitats in West Virginia and identified issues that can affect them



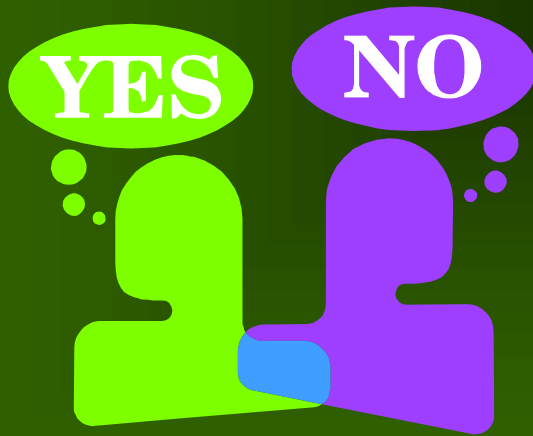
How Did We Do the Plan?

- ◆ We identified potential partners for the plan, a concern that Congress stressed in the State Wildlife Grants legislation



How Did We Do the Plan?

- ◆ We also looked at survey data that told us what the public thought about conservation issues and priorities



What Do We Know?

- ◆ By expert consensus, there are 129 species or groups of species in WV that are *“in greatest need of conservation”*
 - ◆ Birds
 - ◆ Mammals
 - ◆ Fishes
 - ◆ Reptiles and amphibians
 - ◆ Invertebrates

What Do We Know?

- ◆ Habitats that appear to be at-risk include
 - ◆ Red spruce forests
 - ◆ Calcareous forests
 - ◆ Shale barrens
 - ◆ Limestone barrens
 - ◆ Sandstone glades
 - ◆ Hemlock forests
 - ◆ All wetlands
 - ◆ Floodplain forests
 - ◆ Caves
 - ◆ All aquatic habitats



What Do We Know?

- ◆ Public priorities for conservation action
 - ◆ Mitigating factors that degrade water quality
 - ◆ Conservation of terrestrial and aquatic habitats
 - ◆ Restoration of native species
 - ◆ Better management of endangered species including preventative management
 - ◆ Better information and wildlife education programs
 - ◆ Developing additional wildlife recreation facilities, including public lands
 - ◆ Preserving natural areas

What Do We Know?

- ◆ We identified eight major conservation issues
 - ◆ Mining
 - ◆ Commercial and residential development
 - ◆ Atmospheric acid deposition
 - ◆ Stream sedimentation
 - ◆ Forest management
 - ◆ Invasive species
 - ◆ Water pollution
 - ◆ Instream, wetland and riparian habitat loss

What Should We Do?

- ◆ Survey data is inadequate for many species and habitats
 - ◆ Collect better data
 - ◆ Emphasize data collection in habitats and areas under threat
 - ◆ Manage the data better
 - ◆ Make the data more accessible

What Should We Do?

- ◆ But species and habitat conservation can't always wait for perfect data - in some cases, we must act soon or we will lose the opportunity



What Should We Do?

- ◆ Potential conservation actions
 - ◆ Protecting key habitats by purchase of land or through conservation easements
 - ◆ Legislation or regulation
 - ◆ Coordination
 - ◆ Habitat restoration
 - ◆ Species propagation
 - ◆ Management
 - ◆ Education

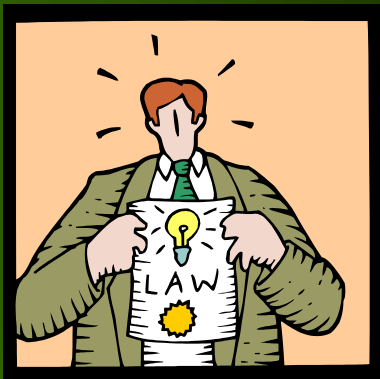
What Should We Do?

- ◆ Protecting key habitats by purchase of land or through conservation easements
 - ◆ Fee simple purchase can be expensive and thus is limited to high-value tracts
 - ◆ Conservation easements are voluntary limitations on development by landowners
 - ◆ Easements keep land on county tax rolls



What Should We Do?

- ◆ Legislation or regulation
 - ◆ More extensive than habitat protection, e.g., limiting collection of rare species
 - ◆ Requires legislative action
 - ◆ Requires public comment period



What Should We Do?

◆ Coordination

- ◆ Work with other agencies and private parties whose actions can positively or negatively affect fish and wildlife habitat
- ◆ WVDNR has management agreements with other agencies and entities that own more than 10% of the state's land area
- ◆ Avoidance or mitigation of negative impacts can present significant conservation opportunities



What Should We Do?

- ◆ Habitat restoration
 - ◆ Active restoration of degraded habitats
 - ◆ Examples include stream fencing, removal of invasive species and liming of streams acidified by atmospheric acid deposition
 - ◆ Good partnership opportunities for watershed groups, landowners, corporations and conservation organizations



What Should We Do?

- ◆ Species propagation
 - ◆ Sometimes necessary to propagate fish and wildlife species to repopulate restored habitats, e.g., mussel propagation to reestablish a mussel bed destroyed by a pollution event



Clubshell mussel

What Should We Do?

◆ Management

- ◆ Active management of habitat is a necessary conservation action
- ◆ Habitats are dynamic and sometimes must be altered through vegetation management to achieve species objectives
- ◆ Sometimes management must limit human impacts to sensitive habitats, e.g., gating of cave entrances



What Should We Do?

◆ Education

- ◆ One of the most important conservation actions
- ◆ Fish and wildlife species are sometimes threatened because the public does not understand species' needs or importance
- ◆ Can preclude the need for more aggressive action
- ◆ A necessary component of public support for other actions
- ◆ Currently not fundable under State Wildlife Grants



What Should We Do?

◆ Recreation

- ◆ Wildlife recreation facilities are a public priority
- ◆ Recreation cements the relevance of conservation
- ◆ Helps secure public support for other actions
- ◆ Currently not fundable under State Wildlife Grants



What Should We Do?

- ◆ Species and species group plans
 - ◆ The *Wildlife Conservation Action Plan* contains individual plans for 129 species and species groups *in greatest need of conservation*



What Should We Do?

- ◆ Species and species group plans
 - ◆ Each species plan addresses
 - ◆ Species status and known distribution
 - ◆ Research and survey needs
 - ◆ Conservation issues and actions
 - ◆ Selected actions for initial implementation
 - ◆ Monitoring actions

What Should We Do?

- ◆ Habitat plans for at-risk habitats
 - ◆ The *Wildlife Conservation Action Plan* contains individual plans for at-risk habitats of importance to *species in greatest need of conservation*



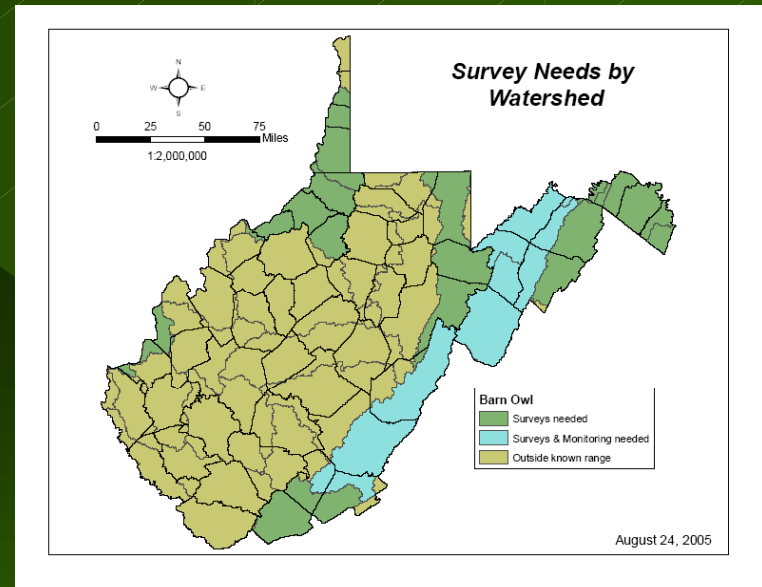
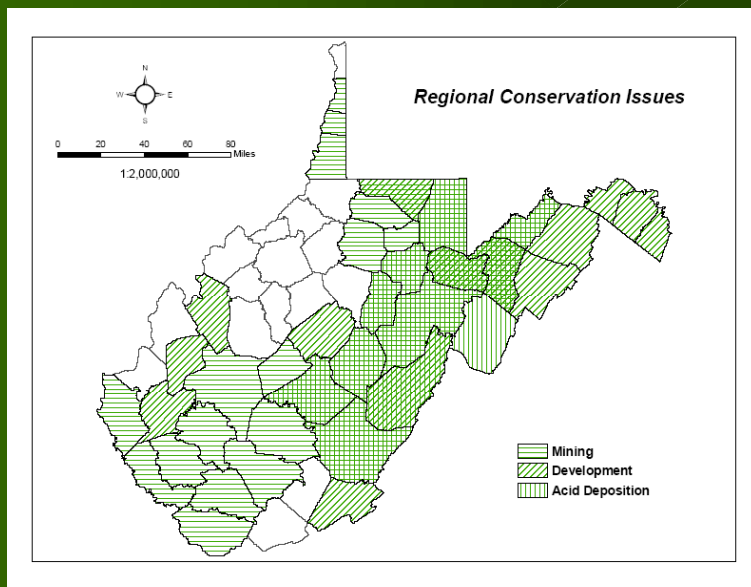
What Should We Do?

- ◆ Habitat plans for at-risk habitats
 - ◆ Each habitat plan addresses
 - ◆ Habitat description
 - ◆ *Species in greatest need* associations
 - ◆ Habitat location and status
 - ◆ Data, research and monitoring needs
 - ◆ Conservation issues and actions

How Will the Plan be Implemented?

- ◆ Partnerships with other agencies, private businesses, conservation groups and private individuals to address priority actions
- ◆ Priorities will include simultaneous data collection and conservation action
- ◆ Data collection and conservation action will be regionally prioritized in response to conservation issues
- ◆ A land conservation initiative will be a key component

How Will the Plan be Implemented?



Regional issues suggest regional survey/monitoring needs and conservation action

How Will the Plan be Implemented?

- ◆ Coordination among partners will be key to effective plan implementation
- ◆ Every two years, WVDNR will host a symposium for partners and the public to:
 - ◆ Share information on species and habitats
 - ◆ Reassess status of *species in greatest need*
 - ◆ Prioritize actions for the next two years
 - ◆ Revise *Wildlife Conservation Action Plan* as necessary

How Will We Know if We're Making Progress?

- ◆ The answer is simple
 - ◆ Monitoring species and habitats at sites
 - ◆ Monitoring the effectiveness of conservation actions
- ◆ Monitoring is not!
 - ◆ Surveys needed before establishing monitoring sites
 - ◆ Many monitoring sites have to be established
 - ◆ Logistics will be demanding
 - ◆ Will require effective partnerships

When Will We Revisit the Plan?

- ◆ Every two years the plan will be reassessed and revised as necessary



What Major Changes will the Plan Foster?

- ◆ Proactive management of species in greatest need
- ◆ Stronger partnerships between agencies, businesses, conservation groups and citizens
- ◆ Focus on regional issues and actions
- ◆ Emergence of a major land conservation initiative with benefits for landowners, farmers, conservationists and sportsmen

WVDNR Director Frank Jezioro on the *West Virginia Conservation Action Plan*

“The plan is really a roadmap for habitat conservation in West Virginia. That's a goal shared by hunters, anglers, birdwatchers, nature photographers and everyone else who enjoys the outdoors.”



Courtesy D. McAuley, USGS

Appendix 7. Ongoing Monitoring Activities for SGNC and Habitats

Monitoring Target	Ongoing Activities
Birds	BBS Routes 148 Point Count Routes Water Bird Surveys Cerulean and Golden-winged Warbler Surveys Loggerhead Shrike Surveys Bald Eagle Nest Monitoring Peregrine Falcon Nest Monitoring Saw-whet Owl Nest Box Monitoring Barn Owl Nest Box Monitoring Winter Backyard Bird Counts Christmas Bird Counts International Migratory Bird Day Counts Raptor Migration Counts at Hanging Rock Observatory Bird Banding at the Allegheny Front Migration Observatory Compilation of Osprey and Whip-poor-will records
Mammals	Allegheny Woodrat Monitoring-- Long-term Monitoring Sites Cave Observations during Bat Counts Bat Surveys & Monitoring--Annual Virginia Big-eared Summer Censuses Biennial Hibernacula Surveys (All Species Including Two Endangered Bats) Bat Mist Net Surveys (All Species) Small-footed Bat Studies – North Fork Mountain Northern Flying Squirrel Nest Box Monitoring Small Mammal Surveys at selected WMAs Monitoring Bat Houses Placed at WMAs, State Parks & Forests Game Checking for Fisher
Amphibians	PARC Frog Call Routes Surveys for Herpetological Atlas Cheat Mountain Salamander Surveys White-spotted Salamander Surveys Cave Salamander Surveys Wetlands-Survey for Frog Egg Masses
Reptiles	Surveys for Herpetological Atlas Timber Rattlesnake Monitoring
Fish	Statewide Fish Surveys Brook Trout Surveys Establishing Reference Stations along the Cacapon, Elk, Kanawha, and New Rivers and Hackers Creek Statewide Collections Monitoring all Fishes Inventory and Monitoring of Rare Fishes

	<p>Filling Distribution Gaps for all Fishes Characterizing Streams and Rivers Assisting WVDEP on Water Quality Fish Surveys</p>
Invertebrates	<p>Cave Invertebrate Surveys Freshwater Mussel Surveys Long-term Mussel Monitoring Sites at the Elk, Kanawha and Cacapon Rivers and Hackers Creek. Surveys for Dragonfly/Damselfly Atlas Monitoring of the Threatened Flat-spired Three-toothed Land Snail in the Cheat Gorge Cave Invertebrate Surveys Surveys for Dragonfly/Damselfly Atlas Survey for Benthic Invertebrates in Streams Aquatic Snail Surveys (in Conjunction with Mussel Surveys) Tiger Beetle Surveys</p>
Habitats	<p>Water Quality Monitoring on Acidified Streams Wetland Monitoring High Elevation Wetland Monitoring Permanent Monitoring Plots of Balsam Fir Communities Inside and Outside Deer Enclosures in Canaan Valley. Permanent Monitoring Plot of Talus Slope Ice Vent Community at Ice Mountain TNC Preserve. Permanent Monitoring Plots of Heath Barren Communities Inside and Outside the Area of a Wildfire at Bear Rocks TNC Preserve.</p>