



WEST VIRGINIA
ECOLOGICAL SERVICES FIELD OFFICE
PRIORITY PLANNING STRATEGY
FY 2011 – 2013

West Virginia Field Office
U.S. Fish and Wildlife Service

January 2011

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INTRODUCTION

**West Virginia Ecological Services Field Office
Priority Planning Strategy FY 2011 - 2013**

Introduction

U.S. Fish and Wildlife Service Mission

Working with others to conserve, protect, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people.

With the mission of the U. S. Fish and Wildlife Service in mind the Service's West Virginia Field Office (WVFO), Elkins, West Virginia, has developed a multi-year comprehensive strategic priority plan for West Virginia to be utilized in conjunction with the Service's Washington and Region 5 offices' guiding parameters articulated under the Vision, Conservation Principles and Priorities below. The WVFO has incorporated these parameters into our strategic priority plan, weaving our activities not only into these national and regional parameters but also into the Strategic Habitat Conservation (SHC) framework.

Our effort enhances the existing strategic implementation of ongoing collaborative fish and wildlife conservation activities of the WVFO using a landscape-level science-based framework in accordance with the SHC framework. The SHC framework provides a basis for making management decisions about where and how to deliver conservation efficiently to achieve specific biological outcomes.

The Service's Vision, Conservation Principles and Priorities include the following:

- Vision

We will continue to be a leader and trusted partner in fish and wildlife conservation, known for our scientific excellence, stewardship of lands and natural resources, dedicated professionals, and commitment to public service.

- Conservation Principles

1. Stewardship - Our ethic is to conserve natural resources for future generations.
2. Partnerships - We emphasize creative, innovative partnerships.
3. Professionalism - We hold ourselves to the highest ethical standards, strive for excellence, and respect others.
4. Science - Our work is grounded in thorough, objective science.
5. People - Our employees are our most valued asset.
6. Service - It is our privilege to serve the American people.
7. Legacy - We ensure the future of natural resource conservation by connecting people with nature.

- Priorities

1. National Wildlife Refuge (NWR) System - Conserving our lands and resources.
2. Landscape Conservation - Working with others.
3. Migratory Birds - Conservation and management.
4. Threatened and Endangered Species - Achieving recovery and preventing extinction.
5. Aquatic Species - National Fish Habitat Action Plan and trust species.
6. Connecting People with Nature - Ensuring the future of conservation.

The WVFO utilizes the Vision, Conservation Principles and Priorities for guidance in its three programs: Conservation Planning Assistance, Endangered Species, and the Partners for Fish and Wildlife.

WVFO Programs

Conservation Planning Assistance

With regard to the Conservation Planning Assistance Program, FWS uses its authorities under the National Environmental Policy Act, Clean Water Act, Fish and Wildlife Coordination Act, and Federal Power Act to protect fish and wildlife resources. Protection of these resources is accomplished through early coordination between the FWS and other Federal agencies during project planning and design to minimize potential environmental impacts and provide for successful mitigation of unavoidable impacts. The coordination may include projects constructed by Federal agencies, permitted under the U.S. Army Corps of Engineers' regulatory program, and projects licensed for non-Federal hydropower projects, as well as various Federal actions on and off Federal lands.

Endangered Species Program

The Endangered Species Program works to prevent extinction and achieve recovery of listed species by building and maintaining partnerships, promoting good science, and adopting a landscape-scale ecosystem and Strategic Habitat Conservation (SHC) approach to management. For example, the WVFO has recently completed a statewide programmatic Endangered Species Act section 7 consultation with the Natural Resources Conservation Service (NRCS) pertaining to the NRCS conservation practices implemented in West Virginia. In addition, we developed a memorandum of understanding with the West Virginia Division of Highways streamlining consultation and improving on-the-ground conservation statewide.

The WVFO is responsible for conserving Federally-listed threatened and endangered species that occur within the State of West Virginia. In addition, the WVFO acts in the capacity of national species' lead for the Cheat Mountain salamander, Virginia big-eared bat, flat-spined three-toothed land snail, and the plant harperella.

The activities within our Endangered Species Program include candidate conservation, listing, recovery, and consultation. To promote the conservation and recovery of Federally-listed

endangered and threatened species, the Service's endangered species responsibilities include the following:

- Evaluating species for listing, reclassifying, or delisting under the Endangered Species Act.
- Coordinating, implementing, and monitoring candidate conservation actions, and recovery activities for listed species.
- Providing biological and regulatory technical assistance to Federal and non-Federal entities
- Providing technical assistance to States to assist with their endangered species conservation efforts.
- Working with private landowners and others to benefit listed species and prevent new species from being listed.

Partners for Fish and Wildlife

The Partners for Fish and Wildlife (PFW) program protects, enhances, and restores important fish and wildlife habitats on private lands through partnerships. This voluntary cost-share program builds on the strength and interest of committed individuals and organizations to accomplish shared conservation goals.

More than eight years ago, Trout Unlimited (TU) and PFW formed a unique partnership to address farm runoff (i.e. nutrient and sediment) in the Chesapeake Bay headwaters as well as throughout West Virginia. The TU/FWS WVFO Conservation Crew uses fencing to improve livestock management and to exclude livestock from streams and forest habitat, significantly enhancing and restoring riparian and upland forest areas.

Priority Planning Focal Areas

All West Virginia Federally-listed species, Service trust resources (such as migratory birds and interjurisdictional fish), and several Region 5 wide-ranging non-listed species, as well as landscape-level habitat requirements for these species, were considered while identifying the WVFO Priority Planning Focal Areas.

Our plan will serve as a guide for prioritizing the ongoing collaboration and implementation of landscape-level projects with partners within West Virginia for the next three years in West Virginia, in the Chesapeake Bay Watershed headwaters, and across the Appalachian Landscape Conservation Cooperative.

To illustrate our priority areas, we developed a map identifying 11 Priority Planning Focal Areas on which the WVFO will focus our efforts. The Priority Planning Focal Areas are (1) Upper Potomac, (2) Canaan Valley/Blackwater River, (3) Greenbrier River, (4) Potts Creek, (5) Elk River/Upper Kanawha River, (6) Little Kanawha River, (7) West Fork River/Hackers Creek, (8) Cheat River Gorge, (9) Middle Island Creek, (10) Ohio River Mainstem, and (11) High Elevation Forest. In addition to the focal areas depicted on the map, we have three statewide non-geographic focal areas referenced on our focal area map: (12) Bats (13) Energy

Development (i.e., wind, coal, and gas), and (14) Appalachian Landscape Conservation Cooperative, each of which includes the entire State of West Virginia.

Identified with each focal area is a list of species that will benefit from elimination and reduction of threats within the area (e.g., conservation, restoration, and rehabilitation activities), justification for identifying the area as a focal area, and the activities in which the WVFO will be engaged for the next one to three years.

The WVFO has been working collaboratively and strategically with our many and various partners for several years to implement projects, rather than undertaking and completing individual Service projects without partners. We often prioritize and provide other agencies and organizations with biological technical assistance and guidance, and will continue to do so during the next three years. The WVFO will focus our staff and financial resources in the 14 focus areas listed above. We will do so by concentrating on removing and reducing identified threats through implementation of collaborative and landscape-level actions prioritized within the Ecological Services programs and with the assistance of our partners and others. We are aware that in some instances we will be working on species / issues outside the priority focal areas, as appropriate (see Appendix C—Non Focal Area Projects). However, in those instances we will attempt to resolve the matter expeditiously to return our focus to our priorities.

The document contains an introduction and three sections. Section I contains the activities that we are undertaking during FY 2011, broken down by focal area. Section II contains the West Virginia FY 2011 – 2013 comprehensive priority planning strategy. Section II is formatted under the headings Introduction, Biological Planning, Conservation Design, Conservation Delivery, Monitoring, Research, Outreach, and Literature Citations, and is based on the SHC framework. Section III contains the appendices to this document.

SECTION I

FY 2011 ACTIVITIES

West Virginia Ecological Services Field Office

Priority Planning Strategy FY 2011 - 2013

Section I – FY 2011 Activities

Focal Areas

Upper Potomac Focal Area (Map Section 1)

1. Key Species: Harperella, bald eagle, green floater, Brook trout, American eel, Madison Cave isopod, Virginia big-eared bat, Indiana bat, Northern Bulrush, Shale Barren Rock Cress, American black duck, State species of concern.
2. Selected due to: a large number of species, including West Virginia Field Office (WVFO) lead species; area referenced in the Chesapeake Bay Executive Order; area includes Eastern Brook Trout Joint Venture (EBTJV) areas, includes Atlantic Coast Joint Venture areas, and falls under an interstate management plan on American eel. High concentration of migratory birds, including a raptor migratory bottleneck.
3. Focal Activities include: Wetland, stream and riparian restoration to improve water and habitat quality, invasive species control, karst protection (including the George Washington National Forest), establishing the Madison Cave isopod guidelines, removal of fish passage barriers, and project reviews to reduce wind power impacts.
4. Specific 2011 Activities:
 - a. Completed, proposed and in-progress preservation of habitat, including wetlands, upland forest, riparian uplands, streams and improved pasture, through Partners for Fish and Wildlife (PFW) (see Appendix C). Proposed acreage is subject to minor change throughout the FY2011.
 - b. Proposed control of invasive species on approximately 3 acres of the Seneca Creek watershed through the PFW, focusing mainly on Japanese knotweed control.
 - c. Proposed re-treat of invasive species on approximately 2 acres of the Thorn Creek Watershed, focusing on Japanese knotweed control.
 - d. Review and comment on two new proposed wind power projects in Hampshire and Grant counties.
 - e. Review and comment on curtailment study proposals and development of avian and bat protection plans for two wind power projects under construction in Mineral and Grant counties (Pinnacle, New Creek).
 - f. Continue to work on providing upstream passage for the American eel in the watershed. Complete NEPA documentation for eelways on Dams 4 & 5, work with partners to seek funding to design and construct the projects, and begin construction if sufficient funding is obtained.
 - g. Work with other agencies and project proponents to minimize impacts to these watersheds that could affect target species.

High Elevation Forest and Canaan Valley/Blackwater River Focal Areas (Map Sections 2, 11)

1. Key Species: Cheat Mountain salamander, West Virginia northern flying squirrel (WVNFS), Brook trout, red spruce, bald eagle, American black duck.

2. Selected due to: contains WVFO lead species, includes a multi-partner coordinated effort, area has been identified as at-risk from long-term global change (climate change), includes Canaan Valley NWR resources, US Forest Service plans, and EBTJV areas, and has a high concentration of migratory birds.
3. Focal Activities include: Forest restoration, connectivity, cold water stream/riparian restoration, fish passage barrier removal.
4. Specific 2011 Activities:
 - a. Continue to participate and contribute to Central Appalachian Spruce Restoration Initiative (CASRI) planning and project implementation activities.
 - b. Work with partners to develop and select projects to utilize the WV Department of Highways WVNFS Conservation Fund.
 - c. Work with other agencies and project proponents to minimize impacts to these habitats that could affect target species.

Greenbrier River Focal Area (Map Section 3)

1. Key Species: Green floater, West Virginia northern flying squirrel, Indiana bat, Cheat Mountain salamander, Virginia Spiraea, American black duck, Brook trout.
2. Selected due to: Large number of species of interest, high concentration of migratory birds, EBTJV area.
3. Focal Activities: riparian/wetland protection/restoration, sinkhole, upland protection/restoration to reduce siltation/sedimentation, improve water quality.
4. Specific 2011 Activities:
 - a. Completed, proposed and in-progress preservation of habitat, including wetlands, upland forest, riparian uplands, streams and improved pasture, by PFW (see Appendix C). Proposed acreage is subject to minor change throughout the FY2011.
 - b. Work with other agencies and project proponents to minimize impacts to these habitats that could affect target species.

Potts Creek Focal Area (North and South Forks, Main Stem) (Map Section 4)

1. Key Species: Mussels, Indiana bat, Brook trout.
2. Selected due to: considered priority habitat for migratory birds, only habitat for James River Spiny Mussel within state, EBTJV area.
3. Focal activities: collaboration with landowners to exclude livestock, riparian/wetland preservation and restoration, upland restoration to improve water quality and streambed stability.
4. Specific 2011 Activities
 - a. A project in planning to preserve habitat, possibly including wetlands, upland forest, riparian uplands, streams and improved pasture, by PFW. Project will most likely take place either in 2011 or 2012.

Elk River/Upper Kanawha River Focal Area (Map Section 5)

1. Key Species: Diamond darter, 4 listed/candidate mussels, Virginia big-eared bat, Indiana bat, Cheat Mountain salamander, West Virginia northern flying squirrel, American black duck.

2. Selected due to: large concentration of listed species, including WVFO lead species, identified in mussel recovery plans, high concentration of migratory birds.
3. Focal Activities: Water quality protection, population augmentation/restoration, establishing a captive population of diamond darter, getting the diamond darter listed, avoiding direct habitat disturbances, reduction of sedimentation/siltation, riparian restoration, project reviews to reduce impacts, agreements regarding energy development projects and determining species responses to projects.
4. Specific 2011 Activities:
 - a. Develop a listing package for the diamond darter.
 - b. Continue to work with West Virginia University and Conservation Fisheries, Inc. to develop a captive ark population and conduct reproductive research on the diamond darter.
 - c. Conduct outreach on the proposed listing of the snuffbox, rayed bean, sheepsnose, and spectacle case mussels.
 - d. Continue to participate in the Ohio River Basin Fish Habitat Partnership and advocate for the incorporation of mussel conservation into strategic planning and implementation.
 - e. Work with other agencies and project proponents to minimize impacts to these watersheds that could affect target species.

West Fork River/Hackers Creek Focal Area (Map Section 7)

1. Key Species: Indiana bat, clubshell mussel, northern riffleshell, American black duck.
2. Selected due to: key mussel habitat, threats from Marcellus shale development, high concentration of migratory birds.
3. Focal Activities: Riparian/wetland protection/restoration, upland protection/restoration, guidance on projects proposed in watershed.
4. Specific 2011 Activities:
 - a. Completed, proposed and in-progress preservation of habitat, including wetlands, upland forest, riparian uplands, streams and improved pasture, through PFW (see Appendix C). Proposed acreage is subject to minor change throughout the FY2011.
 - b. Work with other agencies and project proponents to minimize impacts to these habitats that could affect target species.

Middle Ohio Watershed Focal Area, Including West Fork, Middle Island Creek, Little Kanawha (Map Sections 6, 7, 9)

1. Key Species: Listed/candidate mussels, Indiana bat, American black duck, American eel, brook trout.
2. Selected due to: large number of species, includes Ohio River Islands NWR lands, EBTJV areas, and high concentration of migratory birds.
3. Focal Activities: Stream/riparian restoration and protection, water quality/quantity project reviews, projected energy approaches, large project species response, population evaluation and restoration, fish passage barrier removal.
4. Specific 2011 Activities:
 - a. Completed, proposed and in-progress preservation of habitat, including wetlands, upland forest, riparian uplands, streams and improved pasture, through PFW (see

Appendix C). Proposed acreage is subject to minor change throughout the FY2011.

- b. Conduct outreach on the proposed listing of the snuffbox mussel.
- c. Seek funding and potentially begin survey efforts to determine mussel distribution and abundance in these watersheds.
- d. Continue to support the removal of dams within this watershed that are barriers to fish passage and are reducing habitat suitability for mussels.
- e. Work with other agencies and project proponents to minimize impacts to these watersheds that could affect target species.

Cheat River Gorge (Map Section 8)

1. Key Species: Flat-spined three-toothed snail, Indiana bat.
2. Selected due to: WVFO species lead, also possibility for discrete, easy actions with large chance of success and recovery.
3. Focal Activities: forestry management plans, delineating habitat for snail, purchase of habitat.
4. Specific 2011 Activities:
 - a. Update the 5 year status review for the flat-spined three toothed land snail.
 - b. Work with partners to purchase/conservate additional habitat that supports the snail.
 - c. Work with other agencies and project proponents to minimize impacts habitats that support this species and to develop appropriate forest management guidelines.

Ohio River Main Stem Focal Area (Map Section 10)

1. Key Species: listed mussels, bald eagle, American black duck
2. Selected due to: priority mussel habitat, many existing partnerships in the area, Ohio River Islands NWR.
3. Focal Activities: mussel population conservation, stream/riparian habitat restoration and preservation.
4. Specific 2011 Activities:
 - a. Conduct outreach on the proposed listing of the spectaclecase and sheepnose mussel.
 - b. Continue to participate in the Ohio River Restoration Technical Committee and conduct restoration activities in response to a Natural Resource Damage Assessment (NRDA) settlement.
 - c. Work with other agencies and project proponents to minimize impacts to these watersheds that could affect target species.

Non-geographic Focal Areas (Map Sections 12, 13, and 14)

Bats (Map Section 12)

1. Bats (Indiana bats, Virginia big-eared bats)
 - a. Justification for selection:

- i. Include petitioned species: Northern Long Eared bat, Small footed bat, Little brown bat
- ii. Selected due to: WVFO species lead, critical habitat, significant threat from White Nose Syndrome (WNS), cumulative threat from wind power development.
- iii. Focal activities: WNS response, assessing karst/cave protection, caver/landowner outreach.
 - 1. Stream/riparian restoration and protection, forest habitat management at known hibernacula and maternity areas, program-level guidance on project reviews.
- iv. Indiana bat: only critical habitat located in WV; has largest concentration of bats (Hellhole Cave). Maternity populations may be present statewide.
- v. Virginia big-eared bat: all critical habitat is in WV (4 caves) and 70% of total population.
- b. Specific 2011 Activities:
 - i. Review and process permit application for the Beech Ridge Wind Power Habitat Conservation Plan.
 - ii. Continue efforts to address WNS, including: the development and implementation of research to address potential resistance of VBEB to WNS; captive holding techniques/planning; outreach to cavers, landowners, and the public; conduct surveys to quantify the impacts of WNS; and coordinating with others to develop response plans to minimize the impacts of this disease.
 - iii. Work with other agencies and project proponents to minimize impacts habitats that support this species, to find and protect additional Indiana bat maternity colonies, and minimize disturbances to caves used by bats.
 - 1. Developed improved programmatic recommendations for projects that have the potential to impact this species.

Energy Development (Map Legend # 13)

NOTE: See Appendix D for Oil and Gas Well Maps

2. Energy Development—Wind, Coal, Gas

- a. Key Species: bats, mussels.
- b. Selected due to: significant landscape/ecosystem-level efforts, can affect population level declines, can enact a program-level response with beneficial effects, migratory bird habitats. Energy development has influences on key species and habitats throughout the state of West Virginia.
- c. Focal activities: work with regulatory agencies to develop regulations, program recommendations, project proponents to develop bird/bat avoidance plans or to reduce impacts, monitoring and research into effects of energy development.
- d. Specific 2011 Activities (Wind):
 - i. Collaborate with wind power developers and researchers to find solutions to reduce bird and bat mortality at projects (e.g. curtailment experiments at Mt. Storm, Beech Ridge, Laurel Mountain, New Creek and Pinnacle).

- ii. Assist wind power companies in developing avian and bat protection plans (Laurel Mountain, Pinnacle, New Creek) or habitat conservation plans (Beech Ridge).
- iii. Assist wind power developers in avoiding selection of sites that pose high risks to listed and unlisted species.
- e. Specific 2011 Activities (Coal and Marcellus Shale):
 - i. Work with the West Virginia Department of Environmental Protection (WVDEP) and/or gas companies to develop appropriate measures to minimize impacts from Marcellus shale drilling, particularly when projects could impact listed species. Attempt to develop programmatic approaches or recommendations, or participate in the development and review of any proposed new regulations that address this activity.
 - ii. Coal
 - 1. Spruce No. 1 Mine - WVFO in 2011 has provided and will continue to provide, as requested, technical assistance to the EPA regarding the CWA 404(c) review of the Spruce No. 1 Surface Mine in Logan County in southern WV. The mine as proposed would impact over 2,200 acres of forest and bury nearly 7.5 miles of headwater streams.
 - a. Assistance has included:
 - i. Providing information used by EPA to support their proposed, recommended and final 404(c) determinations as well as providing the best available scientific information regarding potential impacts to Service trust resources (migratory birds, listed bats) and impact assessments for salamanders and macroinvertebrates.
 - ii. Assisting EPA in drafting and strengthening responses to public comments received on their proposed and recommended determinations and has completed ESA section 7 review of EPA's action.
 - iii. Drafting briefing papers and letters for Regional Office and Washington Office review/signature and participating in conference calls with both.
 - 2. In FY 2011, WVFO finalized an Interagency Agreement with the EPA by which EPA is providing funding to WVFO for increased support of coal-related Clean Water Act 404 program activities in WV.
 - a. Includes increased participation in review of proposed mining activities, jurisdictional wetland determinations, and mitigation efforts.
 - b. Increased and consistent WVFO participation in Enhanced Coordination Process (ECP) and mine pre-application meetings in accordance with the June 2009 interagency MOU to reduce the adverse environmental impacts of

Appalachian coal mining and to strengthen and streamline review and permitting of coal projects.

- c. Assisted (and will continue to assist) EPA with collection of mine water-quality samples to support and validate development of water-quality standards and thresholds that have the potential to influence coal mining activities across the landscape.
3. WVFO continues to participate on the wetland and stream mitigation Interagency Review Team, whose efforts are largely geared to improving assessment and mitigation of mining-related impacts.
 - a. Team has guided the development of WV's first mitigation banks, continues to review proposals for new banks, and is working with state and NGO partners (TNC, Canaan Valley Institute) to develop and implement projects under the In-lieu Fee Program.
 - b. WVFO has also developed and continues to test a Stream and Wetland Valuation Metric designed to better quantify impacts and mitigation benefits.
 4. WVFO continues to participate in other activities related to the 2009 Interagency MOU, including reviewing and providing comments on OSM's proposed Stream Buffer Rule, and EPA's proposed Conductivity Benchmark and associated guidance.
 5. WVFO has designated staff to participate on the USACE Hydrogeomorphic Method Product Development Team, which is charged with designing and implementing a 2-year validation study for the USACE' "Operational Draft Regional Guidebook for the Functional Assessment of High-gradient Ephemeral and Intermittent Headwater Streams in Western West Virginia and Eastern Kentucky."

iii. Marcellus Shale

1. In FY2011, WVFO identified and reported to the USACE-Pittsburgh District a CWA violation where fill was placed without a USACE CWA 404 permit in the floodplains of Hackers Creek and one of its unnamed tributaries near the Jane Lew Industrial Park in Lewis County. The purpose of the fill was to create a facility and storage area to support Marcellus-related exploration and development activities.
 - a. In FY2011, WVFO continued working with the USACE, WVDNR and the applicant in the Hackers Creek watershed to develop a mitigation plan to offset or avoid project impacts, reducing the threat to mussels and their habitat in an approximately half-mile stretch of Hackers Creek as well as downstream from the stretch.
 - i. The draft plan includes removal of debris from the Hackers Creek floodplain, a stormwater treatment

facility, in-stream erosion control work, and compensation for filled wetlands. It is anticipated that the applicant will complete the mitigation plan and implement its measures fully in FY2011.

2. WVFO teamed-up with Law Enforcement to arrange a small-airplane reconnaissance flight to investigate and photo-document the locations and extent of Marcellus-shale-related activities and to assess potential impacts to waterways that support Federally-listed mussels. The flight covered Hackers Creek, South Fork Hughes River, Middle Island Creek, Meathouse Fork of Middle Island Creek, and the Elk River. This survey will allow comparison with future surveys to track the expansion of Marcellus development in focal watersheds.
3. In FY2011, WVFO responded to calls from citizens concerned about a proposed Marcellus drilling project in Monroe County, WV. Concern focused on the preponderance of karst geology in the area and the project's proximity to a karst cave known to support hibernating Indiana bats. CPA staff contacted WVDEP Division of Oil and Gas personnel to inform them of the potential ESA issues and to recommend that WVDEP and the project proponent provide us with specific information to allow us to evaluate the potential for impacts.
 - a. WVFO is in the process of responding to two FOIA requests regarding this project and continues to reach out to WVDEP and Gordy Oil Company to complete an assessment of potential conflicts.
 - b. Endangered Species staff provided information to all citizens who contacted WVFO regarding the project, and CPA and ES staff briefed the RO and coordinated with the regional FOIA officer.
4. WVFO will continue to seek opportunities in FY 2011 and beyond to meet with regulatory and resource agencies to address these potential impacts of Marcellus-related water withdrawals from listed mussel streams during dry/drought conditions, including the WVDEP Division of Oil and Gas and the WVDNR.
 - a. WVFO Field Supervisor has requested a meeting between WVDEP, WVDNR and WVFO to discuss opportunities for avoiding and minimizing potential impacts to listed and candidate species.
5. WVFO CPA staff will, in FY2011, draft comments on WVDEP's recently-released draft regulations for Marcellus-related activities in WV.

Appalachian Landscape Conservation Cooperative (Map Legend # 14)

1. Key Species: All WVFO key species; see Appendix A.

2. Selected due to: West Virginia is a key part of the larger Appalachian LCC effort, working at the forefront of launching LCC activities and moving forward with development of cooperative partnerships between LCC partners. Also, West Virginia is unique in that it is the only state fully encompassed within the Appalachian LCC, resulting in the ability for West Virginia to focus on driving the LCC forward in its efforts. The Appalachian LCC will increase and enhance partnerships, leveraging funding and capabilities of the WVFO and other LCC members to effect an increase in capabilities as well as furthering on-the-ground projects. This opportunity to generate an expansive network of highly useful partnerships makes the Appalachian LCC a high priority for the WVFO.
3. Focal Activities: Utilizing Appalachian LCC partnerships in on-the-ground projects to enhance the capabilities of the WVFO. Participating in the development of the Appalachian LCC infrastructure.
4. Specific 2011 Activities:
 - a. The planning and arrangement of workshops and meetings with constituents of the Appalachian LCC, both from West Virginia and from other states in the LCC.
 - b. The development of a combined GIS and information system to facilitate coordination between participating organizations in the Appalachian LCC.

SECTION II

WEST VIRGINIA ECOLOGICAL SERVICES FIELD OFFICE COMPREHENSIVE PRIORITY PLANNING STRATEGY FY 2011 – 2013

West Virginia Ecological Services Field Office
FY 2011 – 2013 Priority Plan Format

The following pages include all West Virginia Federally-listed species and their listing status, candidate species, Service trust resources (such as migratory birds and interjurisdictional fish), and several Region 5 wide-ranging non-listed species

FRAMEWORK

Other Species Benefitting	
Introduction	Species Information: Justification for species selection:
Biological Planning	Threats and Threat Assessment: Partners/Potential Funding:
	Population Goal for WVFO: Objectives:
Conservation Design	Strategies for Addressing the Threats: Partners/Potential Funding:
Conservation Delivery	(Delivery implementation – guidance taken from Conservation Design) Partners/Potential Funding:
Monitoring	Adaptive Management Partners/Potential Funding:
Research	Based on Threats and Threat Assessment: For Population Goal for WVFO:
Outreach	WVFO outreach is primarily done through one-on-one interaction because of limited staffing, and is not able to undertake broadscale outreach efforts.

References/Literature Cited

Bats-E

Other Species Benefitting	
Introduction	<p>Species Information: The following listed bats have similar habitat requirements and are grouped together in order to facilitate addressing the common requirements. Individual species needs will be added under each species:</p> <p>Indiana bat (<i>Myotis sodalis</i>) – E</p> <p>Virginia big-eared bat (<i>Corynorhinus townsendii virginianus</i>)– E</p>
Biological Planning	<p>Threats and Threat Assessment:</p> <ol style="list-style-type: none"> 1. Disease/Predation <ol style="list-style-type: none"> a. White-nose syndrome (WNS) (3.12) 2. Natural or manmade factors (3.13) <ol style="list-style-type: none"> a. Wind turbines (wind power) (3.13) b. Residential and commercial development (3.11) <ol style="list-style-type: none"> i. Land use changes c. Dam construction (1.73) d. Cave collapse (1.73) 3. Habitat/range destruction, modification, or curtailment <ol style="list-style-type: none"> a. Migration pathways and swarming sites relate to loss and disturbance of habitat (1.113) b. Natural resource extraction (3.11) <ol style="list-style-type: none"> i. Quarries, mines, saltpeter (1.73) ii. Proposed quarries around Hellhole c. Doors, gates controlling cave access due to increased tourism <ol style="list-style-type: none"> i. Air flow ii. Temperature increase iii. Impediments of flight path result in injured bats and also mortality (can lead to an increase in predation) (1.72) d. Non-manmade objects (detritus from mud, leaf litter, tree slash, etc.) (3.14) <ol style="list-style-type: none"> i. Lead to internal cave flooding ii. Disrupt air flow iii. Temperature fluctuations e. Agriculture (watershed/landscape modification, creation of monocultures) (1.79) <ol style="list-style-type: none"> i. Dredge and channelization ii. Loss of riparian vegetation f. Degradation of summer roosting sites (8.2) <ol style="list-style-type: none"> i. Residential and commercial development g. Impacts on winter hibernacula (8.2) <ol style="list-style-type: none"> i. Gas drilling, filling, etc. 4. Disturbance of Hibernating Bats (1.80) <ol style="list-style-type: none"> a. Human disturbance <ol style="list-style-type: none"> i. Recreational caving and spelunking ii. Cave commercialization

	<ul style="list-style-type: none"> iii. Vandalism (3.14) iv. Research-related activities b. Seldom results in mortality, but impacts survival rates and reproduction. c. Compounded by physical disturbance of hibernation (1.71) d. Exhaustion of energy reserves (2.20)(7)(1.113) e. Abandonment of cave if long term disturbances occur (6) 5. Climate change (1.100-101) <ul style="list-style-type: none"> a. northern expansion of hibernating population shift <ul style="list-style-type: none"> i. Mismatched phenology in food chains ii. Change in roosting temperatures, possible effects on development 6. Regulatory Mechanisms (3.13) <ul style="list-style-type: none"> a. Zoning and land use regulations <ul style="list-style-type: none"> i. Regulations do not hinder development and mining activities in range – only curtails ii. Provide oversight and control on effects to species iii. Only address prevailing concern at the current time b. Lack of state legislation <ul style="list-style-type: none"> i. WV has no state-wide threatened and endangered species legislation c. Ownership of caves/land (3.10)(7) <ul style="list-style-type: none"> i. Management and access differ ii. Private vs. state/federal 7. Factors exacerbating biological intrinsic needs (1.113) <ul style="list-style-type: none"> a. Energetic impacts of significant disruptions to roosting areas (both in hibernacula and maternity colonies) b. Availability of hibernation habitat c. Connectivity and conservation of roosting-foraging and migration corridors d. Conservation of habitat currently supporting or in proximity to maternity colonies
	<p>Population Goal for WVFO:</p> <ul style="list-style-type: none"> 1. Maintain stable populations over the next 3 years, 2. Alleviate threats to the species so that protections under the ESA are no longer necessary. (1.20) <p>Objectives:</p> <ul style="list-style-type: none"> 1. Indiana Bat : contribute to reclassification efforts by addressing the following parameters: (1.8) <ul style="list-style-type: none"> a. Permanent protection of (80 percent) of Priority 1 hibernacula, b. A minimum overall population number equal to the 2005 estimate (457, 000), and c. Documentation of a positive population growth rate over five sequential survey periods (10-years). d. Delisting will be sought after reclassification and efforts

	<p>will then shift to addressing the following parameters: (1.8-9)</p> <ul style="list-style-type: none"> e. Permanent protection of 50 percent of Priority 2 hibernacula, f. A minimum overall population number equal to the 2005 estimate, and g. Continued documentation of a positive population growth rate over an addition five sequential survey periods. <p>2. Virginia big-eared bat : efforts for this species will focus on reclassification efforts from endangered to threatened status:</p> <ul style="list-style-type: none"> a. Documentation of long-term protection of 95 percent of all known active colony sites, b. Documentation of stable or increasing populations at 95 percent of the known active maternity sites and hibernacula for a period of five years, c. Foraging habitat must be identified and restored as much as possible, and d. A periodic monitoring program must be established to ensure a continued awareness of the status of these animals. <ul style="list-style-type: none"> i. As stated in the 1984 Recovery Plan, likelihood of the Virginia big-eared bat recovering to a point where it can be removed from the threatened list is unlikely. Therefore, this matter should be reconsidered at the time its status is reduced from endangered to threatened. (3.28)
<p>Conservation Design (how to address threats)</p>	<p>Strategies for Addressing the Threats:</p> <ul style="list-style-type: none"> 1. General: <ul style="list-style-type: none"> a. Participate through commenting on and reviewing regulations and best management practices from other agencies, NGOs and industries, with regards to mitigating threats to species and/or habitats of interest. b. Loss of habitat <ul style="list-style-type: none"> i. Target Service habitat restoration/enhancement projects to benefit this species. ii. Leverage money and partners to protect and improve winter habitat (Refuges, etc.) c. Recovery Plan d. Maximize protection of winter hibernacula e. Refuges 2. Indiana bat: (1.114) <ul style="list-style-type: none"> a. Conservation and management of habitat (hibernacula, swarming, and to a degree, summer); b. Public education and outreach. 3. Virginia big-eared bat: (2.29-33) <ul style="list-style-type: none"> a. Search for undocumented caves of importance; b. Prevent human disturbance of maternity colonies and hibernacula; c. Protection of caves providing habitat for solitary big-eared

	<ul style="list-style-type: none"> bats; d. Prevent adverse modifications to essential habitat; and, e. Develop and maintain public support for species protection. <p>4. Existing strategies:</p> <ul style="list-style-type: none"> a. Revised I-bat recovery plan drafted in April 2007; should be used as primary plan for WV activities (except that WNS wasn't known at that time) <ul style="list-style-type: none"> i. (Provide assistance to R-3 to complete Recovery Plan as requested) ii. 5-year review completed September 2009 b. WNS National Plan c. WV State Wildlife Action Plan – document is very large <p>5. Future planning documents:</p> <ul style="list-style-type: none"> a. I-bat demographic model should assist with determining how many I-bats are needed in a given recovery unit
<p>Conservation Delivery (implementation – guidance taken from Conservation Design)</p>	<p>The participation in the following delivery items will usually take the form of commentary or recommendations, collaboration, funding, document and design creation, or some other form of work with agencies, NGOs, industries or other stakeholders.</p> <p>1. General:</p> <ul style="list-style-type: none"> a. Influence regulatory agency decisions regarding projects that will result in loss of habitat and habitat functions for this species. b. Conserve and manage habitats: <ul style="list-style-type: none"> i. Summer habitat to maximize survival and fecundity ii. Hibernacula and winter populations c. Guidance for coal mining in line with the 2009 Range-wide Indiana Bat Guidelines d. Wind power: testing effectiveness of operational changes (i.e., curtailment of turbines) e. Develop and implement public information and outreach f. Minimize adverse impacts to I-bat during project reviews <ul style="list-style-type: none"> i. Ensure implementation of conservation measures of existing bats through follow up with Federal agency/project sponsor ii. Habitat protection through informal and formal consultations and HCPs <p>2. Indiana bat: (<i>I.126</i>)</p> <ul style="list-style-type: none"> a. Hibernacula-related recovery actions b. Conserve and manage hibernacula and their winter populations c. Reduce current threats at known hibernacula d. Assess current threats and conservation measures at all P1 and P2 hibernacula and develop a prioritized list of hibernacula in need of remedial actions e. Implement existing or develop new technical guidance for

	<ul style="list-style-type: none"> installing bat-friendly gates and other human barriers and deterrents f. Minimize human disturbance of hibernating bats related to survey and research activities <p>3. Virginia big-eared bat:</p> <ul style="list-style-type: none"> a. Monitor population trends b. Search for undocumented caves of importance to big-eared bats c. Prevent human disturbance of maternity colonies and hibernacula d. Protection of caves providing habitat for solitary big-eared bats e. Prevent adverse modifications to essential habitat f. Develop and maintain public support for species protection g. Prepare and maintain a management profile for each colony site
Monitoring	<p>Monitoring efforts from this office will largely consist of the development of plans, securing funding and other support for collaborators who are monitoring priority threats, species or areas.</p> <ul style="list-style-type: none"> 1. Develop protocols to measure success of all conservation delivery activities. 2. Range wide population monitoring at the hibernacula with improvements in census techniques; 3. Monitor population trends. 4. Work with Partners to identify leads for accomplishing monitoring activities. 5. Develop best management practices from results of monitoring to inform future bat population restoration activities. 6. Require or recommend monitoring: <ul style="list-style-type: none"> a. Forest Service required monitoring b. Wind power required monitoring 7. Adaptive management
Research	<p>The WVFO performs research cooperatively with other agencies, organizations and individuals. If research opportunities arise on the listed subjects of interest, the WVFO will support and assist in the cooperative research effort.</p> <p>For Threats and Threat Assessment:</p> <ul style="list-style-type: none"> 1. General: <ul style="list-style-type: none"> a. White Nose Syndrome <ul style="list-style-type: none"> i. Etiology ii. Transmission iii. Treatment b. Wind <ul style="list-style-type: none"> i. Mortality minimization measures, ii. Operational changes

	<ul style="list-style-type: none"> iii. Changes of flight patterns c. Plan and conduct research essential for recovery 2. Indiana Bat: (1.114) <ul style="list-style-type: none"> a. Range wide demographic data (to model extinction risk, detect regional and age class differences in survival, etc.) b. Ideal microclimate for hibernation; c. Importance of optimum hibernation microclimate throughout its range; d. Characteristics of a maternity colony with positive recruitment; e. Specific habitat quality and quantity parameters necessary for a self-sustaining maternity colony; <ul style="list-style-type: none"> i. E.g.: migration habitat use, summer habitat use f. Effect and exposure of Indiana bats to various classes of contaminants throughout the annual cycle; g. Response of Indiana bat to perturbations in summer habitat h. Understanding the role that habitats nears hibernacula play in swarming; i. The role of caves used for swarming that are not hibernacula; j. Aspects of migration, including timing, energetics, and habitat use; and k. Effect of global warming on the species' disruption and hibernacula. l. Further research into the requirements of and threats to the species. 3. Virginia big-eared bat: (3.17-18) <ul style="list-style-type: none"> a. Genetic research <ul style="list-style-type: none"> i. Evaluate relationship between VBEB in New River Gorge to other populations in WV and VA, as well as their relationship to NC populations <ul style="list-style-type: none"> 1. Interoffice collaboration b. Telemetry and tracking studies <ul style="list-style-type: none"> i. Foraging patterns and seasonal movements for males and non-reproductive females ii. Document spring, summer, and fall movements in Pendleton County, WV and Highland County, VA <ul style="list-style-type: none"> 1. Evaluate potential effects of wind farms being proposed in area c. Mapping of important caves <ul style="list-style-type: none"> i. Germany Valley (Hellhole and Schoolhouse Caves) ii. Other important caves help assess natural changes over time or evaluate future threats from development (e.g.: mining, drilling, other construction.) d. Search for undocumented caves of importance <ul style="list-style-type: none"> i. Interviews with local spelunkers and cave descriptions in literature ii. Winter surveys when hibernating VBEB might be present
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	<ul style="list-style-type: none"> e. Research to determine what types of siting and/or operation changes will eliminate or reduce bat mortality at wind farm project proposals in vicinity of VBEB caves <ul style="list-style-type: none"> i. Development of consistent guidelines and permitting requirements at either state or federal level f. Health effects of strebilid flies on VBEB g. Conduct surveillance for WNS <p>For Population Goal for WVFO:</p> <ul style="list-style-type: none"> 1. Research needed: seasonal migration patterns (winter and summer)
Outreach	<p>WVFO outreach is primarily done through one-on-one interaction because of limited staffing, and is not able to undertake broad scale outreach efforts.</p> <ul style="list-style-type: none"> 1. Landowner education 2. Public involvement 3. Inter-agencies coordination and collaboration 4. Caving clubs 5. Land-use planning 6. WVFO website <ul style="list-style-type: none"> o Example: NC-ES Field Office

References/Literature Cited

1. **Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision.** DOI – USFWS; April 2007: http://ecos.fws.gov/docs/recovery_plan/070416.pdf.
2. **Recovery Plan: Ozark Big-Eared Bat and Virginia Big-Eared Bat.** DOI – USFWS; 1984: http://ecos.fws.gov/docs/recovery_plan/840508.pdf.
3. **Virginia Big-Eared Bat 5-Year Review: Summary and Evaluation.** DOI – USFWS; 2008: http://ecos.fws.gov/docs/five_year_review/doc1963.pdf.
4. **Indiana Bat Recovery Plan.** USFWS New York Field Office
5. **Virginia Ecological Services Strategic Plan, 2010 – 2014.** USFWS Virginia Field Office
6. **Comprehensive Species Report: *Corynorhinus townsendii virginianus*.** NatureServe Explorer: <http://www.natureserve.org/explorer/servlet/NatureServe?init=Species>
7. **Comprehensive Species Report: *Myotis sodalis*.** Nature Serve Explorer: <http://www.natureserve.org/explorer/servlet/NatureServe?init=Species>
8. **US Fish and Wildlife Service New York Field Office 3-yr Strategic Plan.** USFWS New York Field office
9. **The IUCN Red List of Threatened Species: *Myotis sodalis*:** <http://www.iucnredlist.org/apps/redlist/details/14136/0>
10. **Guide to Federally Listed Endangered and Threatened Species of North Carolina.** North Caroline Natural Heritage Program, Division of Parks and Recreation. Raleigh, NC: 2001. <http://www.ncnhp.org/Images/15.pdf>
11. **White nose Syndrome National Plan:** http://www.fws.gov/whitenosesyndrome/pdf/WNSNational%20Plan_DRAFT_10.21.2010.pdf

12. **West Virginia State Wildlife Action Guide:**
<http://www.wvdnr.gov/Wildlife/PDFFiles/wwwcap.pdf>
13. **Virginia Big-eared Bats in North Carolina.** USFWS North Carolina Ecological Services Field Office website: <http://www.fws.gov/nc-es/mammal/vbigear.html>

Mussels-E, C, P

Other Species Benefitting	Fish host species, non-listed native mussel species
Introduction	<p>Species Information: The following listed and candidate mussels have similar habitat requirements and are grouped together in order to facilitate addressing the common requirements. Individual species needs will be added under each species.</p> <p>Clubshell mussel (<i>Pleurobema clava</i>) - E Fanshell mussel (<i>Cyprogenia stegaria</i>) - E James spinymussel (<i>Pleurobema collina</i>)- E Pink mucket pearly mussel (<i>Lampsilis orbiculata [=l. abrupta]</i>)- E Northern riffleshell mussel (<i>Epioblasma torulosa rangiana</i>) - E Rayed bean mussel (<i>Villosa fabalis</i>) - C Sheepnose mussel (<i>Plethobasus cyphus</i>)- C Spectaclecase mussel (<i>Cumberlandia monodonta</i>) - C Tubercled-blossom pearly mussel (<i>Epioblasma torulosa torulosa</i>)- E Green floater (<i>Lasmigona subviridis</i>)– species of concern; candidate assessment underway Snuffbox (<i>Epioblasma triquetra</i>)- soon to be proposed or listing</p>
Biological Planning	<p>Threats and threat assessment: Conduct watershed-wide population assessments of threats</p> <ol style="list-style-type: none"> 1. Habitat loss or disturbance/fragmentation <ol style="list-style-type: none"> a. In-stream activities: dredging, gravel bar removal, pipeline construction, channelization, impoundment (1) (2) b. Right-of-Way development and management (3) 2. Water withdrawals. <ol style="list-style-type: none"> a. Marcellus Shale b. Agriculture c. Urban 3. Water quality degradation, point and non-point sources <ol style="list-style-type: none"> a. Alteration of runoff patterns from development (2) b. Agriculture/Forestry impacts (runoff, livestock, land and water management, nutrient loading) (3) (1) 4. Sedimentation, siltation and erosion (1, 2, 3, 4) <ol style="list-style-type: none"> a. Eutrophication (1) 5. Mineral Resource Development (3) 6. Transportation and commercial/industrial development <ol style="list-style-type: none"> a. Commercial navigation (9) 7. Power Generation (3) <ol style="list-style-type: none"> a. Acid precipitation and other airborne pollutants (4) 8. Climate change (potential increases in stream temperature) <ol style="list-style-type: none"> a. Hydrologic changes (3) b. Changes in instream temps. (3) c. Increased drought, rainfall (3) d. Human migration/relocation (3) 9. Population Viability <ol style="list-style-type: none"> a. Demographics Constraints (isolated populations, small

	<p>populations, genetics) (3)</p> <ol style="list-style-type: none"> 10. Blocked passage of fish hosts <ol style="list-style-type: none"> a. Impoundment (I.iv) b. Extirpation (I.vi) 11. Non-native/problematic native species (3) <ol style="list-style-type: none"> a. Zebra mussel, Asian clam (I) (4) 12. Disease (3) 13. Illegal take, over-harvest by institutions for research (4), (1) 14. Inadequacy of current regulatory mechanisms (2) <ol style="list-style-type: none"> a. Enforcement of regulations b. Mixing zones (where water quality limits can be exceeded) 15. Recreation (3) <ol style="list-style-type: none"> a. Introduction of disease, non-native b. ATV (destruction of habitat)
	<p>Population Goal for WVFO:</p> <ol style="list-style-type: none"> 1. Hackers Creek: smaller watershed; large diversity of threats <ol style="list-style-type: none"> a. stabilize population; prevent extirpation in watershed 2. Quantify populations in many WV watersheds 3. General population goals (1) <ol style="list-style-type: none"> a. A viable, reproducing population that is stable or increasing. 4. Species population goals (1) <ol style="list-style-type: none"> a. Clubshell mussel: (I.i) <ol style="list-style-type: none"> i. Viable population: sufficient number of reproducing individuals to have a stable or increasing population. (Secondary: all populations large enough to survive a single adverse ecological event) b. Fanshell mussel: (I.ii) <ol style="list-style-type: none"> i. A reproducing population that is large enough to maintain sufficient genetic variation to enable it to evolve and respond to natural habitat changes. c. James spiny mussel: (I.iii) <ol style="list-style-type: none"> i. Populations that are stable or expanding, with evidence of recent recruitment (specimens age five or younger) d. Pink mucket pearly mussel: (I.iv) <ol style="list-style-type: none"> i. Two additional viable populations occur in any 2 rivers except Tennessee, Cumberland and Meramec rivers. ii. Viable=A population large enough to allow it to maintain sufficient genetic variation to allow it to evolve and respond to natural habitat changes. iii. Population large enough to survive a single ecological event, with a minimum of 2 year classes between 4 and 10 years of age as evidence of reproduction. e. Northern riffleshell mussel: (I.v) <ol style="list-style-type: none"> i. Viable population: sufficient number of

	<p>reproducing individuals to have a stable or increasing population. (Secondary: all populations large enough to survive a single adverse ecological event)</p> <ul style="list-style-type: none"> f. Rayed bean mussel: (<i>I.vi.</i>) <ul style="list-style-type: none"> i. Remaining rayed bean populations are small and geographically isolated, making them susceptible to a single catastrophic event and making natural repopulation and genetic interchange impossible. g. Sheepnose mussel: (<i>I.vi.</i>) <ul style="list-style-type: none"> i. Most extant populations have few individuals. Populations may have extreme difficulty in successfully reproducing. Threats that affect the ability to reproduce over time could result in essentially sterile, aging, disjunct populations. h. Spectaclecase mussel: (<i>I.vi.</i>) (<i>I.x</i>) <ul style="list-style-type: none"> i. Examples of viable populations: 10 populations are reproducing or supported via immigration from large populations, and three or four of these populations may be described as large. ii. Survey work continues in many portions of the range of the spectaclecase. Information gathered from these surveys will help determine its population status and guide its conservation. i. Tubercled-blossom pearly mussel: (<i>I.xi</i>) (<i>I.xii</i>) <ul style="list-style-type: none"> i. <i>Epioblasma torulosa torulosa</i> is currently listed as likely extinct. ii. Locate, maintain and enhance any remaining populations (if at all possible). j. Green floater: (<i>I.xiii</i>) <ul style="list-style-type: none"> i. This species has recently been found more infrequently and in generally lower numbers than previously with many documented extirpated occurrences. However, this species is easier to overlook than others and might be under-sampled; and it still maintains a wide range. k. Snuffbox: (<i>I.xiv</i>) <ul style="list-style-type: none"> i. This species is declining throughout its widespread range and has become increasingly rare, although several dozen occurrences remain; many of them with good viability <p>5. Determine which species need identification of WV population objectives (because they are not specified in recovery plans or other documents)</p> <p>6. Prioritize conservation of mussel streams using Focal Area map (see Appendix B, Justification Document)</p>
	<p>Objectives: Common Objectives: (1, 2, 3, 4)</p> <ol style="list-style-type: none"> 1. De-listing from Federal endangered or threatened status 2. Establish populations that are reproducing and stable or increasing.

3. Protect populations from both natural and anthropomorphic threats.
4. For species of concern:
 - a. Determine fish host
 - b. Prevent disruptive stream management, e.g. impoundment, sedimentation, channeling, dams, etc.
 - c. Research on organisms, population trends and threats.

Species Objectives:

1. Clubshell mussel: (*I.i*)
 - a. Reclassify from endangered status to threatened status when sufficient threats to population have been removed.
 - b. Remove the clubshell ... from the Federal list of endangered and threatened species when viable populations are established and protected.
 - i. A viable population=sufficient numbers of reproducing individuals to maintain stable or increasing population, retaining as much genetic variability as possible.
 - ii. [Populations] must be large enough to survive a single adverse ecological event.
2. Fanshell mussel: (*I.ii*)
 - a. Remove the species from the Federal List of Endangered and Threatened Wildlife and Plants.
 - b. Restore viable populations of the fanshell to a significant portion of its historic range.
3. James spinyshell mussel: (*I.iii*)
 - a. Reclassify *P. collina* from endangered to threatened status when the likelihood of extinction in the foreseeable future has been eliminated
 - b. Populations ... are distributed widely enough within their respective habitats such that it is unlikely that a single adverse event in the river would result in the total loss of that population.
 - i. For a re-established population, surveys must show that three year-classes, including one year-class of age 10 or older, have been naturally produced within each of the population centers.
4. Pink mucket pearly mussel: (*I.iv*)
 - a. De-list species from federal endangered and threatened species list.
 - i. Protect species and habitat from foreseeable and present threats that may interfere with the survival of populations.
 - b. Restore viable populations to historic habitat. (A population large enough to allow it to maintain sufficient genetic variation to allow it to evolve and respond to natural habitat changes.)
5. Northern riffleshell mussel: (*I.v*)
 - a. Reclassify from endangered status to threatened status when sufficient threats to population have been removed.
 - b. Remove from the Federal list of endangered and threatened species when viable populations are established and

	<p>protected.</p> <ol style="list-style-type: none"> i. A viable population=sufficient numbers of reproducing individuals to maintain a stable or increasing population. Populations should include as many subpopulations as possible to maintain whatever genetic variability now remains. ii. [Populations] must be large enough to survive a single adverse ecological event. <ol style="list-style-type: none"> 6. Rayed bean mussel: (<i>I.viii</i>), <ol style="list-style-type: none"> a. Protect extant populations and reduce or eliminate threats. b. Propagation technology should be developed to facilitate population augmentation and reintroduction into historical habitat. c. Determine effective population size for long term viability. 7. Sheepnose mussel: (<i>a-c,I.viii</i>), (<i>d, I.ix</i>) <ol style="list-style-type: none"> a. Protect extant populations and reduce or eliminate threats. b. Propagation technology should be developed to facilitate population augmentation and reintroduction into historical habitat. c. Determine effective population size for long term viability. d. Conservation activities that benefit the species include funding programs, research and surveys, outreach, and habitat improvements and conservation. 8. Spectaclecase Mussel: (<i>a-c,I.viii</i>)(<i>d, I.x</i>) <ol style="list-style-type: none"> a. Protect extant populations and reduce or eliminate threats. b. Propagation technology should be developed to facilitate population augmentation and reintroduction into historical habitat. c. Determine effective population size for long term viability. d. Determine fish host to facilitate repatriation and protection of extant populations. 9. Tubercled-blossom pearly mussel: (<i>I.xii</i>) <ol style="list-style-type: none"> a. Restore populations along their historic range. b. De-list the species by: <ol style="list-style-type: none"> i. Establishing a reproducing population ii. Protect the species and habitat from foreseeable natural and anthropogenic disruption and harm c. These objectives are considered improbable due to the lack of known organisms in the wild. 10. Green floater: (<i>I.xiii</i>) <ol style="list-style-type: none"> a. Determine population status and trends of local occurrences. b. Fish host(s) need to be determined. c. Documentation of differences between extirpated and extant element occurrences should be performed as possible to determine causes of extirpation. 11. Snuffbox: (<i>I.xiv</i>) <ol style="list-style-type: none"> a. Work out certain life history characteristics, determine fish host to aid in repatriation and protection of extant populations.
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<p>Conservation Design (how to address threats)</p>	<p>Strategies for addressing the threats:</p> <ol style="list-style-type: none"> 1. Participate by commenting on and reviewing regulations and best management practices from other agencies, NGOs and industries, with regards to mitigating threats to species and/or habitats of interest. 2. Loss of habitat: <ol style="list-style-type: none"> a. Design Service habitat restoration/enhancement projects to benefit these species b. Identify money and partnerships to protect and improve habitat c. Identify priority locations for restoration (ORVE criteria) (6) d. Form additional partnerships to facilitate designing additional projects, zoning for projects (private land, industry, transportation, forestry, agriculture, etc.) (3) e. Create a comprehensive watershed program (1.i) f. Protect lands (3) 3. Water withdrawals 4. Water quality degradation <ol style="list-style-type: none"> a. Support nutrient management (livestock, hatcheries) (3) 5. Sedimentation, siltation, erosion. <ol style="list-style-type: none"> a. Encourage installment enhanced erosion and sediment control (3) 6. Mineral resource development <ol style="list-style-type: none"> a. Review permitting regulations and environmental safety regulations. (5) b. Monitor industry to ensure and enforce compliance (5) c. Collaborate on locating and appropriately addressing abandoned mines and wells (5) d. Outreach on environmental impacts (3) 7. Power generation <ol style="list-style-type: none"> a. Monitor, work with industry to reduce impact (3) 8. Transportation/commercial and industrial development <ol style="list-style-type: none"> a. Work with agencies and industries to develop least-impact strategies (3) <ol style="list-style-type: none"> i. DOI's Natural Resource Damage Assessment and Restoration Program (6) b. Monitor changes in runoff patterns (2) c. Monitor activities and address violations quickly (5) d. Section 7 consultations (3) 9. Climate change <ol style="list-style-type: none"> a. Coordinate with states and other partners to apply tools to guide management responses to climate impacts. 10. Population viability <ol style="list-style-type: none"> a. Translocation/translocation protocol (1.i.) b. Support the development of propagation technology (1.viii) 11. Blocked passage of fish hosts <ol style="list-style-type: none"> a. Encourage removal or amendment of impoundments and other impediments to fish host passage. (1,5) b. Support the development of fish host propagation technology (1.viii)
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	<ul style="list-style-type: none"> 12. Non-native/problematic native species <ul style="list-style-type: none"> a. Develop eradication plans for invasive riparian vegetation. (3, 5) b. Outreach to target audiences (boaters, riparian landowners, horticulture) (3) 13. Illegal take, over-harvest by institutions for research 14. Inadequacy of current regulatory mechanisms 15. Recreation
<p>Conservation Delivery (implementation – guidance taken from Conservation Design)</p>	<p>The participation in the following delivery items will usually take the form of commentary or recommendations, collaboration, funding, document and design creation, or some other form of work with agencies, NGOs, industries or other stakeholders.</p> <ul style="list-style-type: none"> 1. Influence regulatory agency decisions regarding projects that will result in loss of habitat and habitat functions for these species 2. Loss of habitat <ul style="list-style-type: none"> a. Implement Service habitat restoration/enhancement projects to benefit these species b. Remove dams and alleviate other impediments to fish passage, use natural stream channel design (5) c. Leverage money and partners to protect and improve habitat d. Inform stakeholders of governmental programs available for assistance/cost-share (5) e. Create comprehensive watershed program (1.i) <ul style="list-style-type: none"> i. Restoration of watershed vegetation (5) ii. Livestock exclusion from waterways (5) iii. Habitat restoration (3) f. Implement priority actions in priority streams and rivers (5) <ul style="list-style-type: none"> i. Initiate and participate in ecosystem conservation efforts. ii. Protect and manage mussel populations and their habitat on a site-specific basis. iii. As needed, restore habitats and reintroduce the species to suitable areas. iv. Enlist public support for the recovery process through an outreach program and providing incentives for public support. 3. Water withdrawals 4. Water quality degradation <ul style="list-style-type: none"> a. Work with agencies (WVDEP, USGS, State Regulators, USDA RC&D, NRCS, EPA, TNC, and Dept. of Health) to identify sources of water quality degradation and address them. b. 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. (8) c. Work to contribute toward stream bed stabilization (5) d. Restoration of watershed vegetation (5)

	<ul style="list-style-type: none"> e. Livestock exclusion from waterways (5) 5. Sedimentation, siltation, erosion <ul style="list-style-type: none"> a. Stream bank stabilization (5) b. Restoration of watershed vegetation (5) c. Livestock exclusion (5) 6. Mineral resource development 7. Power generation 8. Transportation/commercial and industrial development 9. Climate change <ul style="list-style-type: none"> a. Habitat restoration. 10. Population viability <ul style="list-style-type: none"> a. Transplant mussels from other locations (Kentucky fanshell example) <ul style="list-style-type: none"> a. ORVE has a salvage and transport protocol (6) b. Remove individuals from watershed and breed in captivity to maintain gene pool until threat is reduced (5) <ul style="list-style-type: none"> a. ORVE efforts (6) 11. Blocked passage of fish hosts <ul style="list-style-type: none"> a. Remove barriers to fish host passage. 12. Non-natives <ul style="list-style-type: none"> a. Inform stakeholders of governmental programs available for assistance/cost-share (5) 13. Inadequacy of current regulatory mechanisms <ul style="list-style-type: none"> a. Pursue listing of species of concern, where appropriate (8)
Monitoring	<p>Monitoring efforts from this office will largely consist of the development of plans, securing funding and other support for collaborators who are monitoring priority threats, species or areas.</p> <ul style="list-style-type: none"> 1. Develop protocols to measure success of all conservation delivery activities. 2. Work with partners to identify leads for accomplishing monitoring activities. 3. Support established monitoring locations on several streams and encourage expansion to other streams, with a revisit at least every 5 years (8.616) 4. Continue monitoring threats as part of adaptive management strategy.
Research	<p>The WVFO performs research cooperatively with other agencies, organizations and individuals. If research opportunities arise on the listed subjects of interest, the WVFO will support and assist in the cooperative research effort.</p> <ul style="list-style-type: none"> 1. Map existing populations, threats, watersheds. (1) <ul style="list-style-type: none"> a. Determine extant range (1, 8) b. Determine historic range (1, 8) c. Determine intersection of threats and ranges 2. Water quality degradation - Research needed: <ul style="list-style-type: none"> a. Effects of Marcellus shale drilling; water withdrawal; wastewater (frac water) disposal; b. Mining runoff on mussels (e.g., conductivity levels)

	<ul style="list-style-type: none"> c. Effects of common contaminants on all life stages, especially silt (<i>I.viii</i>) (2) 3. Habitat loss or disturbance - Research needed: <ul style="list-style-type: none"> a. Degradation of watershed functions in headwaters b. effects of mountain top mining and deep underground coal mining c. Water withdrawals - mining, oil & gas d. Nutrient loading; effects and locations (3) 4. Sedimentation and erosion - Research needed: <ul style="list-style-type: none"> a. effects of sedimentation: i.e., quantification of sedimentation levels that will affect species 5. Climate change- model climate change effects on stream temperatures, hydrology, acidity, etc, 6. Infiltration of and effects from invasives (zebra mussels, Asian clams) (3) 7. Identify areas in need of riparian restoration (3). <ul style="list-style-type: none"> a. Develop best methods for restoration on a case-by-case basis. 8. Develop and implement standardized protocols, associated forms, databases, instruction and training for data collection and storage, to allow easy integration of data from multiple sources (8) <p>For Population Goal for WVFO:</p> <ul style="list-style-type: none"> 1. Collect data on species that is necessary for their recovery. 2. Recruitment - Research needed: determine survival rates, model population viability, determine host fish <ul style="list-style-type: none"> a. Fill in knowledge gaps for life history of species (<i>I.i</i>) b. Assess genetic differences among remaining populations (3) c. Determining the developing criteria indicative of healthy viable populations (<i>I.viii</i>) d. Producing habitat suitability criteria for translocation efforts, performing taxonomic distinctiveness studies rangewide (<i>I.viii</i>) e. Capture museum specimens for all WV species. (8)
Outreach	<ul style="list-style-type: none"> 1. WVFO website <ul style="list-style-type: none"> a. USFWS Midwest Region Endangered Species website <ul style="list-style-type: none"> i. Endangered and Threatened Freshwater Mussels ii. Partnerships for Ohio River Mussels 2. Landowner education 3. Public involvement <ul style="list-style-type: none"> a. Create an education program for the public, emphasis toward commercial mussel fishermen. (1.iii.19) b. Agencies (USDA, EPA, Army Corps of Engineers, WVDOT, USFS) c. Land-use planning d. Contact wastewater treatment facilities e. Obtain streams of concern from WV Division of

	<p>Environmental Protection website</p> <ul style="list-style-type: none"> i. See Reference 7 f. Contact oil and gas groups g. Marcellus shale: contact groups to educate on water withdrawals h. Develop and disseminate education and outreach materials to increase public awareness and support for freshwater mussel conservation. (6) i. Draft an MOU with State to collaborate on conservation of mussels
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 - ii. http://ecos.fws.gov/docs/recovery_plan/910709.pdf (pg. 6)
 - iii. http://ecos.fws.gov/docs/recovery_plan/900924b.pdf (pg 13)
 - iv. http://ecos.fws.gov/docs/recovery_plan/pink%20mucket%20rp.pdf (pg. 12, 16, 22)
 - v. http://ecos.fws.gov/docs/recovery_plan/940921.pdf (pg. 29)
 - vi. http://ecos.fws.gov/docs/federal_register/fr4246.pdf (pg. 24878)
 - vii. <http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Villosa+fabalis> (Conservation Status, Management Summary, Ecology & Life History)
 - viii. http://www.fws.gov/orve/online_symposium_three_mussels.html
 - ix. http://www.fws.gov/ecos/ajax/docs/candforms_pdf/r3/F046_I01.pdf (pg. 15)
 - x. http://www.fws.gov/ecos/ajax/docs/candforms_pdf/r3/F00X_I01.pdf (pg. 16, 18)
 - xi. <http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Epioblasma+torulosa+torulosa> (Conservation status, Management Summary, Ecology & Life History)
 - xii. http://ecos.fws.gov/docs/recovery_plan/850125.pdf (pg. 26)
 - xiii. <http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Lasmignona+subviridis> (Conservation status, Management Summary, Ecology & Life History)
 - xiv. <http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Epioblasma+triqueta> (Conservation status, Management Summary, Ecology & Life History)
2. http://ecos.fws.gov/docs/five_year_review/doc2580.pdf (pg. 12-14, 17)
3. VIRGINIA ECOLOGICAL SERVICES STRATEGIC PLAN 2010 – 2014 (Appendix 4, pg. 60-107, Appendix 5, pg. 108-132)
4. <http://www.fws.gov/orve/stratplan.html>
5. The Hackers Creek Watershed Inventory and Threat Assessment, Jennifer Haney, 2010 (pg. 11, 61-64)
6. <http://restoration.doi.gov/>
7. [http://www.dep.wv.gov/WWE/watershed/IR/Documents/DRAFT%202010%20303\(d\)%20Documents/303\(d\)%20Draft%20Supplemental%20Portions%20Only.pdf](http://www.dep.wv.gov/WWE/watershed/IR/Documents/DRAFT%202010%20303(d)%20Documents/303(d)%20Draft%20Supplemental%20Portions%20Only.pdf)
8. <http://www.wvdnr.gov/Wildlife/PDFFiles/wvwcap.pdf> (file is 70 MB, very large) (pg. 616, 682)
9. ORVE Mussel Strategic Action Plan (1997) (pgs. ii., 6, 7, 8, 53, 54)
10. **Threatened and Endangered Species: Clubshell Mussel Fact Sheet.** USFWS <http://www.fws.gov/midwest/endangered/clams/pdf/clubshell.pdf>

11. **Threatened and Endangered Species: Fanshell Mussel Fact Sheet.** USFWS. <http://www.fws.gov/midwest/Endangered/clams/pdf/fanshell.pdf>
12. **James Spiny mussel Fact Sheet.** USFWS. http://www.fws.gov/northeast/virginiafield/pdf/endspecies/fact_sheets/james%20spiny.pdf
13. **Threatened and Endangered Species: Pink Mucket Pearly Mussel Fact Sheet.** USFWS. <http://www.fws.gov/midwest/endangered/clams/pdf/pink-mucket.pdf>
14. **Threatened and Endangered Species: Northern Riffleshell Mussel Fact Sheet.** USFWS <http://www.fws.gov/midwest/endangered/clams/pdf/n-riffleshell.pdf>
15. **Northern Riffleshell Mussel Fact Sheet.** USFWS. <http://www.fws.gov/midwest/endangered/clams/rayedbean/pdf/RayedBeanFactSheetNov2010.pdf>
16. **Species Profile: *Plethobasus cyphus*.** Minnesota Department of Natural Resources. <http://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=IMBIV34030>
17. **Species Profile: *Cumberlandia monodonta*.** Minnesota Department of Natural Resources. <http://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=IMBIV08010>
18. **USFWS Endangered Species: Tubercled Blossom Pearly Mussel.** USFWS website: http://www.fws.gov/midwest/endangered/clams/tuber_fc.html
19. **Freshwater Mussel Species of Concern: Green Floater.** Pennsylvania Natural Heritage Program. <http://www.naturalheritage.state.pa.us/factsheets/12224.pdf>
20. **Snuffbox Fact Sheet.** USFWS. <http://www.fws.gov/midwest/endangered/clams/snuffbox/pdf/SnuffboxFactSheetNov2010.pdf>
21. **Endangered and Threatened Freshwater Mussels.** USFWS Midwest Region Endangered Species website: <http://www.fws.gov/midwest/endangered/clams/index.html>
22. **Partnerships for Ohio River Mussels.** USFWS Midwest Region Endangered Species website: http://www.fws.gov/midwest/endangered/clams/ohio_rvr.html

Harperella - E

Other Species Benefitting	
Introduction	Species Information: Harperella (<i>Ptilimnium nodosum</i>)- E
Biological Planning	Threats and Threat Assessment: <ol style="list-style-type: none"> 1. Hydrological changes <ol style="list-style-type: none"> a. Plant can only tolerate a narrow range of water depths (1) b. Stream dredging, ditching/drainage of wetlands that support pond populations, dam building, reservoirs, increased surface water run-off from impervious surfaces (3) 2. Water degradation, siltation, erosion <ol style="list-style-type: none"> a. Pesticide and herbicide runoff (1) b. Pollution, wastewater releases, algal blooms (3) c. Increased sewage (1) d. Development, loss of riparian vegetation, poor management of logging and agriculture, road building/maintenance (3) e. Acid precipitation and other airborne pollutants (5) f. Silt from poor erosion control practices at construction sites, logging sites, and agricultural sites (6) <ol style="list-style-type: none"> i. Greenhouse studies have documented that increased turbidity reduced harperella growth rates by 40% 3. Agriculture <ol style="list-style-type: none"> a. Trampling and bank destabilization through human use. (1) b. Nitrate concentration increases (1) 4. Population viability (1) <ol style="list-style-type: none"> a. Small populations (1) b. Genetically distinct “pond form” (Nodosum) and “riverine form” (Fluviatile) (1) <ol style="list-style-type: none"> i. Nodosum largely restricted to South Carolina and Georgia. (1) c. Seed dispersal challenges (seeds aquatically dispersed, suitable downstream habitat may not be available) (1) <ol style="list-style-type: none"> i. Apparently suitable but unoccupied habitat is present within occupied streams and in adjacent watersheds and that colonization events at these new sites has been limited (6) 5. Mineral resource development <ol style="list-style-type: none"> a. Water acidification (1) b. Marcellus Shale (5) 6. Habitat disturbances/fragmentation <ol style="list-style-type: none"> a. Range has been subdivided and developed residentially on Cacapon river. (1) b. Erosion of stream banks by riparian vegetation removal.

	<ul style="list-style-type: none"> (1) c. Trampling and bank destabilization through human use. (1) <ul style="list-style-type: none"> i. ATVs, foot traffic, heavy equipment, debris build-up (3) ii. Cacapon Resort State Park activities, incl. water diversion for golf course (1) d. Direct development and habitat loss on the site from creation of canoe launches, placement of fill, or land-use conversion for agriculture, commercial, or residential development. (6) 7. Transportation and commercial development (1, 4) <ul style="list-style-type: none"> a. 10,000 individuals killed in 1980s in WV from housing development. 8. Non-natives <ul style="list-style-type: none"> a. <i>Arthraxon hispidus</i> (1), purple loosestrife, <i>Microstegium vimineum</i>, Asian spiderwort, air potato (6) b. Hemlock woolly adelgid kills stream bank hemlocks, disturbs harperella habitat. (6) 9. Climate change <ul style="list-style-type: none"> a. Extreme weather events: flooding, droughts, or ice-scour (3) b. Increased drought, rainfall (5) c. Human migration/relocation (5) 10. Inadequacy of current regulatory mechanisms <ul style="list-style-type: none"> a. Does not occur entirely on Federal land, no protection in place for private land (4) b. Enforcement of current regulations 11. Recreation <ul style="list-style-type: none"> a. ATV activity (6)
	<p>Population Goal for WVFO:</p> <ul style="list-style-type: none"> 1. Quantify populations in WV watersheds (Sleepy Creek, Cacapon River [1]) 2. To down-list species: 13 stable populations under permanent protection (1) 3. To de-list species: 26 self-sustaining populations within historical range under permanent protection (1) <ul style="list-style-type: none"> a. Self-sustaining populations of <i>P. nodosum</i> are defined as being large enough to have a high probability of (1) surviving normal population cycles, (2) persisting through natural extremes in weather, and (3) containing sufficient genetic variation to adapt to natural habitat changes. [1] 4. There are currently a total of 24 extant populations, indicating that 11 new populations have either been discovered or been established since the time of listing. (6) <p>Objectives:</p> <ul style="list-style-type: none"> 1. De-list Species (1) 2. Protect populations from natural and anthropomorphic threats.

<p>Conservation Design (how to address threats)</p>	<p>Strategies for Addressing the Threats:</p> <ol style="list-style-type: none"> 1. Participate by commenting on and reviewing regulations, least-impact strategies and best management practices from other agencies, NGOs and industries, with regards to mitigating threats to species and/or habitats of interest. 2. Hydrological changes <ol style="list-style-type: none"> a. Protect drainage system upstream from perturbations from mining, dams, construction and agriculture (1) 3. Water degradation: <ol style="list-style-type: none"> a. Identify impacts throughout watershed, seek watershed-wide conservation measures (1) 4. Population viability <ol style="list-style-type: none"> a. Work with other agencies to develop techniques for propagation, cultivation and transplantation. (1) 5. Mineral resource development <ol style="list-style-type: none"> a. Review permitting regulations and environmental safety regulations(5) b. Monitor industry to ensure and enforce compliance(5) 6. Habitat disturbances/fragmentation <ol style="list-style-type: none"> a. Influence regulator agency (e.g., EPA, Corps, WV Division of Environmental Protection) decisions regarding projects that will result in loss of habitat and habitat functions for these species b. Develop additional reintroduction/restoration opportunities (6) c. Develop regulations and best management practices with other agencies. d. Design Service habitat restoration/enhancement projects to benefit these species. e. Identify money and partnerships to protect and improve habitat. c. Form additional partnerships to facilitate designing additional projects, zoning for projects (private land, industry, transportation, forestry, agriculture, etc.) (5) d. Protect existing sites/populations (1) e. Re-establish populations within historical range (2) f. Enforcement of current regulations (5) 7. Transportation and commercial development <ol style="list-style-type: none"> a. Section 7 consultations. 8. Non-Natives <ol style="list-style-type: none"> b. Develop eradication plans for problematic species (Japanese knotweed, <i>Arthraxon hispidus</i>, purple loosestrife) c. Outreach to target audiences (landowners, agricultural industry) 9. Climate change 10. Inadequacy of current regulatory mechanisms <ol style="list-style-type: none"> a. Evaluate effectiveness of protection programs (2)
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<p>Conservation Delivery (implementation – guidance taken from Conservation Design)</p>	<p>The participation in the following delivery items will usually take the form of commentary or recommendations, collaboration, funding, document and design creation, or some other form of work with agencies, NGOs, industries or other stakeholders.</p> <ol style="list-style-type: none"> 1. Influence regulatory agency (e.g., EPA, Corps, WV Division of Environmental Protection) decisions regarding projects that will result in loss of habitat and habitat functions for these species 2. Hydrological changes <ol style="list-style-type: none"> a. Advocate for the avoidance of hydrological manipulations (1) 3. Water degradation <ol style="list-style-type: none"> a. Work with agencies to identify sources of water quality degradation and address them. (5) b. Work to contribute to stream bed stabilization (5) c. Livestock exclusion from waterways (5) d. 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 pertinent streams (5) 4. Population viability <ol style="list-style-type: none"> a. Search for additional populations. (1) b. Transplant from other populations (1, 5) c. Develop cultivated sources of plants and provide for seed storage. (1)(6) 5. Mineral resource development <ol style="list-style-type: none"> a. Implement and enforce current regulations (5) 6. Habitat disturbances/fragmentation <ol style="list-style-type: none"> a. Protect plants and their habitat through landowner cooperation, land protection, and regulatory authorities. (1) <ol style="list-style-type: none"> i. Determine habitat protection priorities, define habitat requirements. (1) ii. Livestock exclusion from waterways (5) iii. Use natural stream channel design (5) b. Where needed, seek conservation of watersheds to protect populations. (1) c. Support opportunities to secure permanent protection for populations (1) d. Remove or remodel dams and other water control methods to retain needed water levels (1,5) e. Leverage money and partners to protect and improve habitat. f. Inform the public about the plant’s status and recovery needs. (1) 7. Transportation and commercial development 8. Non-natives <ol style="list-style-type: none"> a. Manage invasive species in and around relevant habitats, with emphasis on early detection, rapid response and
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	<p>containment.</p> <p>b. Inform landowners of cost-share programs (NRCS) available to aid in treatment of non-natives (5)</p> <p>9. Climate change</p> <p>10. Inadequacy of current regulatory mechanisms</p>
Monitoring	<p>Monitoring efforts from this office will largely consist of the development of plans, securing funding and other support for collaborators who are monitoring priority threats, species or areas.</p> <ol style="list-style-type: none"> 1. Adaptive management 2. Monitor effects of conservation efforts 3. Monitor size and extent of populations (1) 4. Map and monitor potential and existing threats to populations (1) 5. Search for additional populations (1) 6. Work with partners to ensure more consistent monitoring both for individual populations and between populations is needed
Research	<p>The WVFO performs research cooperatively with other agencies, organizations and individuals. If research opportunities arise on the listed subjects of interest, the WVFO will support and assist in the cooperative research effort.</p> <p>For Threats and Threat Assessment:</p> <ol style="list-style-type: none"> 1. Research needed: <ol style="list-style-type: none"> a. Identify existing and potential threats (1) b. Determine watershed boundaries for species (1) c. Correlate past and ongoing habitat disturbances with population trends (1) d. Delineate potential habitat (2) 2. Water quality and quantity changes - Research needed: <ol style="list-style-type: none"> a. Effects of hydrological changes on species. b. Effects of watershed changes (6) c. Effects of natural gas drilling; water withdrawal; wastewater (frac water) disposal; d. Mining runoff e. Effects of common contaminants on all life stages, especially silt (5) 3. Habitat loss or disturbance - Research needed: <ol style="list-style-type: none"> a. Degradation of watershed functions in headwaters b. effects of mountain top mining and deep underground coal mining c. Water withdrawals - mining, oil & gas d. Nutrient loading; effects and locations (3) 4. Sedimentation and erosion - Research needed: <ol style="list-style-type: none"> a. effects of sedimentation: i.e., quantification of sedimentation levels that will affect species 5. Climate change- model climate change effects on stream temperatures, hydrology, acidity, etc, <ol style="list-style-type: none"> a. Work with other agencies (USGS, NOAA, TNC) on

	<p>research in terms of trends/impacts (5)</p> <ol style="list-style-type: none"> 6. Identify areas in need of riparian restoration (3). <ol style="list-style-type: none"> a. Develop best methods for restoration on a case-by-case basis. <p>For Population Goal for WVFO:</p> <ol style="list-style-type: none"> 1. Study species and habitat characteristics. (1) <ol style="list-style-type: none"> a. Long-term demographics studies (1) b. See 5 year review (6) 2. Genetic research (1) 3. Develop transplant techniques, determine live plant cultivation needs, seed storage conditions (1) 4. Determine length of seed storage in ponds (2) 5. Conduct further genetic studies (2) <ol style="list-style-type: none"> a. See 5-year Review (6) 6. Develop a cultivated source of plants (2)
<p>Outreach</p>	<p>WVFO outreach is primarily done through one-on-one interaction because of limited staffing, and is not able to undertake broadscale outreach efforts.</p> <ol style="list-style-type: none"> 1. WVFO website <ol style="list-style-type: none"> a. Example: North Carolina ES Field Office 2. Support efforts of Sleepy Creek Watershed Association 3. Support efforts of Blue Heron Environmental Effort

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2. <https://ecos.fws.gov/roar/pub/planImplementationStatus.action?documentId=600144&entityId=991>
3. <http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Ptilimnium+nodosum> (Conservation status, Management Summary, Ecology & Life History)
4. http://ecos.fws.gov/docs/federal_register/fr1482.pdf (pg. 37980)
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8. **Harperella in North Carolina.** USFWS North Carolina Ecological Services Field Office website: <http://www.fws.gov/nc-es/plant/harperella.html>

Northeastern Bulrush - E

Other Species Benefitting	
Introduction	<p>Species Information: Northeastern bulrush (<i>Scirpus ancistrochaetus</i>)- E</p> <p>Habitat includes sinkhole ponds atop a low, flat sandstone ridge, and small seasonal ponds. (2.8)</p>
Biological Planning	<p>Threats and Threat Assessment:</p> <ol style="list-style-type: none"> 1. Anthropogenic <ol style="list-style-type: none"> a. Human-related activities that lead to the destruction or modification of habitat. (1.31 – 1.32), (2.12) <ol style="list-style-type: none"> i. Destruction or degradation through wetland filling, draining, and dredging for development; agriculture; and recreation purposes. ii. Residential development iii. Any practice that will disrupt or alter the flow of surface water into wetlands: <ol style="list-style-type: none"> 1. Timber harvesting; 2. construction and use of logging roads, fire roads; 3. Off-trail vehicle use in sensitive habitats or during periods of drought; 4. Oil and gas development; 5. Pipeline and power maintenance; and, 6. Recreation. iv. Erosion, sedimentation, and runoff from agricultural lands and construction sites, may be less direct but potentially serious. v. ATV damage during drought b. Inadequate Federal and state laws and regulations to counter threats. 2. Natural (1.33 – 1.34) <ol style="list-style-type: none"> a. Stochastic events <ol style="list-style-type: none"> i. Tree falls ii. Floods iii. Severe drought iv. Insect or disease attack b. Other, natural threats <ol style="list-style-type: none"> i. Fire ii. Succession, iii. Beaver and long-term disruption of natural water level fluctuations c. Inbreeding, with subsequent loss of genetic diversity <ol style="list-style-type: none"> i. At risk are small, isolated populations

	<p>Population Goal for WVFO: (1.37)</p> <ol style="list-style-type: none"> 1. Primary strategy involves restoring the species' range wide distribution through protection of known extant populations and their habitat. 2. Conduct searches for additional populations. 3. Ensure long-term viability: conduct searches for additional populations, with investigations into ecological requirements possibly leading to management of the species. <p>Objectives: (1.37)</p> <p>The objective of this recovery plan is to reclassify <i>S. ancistrochaeius</i> from endangered to threatened status. Reclassification will be considered when the following conditions have been met:</p> <ol style="list-style-type: none"> 1. Long-range protection is secured for a total of 20 populations. <ol style="list-style-type: none"> a. Protection of these populations should be from present and foreseeable anthropogenic and natural threats that may interfere with survival b. Adequate protection measures comprise land acquisition, conservation easements, and measures to protect local watersheds in which the species is found. 2. Annual monitoring over a 10-year period showing a sample of 20 representative populations are stable or increasing. <ol style="list-style-type: none"> a. General population, reproductive, and habitat trends should indicate a capacity for being self-sustaining in the wild over the long-term, with little or no management intervention. 3. Life history and ecological requirements are understood sufficiently to allow for effective protection, monitoring, and as needed, management.
<p>Conservation Design (how to address threats)</p>	<p>Strategies for Addressing the Threats:</p> <ol style="list-style-type: none"> 1. Participate through commenting on and reviewing regulations and best management practices from other agencies, NGOs and industries, with regards to mitigating threats to species and/or habitats of interest 2. Protect all known extant populations and their habitat (1.38-40) <ol style="list-style-type: none"> a. Identify essential habitat b. Support opportunities to secure permanent protection for populations (1) c. Seek cooperation and active support of private landowners and public land managers 3. Conduct range wide searches in areas of suitable habitat for additional populations (1.40)
<p>Conservation Delivery (implementation – guidance taken from Conservation Design)</p>	<p>The participation in the following delivery items will usually take the form of commentary or recommendations, collaboration, funding, document and design creation, or some other form of work with agencies, NGOs, industries or other stakeholders.</p> <ol style="list-style-type: none"> 1. Influence regulatory agency decisions regarding projects that will result in loss of habitat and habitat functions for these species

	<ol style="list-style-type: none"> 2. Secure protection for sites on public and private lands; (2.18) <ol style="list-style-type: none"> a. Establish management and habitat protection agreements with state and Federal agencies b. Partner with non-governmental organizations 3. Implement management tools to reduce threats and monitor the effectiveness of these recovery actions. (2.18) <ol style="list-style-type: none"> a. Identify, monitor, and alleviate threats to each population b. Funding 4. Secure, and store or propagate genetic material from each genotype (1.46) <ol style="list-style-type: none"> a. Store a small sample of seeds from each genotype
Monitoring	<p>Monitoring efforts from this office will largely consist of the development of plans, securing funding and other support for collaborators who are monitoring priority threats, species or areas.</p> <ol style="list-style-type: none"> 1. Support ongoing DNR monitoring effort through funding and design guidance.
Research	<p>The WVFO performs research cooperatively with other agencies, organizations and individuals. If research opportunities arise on the listed subjects of interest, the WVFO will support and assist in the cooperative research effort.</p> <p>For Threats and Threat Assessment:</p> <ol style="list-style-type: none"> 1. Kinds of change to the habitat which affect the growth, reproduction, and elimination of plant (3.a) 2. Characterization of environment (3.c) <ol style="list-style-type: none"> a. Physical <ol style="list-style-type: none"> i. Characteristics of hydrology, soils pH, nutrient status, temperature, precipitation, and light regime b. Biological <ol style="list-style-type: none"> i. Associated plants and animals ii. Competition iii. Predators or grazers iv. Population fluctuations <p>For Population Goal for WVFO:</p> <ol style="list-style-type: none"> 1. Determine habitat characteristics and environmental requirements (1.45-46) <ol style="list-style-type: none"> a. Characterize the habitat of study sites b. Determine to what degree and under what conditions competitors may threaten species c. Investigate the effects of land management practices on the species d. Investigate the effects of beaver activities on hydrological regime and demography of the bulrush 2. Investigate genetic variability and viability (1.46) <ol style="list-style-type: none"> a. Evaluate the genetic identity of individual plants <ol style="list-style-type: none"> i. Genetics Research

	<ul style="list-style-type: none"> b. Determine the degree of intra- and inter-population genetic variability c. Determine to what extent seed viability varies with the extent of clonality in populations 3. Investigate life history and reproductive strategy (1.43-45) <ul style="list-style-type: none"> a. Determine and assess demographic characteristics of study populations b. Investigate the relative importance of sexual vs. asexual reproduction and recruitment c. Experimentally investigate the species' habitat requirements for recruitment (sexual and asexual) d. Investigate the significance of seed banking and seed dispersal 4. Develop reliable census techniques (1.40-42) <ul style="list-style-type: none"> a. Develop consistency in the definition of plant terms b. Detail methods to identify non-sexually reproducing individuals readily in the field c. Describe methods for measuring the size and health of individual plants d. Develop consistent, reliable census techniques for use throughout the species' range 5. Population trends associated with active management of species and habitat (3.a) <ul style="list-style-type: none"> a. Habitat need of plant b. Stability of populations in changing environments 2. Extent the species interbreeds with other taxa (3.c) 3. Relative roles of sexual vs. asexual production (3.c) <ul style="list-style-type: none"> a. Role differences from place to place b. Role differences in change of habitat (wet years to dry years) 4. Life history and ecological requirements (2.19) <ul style="list-style-type: none"> a. Genetic variation between populations, herbivory, shading, and seed bank formation
Outreach	<p>WVFO outreach is primarily done through one-on-one interaction because of limited staffing, and is not able to undertake broad scale outreach efforts.</p> <ul style="list-style-type: none"> 1. WVFO website <ul style="list-style-type: none"> a. Example: PA DCNR 2. Develop an information brochure/packet for distribution to landowner, managers, and other interested parties (1.47)

References/Literature Cited

1. **Northeastern Bulrush: Recovery Plan.** Copeyon, Carole K., DOI – USFWS, PA Field Office; 25 August 1993. http://ecos.fws.gov/docs/recovery_plan/930825.pdf

2. **Northeastern Bulrush: 5-Year Review: Summary and Evaluation.** DOI – USFWS, PA Field Office; Fall 2008. http://ecos.fws.gov/docs/five_year_review/doc2618.pdf

3. **Comprehensive Species Report:** *Scirpus ancistrochaetus*. *Management Summary*. Nature Serve Explorer: <http://www.natureserve.org/explorer/servlet/NatureServe?init=Species>
 - a. Management Requirements
 - b. Monitoring Requirements
 - c. Management Research Needs
4. **Northeastern Bulrush Fact Sheet.** USFWS. <http://www.fws.gov/northeast/pdf/bulrush.pdf>
5. **Endangered Plants: Northeastern Bulrush.** PA Department of Conservation and Natural Resources. <http://www.dcnr.state.pa.us/wrep/bulrush.aspx>

Shale Barren Rock Cress - E

Other Species Benefitting	
Introduction	Species Information: Shale barren rock cress (<i>Arabis serotina</i>)- E
Biological Planning	Threats and Threat Assessment: <ol style="list-style-type: none"> 1. Habitat Loss <ol style="list-style-type: none"> a. Road/railroad/trail construction and maintenance (1) b. Erosion (1) c. Inundation resulting from flood control measures (1) 2. Pollinator decline <ol style="list-style-type: none"> a. Due to the spraying of Dimilin and BT insecticides for gypsy moth control 3. Competition from exotic plants <ol style="list-style-type: none"> a. <i>Centauria maculata</i> (1) b. Grasses (1) 4. Population Viability <ol style="list-style-type: none"> a. Small number of individuals in each occurrence (1) b. Susceptible to competition; grows in open areas on shale barrens (1) c. Susceptible to random disasters (2) d. Insufficient genetic diversity? 5. Climate change <ol style="list-style-type: none"> a. Drought (2) 6. Herbivory <ol style="list-style-type: none"> a. Livestock grazing (2) b. Deer browsing (1) c. Lepidoptera (Olympic marble butterfly larvae, <i>Pieris</i> spp.) (2) d. Fungus (2) e. Over-collection by humans (2) 7. Inadequacy of current regulatory mechanisms <ol style="list-style-type: none"> a. Several populations on private land. (2)
	Population Goal for WVFO: <ol style="list-style-type: none"> 1. To down-list to threatened: 20 demonstrably self-maintaining populations throughout the historical range (2) 2. To de-list: 15 additional self-maintaining populations with permanently protected habitats (2) Objectives: <ol style="list-style-type: none"> 1. Remove <i>Arabis serotina</i> from the list of endangered and threatened species. (2) <ol style="list-style-type: none"> a. Protect habitats of populations (2) b. Store seeds in case of catastrophic event (2)
Conservation Design (how to address threats)	Strategies for Addressing the Threats: <ol style="list-style-type: none"> 1. Participate through commenting on and reviewing regulations and

	<p>best management practices from other agencies, NGOs and industries, with regards to mitigating threats to species and/or habitats of interest</p> <ol style="list-style-type: none"> 2. Pollinator decline: <ol style="list-style-type: none"> a. Work with federal and state agencies to protect extant populations under their jurisdiction from pesticide applications for gypsy moth control (or for other reasons). 3. Habitat Loss <ol style="list-style-type: none"> a. Form additional partnerships to facilitate designing additional projects, zoning for projects (private land, industry, transportation, forestry, agriculture, etc.) (4) b. Protect existing sites/populations (4) <ol style="list-style-type: none"> i. Implement/enforce regulations to protect populations and their habitat. (2) c. Re-establish populations within their historical range (4) 4. Non-native invasive species <ol style="list-style-type: none"> a. Develop eradication plans for problematic species (4) b. Outreach to target audiences (landowners, public lands managers) (4) 5. Population Viability <ol style="list-style-type: none"> a. Encourage agencies developing techniques for propagation, cultivation and transplantation (4) 6. Climate change <ol style="list-style-type: none"> a. Coordinate with states and other partners to apply tools to guide management responses to climate impacts (drought). 7. Herbivory 8. Inadequacy of current regulatory mechanisms
<p>Conservation Delivery (implementation – guidance taken from Conservation Design)</p>	<p>The participation in the following delivery items will usually take the form of commentary or recommendations, collaboration, funding, document and design creation, or some other form of work with agencies, NGOs, industries or other stakeholders.</p> <ol style="list-style-type: none"> 1. Influence regulator agency decisions regarding projects that will result in loss of habitat and habitat functions for these species 2. Recovery Plan actions (2): <ol style="list-style-type: none"> a. Support opportunities to secure permanent protection for self-maintaining populations and their habitat. b. Search for additional populations. c. Study life history, ecological, and population parameters and establish guidelines for determining what constitutes a self-maintaining population. d. Support management of populations for the maintenance of each population and its habitat. 3. Habitat loss <ol style="list-style-type: none"> a. Work with the George Washington Jefferson National Forest on their forest plan. b. Protect Shale Barren lands with a sufficient buffer of scrub oak woodland or other habitat type to reduce the effects of pesticide application and other factors (1) c. Section 7 consultations (3)

	<ul style="list-style-type: none"> d. Protect plants and their habitat through landowner cooperation, land protection and regulatory authorities (4) 4. Pollinator decline: <ul style="list-style-type: none"> a. Exempting shale barren communities from pesticide application for gypsy moth control (1) 5. Herbivory 6. Non-native invasive species <ul style="list-style-type: none"> a. Manage exotic plants outside of shale barren habitat in order to prevent invasion. 7. Population Viability <ul style="list-style-type: none"> a. Support the development of cultivated sources of plants and provide for seed storage (4) 8. Climate change <ul style="list-style-type: none"> a. Habitat protection (4)
Monitoring	<p>Monitoring efforts from this office will largely consist of the development of plans, securing funding and other support for collaborators who are monitoring priority threats, species or areas.</p> <ul style="list-style-type: none"> 1. Adaptive management <ul style="list-style-type: none"> a. Develop and implement comprehensive monitoring program. (2,5) 1. Work with others to develop appropriate monitoring schemes, and assist in implementation. 2. Search for additional populations (2) 5. Support monitoring of extant populations and their habitat on a regular basis.
Research	<p>The WVFO performs research cooperatively with other agencies, organizations and individuals. If research opportunities arise on the listed subjects of interest, the WVFO will support and assist in the cooperative research effort.</p> <p>For Threats and Threat Assessment:</p> <ul style="list-style-type: none"> 1. Current research efforts should provide all necessary information necessary to formulate conservation needs for <i>A. serotina</i> (1) 2. Effects of fire management regimes 3. Contacts for current research/monitoring projects: (1) <ul style="list-style-type: none"> a. VA FWS and VA Dept. of Ag.: Garrie Ralph, 1943 Kings Road, Glen Allen, VA 23060. b. Mike Likins, Virginia Department of Agriculture and Commerce, Washington Bldg., Richmond, VA 23219. Telephone No. (804) 371-0633. c. P. J. Harmon, Botanist, West Virginia Natural Heritage Program, Department of Natural Resources, P.O. Box 67, Elkins, WV 26241. Telephone No. (304) 637-0245 <p>For Population Goal for WVFO:</p> <ul style="list-style-type: none"> 1. Life-history information (2,5) 2. Genetic variability between populations/within species. (5)

	<ol style="list-style-type: none"> 3. Seed bank assessment (3) 4. Search for additional populations (5)
Outreach	<p>WVFO outreach is primarily done through one-on-one interaction because of limited staffing, and is not able to undertake broadscale outreach efforts.</p> <ol style="list-style-type: none"> 1. WVFO website <ol style="list-style-type: none"> a. Example: VA-ES Field Office

References/Literature Cited

1. http://www.natureserve.org/explorer/servlet/NatureServe?searchSpeciesUid=ELEMENT_GLOB_AL.2.142676 (Conservation status, Management Summary, Ecology & Life History)
1. http://ecos.fws.gov/docs/recovery_plan/910815.pdf (pgs. 11-14, 18-24)
2. http://ecos.fws.gov/docs/federal_register/fr1501.pdf (pgs. 2,3)
3. 3 Year Annual Work Plan (mussel and harperella sections)
4. <http://ecos.fws.gov/roar/pub/planImplementationStatus.action?documentId=600306&entityId=1076>
5. **Shale Barren Rock Cress Fact Sheet.** USFWS VA-ES Field Office.
http://www.fws.gov/northeast/virginiafield/pdf/endspecies/fact_sheets/shale%20barren.pdf
6. **USFWS VA-ES Field Office website:**
http://www.fws.gov/northeast/virginiafield/EndSpec_FedAct.html

Virginia Spiraea - T

Other Species Benefitting	
Introduction	Species Information: Virginia spiraea (<i>Spiraea virginiana</i>)- T
Biological Planning	Threats and Threat Assessment: <ol style="list-style-type: none"> 1. Human activity (<i>1.23</i>) <ol style="list-style-type: none"> a. Impoundments <ol style="list-style-type: none"> i. Prohibits downstream motility of propagules ii. Clones are destroyed by rising water b. Road building c. Water-release regulation (erosion control) d. Lack of watershed management e. Uncontrolled development of rivers 2. Biological (<i>1.24</i>) <ol style="list-style-type: none"> a. Deer browse b. Non-native invasive species <ol style="list-style-type: none"> i. Increased competition and loss of habitat
	Population Goal for WVFO: Objectives: The recovery objective is to delist the species by meeting the following conditions: (<i>1.27</i>) <ol style="list-style-type: none"> 1. Any existing or, if possible, a minimum of three stable populations are permanently protected in each drainage system where populations are currently known; 2. A minimum of three stable populations are established or found in each drainage where, although documented vouchers have been collected, the species is not currently known. These populations must also be permanently protected; 3. Potential habitat in all states with present or past collections has been searched for other populations; and, 4. Representative genotypes are cultivated in permanent collections with adequate locality information.
Conservation Design (how to address threats)	Strategies for Addressing the Threats: <ol style="list-style-type: none"> 1. Participate through commenting on and reviewing regulations and best management practices from other agencies, NGOs and industries, with regards to mitigating threats to species and/or habitats of interest 2. Preservation (<i>1.25</i>) <ol style="list-style-type: none"> a. Known populations receive permanent protection b. Efforts towards finding new populations before they become extirpated 3. Understand and extend knowledge (<i>1.25</i>) <ol style="list-style-type: none"> a. Distinguishing genetically different individuals <ol style="list-style-type: none"> i. DNA fingerprints for populations to provide a

	<p style="text-align: center;">guide for (future) genotype preservation and relationship</p> <ul style="list-style-type: none"> b. Environmental factors and tolerances for survival and reproductions <p>4. Manage and Monitor (<i>1.25-26</i>)</p> <ul style="list-style-type: none"> a. Clonal preservation b. Defer intensive management and re-establish <ul style="list-style-type: none"> i. Species' genetic and ecological should first be understood c. Stock of cultivated material should be maintained for experimentation and for re-establishment d. Crossing between native populations and re-established clones should be prevented
<p>Conservation Delivery (implementation – guidance taken from Conservation Design)</p>	<p>The participation in the following delivery items will usually take the form of commentary or recommendations, collaboration, funding, document and design creation, or some other form of work with agencies, NGOs, industries or other stakeholders.</p> <ol style="list-style-type: none"> 1. Influence regulator agency decisions regarding projects that will result in loss of habitat and habitat functions for these species 2. Protect existing populations and essential habitat (<i>1.27-29</i>) <ul style="list-style-type: none"> a. Identify and monitor threats to each existing populations; b. Seek cooperation and active support of private and public landowners; c. Secure permanent protection for all known populations; <ul style="list-style-type: none"> i. Bluestone River ii. Meadow River iii. Gauley River iv. Glen Daniels 3. Conduct range wide searches in areas of suitable habitat for additional populations. (<i>1.29</i>) 4. Conduct site-specific manipulation to maintain existing populations. (<i>1.30</i>) 5. Distinguish between N and n individuals. (<i>1.30</i>) 6. Maintain representative material from each known genotype in permanent cultivation. (<i>1.30</i>) 7. Investigate the species' environmental tolerance and habitat characteristics. (<i>1.31</i>) <ul style="list-style-type: none"> a. Establish baseline environmental determinants; b. May involve monitoring clonal size and distribution and compare the effects of known flow regimes in both disturbed and natural systems; c. Conduct long-term demographic studies. 8. As appropriate, reintroduce in additional drainage systems within the species' historical range. (<i>1.32</i>) <ul style="list-style-type: none"> a. Buckhannon River 9. Evaluate the effectiveness of protection and management programs and redirect efforts as necessary. (<i>1.33</i>) 10. Non-native invasive species management <ul style="list-style-type: none"> a. Limit use of pesticides

	<ul style="list-style-type: none"> b. Eradication of invasive species c. Native restoration <p>11. Deer browsing</p> <ul style="list-style-type: none"> a. Determine if there are measures to reduce the effects of deer browse.
Monitoring	<p>Monitoring efforts from this office will largely consist of the development of plans, securing funding and other support for collaborators who are monitoring priority threats, species or areas.</p> <ul style="list-style-type: none"> 1. After recovery, ascertain the species' long-term status (<i>1.33</i>) 2. Continue regular schedule of monitoring known populations at known sites. (<i>3.c</i>)
Research	<p>The WVFO performs research cooperatively with other agencies, organizations and individuals. If research opportunities arise on the listed subjects of interest, the WVFO will support and assist in the cooperative research effort.</p> <p>For Threats and Threat Assessment:</p> <ul style="list-style-type: none"> 1. Determine if scouring appears necessary to limit competitive species. (<i>3.b</i>) 2. Determine if recreation use impacts sub-populations. (<i>3.b</i>) <p>For Population Goal for WVFO:</p> <ul style="list-style-type: none"> 1. Determine if raised species will survive in natural habitat. (<i>3.e</i>) 2. Determine if introduced clones will eventually result in viable cross pollinated seedlings. (<i>3.e</i>) 3. Determine if reciprocal transplants among populations may be required to restore genetic variations to enable successful reproduction (<i>3.a</i>) 4. Germination rates and viability (<i>3.d</i>) 5. Distinguish genetically different individuals. (<i>1.25</i>)
Outreach	<p>WVFO outreach is primarily done through one-on-one interaction because of limited staffing, and is not able to undertake broadscale outreach efforts.</p> <ul style="list-style-type: none"> 1. WVFO website <ul style="list-style-type: none"> a. Example: NC – Asheville ES Field Office 2. Develop an information packet for landowners and land mangers. (<i>1.32</i>)

References/Literature Cited

1. **Virginia Spiraea: Recovery Plan.** Ogle, Douglas W., DOI – USFWS, Region 5; 13 November 1992. http://ecos.fws.gov/docs/recovery_plan/921113a.pdf
2. **Species Profile for Virginia Spiraea: Map of Species Occurrences.** DOI – USFWS website: <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=Q2R1#recovery>

3. **Comprehensive Species Report: *Spiraea virginiana*. *Management Summary*.** Nature Serve

Explorer: <http://www.natureserve.org/explorer/servlet/NatureServe?init=Species>

- a. Stewardship Overview
- b. Management Requirements
- c. Monitoring Requirements
- d. Management Research Programs
- e. Management Research Needs

4. **Virginia Spiraea Fact Sheet:** USFWS VA-ES Field Office.

http://www.fws.gov/northeast/virginiafield/pdf/endspecies/fact_sheets/va%20spiraea.pdf

5. **Information on Threatened and Endangered Species: *Virginia spiraea*.** USFWS: Asheville Ecological Services Field Office website:

http://www.fws.gov/asheville/htmls/listedspecies/Virginia_spiraea.html

Cheat Mountain Salamander - T

Other Species Benefitting	
Introduction	<p>Species Information:</p> <p><u>Amphibians</u> Cheat Mountain salamander (<i>Plethodon nettingi</i>)- T</p>
Biological Planning	<p>Threats and Threat Assessment:</p> <ol style="list-style-type: none"> 1. Habitat loss <ol style="list-style-type: none"> a. Development of private lands (2.15) b. Human activity (1.10) <ol style="list-style-type: none"> i. logging or road construction c. Natural forces (1.10) <ol style="list-style-type: none"> i. forest fires 2. Habitat modification (1.10-11) <ol style="list-style-type: none"> a. Removal of canopy, foraging cover, or refugia b. Road development c. Ski slopes d. Utility right of ways e. Some wildfires f. Various timber harvesting methods g. Mineral Resource Development h. Wildlife openings i. Insect infestation j. Heavily used trails 3. Habitat (and gene pool) fragmentation (1.10-11) <ol style="list-style-type: none"> a. Roads and trails <ol style="list-style-type: none"> i. Removal of leaf and forest litter leave trails and roads bare 4. Natural (1.11) <ol style="list-style-type: none"> a. Periods of drought b. Natural reduction of canopy trees <ol style="list-style-type: none"> i. storms c. Inter-specific competition 5. Divided populations (1.11) <ol style="list-style-type: none"> a. Subpopulations prevent complete gene flow through original populations 6. Climate Change <ol style="list-style-type: none"> a. Acid precipitation (1.12) <ol style="list-style-type: none"> i. Change in soil pH b. Warmer temperatures (2.20) <ol style="list-style-type: none"> i. Further restrict habitat
	<p>Population Goal for WVFO: (1.15)</p> <ol style="list-style-type: none"> 1. Monitoring of ten populations over a period of ten years showing them to be stable or expanding. <ol style="list-style-type: none"> a. Populations to represent both large and small populations and distributed range-wide

	<p>2. At least 100 extant populations throughout its range are permanently protected</p> <p>Objectives: (1.15)</p> <ol style="list-style-type: none"> 1. To remove the Cheat Mountain salamander from the list of Federally-endangered and threatened species. 2. Sufficient life history information exists to conduct appropriate management as needed. 3. Regular monitoring and management programs are implemented on a continual basis that will extend at least five years beyond the time of delisting.
<p>Conservation Design (how to address threats)</p>	<p>Strategies for Addressing the Threats:</p> <ol style="list-style-type: none"> 1. Participate through commenting on and reviewing regulations and best management practices from other agencies, NGOs and industries, with regards to mitigating threats to species and/or habitats of interest 2. Develop a monitoring program and establish long-term, site specific management strategies. (1.23) <ol style="list-style-type: none"> a. Implement a monitoring program. b. Implement a long-term management program.
<p>Conservation Delivery (implementation – guidance taken from Conservation Design)</p>	<p>The participation in the following delivery items will usually take the form of commentary or recommendations, collaboration, funding, document and design creation, or some other form of work with agencies, NGOs, industries or other stakeholders.</p> <ol style="list-style-type: none"> 1. Influence regulator agency decisions regarding projects that will result in loss of habitat and habitat functions for these species 2. Landscape-level habitat evaluation and restoration of red spruce-northern hardwood habitats. (1.25) 3. Protect occupied habitats. (1.18-20) <ol style="list-style-type: none"> a. Delineate occupied habitats. b. Monitor threats. c. Support opportunities to secure permanent protection for populations (1) d. Protect occupied habitats and <i>P. nettingi</i> populations on public lands. e. Protect occupied habitats and <i>P. nettingi</i> populations on private lands. 4. Define the total range of the species. 5. Assess population characteristics.
<p>Monitoring</p>	<p>Monitoring efforts from this office will largely consist of the development of plans, securing funding and other support for collaborators who are monitoring priority threats, species or areas.</p> <ol style="list-style-type: none"> 1. Fund, design and support agency efforts for monitoring, advocating for: <ol style="list-style-type: none"> a. Monitoring of benchmark populations should be

	<p>established on regular basis.</p> <ol style="list-style-type: none"> b. Conducting surveys at existing sites to determine status of population and any changed to habitat. c. Monitoring and evaluation should occur at apparently declining populations to determine exact cause of decline. d. Monitoring known populations to determine their status, territoriality, home range, environmental changes, and competitive pressures.. e. Survey additional areas within the known range to gain additional information about the species' distribution and abundance. f. Continuation of searches for new populations in areas of known range. (1.24)
<p>Research</p>	<p>The WVFO performs research cooperatively with other agencies, organizations and individuals. If research opportunities arise on the listed subjects of interest, the WVFO will support and assist in the cooperative research effort.</p> <p>For Threats and Threat Assessment:</p> <ol style="list-style-type: none"> 1. Pollution (1.12) <ol style="list-style-type: none"> a. Acid precipitation and effects on soil pH tolerance of species. 2. Genetic studies completed to look at genetic diversity across the species' range. (1.24) 3. Conduct long-term studies to monitor movements across roads and trails. (3.5E-39) 4. Determine the effects of human-induced habitat alterations. <p>For Population Goal for WVFO:</p> <ol style="list-style-type: none"> 1. Viability of known populations (1.13) 2. Define what constitutes a <i>P. nettingi</i> population (1.24) 3. Characterize habitat parameters. (1.20-21) <ol style="list-style-type: none"> a. Ascertain variables associated with "quality" habitats. b. Determine effect of habitat alterations. c. Determine habitat parameters common to large populations. d. Compare elevation disparity between northern and southern populations. 4. Conduct other studies of ecology and life history. (1.22) <ol style="list-style-type: none"> a. Determine biological factors such as reproductive biology, growth rates, and genetic variability among populations. b. Determine food items. c. Identify significance of interspecific competition. d. Determine reproductive biology. e. Identify any phenotypic variability among populations. f. Conduct other ecological studies.

<p>Outreach</p>	<p>WVFO outreach is primarily done through one-on-one interaction because of limited staffing, and is not able to undertake broadscale outreach efforts.</p> <ol style="list-style-type: none"> 1. WVFO website 2. USFWS-CVNWR 3. Formation of a Cheat Mountain salamander working group or formal recovery team 4. Continue cooperation with USFS to protect salamander sites on the Forest and maintain forest plan strategies. (3.5E-39) <ol style="list-style-type: none"> a. May include re-routing hiking trails or closure of forest roads. 5. Discourage the public from removing salamanders from the wild. (3.5E-40) <ol style="list-style-type: none"> a. Law Enforcement Officer 6. Coordinate with project developers and landowners to address impacts of second-home development, timbering, road/trail construction or other projects detrimental to habitat. (3.5E-39) 7. Develop an education and information program. (1.24) <ol style="list-style-type: none"> a. Develop training and awareness programs for government agencies. b. Release educational information to the general public.
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References/Literature Cited

1. **Cheat Mountain Salamander: Recovery Plan.** Pauley, Thomas K., DOI – USFWS, Region 5; 25 July 1991. http://ecos.fws.gov/docs/recovery_plan/910725.pdf
2. **Cheat Mountain Salamander 5-Year Review: Summary and Evaluation.** DOI – USFWS, WVFO; September 2009. http://ecos.fws.gov/docs/five_year_review/doc3267.pdf
3. **West Virginia State Wildlife Conservation Action Plan.** West Virginia Division of Natural Resources; Wildlife Resources Section. <http://www.wvdnr.gov/Wildlife/PDFFiles/wvwcap.pdf> pg 716
4. **WV Wildlife Diversity Notebook: Cheat Mountain Salamander.** http://www.wvdnr.gov/wildlife/magazine/Archive/05Summer/wildlife_diversity_salamander.shtm

Diamond Darter - C

Other Species Benefitting	
Introduction	Species Information: Diamond darter (<i>Crystallaria cincotta</i>) - C
Biological Planning	Threats and Threat Assessment: <ol style="list-style-type: none"> 1. Habitat destruction/modification (2) <ol style="list-style-type: none"> a. Development, loss of riparian vegetation, poor management of logging and agriculture, road building/maintenance (3) b. Range has been reduced by 90%+ (5) c. Stream dredging, dam building, reservoirs (3) 2. Water Quality degradation (2) <ol style="list-style-type: none"> a. Nutrient load/sewage (2) b. Pesticide/herbicide runoff (3) c. Pollution, wastewater releases, algal blooms (3) d. Nutrient loads, increased sewage (3) 3. Mineral Resource Development (1,2) <ol style="list-style-type: none"> a. Water acidification (3) b. Marcellus shale (3) 4. Siltation/sedimentation (2) 5. Population Viability <ol style="list-style-type: none"> a. Genetic limitations/inbreeding (1,2) 6. Overutilization for scientific purposes (1) 7. Climate Change <ol style="list-style-type: none"> a. Drought (3) b. Water acidification (3) c. Extreme weather events (3)
	Population Goal for WVFO: <ol style="list-style-type: none"> 1. Reduce risk of extinction due to habitat-based threats. (2) Objectives: <ol style="list-style-type: none"> 1. Obtain listing for the Diamond Darter as Endangered. 2. The continued presence of the diamond darter within the Elk River watershed, as documented through surveys or other monitoring efforts. (2) 3. Reducing habitat-based threats to the diamond darter through actions that protect its range. (2)
Conservation Design (how to address threats)	Strategies for Addressing the Threats: <ol style="list-style-type: none"> 1. Propose having the Diamond Darter listed as endangered. 2. Participate through commenting on and reviewing regulations and best management practices from other agencies, NGOs and industries, with regards to mitigating threats to species and/or habitats of interest 3. Habitat destruction/modification (2) <ol style="list-style-type: none"> a. Design Service habitat restoration/enhancement projects to benefit these species

	<ul style="list-style-type: none"> b. Identify money and partnerships to protect and improve habitat. c. Form additional partnerships to facilitate designing additional projects, zoning for projects (private land, industry, transportation, forestry, agriculture, etc.) (3) d. Create a comprehensive watershed program (3) e. Section 7 consultations. <ul style="list-style-type: none"> 4. Water quality degradation (2) <ul style="list-style-type: none"> a. Identify impacts throughout watershed, seek watershed-wide conservation measures (3) b. DOI Natural Resource Damage Assessment and Restoration Program <ul style="list-style-type: none"> 5. Mineral resource development (2) <ul style="list-style-type: none"> a. Review permitting regulations and environmental safety regulations (3) b. Collaborate with other agencies to locate and appropriately address abandoned mines and wells (3) c. Work with partners to reduce habitat-based threats, focusing on the threats of coal mining, oil and gas development, and direct habitat alterations. (2) <ul style="list-style-type: none"> 6. Siltation/sedimentation (2) <ul style="list-style-type: none"> a. Developed enhanced erosion and sediment control. <ul style="list-style-type: none"> 7. Population Viability 8. Overutilization for scientific purposes (1) 9. Inadequacy of current regulatory mechanisms (3) 10. Climate Change <ul style="list-style-type: none"> a. Coordinate with states and other partners to apply tools to guide management responses to climate impacts.
<p>Conservation Delivery (implementation – guidance taken from Conservation Design)</p>	<p>The participation in the following delivery items will usually take the form of commentary or recommendations, collaboration, funding, document and design creation, or some other form of work with agencies, NGOs, industries or other stakeholders.</p> <ul style="list-style-type: none"> 1. List the diamond darter as endangered. 2. Influence regulator agency decisions regarding projects that will result in loss of habitat and habitat functions for these species 3. Habitat destruction/modification (2) <ul style="list-style-type: none"> a. Implement service habitat restoration/enhancement projects to benefit the darter. b. Leverage money and partners to protect and improve habitat c. Inform stakeholders of governmental programs available for assistance/cost share (3) <ul style="list-style-type: none"> i. Reduction of nutrient load ii. Livestock exclusion a. Protect drainage system upstream from perturbations from mining, dams, construction and agriculture (3) d. Restoration of watershed vegetation (3) e. Use natural stream channel design (3) f. Remove or remodel dams and other water control methods

	<p>(3)</p> <ol style="list-style-type: none"> 4. Water quality degradation (2) <ol style="list-style-type: none"> a. Work with agencies to identify sources of water quality degradation and address them. (3) b. Support nutrient management (fencing, livestock exclusion, nutrient management plan) 5. Mineral resource development (2) <ol style="list-style-type: none"> a. Work with partners to reduce habitat-based threats, focusing on the threats of coal mining, oil and gas development, and direct habitat alterations. (2) 6. Siltation/sedimentation (2) <ol style="list-style-type: none"> a. Stream bank stabilization (3) b. Restoration of watershed vegetation (3) c. Livestock exclusion (3) 7. Population viability <ol style="list-style-type: none"> a. Assist/encourage in the development and maintenance of a captive-held “ark population” in order to avert potential extinction in the event of a major spill event on the Elk River. (2) b. Re-establish species in Elk River, historical range. 11. Overutilization for scientific purposes (1) 12. Inadequacy of current regulatory mechanisms (3) <ol style="list-style-type: none"> a. Work to get species listed as endangered. b. Inform public about species and recovery needs (3) 13. Climate change <ol style="list-style-type: none"> a. Habitat restoration (3)
<p>Monitoring</p>	<p>Monitoring efforts from this office will largely consist of the development of plans, securing funding and other support for collaborators who are monitoring priority threats, species or areas.</p> <ol style="list-style-type: none"> 1. Adaptive management 2. Develop and implement a program to regularly monitor diamond darter populations and habitat quality within Elk River. (2) 3. Search for additional darter populations. (2) 4. Watershed monitoring to prevent point/non-point source pollution (illegal dumping, improper waste disposal, sinkholes (3)
<p>Research</p>	<p>The WVFO performs research cooperatively with other agencies, organizations and individuals. If research opportunities arise on the listed subjects of interest, the WVFO will support and assist in the cooperative research effort.</p> <p>For Threats and Threat Assessment:</p> <ol style="list-style-type: none"> 1. Quantify effects of <ol style="list-style-type: none"> a. Coal, oil and gas development on species (2) b. Sedimentation and siltation on species (3) c. Common contaminants on species (3) 2. Nutrient loading effects and locations (3)

	<ol style="list-style-type: none"> 3. Degradation of watershed functions in headwaters (3) 4. Use tools related to climate change effects on stream temp, hydrology, acidity, etc. (3) <p>For Population Goal for WVFO:</p> <ol style="list-style-type: none"> 1. Support research on developing propagation technology (3) 2. Estimate effective population size (2) <ol style="list-style-type: none"> a. Model population viability (3) b. Genetics research (3) 3. Life history, habitat requirements (2) <ol style="list-style-type: none"> c. Larval stage piscivory
Outreach	<p>WVFO outreach is primarily done through one-on-one interaction because of limited staffing, and is not able to undertake broadscale outreach efforts.</p> <ol style="list-style-type: none"> 1. WVFO website <ol style="list-style-type: none"> a. Example: Ohio Department of Natural Resources, Division of Wildlife website b. Add diamond darter videos 2. Target landowners in Elk River watershed to highlight the importance of the Elk River, the diamond darter and the need to maintain high water quality (2) 3. Create a Flickr to share photos and information with the public.

References/Literature Cited

1. http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=2009_register&doc id=fr09no09-23
2. http://ecos.fws.gov/docs/action_plans/doc3080.pdf (pgs. 1-5)
3. 3 Year Annual Work Plan (mussel and harperella sections)
4. <http://www.fish.state.pa.us/education/catalog/darters.html>
5. <http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Crystallaria+cincotta> (Conservation status, Management Summary, Ecology & Life History)
6. **Diamond Darter Fact Sheet.** USFWS. http://www.fws.gov/northeast/pdf/DiamondDarter_1010.pdf
7. **Diamond Darter.** ODNR Division of Wildlife website: http://www.dnr.state.oh.us/Home/species_a_to_z/SpeciesGuideIndex/diamonddarter/tabid/21831/Default.aspx

Madison Cave Isopod - T

Other Species Benefitting	
Introduction	Species Information: Madison Cave isopod (<i>Antrolana lira</i>) - T
Biological Planning	Threats and Threat Assessment: <ol style="list-style-type: none"> 1. Population Viability <ol style="list-style-type: none"> a. Small population size (<i>I</i>) b. Low reproductive potential as a species (<i>I</i>) c. Results in vulnerability to perturbation (<i>I</i>) 2. Groundwater Degradation <ol style="list-style-type: none"> a. Urban and agricultural development (<i>I</i>) b. Poultry farms (<i>I</i>) c. Mineral Resource Development 3. Habitat destruction <ol style="list-style-type: none"> a. Urban/commercial development, transportation, agriculture (<i>I</i>) 4. Recreation <ol style="list-style-type: none"> a. Potential for disturbance from caving activities (small potential) (<i>I</i>)
	Population Goal for WVFO: <ol style="list-style-type: none"> 1. Populations of <i>Antrolana lira</i> and groundwater quality are shown to be stable over a ten-year monitoring period (<i>1</i>) Objectives: (information from Recovery Plan, etc.) <ol style="list-style-type: none"> 1. De-list Madison Cave isopod (<i>I</i>) <ol style="list-style-type: none"> a. Protect isopod from potential threats to quality of habitat. 2. Protect the recharge zone of the deep karst aquifer at each of the population sites from all significant contamination sources (<i>I</i>) 3. Sufficient population sites are protected to maintain the genetic diversity of the species. (<i>I</i>)
Conservation Design (how to address threats)	Strategies for Addressing the Threats: <ol style="list-style-type: none"> 1. Continue development of the Madison Cave isopod guidelines to protect populations in both West Virginia and Virginia. 2. Participate through commenting on and reviewing regulations, least-impact and best management practices from other agencies, NGOs and industries, with regards to mitigating threats to species and/or habitats of interest 3. Population Viability <ol style="list-style-type: none"> a. Study life history and population dynamics (<i>I</i>) b. Genetic research (<i>3</i>) 4. Groundwater degradation <ol style="list-style-type: none"> a. Identify potential sources and entry points of contamination for deep karst aquifer habitat. (<i>I</i>) b. Protect known populations and habitats, taking a watershed perspective. (<i>I</i>) c. Monitor land use practices to determine pollution sources (<i>I</i>)

	<p>5. Habitat Destruction</p> <p>a. Identify money and partnerships to protect habitat. (3)</p>
<p>Conservation Delivery (implementation – guidance taken from Conservation Design)</p>	<p>The participation in the following delivery items will usually take the form of commentary or recommendations, collaboration, funding, document and design creation, or some other form of work with agencies, NGOs, industries or other stakeholders.</p> <ol style="list-style-type: none"> 1. Implement Guidelines developed to protect Madison Cave Isopod populations in both West Virginia and Virginia. 2. Influence regulator agency decisions regarding projects that will result in loss of habitat and habitat functions for these species 3. Groundwater degradation: <ol style="list-style-type: none"> a. Work with agencies to identify sources of groundwater degradation and address them. (3) b. Establish cooperative program between public and private entities to maintain or enhance groundwater quality (1) <ol style="list-style-type: none"> i. Support the efforts of Forest Stewardship Programs (1) c. Avoiding the use of pesticides in and around established habitats (1) d. Restricting/reducing the discharge of hazardous materials (from poultry farms and cropland) entering lakes, streams, rivers, etc. (1) e. Minimizing construction and land use changes within the species' habitat range (1) 4. Habitat destruction <ol style="list-style-type: none"> a. Inform stakeholders of governmental programs available for assistance/cost-share (3) 5. Recreation (caving)
<p>Monitoring</p>	<p>Monitoring efforts from this office will largely consist of the development of plans, securing funding and other support for collaborators who are monitoring priority threats, species or areas.</p> <ol style="list-style-type: none"> 1. Implement a program to monitor progress of the recovery plan. (1) 2. Fund monitoring of populations of Madison Cave Isopod.
<p>Research</p>	<p>The WVFO performs research cooperatively with other agencies, organizations and individuals. If research opportunities arise on the listed subjects of interest, the WVFO will support and assist in the cooperative research effort.</p> <p>For Threats and Threat Assessment: Research needed:</p> <ol style="list-style-type: none"> 1. Determine sources and entry points of contamination for karst habitats (1)

	<p>For Population Goal for WVFO:</p> <ol style="list-style-type: none"> 1. Collect baseline ecological data relevant to management and recovery. (I) <ol style="list-style-type: none"> a. Population size, trends, number of populations b. Feeding habits c. Life history d. Habitat requirements (temperature range, pH, etc.) e. Habitat attributes (aquifer sizes, locations) <ol style="list-style-type: none"> i. Could use dye tracing to determine aquifer size, groundwater recharge range (I) 2. Population Viability <ol style="list-style-type: none"> a. Model population viability, determine viable population size 3. Determine the number of genetic populations of <i>A. lira</i>. (I) 4. Search for other populations (I) 5. Determine effects of local quarrying activities, if any.
<p>Outreach</p>	<p>WVFO outreach is primarily done through one-on-one interaction because of limited staffing, and is not able to undertake broadscale outreach efforts.</p> <ol style="list-style-type: none"> 1. WVFO website <ol style="list-style-type: none"> a. Example: USFWS VA-ES Field Office website and fact sheet

References/Literature Cited

1. http://ecos.fws.gov/docs/recovery_plan/960930d.pdf (pg. 13-20)
2. http://ecos.fws.gov/docs/federal_register/fr483.pdf (pg. 66410)
3. 3 Year Annual Work Plan (mussel and harperella sections)
4. **WV Wildlife Diversity Notebook: Madison Cave Isopod.**
<http://www.wvdnr.gov/Wildlife/Magazine/Archive/05Fall/madison.pdf>
5. **USFWS VA-ES Field Office website:**
http://www.fws.gov/northeast/virginiafield/EndSpec_FedAct.html
6. **Madison Cave Isopod Fact Sheet.** USFWS VA-ES Field Office.
http://www.fws.gov/northeast/virginiafield/pdf/endspecies/Fact_Sheets/madison%20cave%20isopod.pdf

American Eel-P

Other Species Benefitting	Tributary spawning species, redhorse/white suckers, walleye (1.1) Completion of the eelways may also increase the abundance of freshwater mussel species such as <i>Elliptio complanata</i> in the upper Potomac River. (4)
Introduction	Species Information: American eel (<i>Anguilla rostrata</i>)—Petitioned for Listing
Biological Planning	Threats and Threat Assessment: <ol style="list-style-type: none"> 1. Barriers to riverine movement and upstream habitat access (1.1) <ol style="list-style-type: none"> a. Can also increase stress and predation (3) b. Ten dams impede eel passage within the Potomac River Watershed. (3) 2. Habitat degradation and alteration (1.1) (2) 3. Access to tributaries (2) 4. Contaminants (1.1) <ol style="list-style-type: none"> a. Mortality, changes in behavior, and decreases in fecundity. (2) 5. Parasitism (1.1) 6. Climate change- potential to affect ocean currents and dispersal of larval eel (1.1) 7. Population viability <ol style="list-style-type: none"> a. Lengthy time period before sexual maturity (2)
	Population Goal for WVFO: <ol style="list-style-type: none"> 1. Protect and enhance the abundance of American eel and contribute to the viability of the American eel spawning population. (2) 2. Provide for sustainable commercial, subsistence, and recreational fisheries by preventing overharvest of any eel life stage. (2) Objectives: <ol style="list-style-type: none"> 1. Enhance/maintain American eel populations in West Virginia. (1.1) 2. Maintenance of American eel as a self-sustaining component of the fish community through reducing all sources of mortality and facilitate upstream passage at impediments. (1.2) 3. Protect and enhance American eel abundance in all watersheds where eel now occur. (2) 4. Where practical, restore American eel to those waters where they had historical abundance but may now be absent. (2)
Conservation Design (how to address threats)	Strategies for Addressing the Threats: <ol style="list-style-type: none"> 1. Participate through commenting on and reviewing regulations and best management practices from other agencies, NGOs and industries, with regards to mitigating threats to species and/or habitats of interest 2. Address barriers to riverine movement and upstream habitat access by: (1.2,1. 3)

	<ul style="list-style-type: none"> a. Barrier mitigation and habitat restoration/enhancement. <ul style="list-style-type: none"> i. The Service is restoring populations of American eel in the Potomac River Watershed by working to install upstream and downstream eel passage structures and eelways on dams. (4) b. Provide technical assistance on stream restoration projects in the watershed; target Service habitat restoration and enhancement projects to benefit American eel; preserve, restore and/or enhance streams known to support American eels c. Seeking to minimize loss of habitat by influencing regulatory agency decisions regarding projects that might result in degradation of habitat function. <p>3. Address habitat degradation and alteration (1.3)</p> <ul style="list-style-type: none"> a. Facilitate habitat preservation through coordination with listed partners. <p>4. Address potential contaminants issues: (1.3)</p> <ul style="list-style-type: none"> a. Identify impacts throughout watershed, seek watershed-wide conservation measures (3) b. Seeking to minimize loss of habitat by influencing regulatory agency decisions regarding projects that might result in degradation of habitat function. c. Develop regulations and best management practices for land use change/impacts on water (3) <p>5. Parasitism (1.3)</p> <p>6. Climate change- (1.3)</p> <ul style="list-style-type: none"> a. Coordinate with states and other partners to apply tools to guide management responses to climate impacts.
<p>Conservation Delivery (implementation – guidance taken from Conservation Design)</p>	<p>The participation in the following delivery items will usually take the form of commentary or recommendations, collaboration, funding, document and design creation, or some other form of work with agencies, NGOs, industries or other stakeholders.</p> <p>On the ground actions using strategies to address threats (1.4)</p> <ul style="list-style-type: none"> 1. Seek to minimize loss of habitat by influencing regulatory agency decisions regarding wetland draining and stream relocation, modifications, including bulk heading; dams; and “unnatural” erosion mitigation practices, agricultural practices that diminish stream and wetland values for wildlife, dredging and placement of fill in streams and wetlands. (1.3) 2. Address barriers to riverine movement and upstream habitat access by barrier mitigation and habitat restoration/enhancement. (1.4) 3. Contaminants <ul style="list-style-type: none"> a. Assess the response of the American Eel to water contaminants (2)
<p>Monitoring</p>	<p>Monitoring efforts from this office will largely consist of the development of plans, securing funding and other support for collaborators who are monitoring priority threats, species or areas.</p>

	<ol style="list-style-type: none"> 1. Adaptive management (1.4) 2. Monitoring to measure success of up and down-stream passages (1.4) 3. Investigate potential barrier removals and available habitat both pre- and post-removal (1.4)
<p>Research</p>	<p>The WVFO performs research cooperatively with other agencies, organizations and individuals. If research opportunities arise on the listed subjects of interest, the WVFO will support and assist in the cooperative research effort.</p> <p>For Threats and Threat Assessment:</p> <ol style="list-style-type: none"> 1. Determine genetic diversity of WV population (1.2) 2. Enumeration of upstream migrating eel at the existing eel ladders serves as an indicator of year class strength. (1.2) (2) 3. Increase understanding of factors affecting eel population dynamics and life history through increased research and monitoring. (2) 4. Investigate the abundance level of eel at the various life stages, necessary to provide adequate forage for natural predators and support ecosystem health and food chain structure. (2) <p>Recommended research by the ASMFC (2):</p> <ol style="list-style-type: none"> 1. Investigate growth rates for males and females throughout their range; habitat preferences of males and females; predator-prey relationships; behavior and movement of American eel during their freshwater residency 2. Evaluate contaminant effects on American eel and the effects of bioaccumulation with respect to impacts by age on survival and growth and effect on maturation and reproductive success. 3. Determine growth rates of male and female American eel in different habitats. 4. Determine if geographic sub-populations exist, which may have implications for management. 5. Evaluate the impact, both upstream and downstream, of barriers on American eel with respect to population and distribution affects. Determine areas of extirpation and historical distribution. 6. Investigate, develop, and improve technologies for American eel passage upstream and downstream. 7. Evaluate the ecosystem importance of American eels as prey, predators, and mechanisms of transporting freshwater biomass to marine systems. 8. Determine fecundity-length and fecundity-weight relations for female American eel from various parts of its geographic range. 9. Identification and understanding of American eel habitat needs for all life stages 10. Model the effect of increased habitat availability and reductions in mortality at various freshwater life stages on escapement. 11. Research techniques (physical and behavioral) for providing upstream and downstream passage around dams

	12. Quantify and assess male eel habitat and male eel abundance
Outreach	<p>WVFO outreach is primarily done through one-on-one interaction because of limited staffing, and is not able to undertake broadscale outreach efforts.</p> <ol style="list-style-type: none"> 1. WVFO website <ol style="list-style-type: none"> a. USFWS Northeast Region newsroom and facts 2. Attend meetings to fully understand other organization/agencies efforts towards American eel restoration and to assist in further advancing efforts – low priority

References/Literature Cited

1. NYFO American Eel Recovery Plan
2. Interstate Fishery Management Plan for American Eel, April 2000 (pgs. iv, v, 9-10, 21, 36, 38, 42, 44, 46-47, 51, 53-54, 59, 62-65)
3. 3 Year Annual Work Plan (mussel and harperella sections)
4. Draft Potomac Eel Fact Sheet
5. **American Eel Fact Sheet.** MIT, June 2006.
<http://massbay.mit.edu/seafood/americaneel.pdf>
6. **USFWS Northeastern Region Newsroom: Facts about American Eel.**
<http://www.fws.gov/northeast/newsroom/facts.html>
7. **USFWS Northeastern Region Newsroom: American Eel.**
<http://www.fws.gov/northeast/newsroom/eels.html>

Brook Trout-NL

Other Species Benefitting	American eel, American shad, longtail salamander, hellbender, wood turtle (1.1)
Introduction	<p>Species Information:</p> <p>Brook trout (<i>Salvelinus fontinalis</i>)—Not Listed</p>
Biological Planning	<p>Threats and Threat Assessment:</p> <ol style="list-style-type: none"> 1. Loss of habitat and habitat function; habitat degradation and alteration- nutrients, sediment, development/clearing of riparian zone (medium/low threat, agriculture (medium threat), and urbanization. (1.2) <ol style="list-style-type: none"> a. Overlap of habitat with mining operations 2. Barriers to migration, including dams and impassable culverts (1.2) 3. Affect from burning mining byproducts (2) 4. Overfishing (2) 5. Competition from non-native salmonids (rainbow, brown trout) (1.3) 6. Climate change; increased water temperatures (1.3) <ol style="list-style-type: none"> a. Regional climate changes (2) 7. Acid precipitation (2)
	<p>Population Goal for WVFO:</p> <ol style="list-style-type: none"> 1. Increase population productivity through habitat improvement within intact watersheds (i.e., expand on core populations). (2) 2. Secure long-term stability of intact populations <p>Objectives:</p> <ol style="list-style-type: none"> 1. Implement statewide strategies that protect, restore, and enhance healthy brook trout populations in West Virginia. (2) 2. Eliminate threats and secure long-term protection of intact brook trout habitats. (2)\ 3. Re-establish self-sustaining brook trout populations in currently “extirpated” watersheds. (2)
Conservation Design (how to address threats)	<p>Strategies for Addressing the Threats:</p> <ol style="list-style-type: none"> 1. Participate through commenting on and reviewing regulations and best management practices from other agencies, NGOs and industries, with regards to mitigating threats to species and/or habitats of interest 2. Loss of habitat (1.3) <ol style="list-style-type: none"> a. Target Service habitat restoration and enhancement projects to benefit brook trout. (1.3) <ol style="list-style-type: none"> i. Add enhancements to natural stream design projects, including planting trees and shrubs to provide shade for water temperature control ii. Promote habitat restoration projects which also

	<ul style="list-style-type: none"> <ul style="list-style-type: none"> <ul style="list-style-type: none"> control sediment entering streams iii. Provide technical assistance on stream restoration projects via natural stream design in the watershed b. Seek to minimize loss of habitat function when habitat is degraded by adjacent land uses by influencing regulatory agencies and landowners decisions. (1.3) 3. Barriers to migration, including dams and impassable culverts. (1.4) <ul style="list-style-type: none"> a. Working with partners, identify barriers for removal utilizing dam removal funds and seek other sources of funding. (1.4) b. Recommend installation of culverts, the modification of which would improve wildlife passage. c. Work with WVDOH projects that seek to correct bridge abutment undermining by stream erosion, by designing and constructing natural stream design features that will change stream bottom elevation and facilitate fish passage. b. For dam and culvert removal and re-design, work to identify stream barriers for removal or restoration to increase fish passage. (1.4) 4. Mineral resource development <ul style="list-style-type: none"> a. Identify affects from acid precipitaion as a result of surface mining on historial populations and habitats b. SEE : Coal Surface Mining section 5. Competition from non-native salmonids (1.4) <ul style="list-style-type: none"> a. Target Service natural stream design stream restoration projects that support brook trout. b. Support the cessation of stocking exotic salmonids. 6. Climate change; increased water temperatures (1.4) <ul style="list-style-type: none"> a. Coordinate with states and other partners to apply tools to guide management responses to climate impacts. 7. Establish baseline benchmarks for success <ul style="list-style-type: none"> a. Stream temperatures b. Fish populations c. Habitat restoration
<p>Conservation Delivery (implementation – guidance taken from Conservation Design)</p>	<p>The participation in the following delivery items will usually take the form of commentary or recommendations, collaboration, funding, document and design creation, or some other form of work with agencies, NGOs, industries or other stakeholders.</p> <ul style="list-style-type: none"> 1. Seek to minimize loss of habitat by influencing regulatory agency decisions regarding wetland draining and stream relocation, modifications, including bulk heading; dams; and “unnatural” erosion mitigation practices, agricultural practices that diminish stream and wetland values for wildlife, dredging and placement of fill in streams and wetlands. (1.3) 2. Re-establish self-sustaining brook trout populations in currently “extirpated” watersheds. (2) <ul style="list-style-type: none"> a. Restore watersheds where temperature and habitat conditions are such that reintroduction of brook trout is

	<p>feasible;</p> <ul style="list-style-type: none"> b. Reintroduce genetically appropriate source populations c. Work with landowners and local communities to provide for long term protection of brook trout habitats and populations in re-established watersheds. <p>3. Loss of habitat (1.4)</p> <ul style="list-style-type: none"> a. Expansion and integration of state, federal and private programs that support riparian zone conservation along brook trout streams (e.g., CREP, WHIP, Partners for Fish and Wildlife, and state, county, and private conservation programs). This should include efforts to integrate alternative mitigation programs. (2) b. Implementation of brook trout specific BMPs for activities that produce non-point source pollutants (e.g., sediments and nutrients) on state, federal, and private lands. (2) c. Target Service habitat restoration and enhancement projects to benefit brook trout (1.4) d. Elimination of acidification threats through “at-source” reductions of acid loads. (2) e. Add enhancements to natural stream design projects, including planting trees and shrubs to provide shade for water temperature control f. Facilitate habitat preservation through coordination with land trusts or NGOs (1.4) g. Preserve, restore and/or enhance streams known to support heritage strains of brook trout (1.3) h. Promote habitat restoration projects which also control sediment entering streams (1.4) i. Provide technical assistance on stream restoration projects via natural stream design in the watershed. (1.4) <p>4. Mineral resource development</p> <ul style="list-style-type: none"> a. Remediate acid mining impacts in drainage systems <p>5. Barriers to migration, including dams and impassable culverts. (1.4)</p> <p>6. Reduce competition from non-native salmonids. (1.4)</p> <p>7. Climate change; increased water temperatures. (1.4)</p> <ul style="list-style-type: none"> a. Target Service habitat restoration and enhancement projects to benefit brook trout. b. Add enhancements to natural stream design projects, including planting trees and shrubs to provide shade for water temperature control
<p>Monitoring</p>	<p>Monitoring efforts from this office will largely consist of the development of plans, securing funding and other support for collaborators who are monitoring priority threats, species or areas.</p> <ul style="list-style-type: none"> 1. Adaptive management 2. Monitor benchmarks for success. (1.6)

<p>Research</p>	<p>The WVFO performs research cooperatively with other agencies, organizations and individuals. If research opportunities arise on the listed subjects of interest, the WVFO will support and assist in the cooperative research effort.</p> <p>For Threats and Threat Assessment:</p> <ol style="list-style-type: none"> 1. Establish sampling protocols and facilitate access to data. (2) 2. Assess current population and habitat conditions.(2) 3. Identify threats and factors limiting brook trout populations. (2) 4. Conduct surveys to determine current population levels and presence/absence. (1.2) <ol style="list-style-type: none"> a. Work with DNR and WVU to assist with brook trout surveys to determine presence/absence and population densities, coupled with habitat investigation. 5. Determine genetic diversity of brook trout in the watershed (1.2) <ol style="list-style-type: none"> a. Quantify genetic variability and identify genetically unique brook trout populations. (2) 6. Loss of habitat and habitat function (1.2) <ol style="list-style-type: none"> a. Need to fund more extensive and frequent streams surveys to determine population size. b. Survey streams for targeted brook trout spawning habitat restoration. c. Evaluate habitat requirements including water quality and other stream characteristics and create a profile for WV brook trout waters d. Need to undertake suitable habitat investigation and mapping (substrate, water temp/quality, instream cover, riparian cover, etc) 7. Determine genetics of WV populations 8. Barriers to migration (1.2). <ol style="list-style-type: none"> a. Identify barriers having an influence on brook trout distribution 9. Competition from non-native salmonids (1.3) <ol style="list-style-type: none"> a. Need to assess impact of competition from stocked and/or naturally reproducing non-native salmonids. Competition/interbreeding with stocked brook trout b. Determine genetic diversity of brook trout in the watershed. 10. Climate change; increased water regimes(1.3) <ol style="list-style-type: none"> a. Identification of climate change related impacts to brook trout.
<p>Outreach</p>	<p>WVFO outreach is primarily done through one-on-one interaction because of limited staffing, and is not able to undertake broadscale outreach efforts.</p> <ol style="list-style-type: none"> 1. WVFO website <ol style="list-style-type: none"> a. Developing fact sheets and best management practices to minimize impacts to brook trout from a suite of different construction activities (1) b. Posting these fact sheets/BMPs on our website (1)

	<ul style="list-style-type: none"> c. Writing substantive comments on proposed Federal agency actions with likely adverse impacts on brook trout (1) d. Developing a poster which targets brook trout conservation e. Provide recommendations on culvert design (1) f. Develop stream buffer guidelines/BMPs and post on website (1) g. WVDNR website h. Eastern Brook Trout Joint Venture website <ul style="list-style-type: none"> 2. Create ongoing communications plan to reach targeted audiences to increase awareness of brook trout and the conditions they represent. (2) 3. Seek funding and support for monitoring needs.

References/Literature Cited

1. NYFO Brook Trout recovery plan
2. http://www.easternbrooktrout.org/docs/EBTJV_WestVirginia_CS.pdf
3. **Fish Facts: Brook Trout.** Maryland Department Natural Resources, April 2007. <http://www.dnr.state.md.us/fisheries/fishfacts/brooktrout.asp>
4. **Go Native: Brook Trout.** West Virginia Department of Natural Resources website: <http://www.wvdnr.gov/Wildlife/BTrout.shtm>
5. **Eastern Brook Trout: Roadmap to Restoration.** Eastern Brook Trout Joint Venture. http://www.easternbrooktrout.org/docs/EBTJV_RoadmapToRestoration_FINAL.pdf

American Black Duck-NL

Other Species Benefitting	American Bittern, Bald Eagle, , Waterfowl (Canvasback, Hooded Merganser, Greater and Lesser Scaup, Wood Duck) (I.1)
Introduction	<p>Species Information:</p> <p>American Black Duck (<i>Anas rubripes</i>)—Not Listed</p> <p>The American Black Duck nests in West Virginia’s high elevation wetland complexes like Canaan Valley and winters in lower elevation spring creeks in West Virginia’s eastern panhandle and on the Ohio and Kanawha Rivers. Black duck breeds in a variety of North American Wetlands, including freshwater wetlands created by beaver (<i>Castor canadensis</i>); brooks lined by speckled alder (<i>Alnus incana</i>); lakes, ponds and bogs throughout mixed hardwood and boreal forests, and salt marshes. Migrants eat seeds, foliage and tubers of aquatic plants, seeds and fruits of terrestrial species, a variety of invertebrates, agricultural grains and occasionally fish and amphibians. (I.1)</p> <p>Justification for species selection: The species is a Species of Concern and is located in West Virginia.</p> <p>The black duck was chosen as a priority species because of its importance in the northeast as well as in West Virginia. The black duck is rated High-High in the Bird Conservation Plan for the ATLANTIC Flyway (USFWS). The high continental concern and precipitous decline in the Northeast makes freshwater wetlands and their relationship to local agriculture a key conservation concern. (I.1)</p>
Biological Planning	<p>Threats and Threat Assessment:</p> <ol style="list-style-type: none"> 1. Loss of habitat: Loss of sufficient quality/quantity habitat within the basin due to water level alterations, draining, dredging, filling, pollution (including CSOs), acid rain, agricultural practices, siltation and invasive species. (I.1) 2. Loss of habitat function (values diminished) (I.2) 3. Invasive Species (I.2) 4. Public use (recreational disturbances) (I.2) 5. Disease, contaminants (I.2) 6. Overharvest (I.2) 7. Nest predation (I.2) 8. Hybridization with mallards (I.2) 9. Changes in habitat community structure (less runoff under most existing climate change models that will result in lower water levels in the region) (I.2) 10. Changes in prey base during breeding season. (I.2) <p>Partners/Potential Funding: Congress; State agencies, NGOs, academia, other Federal agencies</p>

	<p>Population Goal for WVFO:</p> <ol style="list-style-type: none"> 1. No West Virginia specific objectives have been articulated in the joint venture plans. Due to lack of reliable population estimates for most of the species in this habitat suite, numerical population and habitat-area objectives have not been determined. (1.2) <p>Objectives: (information from Recovery Plan, etc.)</p> <ol style="list-style-type: none"> 1. No West Virginia specific objectives have been articulated in the joint venture plans. Due to lack of reliable population estimates for most of the species in this habitat suite, numerical population and habitat-area objectives have not been determined. (1.2)
<p>Conservation Design (how to address threats)</p>	<p>Strategies for Addressing the Threats:</p> <ol style="list-style-type: none"> 1. Loss of habitat (1.3) <ol style="list-style-type: none"> a. Seek to minimize loss of habitat by influencing regulatory agency decisions regarding wetland draining, agricultural practices that diminish wetland values for wildlife, dredging and placement of fill in wetlands with a focus on coastal wetlands. (1.3) b. Target Service habitat restoration and enhancement projects to benefit black ducks (1.3) c. Preserve, restore and/or enhance freshwater wetlands in ACJV and NAWMP in breeding areas and migratory corridors (1.3) d. Protecting all remaining habitat using GIS existing or develop new tools to help identify and target, especially the largest wetlands. (1.3) e. If possible, use NRDAR restoration funds to accomplish BD habitat restoration and protection. (1.3) 2. Loss of habitat function (values diminished) (1.3) <ol style="list-style-type: none"> a. Seek to minimize loss of habitat function when habitat is degraded by adjacent land uses by influencing regulatory agency decisions. (1.3) b. Seek to minimize loss of habitat value by influencing International Joint Commission decisions on river water level management (1.3) 3. Invasive Species <ol style="list-style-type: none"> a. Seek to minimize success of invasive colonization in habitat along Potomac and Shenandoah Rivers by public education- Knotweed conference (1.3) b. Reduce and eliminate yellow iris infestations in Canaan Valley, Tucker County, WV.
<p>Conservation Delivery (implementation – guidance taken from Conservation Design)</p>	<ol style="list-style-type: none"> 1. Loss of habitat <ol style="list-style-type: none"> a. Influence regulatory agency decisions regarding wetland draining, agricultural practices that diminish wetland values for wildlife, dredging and placement of fill in wetlands by: (1.4) <ol style="list-style-type: none"> i. Writing substantive comments on proposed Federal agency actions with likely adverse impacts on black ducks

	<ul style="list-style-type: none"> b. Restore—10 acres of riparian habitat in West Virginia’s eastern panhandle to provide better wintering habitat for black ducks (1.4) <p>2. Loss of habitat function (values diminished)</p> <ul style="list-style-type: none"> a. Influence regulatory agency decision regarding wetland draining, agricultural practices that diminish wetland values for wildlife, dredging and placement of fill in wetlands by (1.4) <ul style="list-style-type: none"> i. Writing substantive comments on proposed Federal agency actions with likely adverse impacts on black ducks <p>3. Invasive Species</p> <ul style="list-style-type: none"> a. Manage and eliminate invasive species in riparian habitat in direct drains to the Potomac and Shenandoah Rivers in West Virginia and Canaan Valley (1.4)
Monitoring	<ul style="list-style-type: none"> 1. Adaptive management 2. Develop protocols to measure success of all conservation delivery activities (1.5) 3. Work with Partners to identify leads for accomplishing monitoring activities (1.5) 4. Develop best management practices from results of monitoring to inform future black duck population restoration activities. (1.5)
Research	Nothing identified
Outreach	<p>WVFO outreach is primarily done through one-on-one interaction because of limited staffing, and is not able to undertake broadscale outreach efforts.</p> <ul style="list-style-type: none"> 1. WVFO website 2. Landowner education (1.5) 3. Public involvement (1.5)

References/Literature Cited

- 1. NYFO American Black Duck Recovery Plan
- 2. **All about Birds: American Black Duck.** Cornell Lab of Ornithology. http://www.allaboutbirds.org/guide/American_Black_Duck/id
- 3. **American Black Duck.** VA Department of Game and Inland Fisheries website: <http://www.dgif.virginia.gov/wildlife/waterfowl/black-duck/>

Appalachian LCC

Introduction	The Appalachian Landscape Conservation Cooperative (LCC) will facilitate regional conservation planning and design to support existing conservation partnerships and promote innovative conservation approaches.
Biological Planning	Threats and Threat Assessment: The Appalachian LCC will work to address threats to species of interest across jurisdictional boundaries by facilitating partnerships and leveraging of manpower, funding and capabilities between participating organizations.
Design and Delivery	Strategies for Addressing the Threats: <ol style="list-style-type: none"> 1. The planning and arrangement of workshops and meetings with constituents of the Appalachian LCC, both from West Virginia and from other states in the LCC. 2. The development of a combined GIS and information system to facilitate coordination between participating organizations in the Appalachian LCC. 3. Utilizing Appalachian LCC partnerships in on-the-ground projects to enhance the capabilities of the West Virginia Field Office.
Monitoring	To be determined by Appalachian LCC.
Research	To be determined by Appalachian LCC.
Outreach	Partners include Federal agencies, state agencies, NGOs and academia. West Virginia is currently at the forefront of planning within the Appalachian LCC.

References/Literature Cited

1. <http://www.fws.gov/northeast/science/alcc.html>
2. http://www.fws.gov/northeast/science/pdf/Appalachian_LCC_factsheet.pdf

High-Elevation Forest Focal Area

Other Species Benefitting	
<p>Introduction</p>	<p>High elevation red spruce northern hardwood area – 3,200 – 3,400-foot elevation</p> <p>Species Information: Cheat Mountain salamander WV northern flying squirrel (WVNFS) Running Buffalo Clover Snowshoe hare Appalachian cottontail Southern rock vole Southern water shrew Meadow jumping mouse Coldwater native trout Northern goshawk Saw-whet owl Swainson’s thrush Yellow-bellied sapsucker Other high elevation species (see Exhibit 2 to the Red Spruce/Northern Hardwood Ecosystem Memorandum of Understanding)</p> <p>Justification for species selection: This ecosystem provides multiple resources for society including: (1) terrestrial and freshwater habitat diversity that sustains significant biological diversity, including many rare species of global or regional significance; large blocks of intact forest that supply water for millions of people living downstream of the Potomac and Ohio River drainages; forests that serve as the “lungs” of the East Coast, filtering pollutants to produce clean air and store carbon to reduce levels in the atmosphere. Data suggest there currently are healthy, productive red spruce forests in West Virginia. The current diversity and relatively intact condition of these high elevation forests make them of high conservation value for creating resiliency needed when considering the potential stressors of long-term changes in temperature and rainfall forecast under changing climate.</p> <p>In 2007, private, State, Federal and non-governmental organizations signed a Memorandum of Understanding (MOU) committing to coordinate actions and work together for the long-term to achieve a common landscape-scale vision: a functioning red spruce-northern hardwood ecosystem restored across portions of its former range on both public and private lands, with the scale, connectivity, maturity and other features that provide functional habitat to sustain and enhance the viability of the many species and natural communities dependent on this ecosystem. This MOU spawned a working group, which has grown and become known as the Central Appalachian Spruce Restoration Initiative (CASRI).</p> <p>The Cheat Mountain salamander is Federally-listed and is located in West</p>

	Virginia. The flying squirrel was delisted in 2008. Both species are located in high elevation spruce habitat in the eastern part of WV. See map, Appendix B
Biological Planning	<p>Threats and Threat Assessment:</p> <ol style="list-style-type: none"> 1. Climate change (different species may benefit or be adversely affected over variable time frames) 2. Habitat conversion and forest fragmentation from development, wind farms, surface mining and natural gas extraction. 3. Pollution 4. Invasive Species 5. Forest pests and pathogens 6. Inter-specific competition <p>NOTE: different components of this ecosystem may be more impacted than others</p>
	<p>Population Goal for WVFO:</p> <ol style="list-style-type: none"> 1. Maintain and increase functional connected habitat for focal species, including threatened, endangered and sensitive species dependent on this ecosystem. <p>Objectives:</p> <ol style="list-style-type: none"> 1. For the Cheat Mountain Salamander: De-List the salamander, maintain at least 10 stable or expanding populations. At least 100 extant populations throughout the range permanently protected. 2. For the WVNFS: Maintain recovered populations.
Conservation Design (how to address threats)	<p>Strategies for Addressing the Threats:</p> <ol style="list-style-type: none"> 3. Participate through commenting on and reviewing regulations and best management practices from other agencies, NGOs and industries, with regards to mitigating threats to species and/or habitats of interest 4. Develop a monitoring program and establish long-term, site specific management strategies.
Conservation Delivery (implementation – guidance taken from Conservation Design)	<p>The participation in the following delivery items will usually take the form of commentary or recommendations, collaboration, funding, document and design creation, or some other form of work with agencies, NGOs, industries or other stakeholders.</p> <ol style="list-style-type: none"> 6. Influence regulator agency decisions regarding projects that will result in loss of habitat and habitat functions for these species 7. Planting spruce/ Spruce restoration 8. Purchasing habitat 9. Develop good understory 10. Connectivity of patches of land 11. State, Federal, and private landowner voluntary conservation restoration or protection

Monitoring	<p>Monitoring efforts from this office will largely consist of the development of plans, securing funding and other support for collaborators who are monitoring priority threats, species or areas.</p> <ol style="list-style-type: none"> 1. Adaptive management 2. Post de-listing monitoring of squirrel 3. CASRI monitoring 4. Long-term monitoring of spruce
Research	<p>The WVFO performs research cooperatively with other agencies, organizations and individuals. If research opportunities arise on the listed subjects of interest, the WVFO will support and assist in the cooperative research effort.</p> <p>For Threats and Threat Assessment: Research Needed:</p> <ol style="list-style-type: none"> 1. Develop a spruce restoration prioritization model to determine the most strategic areas to implement restoration 2. Determine minimum patch and connector sizes necessary to supply functional habitat for rare species. 3. Research the effects of acid deposition and soil/stream acidification on poorly buffered geological formations underlying high elevation forest communities. 4. Research on soil-carbon relationships with conifer forests. 5. Down-scale climate change models to forecast species responses to climate change. 6. Pollution <ol style="list-style-type: none"> a. Acid precipitation and effects on soil pH tolerance of species. 7. Genetic studies completed to look at genetic diversity across the species' range. 8. Conduct long-term studies to monitor movements across roads and trails. 9. Determine the effects of human-induced habitat alterations. <p>For Population Goal for WVFO:</p> <ol style="list-style-type: none"> 1. Monitor the long-term success of habitat restoration efforts, including species population-level responses (especially salamanders). 2. Use newer analytical techniques to analyze presence/absence data of rare species. 3. Viability of known populations 4. Conduct other studies of ecology and life history.
Outreach	<p>WVFO outreach is primarily done through one-on-one interaction because of limited staffing, and is not able to undertake broadscale outreach efforts on its own. We will support CASRI in implementing key outreach activities identified on its 10-year plan:</p> <ol style="list-style-type: none"> 1. Create targeted audience outreach plan that will include producing

	<p>brochures and maps.</p> <ol style="list-style-type: none"> 2. Launch a CASRI partners' web-site containing information about the restoration initiative, financial support needed, and progress toward accomplishing key actions. 3. Increase educational outreach through volunteer recruitment and programs. 4. Provide landowners with informational materials about Farm Bill programs and conservation opportunities for improving spruce habitat. 5. Develop a red spruce learning network and information forum for conservation professionals.
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References/Literature Cited

1. Red Spruce-Northern Hardwood Memorandum of Understanding
2. Spruce Symposium proceedings.
3. Cheat Mountain Salamander Recovery Plan: http://ecos.fws.gov/docs/recovery_plan/910725.pdf
4. CASRI 10 year plan (2010-2020)
5. Liz Byers spruce vegetation report

Upper Potomac Watershed Focal Area Within the Chesapeake Bay Watershed

<p>Other Species Benefitting</p>	<p>#*Harperella *Shale barren rock cress #*Northeastern bulrush #*Madison cave isopod – karst area #*Cheat mountain salamander (portions of habitat) #*Virginia big-eared bat #*Indiana bat * = Federally-listed species # = 5-year review completed</p> <p>American eel – inter-jurisdictional fish Brook trout – inter-jurisdictional fish Bald eagle nests: + major ‘pinch point’ for bald and golden eagles + migration corridor</p> <p>Species of Concern: Green floater</p> <p>Black duck – use during winter as a refuge: springs</p>
<p>Introduction</p>	<p>Watershed Information: Counties: Jefferson, Berkeley, Morgan, Hampshire, Mineral, Hardy, Grant, and Pendleton (2,240,000 acres)</p>
<p>Biological Planning</p>	<p>Threats and Threat Assessment:</p> <ol style="list-style-type: none"> 1. invasive species – e.g., Thorn Creek; Potomac Highland Cooperative Weed and Pest Management Area 2. Fish passage barriers 3. Sedimentation and erosion 4. Water quality degradation – e.g. chicken farms, industrial farm processing; non-point source pollution 5. Stream/wetland habitat loss 6. Loss of riparian habitat buffers and forested habitat 7. Human encroachment 8. Wind farm development 9. Road development 10. Acid mine drainage 11. Climate change 12. Direct mortality (disease, predation) 13. Atmospheric deposition and environmental contaminants

	<p>Population Goal for WVFO:</p> <p>Maintain, stabilize, increase populations of all species</p>
<p>Conservation Design (how to address threats)</p>	<p>Strategies for Addressing the Threats:</p> <p><u>General Conservation Design:</u></p> <ol style="list-style-type: none"> 1. Participate through commenting on and reviewing regulations and best management practices from other agencies, NGOs and industries, with regards to mitigating threats to species and/or habitats of interest. 2. Explore increased coordination on other licenses and permits with partner agencies (e.g., those related to hydropower, wind power, water infrastructure, natural gas extraction and highway projects). (1) <ol style="list-style-type: none"> a. Identify entities with complementary goals or mutual benefits with whom to establish partnerships. (2) 3. Bring in new planning expertise to begin the process of engaging with existing and potential partners and communities to identify important areas and help develop land conservation strategies. (1) <ol style="list-style-type: none"> a. Adapt or develop a watershed-wide strategic, publicly accessible land conservation geographic information and targeting system to support sound conservation planning and decision-making. (1) 4. Use conservation planning products to leverage additional funding for high priority conservation projects (4) 5. With partners, develop the technical capacity to track partner accomplishments and progress towards delivering habitat objectives at multiple scales. (4) 6. Invasive species control <ol style="list-style-type: none"> a. Work with Potomac Highlands CWPMA to develop best management practices to prevent the spread of and manage current populations of invasive species. <ol style="list-style-type: none"> i. Develop and support partnerships among a diverse group of private land owners, concerned citizens, agencies, non-profit organizations, educational facilities and local governments. b. Develop landowner relationships through Fish and Wildlife Partners Programs to manage invasive species on private property. c. Develop eradication plans for problematic species (Japanese knotweed, <i>Arthraxon hispidus</i>, purple loosestrife) 7. Fish passage barriers <ol style="list-style-type: none"> a. Work with Federal, state and local partners to prioritize stream barriers that inhibit fish passage and design priority projects by leveraging funds to remove barriers, retrofit culverts, install passage structures and monitor for presence of indicator species. (1) 8. Sedimentation and erosion <ol style="list-style-type: none"> a. Develop landowner relationships through Fish and Wildlife Partners Programs to install livestock exclusion

	<p style="text-align: center;">mechanisms on private property.</p> <p>9. Water quality degradation – e.g. chicken farms, industrial farm processing; non-point source pollution</p> <ul style="list-style-type: none"> a. Identify pollution reductions from point and non-point sources associated with federal lands that will help restore water quality. (1) b. Use results from watershed models to prioritize locations of actions. (1) c. Identify impacts throughout watershed, seek watershed-wide conservation measures <p>10. Habitat Loss</p> <ul style="list-style-type: none"> a. General <ul style="list-style-type: none"> i. Continue to develop and maintain strong partnerships with GIS experts, ecologists, researchers, and on-the-ground partners in order to accurately characterize past, present and future landscapes(4) ii. Develop and coordinate conservation delivery efforts of mutual interest across jurisdictional boundaries (4) iii. Develop a conservation delivery communication strategy and appropriate tools to help integrate population and habitat conservation objectives into delivery programs or plans, develop outreach strategies and conservation messages, and develop new partners and partnerships. (4) b. Stream/Wetland <ul style="list-style-type: none"> i. Work with Army Corps of Engineers to develop a stream assessment tool that identifies critical functions of streams and thresholds of fluvial geomorphologic stability and biological health. ii. Work with HAP and other agencies to develop a drainage-wide decision support system to help prioritize habitat restoration and AMD mitigation in the upper watershed (1) a. Develop landowner relationships through Fish and Wildlife Partners Programs to manage invasive species on private riparian property. b. Work with Potomac Highlands CWPMA to develop best management practices to prevent the spread of and manage current populations of invasive species in riparian habitats (Japanese Knotweed). <p>11. Loss of riparian habitat buffers and forested habitat</p> <ul style="list-style-type: none"> a. Explore funding incentives for installation of targeted riparian forest buffers. (1) <p>12. Human encroachment</p> <p>13. Wind farm development/power generation</p> <p>14. Transportation and commercial development</p> <ul style="list-style-type: none"> a. FWS will continue to provide consultation on habitat mitigation for partners within base funds (1)
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- b. Section 7 consultations.
- 15. Population viability
 - a. Further research into the requirements of and threats to the species
 - b. Work with other agencies to develop techniques for propagation, cultivation and transplantation.
 - c. Re-establish populations within historical range
- 16. Mineral resource development
 - a. Collaborate with agencies involved in locating and appropriately addressing abandoned mines and wells
 - b. Outreach to industry on environmental impacts
 - c. Outreach on water management strategies for industry
- 17. Climate change
 - a. Coordinate with states and other partners to apply tools to guide management responses to climate impacts (*I*)
 - a. Work with other agencies (USGS, NOAA, TNC) on research in terms of trends/impacts
- 18. Direct mortality
- 19. Atmospheric deposition and environmental contaminants
- 20. Inadequacy of current regulatory mechanisms
- 21. Illegal take, over-harvest by institutions for research
- 22. Recreation

Species Design:

- 1. Bats Design
 - a. General:
 - i. Recovery plan
 - ii. Maximum protection of winter hibernacula
 - iii. Refuges
 - b. Indiana bat:
 - i. Conservation and management of habitat (hibernacula, swarming, and to a degree, summer);
 - c. Virginia big-eared bat:
 - i. Search for undocumented caves of importance;
 - ii. Prevent human disturbance of maternity colonies and hibernacula;
 - iii. Protection of caves providing habitat for solitary big-eared bats;
 - d. Please go to these documents for existing strategies:
 - e. Revised I-bat recovery plan drafted in April 2007; should be used as primary plan for WV activities (except that WNS wasn't known at that time)
 - i. (Provide assistance to R-3 to complete Recovery Plan as requested)
 - ii. 5-year review completed September 2009
 - f. [WNS National Plan](#)
 - g. [WV State Wildlife Action Plan](#) – document is very large
 - h. Future planning documents:
 - i. I-bat demographic model should assist with determining how many I-bats are needed in a

	<p style="text-align: center;">given recovery unit</p> <ol style="list-style-type: none"> 2. Harperella design 3. Northern bulrush design 4. Shale barren rock cress design <ol style="list-style-type: none"> a. Pollinator decline: <ol style="list-style-type: none"> i. Work with federal and state agencies to protect extant populations under their jurisdiction from pesticide applications for gypsy moth control (or for other reasons). b. Support DNR efforts to monitor extant populations and their habitat on a regular basis. 5. Cheat Mountain salamander design <ol style="list-style-type: none"> a. Habitat degradation/fragmentation <ol style="list-style-type: none"> i. Develop a monitoring program and establish long-term, site specific management strategies. <ol style="list-style-type: none"> 1. Implement a monitoring program. 2. Implement a long-term management program. ii. Landscape-level habitat evaluation and restoration of red spruce-northern hardwood habitats. 6. Madison Cave isopod design <ol style="list-style-type: none"> a. Continue development of the Madison Cave isopod guidelines to protect populations in both West Virginia and Virginia. b. Groundwater degradation <ol style="list-style-type: none"> i. Work with other agencies to develop regulations and best management practices to prevent groundwater degradation ii. Protect known populations and habitats, taking a watershed perspective. 7. American eel design <ol style="list-style-type: none"> a. Address barriers to riverine movement and upstream habitat access by: <ol style="list-style-type: none"> i. Barrier mitigation and habitat restoration/enhancement. <ol style="list-style-type: none"> 1. The Service is restoring populations of American eel in the Potomac River watershed by working to install upstream and downstream eel passage structures and eelways on dams. ii. Provide technical assistance on stream restoration projects in the watershed; target Service habitat restoration and enhancement projects to benefit American eel; preserve, restore and/or enhance streams known to support American eels iii. Seek to minimize loss of habitat by influencing regulatory agency decisions regarding projects that might result in degradation of habitat function. b. Overfishing c. Address habitat degradation and alteration
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	<ul style="list-style-type: none"> 8. Brook trout design <ul style="list-style-type: none"> a. Loss of habitat <ul style="list-style-type: none"> i. Target Service habitat restoration and enhancement projects to benefit brook trout. <ul style="list-style-type: none"> 1. Add enhancements to natural stream design projects, including planting trees and shrubs to provide shade for water temperature control 2. Promote habitat restoration projects which also control sediment entering streams 3. Provide technical assistance on stream restoration projects via natural stream design in the watershed b. Barriers to migration, including dams and impassable culverts. <ul style="list-style-type: none"> i. Working with partners, identify barriers for removal utilizing dam removal funds and seek other sources of funding. ii. Recommend installation of culverts, the modification of which would improve wildlife passage. iii. Work with WVDOH projects which seek to correct bridge abutment undermining by stream erosion, by designing and constructing natural stream design features that will change stream bottom elevation and facilitate fish passage. iv. For dam and culvert removal and re-design, work to identify stream barriers for removal or restoration to increase fish passage. c. Competition from non-native salmonids <ul style="list-style-type: none"> i. Target Service natural stream design stream restoration to support native salmonid populations ii. Support the cessation of stocking of exotic salmonids d. Work with other agencies to determine how many miles of stream need to be opened to restore access to the highest quality habitat for brook trout. (1) e. Work with the Eastern Brook Trout Joint Venture, local landowners and federal, state and non-governmental partners to identify priority sub-watersheds for habitat improvement for native Eastern brook trout. (1) 9. Green floater design <ul style="list-style-type: none"> a. Sedimentation, siltation, erosion. <ul style="list-style-type: none"> i. Develop regulations and best management practices with other agencies, support regulations/enforcement ii. Develop enhanced erosion and sediment control b. Blocked passage of fish hosts <ul style="list-style-type: none"> i. Encourage removal or amendment of impoundments and other impediments to fish host passage.
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	<p>10. Black duck 11. Migratory birds</p> <ol style="list-style-type: none"> a. Review and comment on avian protection plans for wind power projects. b. Participate in the development of population and habitat objectives for priority species based on the latest assessments by the various bird conservation initiatives and State Wildlife Action Plans (4) c. Target Service projects to benefit populations and habitats.
<p>Conservation Delivery (implementation – guidance taken from Conservation Design)</p>	<p>Strategies for Addressing the Threats: *PFW Participating <u>General Conservation Delivery:</u> The participation in the following delivery items will usually take the form of commentary or recommendations, collaboration, funding, document and design creation, or some other form of work with agencies, NGOs, industries or other stakeholders.</p> <ol style="list-style-type: none"> 1. Ensure implementation of conservation measures through ESA section 7 consultations and follow up with Federal agency/project sponsor 2. Implement Service habitat restoration/enhancement projects to benefit priority species and habitat. 3. Leverage money and partners to protect and improve priority habitat. 4. Influence regulator agency decisions regarding projects that will result in loss of habitat and habitat functions for priority species 5. Invasive Species Control <ol style="list-style-type: none"> a. Restore at least 50 acres of land infested with invasive species through work with the CWPMA a. Work with Potomac Highlands CWPMA to implement management strategies to prevent the spread of and manage current populations of invasive species.* <ol style="list-style-type: none"> i. Establish a rapid response team (1) b. Work with landowners through Fish and Wildlife Partners Programs to manage invasive species on private property.* d. Implement best management practices that will help prevent the introduction and spread of invasive species (3) c. Remove and control invasive species; restore sites after invasive species removal (3)* <ol style="list-style-type: none"> i. Use an integrated approach to invasive species control (3) 6. Water Degradation <ol style="list-style-type: none"> a. Enhance and protect water quality and reduce non-point source pollution through the installation of riparian buffers.* b. Reduce nutrient loads in water through livestock exclusion. * c. Take regulatory and other actions to support state and

	<p>District plans to implement the Total Maximum Daily Loads (TMDL). (1)</p> <ul style="list-style-type: none"> d. Work with agencies (WVDEP, USGS, State Regulators, USDA RC&D, NRCS, EPA, TNC, and Dept. of Health) to identify sources of water quality degradation and address them. e. Work with landowners to reduce or eliminate activities that may be detrimental to water quality (erosion/sedimentation, nutrient loading, chemical pollution, stream channelization, etc.). f. Work to contribute toward stream bank stabilization. g. Work with the NRCS toward restricting/reducing the discharge of hazardous materials (from poultry farms and cropland) entering lakes, streams, rivers, etc. h. Minimizing construction and land use changes within the species' habitat range i. Where needed, seek conservation of watersheds to protect populations. <ul style="list-style-type: none"> i. Support and seek out opportunities to secure permanent protection for populations ii. Remove or remodel dams and other water control methods to retain needed water levels iii. Leverage money and partners to protect and improve habitat. b. Create comprehensive watershed program <ul style="list-style-type: none"> i. Restoration of watershed vegetation ii. Livestock exclusion from waterways iii. Habitat restoration, timber rights acquisition j. Enforce current regulations and develop BMPs for water contamination k. Restoration of watershed vegetation <ul style="list-style-type: none"> i. Add enhancements to natural stream design projects, including planting trees and shrubs to provide shade for water temperature control l. Remove dams and alleviate other impediments to fish passage, use natural stream channel design <p>7. Fish passage barriers</p> <ul style="list-style-type: none"> a. Remove fish passage barriers* b. Implement priority projects by leveraging funds to remove barriers, retrofit culverts, install passage structures and monitor for presence of indicator species. (1) <p>8. Sedimentation, siltation, erosion</p> <ul style="list-style-type: none"> a. Prevent stream bank erosion through invasive species management and stream bank restoration.* b. Reduce sedimentation and erosion through livestock exclusion. * <p>9. Habitat Loss:</p> <ul style="list-style-type: none"> a. Implement at least 5 new PFW agreements per state to restore wetlands on private lands (1) b. General <ul style="list-style-type: none"> a. Identify prime areas of habitat and plan
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	<p>development using WV Green Infrastructure (Conservation Priority Planning)- identification of habitat to conserve (e.g., CPA will assist in locating new roads) *</p> <ul style="list-style-type: none"> b. Habitat protection through informal and formal consultations and HCPs c. Minimize and mitigate threats to prevent further habitat degradation of reduced, greatly reduced, and extirpated populations. (2) <p>c. Stream/Wetland</p> <ul style="list-style-type: none"> i. Enhance and protect stream/wetland habitat, with a focus on connecting geographical gaps in habitat between USDA priority watersheds* ii. Work with Potomac Highlands CWPMA to implement best management practices to prevent the spread of and manage current populations of invasive species in riparian habitats (Japanese knotweed).* iii. Implement priority projects by leveraging funds to remove barriers, retrofit culverts, install passage structures, use natural stream channel design (1)(2) iv. Facilitate and coordinate public-private partnerships to conserve wetland habitat. (4) <p>d. Protect existing sites/populations</p> <ul style="list-style-type: none"> i. Delineate occupied habitats. ii. Monitor threats. <p>e. Re-establish populations within their historical range</p> <p>f. Secure protection for sites on public and private lands;</p> <ul style="list-style-type: none"> i. Establish management and habitat protection agreements with state and Federal agencies ii. Partner with non-governmental organizations. <p>g. Inform stakeholders of governmental programs available for assistance/cost-share</p> <p>10. Loss of riparian habitat buffers and forested habitat</p> <ul style="list-style-type: none"> a. Reverse loss/increase size of riparian habitat buffers* <ul style="list-style-type: none"> a. Restore forest buffers in priority watersheds. (1) b. Leverage funding through the National Fish Habitat Action Plan to implement riparian forest buffer restoration, livestock exclusion and natural stream channel design (1) b. Identify prime areas of habitat and plan development using WV Green Infrastructure (Conservation Priority Planning)- identification of habitat to conserve (e.g., CPA will assist in locating new roads) * <p>11. Mineral resource development</p> <ul style="list-style-type: none"> a. Consult on the remediation of acid mining impacts in drainage systems b. Consult on the elimination of acidification threats through “at-source” reductions of acid loads. <p>12. Non-natives</p> <ul style="list-style-type: none"> a. Manage invasive species in and around relevant habitats,
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	<p>with emphasis on early detection, rapid response and containment.</p> <ul style="list-style-type: none"> b. Inform landowners of cost-share programs (NRCS) available to aid in treatment of non-natives <p>13. Hydrological changes</p> <ul style="list-style-type: none"> a. Advocate for the avoidance of hydrological manipulations b. Advocate for the protection of drainage systems upstream from perturbations from mining, dams, construction and agriculture <p>14. Population viability</p> <p>15. Climate change</p> <ul style="list-style-type: none"> a. Habitat protection and restoration <p>16. Inadequacy of current regulatory mechanisms</p> <ul style="list-style-type: none"> a. Pursue listing of species of concern, where appropriate <p>17. Develop and implement standardized protocols, associated forms, databases, instruction and training for data collection and storage, to allow easy integration of data from multiple sources</p> <p><u>Species Delivery:</u></p> <p>1. Bats Delivery</p> <ul style="list-style-type: none"> a. General: <ul style="list-style-type: none"> ii. Conserve and manage habitats: <ul style="list-style-type: none"> 1. Summer habitat to maximize survival and fecundity 2. Hibernacula and winter populations iii. Provide coal mining guidance through the 2009 range-wide Indiana Bat Guidelines. iv. Minimize adverse impacts to I-bat during project reviews <ul style="list-style-type: none"> 1. Ensure implementation of conservation measures of existing bats through follow up with Federal agency/project sponsor 2. Habitat protection through informal and formal consultations and HCPs b. Indiana bat: (<i>I.126</i>) <ul style="list-style-type: none"> v. Hibernacula-related recovery actions vi. Conserve and manage hibernacula and their winter populations vii. Reduce current threats at known hibernacula viii. Assess current threats and conservation measures at all P1 and P2 hibernacula and develop a prioritized list of hibernacula in need of remedial actions ix. Implement existing or develop new technical guidance for installing bat-friendly gates and other human barriers and deterrents x. Minimize human disturbance of hibernating bats related to survey and research activities c. Virginia big-eared bat: <ul style="list-style-type: none"> xi. Search for undocumented caves of importance to big-eared bats
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	<ul style="list-style-type: none"> xii. Prevent human disturbance of maternity colonies and hibernacula xiii. Protection of caves providing habitat for solitary big-eared bats xiv. Prepare and maintain a management profile for each colony site xv. Appoint a coordinator for all recovery efforts <p>2. Harperella delivery</p> <ul style="list-style-type: none"> a. Habitat disturbances/fragmentation <ul style="list-style-type: none"> i. Protect plants and their habitat through landowner cooperation, land protection, and regulatory authorities. ii. Determine habitat protection priorities, define habitat requirements. iii. Livestock exclusion from waterways iv. Use natural stream channel design b. Inform the public about the plant's status and recovery needs. <p>3. Northern bulrush delivery</p> <ul style="list-style-type: none"> d. Support collaborators in efforts to secure, and store or propagate genetic material from each genotype <ul style="list-style-type: none"> i. Store a small sample of seeds from each genotype <p>12. Shale barren rock cress delivery</p> <ul style="list-style-type: none"> a. Work with the George Washington Jefferson National Forest on their forest plan. b. Recovery Plan actions: <ul style="list-style-type: none"> i. Seek protection of all extant populations, and secure permanent protection for self-maintaining populations and their habitat. ii. Search for additional populations. iii. Study life history, ecological, and population parameters and establish guidelines for determining what constitutes a self-maintaining population. iv. Support management of populations for the maintenance of each population and its habitat. a. Habitat loss <ul style="list-style-type: none"> i. Shale barren habitats must be protected with sufficient buffer of scrub oak woodland or other habitat type to reduce the effects of pesticide application and other factors b. Pollinator decline: <ul style="list-style-type: none"> i. Exempting shale barren communities from pesticide application for gypsy moth control c. Herbivory <ul style="list-style-type: none"> i. Grazing restrictions/livestock exclusion d. Small population size <ul style="list-style-type: none"> i. Support the development of cultivated sources of plants and provide for seed storage <p>4. Madison Cave isopod delivery</p> <ul style="list-style-type: none"> a. Implement guidelines developed to protect Madison Cave
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	<p>isopod populations in both West Virginia and Virginia.</p> <ul style="list-style-type: none"> b. Groundwater degradation: <ul style="list-style-type: none"> i. Work with agencies to identify potential sources and entry points of groundwater contamination for deep karst aquifer habitat and address them. ii. Establish cooperative program between public and private entities to maintain or enhance groundwater quality <ul style="list-style-type: none"> 1. Support the efforts of Forest Stewardship Programs iii. Avoiding the use of pesticides in and around established habitats <p>5. Cheat Mountain salamander delivery</p> <ul style="list-style-type: none"> a. Protect occupied habitats. <ul style="list-style-type: none"> i. Protect occupied habitats and <i>P. nettingi</i> populations on public lands. ii. Protect occupied habitats and <i>P. nettingi</i> populations on private lands. <p>6. American eel delivery</p> <ul style="list-style-type: none"> a. Address barriers to riverine movement and upstream habitat access by barrier mitigation and habitat restoration/enhancement. b. Influence regulatory agencies to regulate construction and water withdrawal activities so as to not interfere with the migration of the American Eel <p>7. Brook trout delivery</p> <ul style="list-style-type: none"> c. Re-establish self-sustaining brook trout populations in currently “extirpated” watersheds. <ul style="list-style-type: none"> i. Restore watersheds where temperature and habitat conditions are such that reintroduction of brook trout is feasible; ii. Work with landowners and local communities to provide for long term protection of brook trout habitats and populations in re-established watersheds. d. Loss of habitat <ul style="list-style-type: none"> iii. Expansion and integration of state, federal and private programs that support riparian zone conservation along brook trout streams (e.g., CREP, WHIP, Partners for Fish and Wildlife, and state, county, and private conservation programs). This should include efforts to integrate alternative mitigation programs. iv. Implementation of brook trout specific BMPs for activities that produce non-point source pollutants (e.g., sediments and nutrients) on state, federal, and private lands. v. Target Service habitat restoration and enhancement projects to benefit brook trout vi. Preserve, restore and/or enhance streams known to support heritage strains of brook trout
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	<ul style="list-style-type: none"> vii. Promote habitat restoration projects which also control sediment entering streams viii. Provide technical assistance on stream restoration projects via natural stream design in the watershed. e. Barriers to migration, including dams and impassable culverts. f. Reduce competition from non-native salmonids. g. Climate change; increased water temperatures. <ul style="list-style-type: none"> ix. Target Service habitat restoration and enhancement projects to benefit brook trout. x. Add enhancements to natural stream design projects, including planting trees and shrubs to provide shade for water temperature control 8. Green floater delivery <ul style="list-style-type: none"> a. Propagation of native freshwater mussels to restore freshwater bivalve communities critical to maintaining water quality and habitat in tributaries of the Bay (<i>I</i>) b. Loss of habitat <ul style="list-style-type: none"> i. Implement priority actions in priority streams and rivers <ol style="list-style-type: none"> 1. Initiate and participate in ecosystem conservation efforts. 2. Protect and manage mussel populations and their habitat on a site-specific basis. 3. Collect data on both species that are necessary for their recovery. 4. As needed, restore habitats and reintroduce the species to suitable areas. 5. Enlist public support for the recovery process through an outreach program and providing incentives for public support. c. Water withdrawals <ul style="list-style-type: none"> i. Implement and enforce existing regulations ii. Implement and enforce developed regulations d. Population Viability <ul style="list-style-type: none"> i. Transplant mussels from other locations (Kentucky fanshell example) ii. ORVE has a salvage and transport protocol iii. Remove individuals from watershed and breed in captivity to maintain gene pool until threat is reduced iv. ORVE efforts e. Blocked passage of fish hosts <ul style="list-style-type: none"> i. Remove barriers to fish host passage ii. Install fish ladders at barriers to fish host passage.
Monitoring	<p><u>General Monitoring</u> Monitoring efforts from this office will largely consist of the development of plans, securing funding and other support for collaborators who are</p>

monitoring priority threats, species or areas.

1. Water Degradation
 - a. Provide input from Partners for Fish and Wildlife to WVDA to inform their monitoring of pollution reduction actions.
 - b. Install scour chains on projects in waterways to measure siltation rates resulting from the project.
 - c. Develop a stream monitoring program that includes bank stability and floodplain connectivity in assessing stream health. (1)
 - d. Systematic watershed monitoring and assessment to determine extent and sources of emerging contaminants and disease on the health of fish and wildlife health and potential impacts of new threats from natural gas development (focused on the Marcellus Shale formation). (1)
2. Invasive species
 - a. Survey and monitor populations of invasive species in target watersheds (3) Focus will be on:
 - i. Annual monitoring of priority areas to ensure resources have not been degraded by invasive species.
 - ii. Trends in infestation number, size and density
 - iii. Support agency efforts to monitor the effect invasive plants have on native or desired vegetation, soil, watershed, wildlife and other resources,
 - iv. The effects of treatment on target invasive plant infestation as well as native or desirable vegetation
 - v. The effectiveness of treatments as implemented
3. Habitat loss
 - a. Work with academic partners and the states to improve monitoring of selected habitats in the Bay and its watershed, including underwater grasses, wetlands, forests and streams. (1)
4. Fish passage
 - a. Conduct fish and freshwater mussel surveys above sites where barriers have been removed in the past 5 years (1)
 - b. Monitor effectiveness of fish passage structures that have been installed in the last 5 years (1)
 - c. Develop a stream monitoring program that includes bank stability and floodplain connectivity in assessing stream health. (1)
 - d. Partner with states and NOAA to document the presence of indicator species such as the American eel at fish passage projects after construction is complete. (1)
5. Adaptive management
 - a. Establish monitoring and indicator species to assess progress and evaluate the effectiveness of management

	<p>actions. (I)</p> <ul style="list-style-type: none"> i. Select species as indicators for stream corridor health and successful fish passage. (I) <ol style="list-style-type: none"> 6. Work with partners to identify leads for accomplishing monitoring activities. 7. Develop and implement comprehensive monitoring program. <ul style="list-style-type: none"> a. Monitor effects of conservation efforts (ongoing) b. Develop protocols to measure success of all conservation delivery activities. c. Adaptive management <ul style="list-style-type: none"> i. Continue monitoring threats as part of adaptive management strategy. d. Implement a program to monitor progress of the recovery plan. 8. Track habitat and threats to species occurrences and species habitat <ul style="list-style-type: none"> a. Monitor land use practices to determine pollution sources b. Map and monitor potential and existing threats to populations 9. Monitor the health, size, and reproductive status of each population <ul style="list-style-type: none"> a. Monitor size and extent of populations b. Select and intensively monitor study sites across species' range that represent different habitat types and population sizes c. Monitor benchmark populations. d. Search for additional populations. 10. Transportation/Commercial Development <p><u>Species monitoring:</u></p> <ol style="list-style-type: none"> 7. Bat monitoring <ul style="list-style-type: none"> g. Develop best management practices from results of monitoring to inform future bat population restoration activities. h. Require or recommend monitoring: <ul style="list-style-type: none"> i. Forest Service required monitoring ii. Wind power required monitoring i. Indiana bat <ul style="list-style-type: none"> i. Range wide population monitoring at the hibernacula with improvements in census techniques j. Virginia big-eared bat <ul style="list-style-type: none"> i. Monitor population trends 8. Harperella monitoring <ul style="list-style-type: none"> k. Work with partners to ensure more consistent monitoring both for individual populations and between populations is needed 9. Northern bulrush monitoring <ul style="list-style-type: none"> l. Support ongoing DNR monitoring effort through funding and design efforts. 10. Shale barren rock cress monitoring
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	<ul style="list-style-type: none"> m. Work with others to develop appropriate monitoring schemes, and assist in implementation. <p>11. Cheat Mountain salamander monitoring</p> <ul style="list-style-type: none"> n. Fund, design and support agency efforts for monitoring, advocating for: <ul style="list-style-type: none"> i. Monitoring of benchmark populations should be established on regular basis. ii. Conducting surveys at existing sites to determine status of population and any changed to habitat. iii. Monitoring and evaluation should occur at apparently declining populations to determine exact cause of decline. iv. Monitoring known populations to determine their status, territoriality, home range, environmental changes, and competitive pressures. <p>12. Madison Cave isopod monitoring</p> <ul style="list-style-type: none"> o. Fund monitoring of populations of Madison Cave Isopod <p>13. American eel management</p> <ul style="list-style-type: none"> p. Monitoring to measure success of up and down-stream passages q. Investigate potential barrier removals and available habitat both pre- and post-removal <p>14. Brook trout monitoring</p> <ul style="list-style-type: none"> r. Adaptive management: work with other agencies to develop monitoring protocol for restoration efforts. s. Establish baseline benchmarks for success <ul style="list-style-type: none"> i. Stream temperatures ii. Fish populations iii. Habitat restoration <p>15. Green Floater Monitoring</p> <ul style="list-style-type: none"> t. Support the established monitoring locations on several streams, encouraging expansion to other streams with a revisit every 5 years.
<p>Research</p>	<p>The WVFO performs research cooperatively with other agencies, organizations and individuals. If research opportunities arise on the listed subjects of interest, the WVFO will support and assist in the cooperative research effort.</p> <p><u>General Research</u></p> <ul style="list-style-type: none"> 1. Collaborate with NOAA, USACE and USGS, Maryland, Virginia, PRFC, ASMFC and academic partners to improve the scientific information needed to manage and restore living resources. (1) 2. Establish a common set of sampling and data management protocols designed to ensure data validity, utility, and accessibility. (2) <ul style="list-style-type: none"> a. Compile and organize existing GIS data (4) 3. Conduct range wide searches in areas of suitable habitat for additional populations <ul style="list-style-type: none"> a. Resurvey sites thought to have suitable habitat b. Identify potentially suitable habitat for additional surveys

	<ul style="list-style-type: none"> a. Survey potential sites for presence (Search for additional populations) c. Verify, catalogue, monitor, and protect any additional populations <p>4. Map existing populations, threats, watersheds.</p> <ul style="list-style-type: none"> a. Determine extant range b. Determine historic range c. Determine intersection of threats and ranges <p>5. Habitat threats research</p> <ul style="list-style-type: none"> a. Determine habitat boundaries for species b. Correlate past and ongoing habitat disturbances with population trends c. Delineate potential habitat <p>6. Water quality and quantity changes - Research needed:</p> <ul style="list-style-type: none"> a. Effects of watershed changes b. Effects of common contaminants on all life stages, especially silt c. Degradation of watershed functions in headwaters d. Water withdrawals - mining, oil & gas e. Nutrient loading; effects and locations f. Work with EPA, DOI, and NOAA to expand the understanding of the extent and seriousness of the toxic contaminant problem Chesapeake Bay watershed and to develop contaminant reduction outcomes by 2013 and strategies by 2015. (1) g. Estimate nutrient and sediment loads delivered from federal lands to the Bay by providing information on property boundaries, land cover, land-use, and implementation of management practices. (1) h. Collaborate with USDA, USGS and EPA, state governments and conservation districts to identify watersheds with the highest nitrogen, phosphorus and sediment delivery to the Bay and its tributary waters. (1) <p>7. Mineral resource development</p> <ul style="list-style-type: none"> a. Work with USGS and EPA to assess the potential impacts of Marcellus Shale-gas extraction on streams and habitats. (1) <ul style="list-style-type: none"> a. Effects of Marcellus shale drilling; water withdrawal; wastewater (frac water) disposal; b. Mining runoff impacts on species and their habitats. c. Effects of mountain top mining and deep underground coal mining on species and their habitats. <p>8. Habitat loss or disturbance - Research needed:</p> <ul style="list-style-type: none"> a. Work with partners to develop detailed soil maps for the watershed where they don't exist (1) b. Conduct comprehensive research to identify vulnerable communities and habitats throughout the watershed and assessing the risks posed by the impacts of climate change. (1) <ul style="list-style-type: none"> i. This work also involves prediction of changes in pollution loads and monitoring actual climate
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	<p style="text-align: center;">impacts in the watershed.</p> <ul style="list-style-type: none"> c. Expand data collection and computer modeling to include wetland buffers and enhanced acres of wetlands, (1) d. Assess the ability of current landscapes to support priority species(4) e. Predict effects of land cover changes due to management changes or other causes (succession, climate change, urbanization) (4) <p>9. Fish and wildlife health</p> <ul style="list-style-type: none"> a. Identify the major sources of different environmental stresses on fish and wildlife so state and federal agencies can consider appropriate control strategies. (1) b. Continue efforts to assess the impact of pathogens, parasites and toxic contaminants on fish kills and intersex conditions in the Potomac watershed. (1) <ul style="list-style-type: none"> i. Determine the primary causes of poor fish health and fish kills in the Bay Watershed (1) <p>10. Climate change</p> <ul style="list-style-type: none"> a. Identify and assess risk to key watershed habitats from potential impacts of climate change and land change. (1) <ul style="list-style-type: none"> i. Assess implications for habitats for key fish and wildlife (such as brook trout) in the watershed. (1) ii. Work with the advisory committees for science, local government and citizens to build an integrated team focused on climate change coordination and information sharing (1) iii. Evaluate the vulnerability methods for fish, wildlife and their habitats, including vulnerability to sea-level rise and storm surges. (1) b. Model climate change effects on stream temperatures, hydrology, acidity, etc, <p>11. Restoration research</p> <ul style="list-style-type: none"> a. USGS will summarize existing results from Poplar Island studies and Blackwater NWR to contribute to wetland restoration planning. FWS will use results of studies in adaptive management context in FY12 and beyond. (1) b. USGS/FWS will summarize results from Blackwater Refuge to show how sea-level rise projections were used for wetland planning. (1) c. Update the Chesapeake Bay Watershed NWI maps to the National Wetlands Mapping Standard, beginning with targeted watersheds (1) d. FWS will develop an improved rapid method to monitor stream restoration projects; (1) <p>12. Model population viability, determine viable population size</p> <p>13. Study species and habitat characteristics.</p> <ul style="list-style-type: none"> a. Long-term demographics studies b. See 5 year review <p>14. Life history and ecological requirements</p> <ul style="list-style-type: none"> a. Genetic variation between populations, herbivory, shading, and seed bank formation
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- b. Genetic variability between populations/within species.
- 15. Determine habitat characteristics and environmental requirements
 - a. Characterize the habitat of study sites
 - b. Determine to what degree and under what conditions competitors may threaten species
 - c. Investigate the effects of land management practices on the species
- 16. Collect baseline ecological data relevant to management and recovery.
 - a. Population size, trends, number of populations
 - b. Feeding habits
 - c. Life history
 - d. Habitat requirements (temperature range, pH, etc.)
 - e. Habitat attributes

Species Research:

- 1. Bats research
 - a. General:
 - i. White Nose Syndrome
 - 1. Etiology
 - 2. Transmission
 - 3. Treatment
 - ii. Wind
 - 1. Mortality minimization measures,
 - 2. Operational changes
 - 3. Changes of flight patterns
 - 4. Wind power: testing effectiveness of operational changes (i.e., curtailment of turbines)
 - 5. Expand knowledge of wind turbine cut-in speeds
 - b. Indiana bat:
 - i. Range-wide demographic data (to model extinction risk, detect regional and age class differences in survival, etc.)
 - ii. Ideal microclimate for hibernation;
 - iii. Importance of optimum hibernation microclimate throughout its range;
 - iv. Characteristics of a maternity colony with positive recruitment;
 - v. Specific habitat quality and quantity parameters necessary for a self-sustaining maternity colony;
 - 1. E.g.: migration habitat use, summer habitat use
 - vi. Effect and exposure of Indiana bats to various classes of contaminants throughout the annual cycle;
 - vii. Response of Indiana bat to perturbations in summer habitat
 - viii. Understanding the role that habitats nears hibernacula play in swarming;

	<ul style="list-style-type: none"> ix. The role of caves used for swarming that are not hibernacula; x. Aspects of migration, including timing, energetics, and habitat use; and xi. Effect of global warming on the species' disruption and hibernacula. <p>c. Virginia big-eared bat:</p> <ul style="list-style-type: none"> i. Genetic research <ul style="list-style-type: none"> 1. Evaluate relationship between VBEB in New River Gorge to other populations in WV and VA, as well as their relationship to NC populations <ul style="list-style-type: none"> a. Interoffice collaboration ii. Telemetry and tracking studies <ul style="list-style-type: none"> 1. Foraging patterns and seasonal movements for males and non-reproductive females 2. Document spring, summer, and fall movements in Pendleton County, WV and Highland County, VA <ul style="list-style-type: none"> b. Evaluate potential effects of wind farms being proposed in area iii. Mapping of important caves <ul style="list-style-type: none"> 1. Germany Valley (Hellhole and Schoolhouse caves) 2. Other important caves help assess natural changes over time or evaluate future threats from development (e.g.: mining, drilling, other construction.) iv. Search for undocumented caves of importance <ul style="list-style-type: none"> 1. Interviews with local spelunkers and cave descriptions in literature 2. Winter surveys when hibernating VBEB might be present v. Research to determine what types of sitting and/or operation changes will eliminate or reduce bat mortality at wind farm project proposals in vicinity of VBEB caves <ul style="list-style-type: none"> 1. Development of consistent guidelines and permitting requirements at either state or federal level vi. Health effects of strebilid flies on VBEB vii. Conduct surveillance for WNS <p>d. For Population Goal for WVFO:</p> <ul style="list-style-type: none"> i. Research needed: seasonal migration patterns (winter and summer) ii. Plan and conduct research essential for recovery <p>4. Harperella Research</p> <ul style="list-style-type: none"> a. Research how hydrological changes affect the species. b. Sedimentation and erosion - Research needed: <ul style="list-style-type: none"> i. effects of sedimentation: i.e., quantification of sedimentation levels that will affect species
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	<ul style="list-style-type: none"> c. Genetic research d. Identify areas in need of riparian restoration (3). <ul style="list-style-type: none"> ii. Develop best methods for restoration on a case-by-case basis. e. Develop transplant techniques, determine live plant cultivation needs, seed storage conditions f. Determine length of seed storage in ponds g. Conduct further genetic studies <ul style="list-style-type: none"> iii. See 5-year Review h. Develop a cultivated source of plants i. Watershed changes: Evaluate and monitor effects of watershed changes: includes species tolerance for increases in siltation and erosion for development of guidelines for land management activities and evaluation of potential effects of development activities upstream (5-year review) j. Population viability research: To understand significance and extent of population fluctuations (5-year review) <p>5. Northern bulrush research</p> <ul style="list-style-type: none"> a. Genetic research b. Develop reliable census techniques <ul style="list-style-type: none"> i. Develop consistency in the definition of plant terms ii. Detail methods to identify non-sexually reproducing individuals readily in the field iii. Describe methods for measuring the size and health of individual plants iv. Develop consistent, reliable censusing techniques for use throughout the species' range c. Investigate life history and reproductive strategy <ul style="list-style-type: none"> i. Determine and assess demographic characteristics of study populations ii. Investigate the relative importance of sexual vs. asexual reproduction and recruitment iii. Experimentally investigate the species' habitat requirements for recruitment (sexual and asexual) iv. Investigate the significance of seed banking and seed dispersal v. Achieve a better understanding of the life history and ecological requirements <ul style="list-style-type: none"> 1. Genetic variation between populations, herbivory, shading, and seed bank formation 2. Funding d. Determine habitat characteristics and environmental requirements <ul style="list-style-type: none"> i. Investigate the effects of beaver activities on hydrological regime and demography of the bulrush e. Investigate genetic variability and viability <ul style="list-style-type: none"> i. Evaluate the genetic identity of individual plants
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	<ul style="list-style-type: none"> ii. Determine the degree of intra- and inter-population genetic variability iii. Determine to what extent seed viability varies with the extent of clonality in populations f. Kinds of change to the habitat which affect the growth, reproduction, and elimination of plant g. Characterization of environment <ul style="list-style-type: none"> i. Physical ii. Characteristics of hydrology, soils pH, nutrient status, temperature, precipitation, and light regime iii. Biological iv. Associated plants and animals v. Competition vi. Predators or grazers h. Population fluctuations i. Population trends associated with active management of species and habitat j. Habitat need of plant k. Stability of populations in changing environments l. Extent the species interbreeds with other taxa m. Relative roles of sexual vs. asexual production <ul style="list-style-type: none"> i. Role differences from place to place ii. Role differences in change of habitat (wet years to dry years) n. Life history and ecological requirements <ul style="list-style-type: none"> i. Genetic variation between populations, herbivory, shading, and seed bank formation 6. Shale barren rock cress research <ul style="list-style-type: none"> a. Current research efforts should provide all necessary information necessary to formulate conservation needs for <i>A. serotina</i> (<i>I</i>) b. Effects of fire management regimes c. Contacts for current research/monitoring projects: (<i>I</i>) <ul style="list-style-type: none"> i. VA FWS and VA Dept. of Ag.: Garrie Ralph, 1943 Kings Road, Glen Allen, VA 23060. ii. Mike Likins, Virginia Department of Agriculture and Commerce, Washington Bldg., Richmond, VA 23219. Telephone No. (804) 371-0633. iii. P. J. Harmon, Botanist, West Virginia Natural Heritage Program, Department of Natural Resources, P.O. Box 67, Elkins, WV 26241. Telephone No. (304) 637-0245 d. Life-history information e. Seed bank assessment 7. Cheat Mountain salamander research <ul style="list-style-type: none"> a. Characterize habitat parameters. b. Ascertain variables associated with “quality” habitats. c. Determine effect of habitat alterations. d. Determine habitat parameters common to large populations. e. Compare elevation disparity between northern and southern
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	<p>populations.</p> <ul style="list-style-type: none"> f. Conduct other studies of ecology and life history. g. Determine food items. h. Identify significance of interspecific competition. i. Determine reproductive biology. j. Identify any phenotypic variability among populations. k. Conduct other ecological studies. l. Define the total range of the species. m. Survey additional areas within the known range to gain additional information about the species' distribution and abundance. n. Assess population characteristics. <ul style="list-style-type: none"> i. Determine biological factors such as reproductive biology, growth rates, and genetic variability among populations. o. Pollution <ul style="list-style-type: none"> i. Acid precipitation and effects on soil pH tolerance of species. p. Genetic studies completed to look at genetic diversity across the species' range. q. Conduct long-term studies to monitor movements across roads and trails. r. Viability of known populations s. Define what constitutes a <i>P. nettingi</i> population <p>8. Madison Cave isopod research</p> <ul style="list-style-type: none"> a. Genetic research b. Determine sources and entry points of contamination for karst habitats c. Collect baseline ecological data relevant to management and recovery. <ul style="list-style-type: none"> i. Population size, trends, number of populations ii. Feeding habits iii. Life history iv. Habitat requirements (temperature range, pH, etc.) v. Habitat attributes (aquifer sizes, locations) <ul style="list-style-type: none"> 1. Could use dye tracing to determine aquifer size, groundwater recharge range d. Determine the number of genetic populations of <i>A. lira</i>. e. Determine effects of local quarrying activities, if any. <p>9. American eel research</p> <ul style="list-style-type: none"> a. Determine genetic diversity of WV population b. Enumeration of upstream migrating eel at the existing eel ladders serves as an indicator of year class strength c. Increase understanding of factors affecting eel population dynamics and life history through increased research and monitoring. d. Investigate the abundance level of eel at the various life stages, necessary to provide adequate forage for natural predators and support ecosystem health and food chain structure e. Determine timing of migrations up and downstream in WV
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	<ul style="list-style-type: none"> f. Contaminants <ul style="list-style-type: none"> i. Assess the response of the American Eel to water contaminants a. Recommended research by the ASMFC (2): <ul style="list-style-type: none"> a. Investigate growth rates for males and females throughout their range; habitat preferences of males and females; predator-prey relationships; behavior and movement of American eel during their freshwater residency b. Evaluate contaminant effects on American eel and the effects of bioaccumulation with respect to impacts by age on survival and growth and effect on maturation and reproductive success. c. Determine growth rates of male and female American eel in different habitats. d. Determine if geographic sub-populations exist, which may have implications for management. e. Evaluate the impact, both upstream and downstream, of barriers on American eel with respect to population and distribution affects. Determine areas of extirpation and historical distribution. f. Investigate, develop, and improve technologies for American eel passage upstream and downstream. g. Evaluate the ecosystem importance of American eels as prey, predators, and mechanisms of transporting freshwater biomass to marine systems. h. Determine fecundity-length and fecundity-weight relations for female American eel from various parts of its geographic range. i. Identification and understanding of American eel habitat needs for all life stages j. Model the effect of increased habitat availability and reductions in mortality at various freshwater life stages on escapement. k. Research techniques (physical and behavioral) for providing upstream and downstream passage around dams l. Quantify and assess male eel habitat and male eel abundance <p>10. Brook trout research</p> <ul style="list-style-type: none"> a. Participate in Eastern Brook Trout Joint Venture study that ranks the existing brook trout populations in Virginia, Maryland and West Virginia for resiliency to climate change. (1) b. Develop a database and framework to identify and prioritize site specific brook trout restoration and conservation projects (1) c. Develop and implement high priority stream passage and barrier removal projects throughout the watershed, focusing on brook trout habitat. Restore/enhance 10 miles brook
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	<p>trout habitat; consistent with the goals and objectives of the Eastern Brook Trout Joint Venture. (1)</p> <ul style="list-style-type: none"> d. Develop and implement habitat restoration projects, focusing on improving water quality (e.g., pH) and restoring natural stream structure and function in 4-8 subwatersheds. (1) b. Quantify genetic variability and identify genetically unique brook trout populations. (2) c. Conduct region-specific field research designed to identify factors limiting brook trout populations throughout their current and native range. (2) <ul style="list-style-type: none"> a. Establish sampling protocols and facilitate access to data. b. Assess current population and habitat conditions. <ul style="list-style-type: none"> i. Identify threats and factors limiting brook trout populations. ii. Conduct surveys to determine current population levels and presence/absence. c. Work with DNR and WVU to assist with brook trout surveys to determine presence/absence and population densities, coupled with habitat investigation. d. Determine genetic diversity of brook trout in the watershed <ul style="list-style-type: none"> i. Quantify genetic variability and identify genetically unique brook trout populations. ii. Need to fund more extensive and frequent streams surveys to determine population size. iii. Determine genetics of WV populations e. Habitat degradation/fragmentation <ul style="list-style-type: none"> i. Survey streams for targeted brook trout spawning habitat restoration. ii. Evaluate habitat requirements including water quality and other stream characteristics and create a profile for WV brook trout waters iii. Need to undertake suitable habitat investigation and mapping (substrate, water temp/quality, instream cover, riparian cover, etc) f. Barriers to migration (1.2). <ul style="list-style-type: none"> i. Identify barriers having an influence on brook trout distribution g. Competition from non-native salmonids (1.3) <ul style="list-style-type: none"> i. Need to assess impact of competition from stocked and/or naturally reproducing non-native salmonids. Competition/interbreeding with stocked brook trout h. Climate change; increased water regimes(1.3) <ul style="list-style-type: none"> i. Identification of climate change related impacts to brook trout. <p>11. Green floater research</p> <ul style="list-style-type: none"> a. Assess effects of water withdrawals on species. b. Support research on the development of host fish propagation technology. c. Water quality degradation - Research needed: <ul style="list-style-type: none"> i. Effects of Marcellus shale drilling; water
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	<p>Mountain Joint Venture to model habitat-population relationships, habitat stability, demographics in response to external forces, etc. (4)</p> <p>e. Answer the questions: how many birds are needed to establish/sustain viable populations of our priority species, and how much habitat is needed to support those populations</p> <p>f. PA satellite telemetry transmitter project – National Aviary Research</p> <p>For Population Goal for WVFO: Maintain, stabilize, increase populations of all species.</p>
<p>Outreach</p>	<p>WVFO outreach is primarily done through one-on-one interaction because of limited staffing, and is not able to undertake broadscale outreach efforts.</p> <ol style="list-style-type: none"> 1. WVFO website 2. Other Chesapeake Bay partners; Congress; State agencies, NGOs, academia, other Federal agencies, NCTC; Conservation Fund (watershed groups, and other partners specific to this area) 3. TU outreach: school age students: headwaters 4. Promote take-back programs for selected pharmaceuticals and other compounds of concern. (1) 5. Work with other federal agencies and the states to ensure that the Environmental and Secondary Environmental Literacy Strategy includes a clear set of priorities related to creating and maintaining schoolyard habitat and green facilities and grounds. (1) 6. Reinvigorate FWS schoolyard habitat program throughout the Chesapeake Bay by leveraging increased investment with other partners (1)

References/Literature Cited

1. Chesapeake Bay Recovery Plan, <http://executiveorder.chesapeakebay.net/file.axd?file=2010%2f5%2fChesapeake+EO+Strategy%20.pdf> (pgs. 2, 4, 7, 10, 22, 24, 26, 35, 37-38, 41, 51-52, 54, 56-57, 65-66, 69-71, 79, 81, 90, 100-101, 103, 117). Also, Chesapeake Bay Recovery Plan Table: <http://executiveorder.chesapeakebay.net/file.axd?file=2010%2f9%2fChesapeake+EO+Action+Plan+FY2011.pdf>
2. Eastern Brook Trout Joint Venture Conservation Plan, http://www.easternbrooktrout.org/docs/EBTJV_WestVirginia_CS.pdf (pgs.2-7)
3. Potomac Highlands CWPMA Management Plan (pgs. 5, 7, 9,
4. Appalachian Mountains Joint Venture: <http://www.amjv.org/library/amjv.pdf> (pgs. 3, 4, 5, 12, 14-16, 19, 22-24, 26)
5. Species recovery plans
6. WVFO 3-Year Priority Plan

Large-scale Surface Coal Mining

Other Species Benefitting	
Introduction	<p>Activity Information: Large-scale Surface Coal Mining</p> <p>Justification for Activity Selection: A landscape-level activity of extensive scope and magnitude that dramatically alters physical terrain, forest and riparian habitats, watershed functions and water quality and chemistry, with potentially adverse consequences for a number of Service trust resources.</p> <p><i>NOTE: See Appendix D for Oil and Gas Well Maps</i></p>
Biological Planning	<p>Threats and Threat Assessment:</p> <ol style="list-style-type: none"> 1. Extensive forest fragmentation with associated potential for impacts to forest interior and area-sensitive species (e.g. cerulean warbler, Louisiana waterthrush); 2. Destruction of headwater streams via valley fills and “mine-throughs,” and loss of associated <u>biological function</u> (e.g., organic inputs, initial breakdown and transport of organic matter to downstream receiving waters), <u>diversity</u> (e.g., loss of aquatic organisms [macroinvertebrates, fish, crayfish, mussels, salamanders, etc.]) and <u>habitat</u> (e.g., loss of physical habitat and food resources for Louisiana waterthrush, Indiana and other bats); 3. Continued and expanded widespread degradation of water quality downstream of surface mining activities (conductivity, selenium, acid mine drainage), with associated impacts to aquatic organisms (in 2 above) and the terrestrial species that feed on them (birds, bats and other mammals, terrestrial salamanders, etc.); 4. Loss of potential elevational refugia (uphill migration) for response to climate change.
	<p>Focal Species for WVFO: Indiana bat (or also N. long-eared and/or E. small-footed bats? – petitioned to list both, and both known to occur in coal fields); Cerulean warbler, Louisiana waterthrush (other birds of conservation concern potentially impacted include Kentucky, Swainson’s, and worm-eating warblers and wood thrush); need to identify which mussel, fish, crayfish and salamander species are most likely to suffer population-level impacts or are most suitable as indicator species and consider these as possible focal species also.</p> <p>Objectives: With Partners:</p> <ol style="list-style-type: none"> 1. Identify focal species (and watersheds and connected/intact areas of greatest importance); 2. Determine current population status and key threats/avenues of impact by focal species; 3. Prioritize focal species based on: <ol style="list-style-type: none"> a. WV’s contribution to (i) range-wide population size/viability and (ii) suitable and potentially-suitable habitat, (i.e., determine WV’s importance

	<p>to the continued persistence of each focal species);</p> <ul style="list-style-type: none"> b. population-level vulnerability to (i) the direct, indirect and cumulative impacts of surface coal mining and (ii) climate change and other stressors (e.g. urban development, logging, oil and gas development, etc.); c. likelihood of response to available/practicable management/conservations efforts; <p>4. Develop measurable habitat and population goals/objectives for priority focal species.</p>
<p>Conservation Design (how to address threats)</p>	<p>Strategies for Addressing the Threats:</p> <ol style="list-style-type: none"> 1. Work with partners to identify and develop interagency management/conservation strategies for maintaining: <ul style="list-style-type: none"> a. core/important areas for focal species (look for areas of overlap of several focal species); b. areas/watersheds of conservation concern/priority (by focal species and among all species); c. landscape-level habitat connectivity requirements (forests and waterways) for focal species; d. aquatic and terrestrial biodiversity and focal species population viability; and e. integrity of headwater systems throughout the coal fields; 2. Model potential focal-species population-level responses/impacts/viability under a variety of mining, habitat-loss/degradation and climate change scenarios; 3. Work with partners (EPA) to develop/refine thresholds for: <ul style="list-style-type: none"> a. conductivity, selenium and other water quality parameters; and b. watershed-level loss of habitat and stream function; 4. Work with partners (OSM) to strengthen implementation and effectiveness of stream/riparian buffers via changes to the Stream Buffer Rule; 5. Develop strategies to: <ul style="list-style-type: none"> a. minimize the terrestrial and aquatic footprints (and, therefore, the associated ecological effects) of future surface mines; and b. remediate water quality degradation from past mining activities; c. improve and refine headwater streams functional assessments, mitigation standards, and performance measures; 6. Continue working with the Appalachian Regional Reforestation Initiative to develop/improve a landscape-level reforestation strategy for mined lands; 7. Work with partners on an interagency cumulative impacts assessment/EIS to accurately document what’s been lost to date (acreage mined, stream miles lost, losses of biological diversity/function, aquatic communities, etc.).
<p>Conservation Delivery (implementation – guidance taken from Conservation Design)</p>	<ol style="list-style-type: none"> 1. Implement interagency management/conservation strategies designed above; <ul style="list-style-type: none"> a. with partners, designate areas/watersheds as “unsuitable for (additional) surface mining”; b. acquire conservation easements or other permanent protection for

	<p>these areas/watersheds, or otherwise prevent impacts to them;</p> <ol style="list-style-type: none"> 2. Influence regulatory agency decisions to avoid, minimize and appropriately compensate for impacts of surface mining on populations and habitats of focal species; <ol style="list-style-type: none"> a. recommend maximum avoidance of “mine-throughs” or valley fills in headwater streams; b. recommend against issuance of permit exemptions and variances to Approximate Original Contour (AOC) requirements; c. recommend sequencing of valley fills and other mine-waste fills, with approvals for successive fills contingent upon achieving water quality standards and maintaining native aquatic fauna downstream of prior fills; d. recommend post-mining land uses that are compatible with habitat conservation for focal bat and migratory bird species; e. ensure implementation of functionally effective (biological, chemical and physical function) stream mitigation projects/efforts.
Monitoring	<ul style="list-style-type: none"> • Adaptive management • Mitigation Effectiveness <ol style="list-style-type: none"> 1. Track losses of mature forest habitats (landscape-level, acreage and rates); 2. Monitor focal bat and bird species relative to cumulative habitat loss; 3. Monitor post-mining land use designations and habitat quality over time (long-term); 4. Watershed-based water quality assessments and monitoring <ol style="list-style-type: none"> a. water chemistry – conductivity, selenium, AMD (acid mine drainage/discharge); b. aquatic macroinvertebrates c. other aquatic and riparian species; d. temperature and volume over time and pre- and post-mining; 5. Monitor stream mitigation effectiveness (biological, chemical, and physical).
Research	<p>The WVFO performs research cooperatively with other agencies, organizations and individuals. If research opportunities arise on the listed subjects of interest, the WVFO will support and assist in the cooperative research effort.</p> <p>For Threats and Threat Assessment: Research needed:</p> <ol style="list-style-type: none"> 1. Measure/model forest loss impacts on focal bat and migratory bird species; <ol style="list-style-type: none"> a. before-and-after bat habitat suitability; b. before-and-after avian diversity, density, productivity, parasitism and survival; 2. Measure/model effectiveness of reforestation efforts; 3. Measure/model watershed– and landscape-level consequences of loss and/or degradation of headwater streams;

	<ul style="list-style-type: none"> a. consequences to focal bat and bird species of diminished diversity and abundance of aquatic macroinvertebrates; b. changes in diversity/abundance and assemblages of other aquatic and riparian species; <ul style="list-style-type: none"> 4. Measure the extent/distance of downstream water quality degradation from surface mining and valley fills; 5. Measure/model impacts of climate change on habitat suitability, distribution, abundance, productivity and survival of focal bat and bird species.
Outreach	<p>WVFO outreach is primarily done through one-on-one interaction because of limited staffing, and is not able to undertake broadscale outreach efforts.</p> <ul style="list-style-type: none"> 1. WVFO website; 2. Presentations to coal companies; 3. Continue to work with WVDEP to update species lists and provide materials that will help mining companies meet their obligations under the ESA and MBTA.

Marcellus Shale

Other Species Benefitting	
Introduction	<p>Activity Information: Marcellus Shale Exploration and Development</p> <p>Justification for Activity Selection: A rapidly-expanding landscape-level activity that has significant potential to impact water quality and quantity, with potentially adverse consequences for federally-listed and candidate freshwater mussels a number of other Service trust resources.</p> <p><i>NOTE: See Appendix D for Oil and Gas Well Maps</i></p>
Biological Planning	<p>Threats and Threat Assessment:</p> <ol style="list-style-type: none"> 1. Construction of large and concentrated drilling pads and associated access roads: <ol style="list-style-type: none"> a. forest fragmentation; b. run-off, erosion and sedimentation; c. potential for barriers to movements of fish and other aquatic organisms; 2. Drilling and hydraulic fracturing (fracking): <ol style="list-style-type: none"> a. potential for spills of drilling fluids, fracking chemicals, or contaminated flow-back waters; b. water withdrawals from streams to support fracking (1 to 5 million gallons per well); c. run-off, erosion, sedimentation and spill potential related to water-truck traffic (1 to 6 months of very heavy truck traffic per well pad, often on roads not designed to handle that level of use); d. damming of headwater streams to provide water necessary for fracking; e. inadequate capacity from treating or disposing of toxic fracking waste water; 3. Industry currently exempt from regulation under the Clean Water Act and the Safe Drinking Water Act; 4. Current State regulatory framework and inspection/enforcement personnel inadequate for ensuring maintenance of water quality and quantity; 5. Potential for impacts to karst, cave (including bat hibernacula) and subterranean stream habitats (and associated rare/endemic species) in some parts of the state.
	<p>Focal Species for WVFO: Listed and candidate freshwater mussels (see individual species accounts above); non-listed freshwater mussels and other aquatic organisms of state conservation concern(?) - need to identify which mussel, fish, crayfish and salamander species are most likely to suffer population-level impacts and consider these as possible focal species also, as well as rare/endemic cave/subterranean stream species.</p> <p>Objectives:</p> <p>With Partners:</p> <ol style="list-style-type: none"> 1. Identify focal species (and watersheds of greatest importance); 2. Determine current population status and key threats/avenues of impact

	<p>by focal species;</p> <ol style="list-style-type: none"> 3. Prioritize focal species based on: <ol style="list-style-type: none"> a. WV’s contribution to (i) range-wide population size/viability and (ii) suitable and potentially-suitable habitat, (i.e., determine WV’s importance to the continued persistence of each focal species); b. population-level vulnerability to (i) the direct, indirect and cumulative impacts of Marcellus Shale development and (ii) climate change and other stressors (e.g. urban development, logging, oil and gas development, etc.); c. likelihood of response to available/practicable management/conservations efforts; 4. Develop measureable habitat and population goals/objectives for priority focal species.
<p>Conservation Design (how to address threats)</p>	<p>Strategies for Addressing the Threats:</p> <ol style="list-style-type: none"> 1. Work with partners to identify and develop interagency management/conservation strategies for maintaining: <ol style="list-style-type: none"> a. core/important areas for focal species (look for areas of overlap of several focal species); b. areas/watersheds of conservation concern/priority (by focal species and among all species); c. landscape-level habitat connectivity requirements (forests and waterways) for focal species; d. aquatic and terrestrial biodiversity and focal species population viability; and e. integrity of stream systems throughout the Marcellus development area; 2. Model potential population-level responses/impacts/viability under a variety of Marcellus development, habitat-loss/degradation and climate change scenarios; 3. Work with partners to develop/refine BMPs for: <ol style="list-style-type: none"> a. well pad and road siting, density, construction and maintenance; b. run-off, erosion and sedimentation control; c. water withdrawals; d. fracking chemical use and storage; and e. treatment/disposal of fracking waste water; 4. Develop strategies to: <ol style="list-style-type: none"> a. minimize the terrestrial and aquatic footprints (and, therefore, the associated ecological effects) of future Marcellus activities; and b. remediate water quality degradation (erosion, sedimentation, perhaps the release of toxic chemicals) from past Marcellus activities.
<p>Conservation Delivery (implementation – guidance taken from Conservation Design)</p>	<ol style="list-style-type: none"> 1. Implement interagency management/conservation strategies designed above; <ol style="list-style-type: none"> a. with partners, designate areas/watersheds as “unsuitable for (additional) Marcellus exploration and development”; b. acquire conservation easements or other permanent protection for these areas/watersheds, or otherwise prevent impacts to them; 2. Influence regulatory agency decisions to avoid, minimize and

	<p>appropriately compensate for impacts of Marcellus exploration and development activities on populations and habitats of focal species;</p> <ol style="list-style-type: none"> 3. For focal species streams/watersheds, develop and implement: <ol style="list-style-type: none"> a. water withdrawal limits/restrictions; b. road- and pad-density limits/restrictions; c. traffic-management measures; 4. Strengthen and ensure consistent implementation of erosion/sedimentation control BMPs; 5. Ensure that access roads do not create barriers to movements of fish and other aquatic organisms; 6. Encourage maximum recycling on hydraulic fracturing chemicals, fluids and flow-back waters; 7. Ensure proper treatment and/or disposal of toxic chemicals and flow-back waters. 8. Lobby Congress to revoke the industry's exemptions from the Clean Water Act and Safe Drinking Water Act (there was no scientifically transparent or defensible process by which these exemptions were evaluated and granted).
Monitoring	<p>Monitor:</p> <ol style="list-style-type: none"> 1. Mussel beds in focal watersheds and those experiencing high levels of Marcellus activity; 2. Well pad and road density in focal watersheds; 3. Water levels, flows, chemistry, temperatures and sedimentation levels in focal watersheds; 4. Stream crossings for barriers to movements of fish and other aquatic organisms; 5. Effectiveness of sedimentation- and erosion-control BMPs and structures.
Research	<p>The WVFO performs research cooperatively with other agencies, organizations and individuals. If research opportunities arise on the listed subjects of interest, the WVFO will support and assist in the cooperative research effort.</p> <p>For Threats and Threat Assessment: Research needed:</p> <ol style="list-style-type: none"> 1. Measure/model habitat fragmentation from road and drilling pad construction; 2. Measure the extent/distance of downstream sedimentation/water quality degradation from Marcellus activities; 3. Compare mussel habitat conditions, survival and reproduction, as well fish host population viability, in watersheds with various levels of Marcellus-related activities; 4. Cumulative impacts assessment.
Outreach	<p>WVFO outreach is primarily done through one-on-one interaction because</p>

	<p>of limited staffing, and is not able to undertake broadscale outreach efforts.</p> <ol style="list-style-type: none">1. WVFO website;2. Presentations to oil and gas companies, target industry conferences/trade shows, etc.;3. Provide species and stream lists/information to WVDEP, Division of Oil and Gas, so that these can be included in information provided to permittees to increase awareness of ESA issues/requirements.
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SECTION III

APPENDICES

Appendix A

Justification for Key Species

1. Mussels
 - a. Justification for selection:
 - i. These species are either Federally-listed or candidate species for listing and are located in West Virginia. As a group, mussels account for roughly half of all listed species in the state. West Virginia has a chronic threat of widespread water quality and quantity issues associated with widespread coal mining, oil and gas development in the Marcellus shale region, and other land uses.
2. Harperella
 - a. Justification for selection:
 - i. This species is Federally-listed and is located in West Virginia. Since the early 1990s, the Sleepy Creek, WV sites have declined from approx. 2,000,000 to 400,000 plants, the Cacapon River, WV sites have declined from approx. 72,000 to 400 plants. Only six of the populations are estimated to consistently support more than 2,000 individual plants, and nine of the populations are estimated to contain less than 400 plants.
3. Northeastern Bulrush
 - a. Justification for selection:
 - i. This species was Federally-listed as endangered in 1991 and has (three) extant populations located in Hardy and Berkley counties and the Chesapeake Bay Watershed in West Virginia. Two of these sites are located on private lands, and one is located on National Forest land managed by the U.S. Forest Service. Populations occurring on private lands are at risk to habitat loss, modifications, and degradation from residential and agricultural development impacts.
4. Shale Barren Rock Cress
 - a. Justification for selection:
 - i. This species is Federally-listed and is located in West Virginia. This species occurs in small populations in a highly specific habitat. It is also within the Potomac Watershed, and consequently the Chesapeake Bay Watershed, a watershed of National interest.
5. Virginia Spiraea
 - a. Justification for selection:
 - i. This species was Federally-listed as threatened in 1990 and is known to be present in six West Virginia counties. Habitat is defined by flood-scoured, oft-disturbed successional riverine areas.
6. Cheat Mountain Salamander
 - a. Justification for selection:
 - i. This species was Federally-listed as a threatened species by U.S. Fish and Wildlife Service in September 1989. Essential and niche habitat exists primarily in the cool and moist high elevation red spruce-Northern

hardwoods environment above 2980 feet within West Virginia's Monongahela National Forest.

7. Diamond Darter
 - a. Justification for selection:
 - i. This species is Federally-listed and is located in West Virginia. Population has a very large decline (decline of >90%, with <10% of population size, range extent, area occupied, and/or number or condition of occurrences remaining). Potential host for Federally-listed mussel species.
8. Madison Cave Isopod
 - a. Justification for selection:
 - i. This species is Federally-listed and is located in West Virginia. Of high scientific interest in crustacean research, especially in the research of relations between marine and freshwater crustaceans.
9. American Eel
 - a. Justification for selection:
 - i. Historically, American eel were the most widely distributed fish in East Coast streams, and comprised more than 25 percent of the total fish biomass. However, the population of this migratory fish has been declining in recent years. This decline is the result of several factors including habitat modification, harvesting of every freshwater life stage, exposure to contaminants, and dams.
10. Brook Trout
 - a. Justification for selection:
 - i. Brook trout are the only salmonid (trout, char, or salmon) native to West Virginia. Brook trout are an excellent sentinel of water quality and will likely also be a sentinel of the effects of climate change over the next century. Brook trout are declining across their entire eastern range; causes for these declines are similar; an integrated approach would be cost effective; and watersheds of concern span state borders and state and Federal jurisdictions.
11. American Black Duck
 - a. Justification for selection:
 - i. The black duck was chosen as a priority species because of its importance in the northeast. The high continental concern and precipitous decline in the Northeast makes freshwater wetlands and their relationship to local agriculture a key conservation concern.

Appendix B

Listed Species Not Included in WVFO 3-year Priority Plan

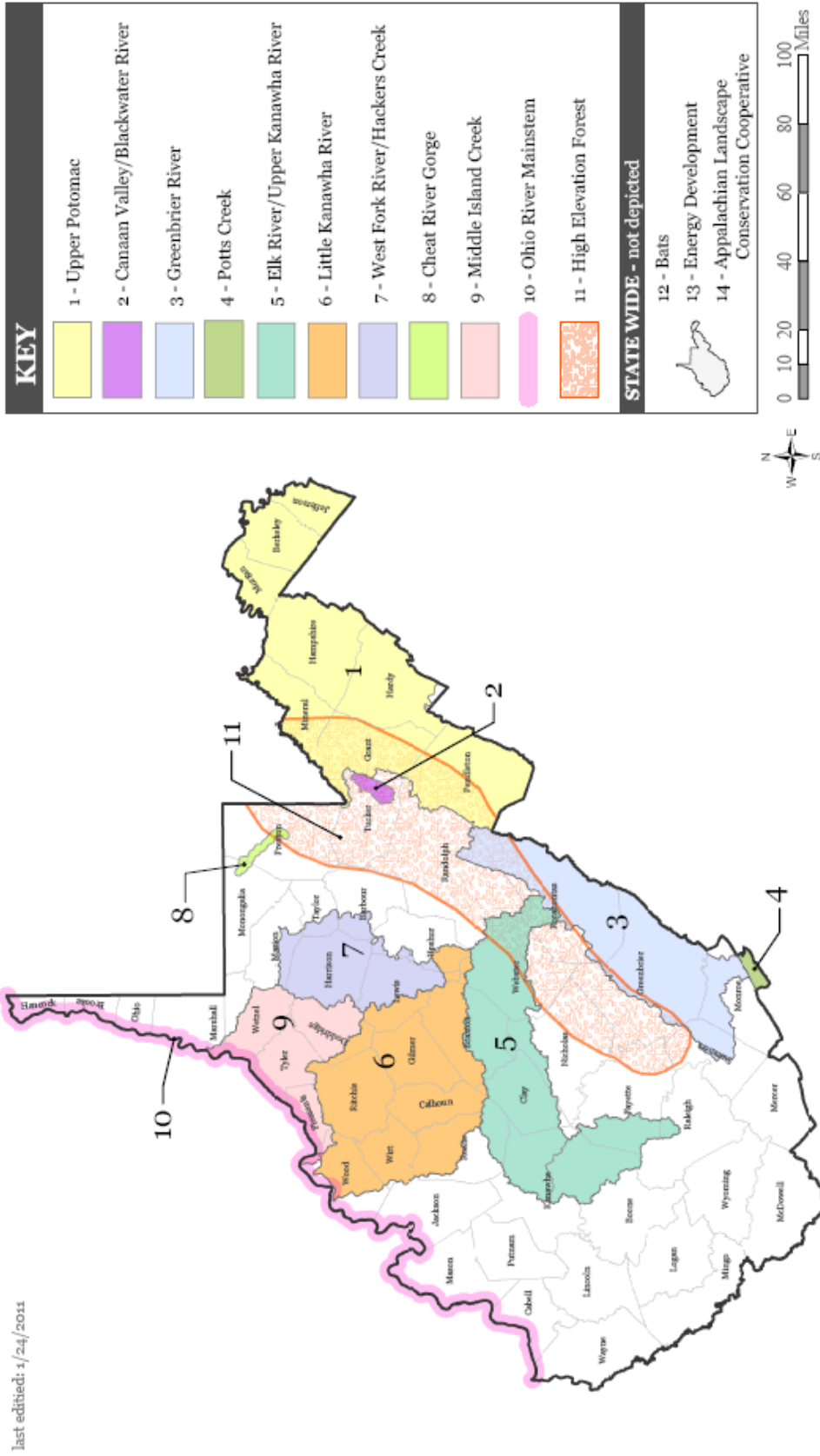
Species	Scientific Name	Justification
Eastern cougar	<i>Felis concolor cougar</i>	May be extinct
Running buffalo clover	<i>Trifolium stoloniferum</i>	Species is on the verge of recovery, with an existing MOU with USDA Forest Service in place.
Small whorled pogonia	<i>Isotria medeoloides</i>	Very few sites in WV

Appendix C

WVFO Focal Area Map

USFWS WEST VIRGINIA FIELD OFFICE-PRIORITY PLANNING FOCAL AREAS

last edited: 1/24/2011



Appendix D

WVFO Partners for Fish and Wildlife Activity Chart as of January 24, 2011

Colors correlate to map section colors (See Appendix C)

Focal Area	County	Status	Wet. (ac)	Rip.Up (ac)	Up.For. (ac)	Stream (mi)	Imp.Past. (ac)
West Virginia							
West Fork/ Hackers Creek (#7 on Map)	Upshur	I	0.5	2.5		0.8	44
	Upshur	P	1.5	103		1.6	116
TOTALS			2	105.5		2.4	160
Greenbrier River (#3 on Map)	Greenbrier	P	3	4.7		0.5	170
	Greenbrier	P	0.3	4		0.3	59
	Monroe	C	5			0.5	32
TOTALS			8.3	8.7		1.3	261
Upper Potomac (#1 on Map)	Hardy	P	0.2	1.3		0.34	19.9
	Hardy	C	0.1	7		0.8	19.9
	Hardy	P	0.1	4		0.7	34.6
	Grant	C	1	9	75.6	0.8	70.8
	Jefferson	P					
	Pendleton	P	5				
	Hardy	P	0.8			0.3	10
TOTALS			7.2	21.3	75.6	2.94	147.1
Little Kanawha River (#6 on Map)	Gilmer	I					400
	TOTALS						400
Ohio River Mainstem (#10 on Map)	Ohio	C			56		46
	Mason	I	1.8	50.7		1.7	20.7
	Mason	P	2.7	141.4		4.4	
TOTALS			4.1	71.7	56	1.7	66.7
Non-Focal Area Projects	Marion	P			93		32
	Barbour	P					501.5
	Randolph	C	0.2	1.8	24		
	Nicholas	C	1				
	Kanawha	P					
	Putnam	P	4	35.5		1.4	31.4
TOTALS			5.2	37.3	117	1.4	564.9

KEY: Wet.=Wetland, Rip. Up.=Riparian Upland, Up. For.=Upland Forest, Imp. Past.=Improved Pasture, (ac)=Acreage, (mi)=Miles, P=Planning, C=Completed, I=Incomplete

Appendix E

Partnership Master List

- Congress
- State agencies
 - West Virginia State Parks
 - West Virginia Department of Transportation
 - West Virginia Divisions: Natural Resources; Mining and Reclamation; Agriculture; Forestry; Tourism; and, Land Restoration.
 - West Virginia Department of Environmental Protection
 - Department of Natural Resources cost share
 - Department of Health
 - West Virginia Department of Agriculture
 - West Virginia Farm Bureau
 - West Virginia Forestry Association,
 - West Virginia State Development Office
 - County Soil and Water Conservation District
- Non-government organizations
 - The Nature Conservancy
 - The National Science Foundation
 - World Wildlife Federation
 - Audubon Society
 - American Zoo and Aquarium Assoc.
 - Ohio River Valley Ecosystem Team
 - Natural Heritage Programs
 - Center for Plant Conservation
 - West Virginia Watershed Network
 - ProjectWET
 - Rivers Coalition
 - Watershed groups
 - The Trust for Public Land,
 - The Conservation Fund– national office,
 - The Freshwater Institute
 - Conservation Fund
- Academia
 - West Virginia University – Division of Forestry and Natural Resources
 - Tennessee Tech
 - Virginia Tech
 - Ohio State University
- Federal agencies
 - U.S. Forest Service
 - U.S. Fish and Wildlife Service
 - Regional Field Offices: VA, NY, etc.
 - National Wildlife Refuges
 - White Sulphur Springs National Fish Hatchery
 - National Conservation Training Center
 - U.S. Department of Agriculture- Rural Development
 - Natural Resources Conservation Service
 - National Oceanic and Atmospheric Association

- Army Corps of Engineers
- Environmental Protection Agency
- U.S. Geological Survey
- National Park Service
- Department of the Interior (Natural Resource Damage Assessment and Restoration)
- Appalachian Landscape Conservation Cooperative
- Office of Surface Mining
- Landowners
- Coal Association and other Industry Organizations,

Specific Species/Focal Area Partners:

Bats:

- Non-government organizations:
 - Caving groups
 - National Speleological Society

Mussels:

- State agencies
 - Fisheries
 - State Sea Grants
- Non-government organizations:
 - Ohio River Mussel Group
 - Ohio River Basin Fish Habitat Partnership
- Academia
 - Tennessee Tech
 - Virginia Tech
 - Ohio State University

Harperella

- Non-government organizations:
 - Friends of Cacapon River
 - Sleepy Creek Watershed Association
 - TNC for Cacapon river (has easement)
 - Maryland Natural Heritage Program (genetics)
 - North Carolina Botanical Garden (cultivation)

Shale Barren Rock Cress

- State Agencies:
 - Virginia Department of Agriculture and Consumers Services (monitors all Virginia populations)
- Federal agencies:
 - United States Navy
 - Monongahela National Forest

Cheat Mountain Salamander

- Academia
 - Species experts and other researchers
 - Formation of Cheat Mountain Salamander working group or formal recovery team
- Federal agencies

- U.S. Geological Survey and National Wetlands Inventory maps

Diamond Darter

- State agencies
 - Fisheries
 - State Sea Grants
- Federal agencies:
 - Grants Program
 - Contaminants Program
 - Law Enforcement Program
 - Federal Highway Admin.

Madison Cave Isopod

- Non-government organizations:
 - Caving groups
 - National Speleological Society

American Eel

- State Agencies
 - Maryland Department of Natural Resources;
 - West Virginia Cooperative Fish and Wildlife Research Unit
- Non-government organizations:
 - Allegheny Energy
- Federal Agencies
 - National Park Service Chesapeake & Ohio Canal National Historic Park;

Brook Trout

- Non-government organizations:
 - WV Brook Trout Conservation Group
 - Trout Unlimited
 - Eastern Brook Trout Joint Venture
- Academia
 - Shepherd's College
 - Davis and Elkins College

American Black Duck

- Non-government organizations:
 - Ducks Unlimited
- Academia
 - Cornell Lab of Ornithology

Energy Development

- State Agencies
 - WVDEP—Office of Oil and Gas
- Non-Government Organizations
 - Natural gas and pipeline companies/consultants
 - Coal companies and their consultants
 - Bat Conservation International
 - Appalachian Regional Reforestation Initiative (ARRI).
- Academia
 - West Virginia University-Water Research Institute

- Marshall, University of Maryland (Palmer)
- Federal Agencies
 - Federal Energy Regulatory Commission

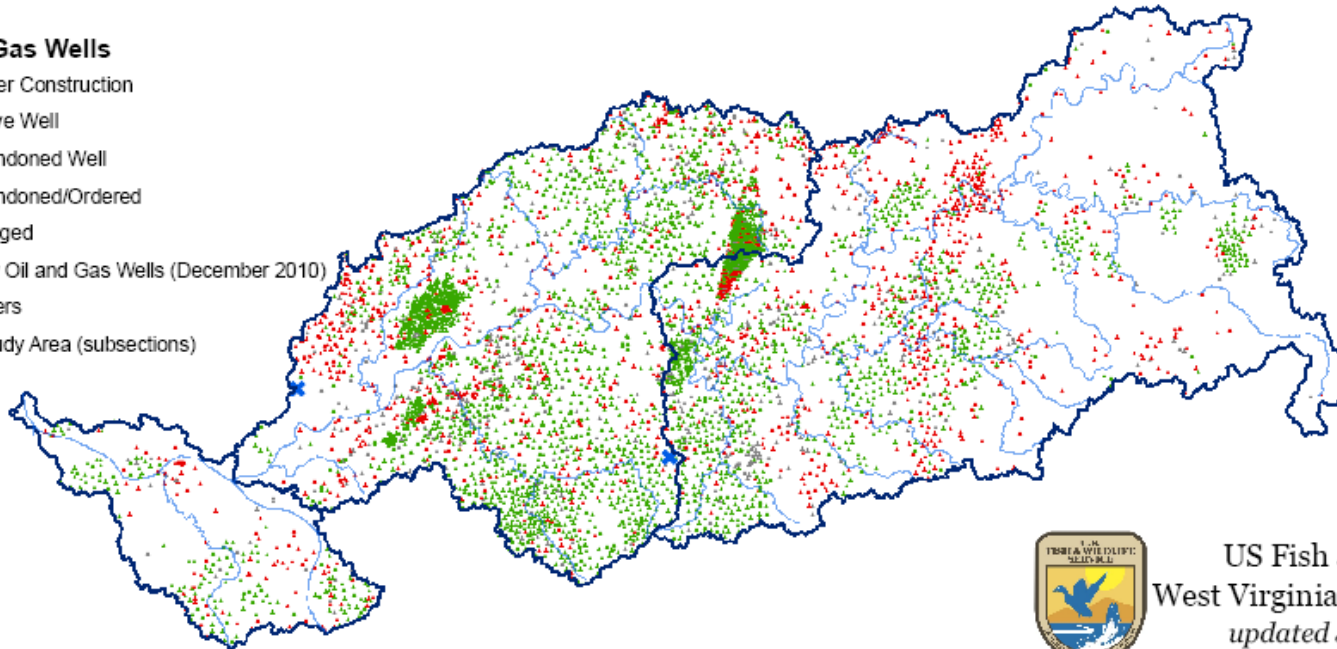
Appendix F

Maps of Oil and Gas Wells

OIL AND GAS WELLS IN DIAMOND DARTER STUDY AREA ELK RIVER WATERSHED

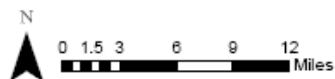
Oil and Gas Wells

- Under Construction
- Active Well
- Abandoned Well
- Abandoned/Ordered
- Plugged
- ✦ New Oil and Gas Wells (December 2010)
- ~ Rivers
- ▭ Study Area (subsections)



US Fish and Wildlife
West Virginia Field Office
updated January 2011

Study Area Inset



UPDATED: Table 2.b. Oil and gas wells by subsections, from WVDEP.

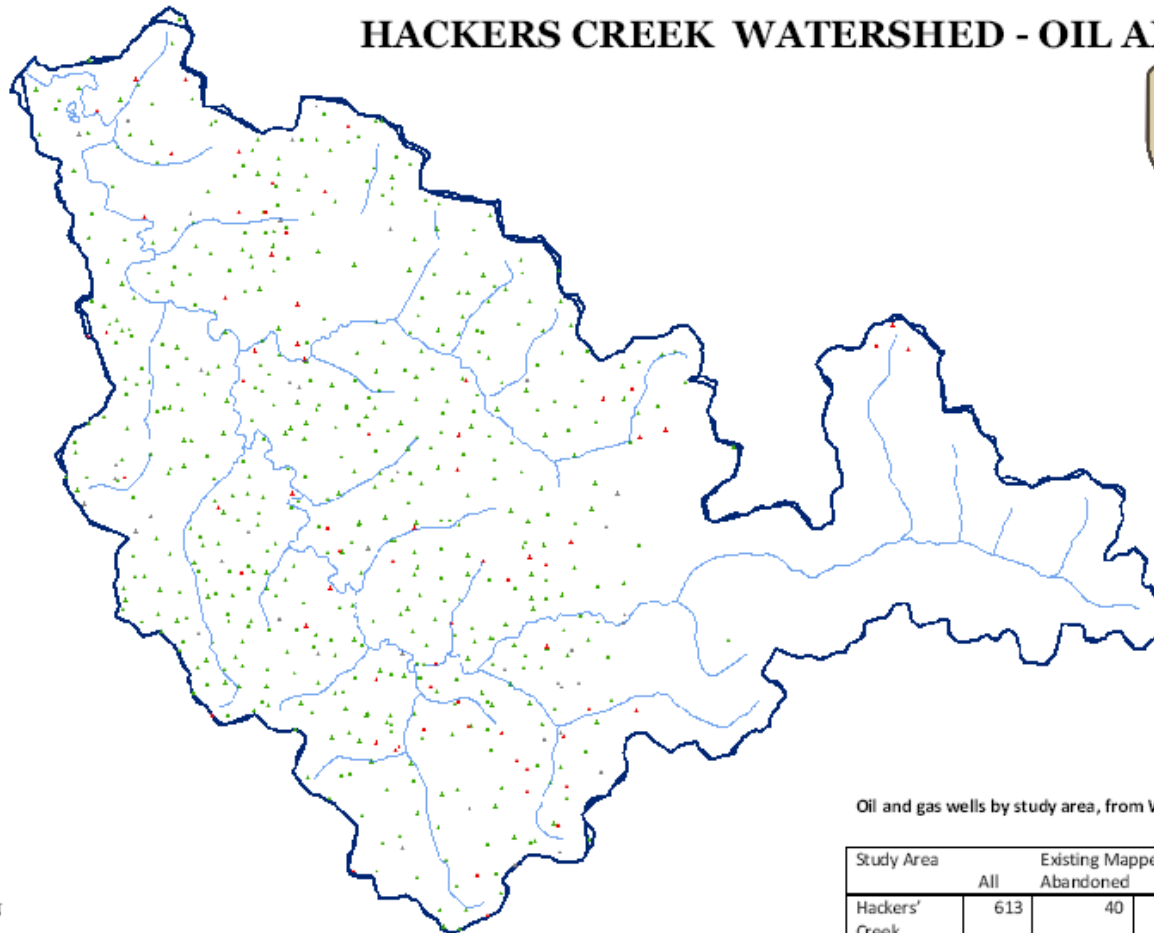
Subsections	Existing Mapped Wells				New Wells		Misc, not depicted*
	All	Abandoned	Active	Plugged	All		
KS	3374	285	2320	769	2		240
KAN	284	23	158	90	0		27
SUT	2164	227	1205	732	0		160
Total	5822	535	3683	1591	2		427

*permit status listed as: never drilled, never issued, future use, not available, or entry was left blank

HACKERS CREEK WATERSHED - OIL AND GAS WELLS STUDY



US Fish and Wildlife
West Virginia Field Office
updated January 2011



Oil and Gas Wells

- Under Construction
- Active Well
- Abandoned Well
- Abandoned/Ordered
- Plugged

- Hackers Creek waterways
- Hackers Creek study area

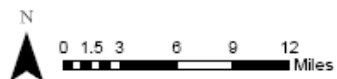
Study Area Inset



Oil and gas wells by study area, from WVDEP.

Study Area	Existing Mapped Wells				New Wells	
	All	Abandoned	Active	Plugged	All	Misc, not depicted*
Hackers' Creek	613	40	502	71	0	72

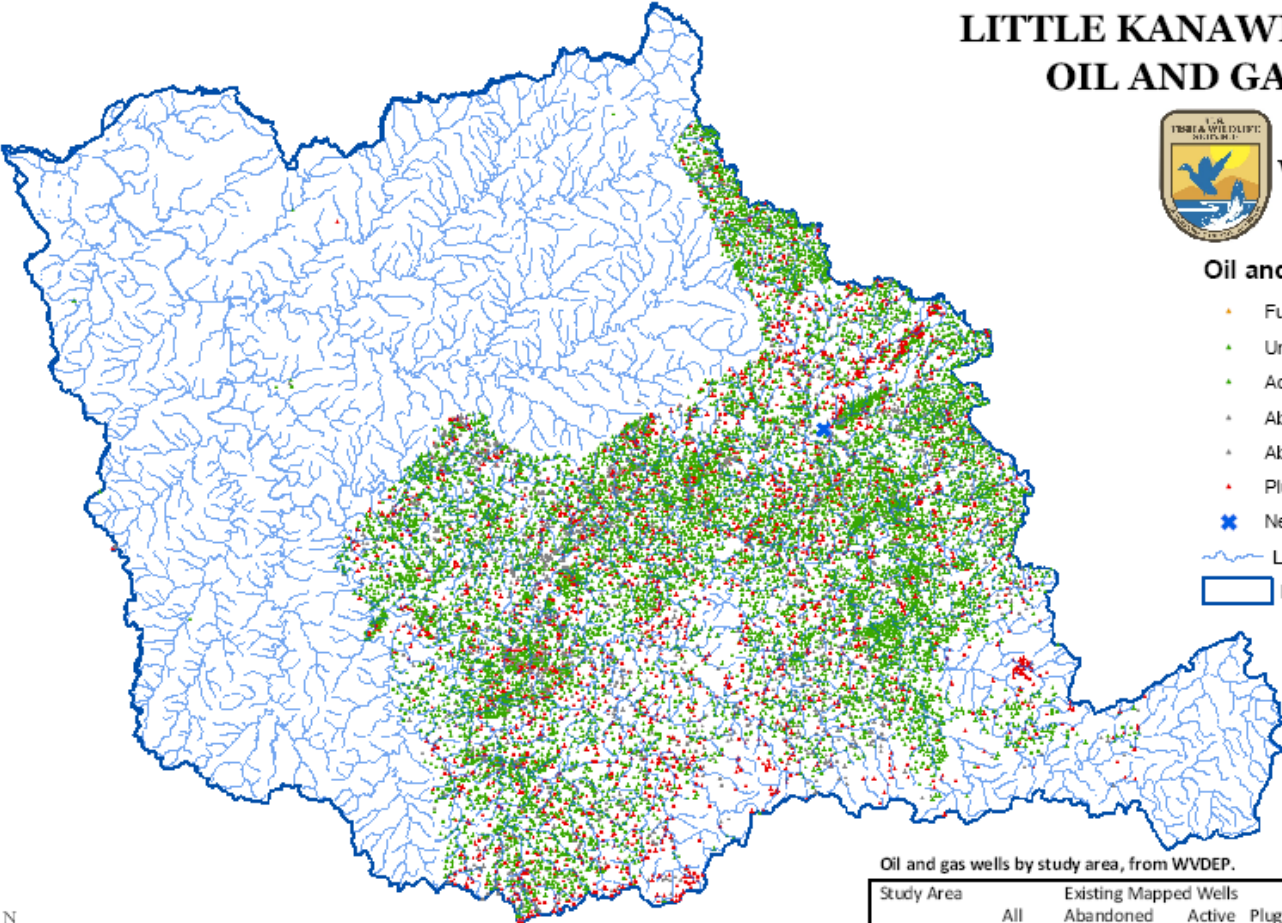
*permit status listed as: never drilled, never issued, future use, not available, or entry was left blank.



LITTLE KANAWHA WATERSHED OIL AND GAS WELLS STUDY



US Fish and Wildlife
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updated January 2011



Oil and Gas Wells

- Future Use
- Under Construction
- Active Well
- Abandoned Well
- Abandoned/Ordered
- Plugged
- ★ New Oil and Gas Wells (December 2010)

- Little Kanawha River waterways
- ▭ Little Kanawha study area

Study Area Inset



Oil and gas wells by study area, from WVDEP.

Study Area	Existing Mapped Wells				New Wells	
	All	Abandoned	Active	Plugged	All	Misc, not depicted*
Little Kanawha	13938	1864	9554	2519	1	1209
River						

*permit status listed as: never drilled, never issued, future use, not available, or entry was left blank.

MIDDLE ISLAND CREEK WATERSHED - OIL AND GAS WELLS STUDY

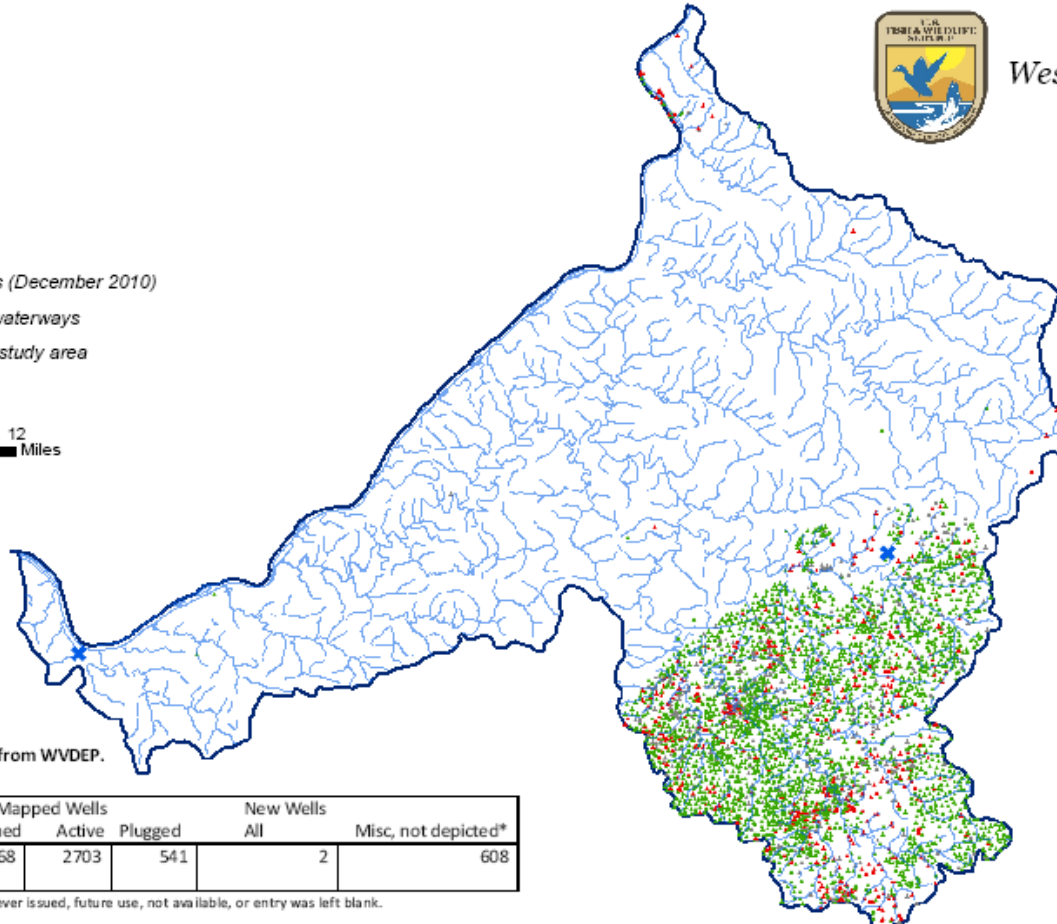
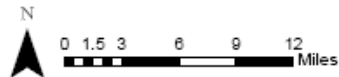


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West Virginia Field Office
updated January 2011

Oil and Gas Wells

- Under Construction
- Active Well
- Abandoned Well
- Abandoned/Ordered
- Plugged
- ✦ New Oil and Gas Wells (December 2010)

~ Middle Island Creek waterways
 [] Middle Island Creek study area



Study Area Inset



Oil and gas wells by study area, from WVDEP.

Study Area	Existing Mapped Wells				New Wells	
	All	Abandoned	Active	Plugged	All	Misc, not depicted*
Middle Island Creek	3712	468	2703	541	2	608

*permit status listed as: never drilled, never issued, future use, not available, or entry was left blank.

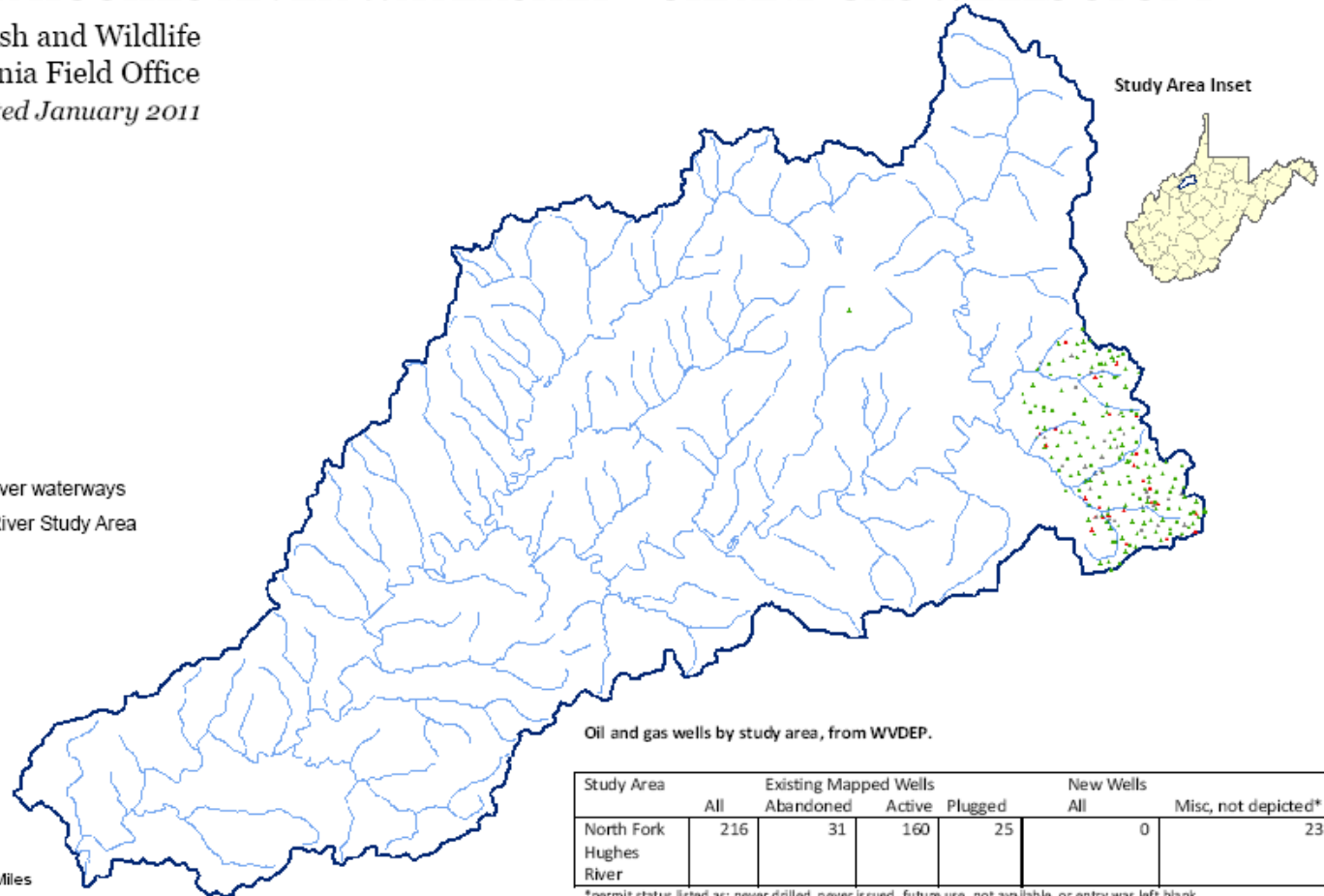
NORTH FORK HUGHES RIVER WATERSHED - OIL AND GAS WELLS STUDY



US Fish and Wildlife
West Virginia Field Office
updated January 2011

Oil and Gas Wells

- Active Well
- Abandoned Well
- Abandoned/Ordered
- Plugged
- North Fork Hughes River waterways
- North Fork Hughes River Study Area



SOUTH FORK HUGHES RIVER WATERSHED - OIL AND GAS WELLS STUDY

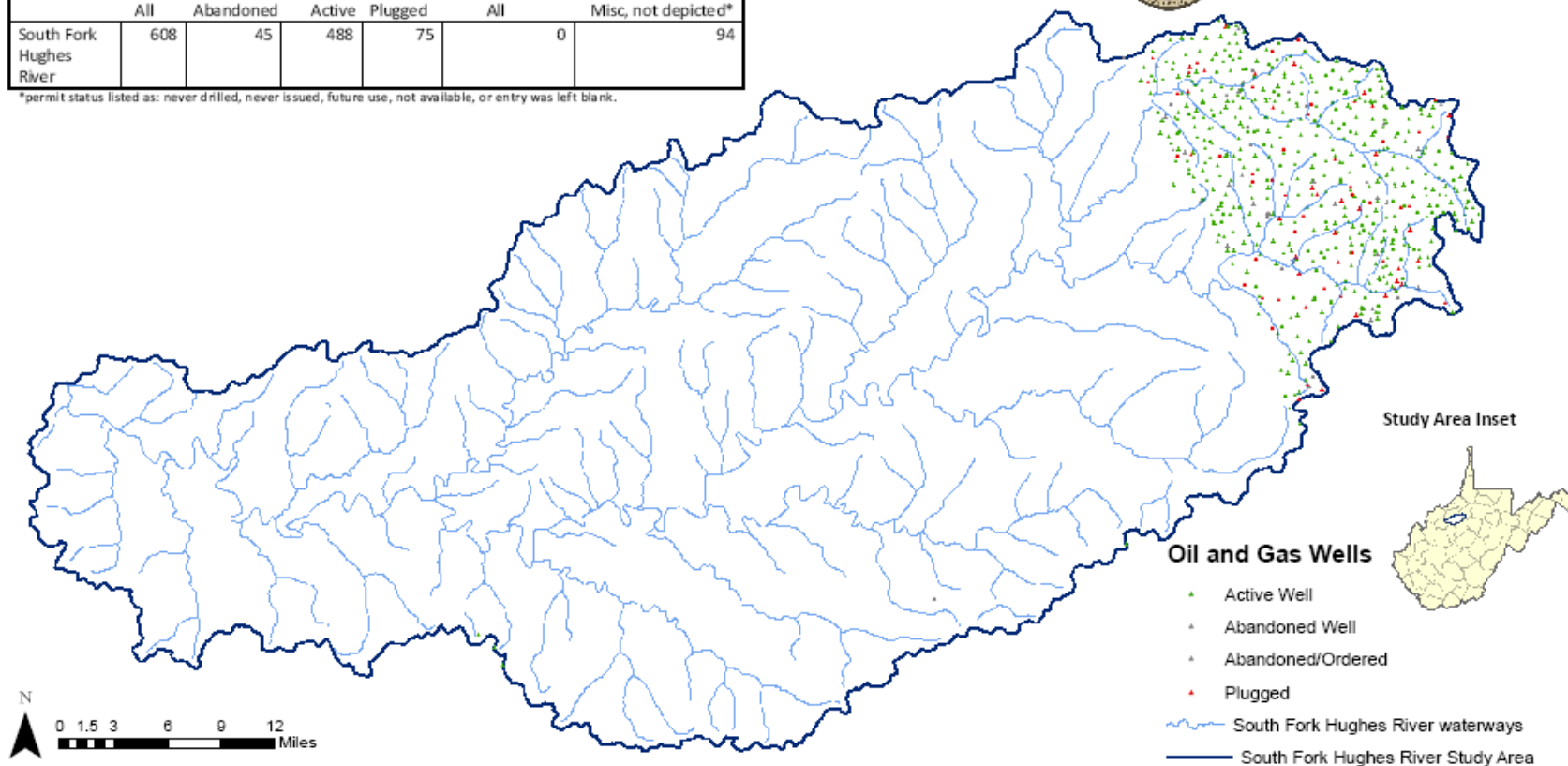
Oil and gas wells by study area, from WVDEP.



US Fish and Wildlife
West Virginia Field Office
updated January 2011

Study Area	Existing Mapped Wells				New Wells	
	All	Abandoned	Active	Plugged	All	Misc, not depicted*
South Fork Hughes River	608	45	488	75	0	94

*permit status listed as: never drilled, never issued, future use, not available, or entry was left blank.



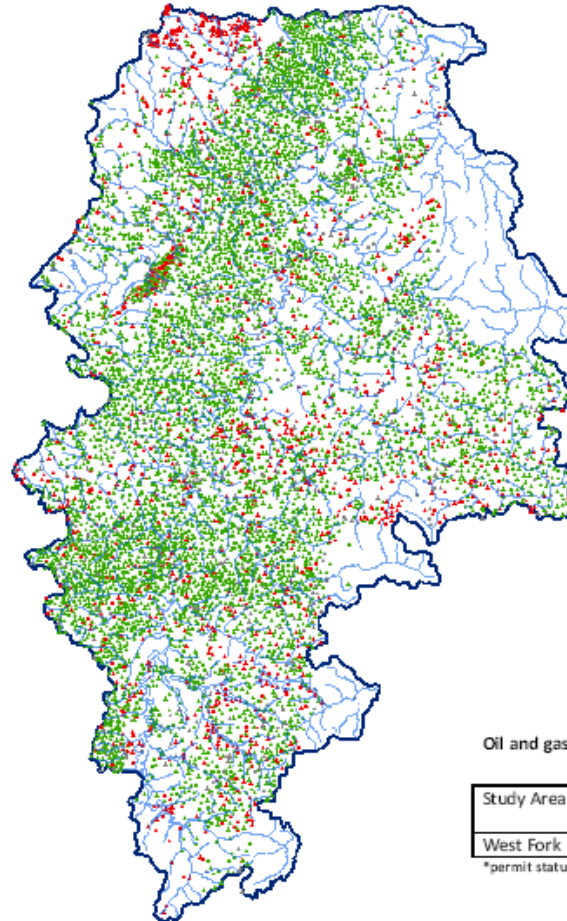
WEST FORK WATERSHED - OIL AND GAS WELLS STUDY



US Fish and Wildlife
West Virginia Field Office
updated January 2011

Oil and Gas Wells

- Under Construction
- Active Well
- Abandoned Well
- Abandoned/Ordered
- Plugged
- ~ West Fork waterways
- ▭ West Fork Study Area



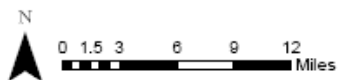
Study Area Inset



Oil and gas wells by study area, from WVDEP.

Study Area	Existing Mapped Wells				New Wells	
	All	Abandoned	Active	Plugged	All	Misc, not depicted*
West Fork	8531	727	6390	1414	0	1324

*permit status listed as: never drilled, never issued, future use, not available, or entry was left blank.



Appendix G

Acronym List

Fish and Wildlife Service Acronyms:

1. CVNWR=Canaan Valley National Wildlife Refuge
2. CPA=Conservation Planning Assistance
3. ES=Endangered Species
4. NC-ES=North Carolina Ecological Services Office
5. NCTC=National Conservation Training Center
6. PFW=Partners for Fish and Wildlife
7. RO=Regional Office
8. SHC=Strategic Habitat Conservation
9. VA-ES=Virginia Ecological Services Office
10. WO=Washington Office
11. WVFO=West Virginia Field Office

Organization Acronyms:

1. Appalachian LCC=Appalachian Landscape Conservation Cooperative
2. ASMFC=Atlantic States Marine Fisheries Commission
3. CASRI=Central Appalachian Spruce Restoration Initiative
4. DOI=Department of the Interior
5. EBTJV=Eastern Brook Trout Joint Venture
6. EPA=Environmental Protection Agency
7. MOU=Memorandum of Understanding
8. NGO=Non-Government Organization
9. NRCS=Natural Resource Conservation Service
10. NRDA=Natural Resource Damage Assessment Process
11. NWR=National Wildlife Refuge
12. ORVE=Ohio River Valley Ecosystem Team
13. OSM=Office of Surface Mining
14. PA DCNR=Pennsylvania Department of Conservation and Natural Resources
15. RC&D=Resource Conservation and Development Program
16. TNC=The Nature Conservancy
17. USACE=U.S. Army Corps of Engineers
18. USFS=United States Forest Service
19. WVDEP=West Virginia Department of Environmental Protection
20. WVDNR=West Virginia Department of Natural Resources

Government Acts:

1. CWA=Clean Water Act
2. ESA=Endangered Species Act
3. ECP=Enhanced Coordination Process
4. FOIA=Freedom of Information Act
5. NEPA=National Environmental Policy Act

Species Acronyms:

1. VBEB=Virginia Big Eared Bat
2. WNS=White Nose Syndrome
3. WVNFS=West Virginia Northern Flying Squirrel
4. T=Threatened
5. E=Endangered
6. C=Species of Concern
7. NL=Not Listed
8. P=Proposed for Listing

General Acronyms

1. ATV=All Terrain Vehicle
2. AMD=Acid Mine Drainage/Discharge
3. AOC=Approximate Original Contour
4. EIS=Ecological Impact Assessment