U.S. Fish & Wildlife Service

Patuxent Research Refuge

Draft Comprehensive Conservation Plan and Environmental Assessment

October 2012

Front Cover:

Cash Lake Fishing Pier
USFWS

Back Cover:

Visitor Center Trail
USFWS

This blue goose, designed by J.N. "Ding" Darling, has become the symbol of the National Wildlife Refuge System.

The *U.S. Fish and Wildlife Service* is the principal Federal agency responsible for conserving, protecting, and enhancing fish, wildlife, plants, and their habitats for the continuing benefit of the American people. The Service manages the 150-million-acre National Wildlife Refuge System comprised of more than 550 national wildlife refuges and thousands of waterfowl production areas. It also operates 70 national fish hatcheries and 81 ecological services field stations. The agency enforces Federal wildlife laws, manages migratory bird populations, restores nationally significant fisheries, conserves and restores wildlife habitat such as wetlands, administers the Endangered Species Act, and helps foreign governments with their conservation efforts. It also oversees the Federal Assistance Program which distributes hundreds of millions of dollars in excise taxes on fishing and hunting equipment to state wildlife agencies.

Comprehensive Conservation Plans provide long-term guidance for management decisions and set forth goals, objectives, and strategies needed to accomplish refuge purposes and identify the Service's best estimate of future needs. These plans detail program planning levels that are sometimes substantially above current budget allocations and, as such, are primarily for Service strategic planning and program prioritization purposes. The plans do not constitute a commitment for staffing increases, operational and maintenance increases, or funding for future land acquisition.

U.S. Fish & Wildlife Service

Patuxent Research Refuge

Draft Comprehensive Conservation Plan and Environmental Assessment

October 2012

Refuge Vision Statement

Positioned near the center of the Baltimore-Washington Corridor, Patuxent Research Refuge is an island of green within a sea of urban development. This large, contiguous block of forest and wetlands provides a unique opportunity for wildlife research on a landscape and local scale in a natural setting. The refuge and our partners interpret the results of research for the visiting public as a way of connecting people with the natural world. As the first national wildlife refuge established for both wildlife and research, and the home of the U.S. Geological Survey's Patuxent Wildlife Research Center, staff and partners are able to conduct cutting-edge wildlife research and passionate interpretation of the natural world in the shadows of protected historic and cultural resources. The North Tract and the National Wildlife Visitor Center provide opportunities for local children, national decision-makers, and the general public from around the world to develop a conservation ethic and learn about the refuge, the National Wildlife Refuge System, and the importance of science and the benefits that green spaces provide to wildlife and people. Patuxent Research Refuge fosters a sense of connection to natural resources for visitors, researchers, and decision-makers while providing a natural corridor for species that migrate naturally or that may need to move in response to future climatic changes. Pieced together from a variety of past uses and owners, this important component of the green infrastructure of the mid-Atlantic provides improved air and water quality for the surrounding area, connects people with the natural world, and allows for conservation at a landscape scale.

U.S. Fish & Wildlife Service

Patuxent Research Refuge

Draft Comprehensive Conservation Plan and Environmental Assessment

October 2012

Summary

Type of Action:	Administrative—Development of a Comprehensive Conservation Plan
Lead Agency:	U.S. Department of the Interior, Fish and Wildlife Service
Location:	Patuxent Research Refuge Laurel, MD
Administrative Headquarters:	Patuxent Research Refuge Laurel, MD
Responsible Official:	Wendi Weber, Regional Director, Northeast Region
For Further Information:	Bill Perry, Natural Resource Planner U.S. Fish and Wildlife Service 300 Westgate Center Drive Hadley, MA 01035-9587 Phone: (413) 253-8468 Email: *northeastplanning@fws.gov*

This Comprehensive Conservation Plan and Environmental Assessment analyzes three alternatives for managing the 12,841-acre Patuxent Research Refuge (refuge) over the next 15 years. This document also contains seven appendixes that provide additional information supporting our analysis. Following is brief overview of each alternative:

Alternative A-Current Management: Alternative A satisfies the National Environmental Policy Act requirement of a "no action" alternative, which we define as "continuing current management." It describes our existing management priorities and activities for Patuxent Research Refuge, and serves as a baseline for comparing and contrasting alternatives B and C.

Alternative B-Forest Restoration and Mixed Public Use: Alternative B is the U.S. Fish and Wildlife Service (Service)-preferred alternative. It combines the actions we believe would best achieve the refuge's purposes, vision, and goals; addresses issues and concerns identified throughout the planning process; responds to public comments and inquiries; and are feasible to implement in accordance with applicable laws, regulations, policies, and guidance.

Alternative B emphasizes the management of specific refuge habitats to support species of conservation concern in the Chesapeake Bay region. In particular, it emphasizes forest biodiversity and ecosystem function. This includes the restoration for a number of impoundments and grasslands to forested areas. In addition, alternative B strives to promote wildlife-dependent public uses, while allowing for non-wildlife-dependent

uses. In particular, it promotes higher quality hunting and fishing programs; expands wildlife observation, viewing, and photography opportunities; and initiates new interpretive program and environmental education opportunities.

Alternative C-Maximize Forest Interior Restoration and Emphasize Wildlife-dependent Public Use Activites: This alternative emphasizes maximizing interior forest habitat. This would require active management to restore a majority of impoundments and grasslands into forested areas that would support forest interior-dwelling species, in addition to other species of conservation concern. Alternative C also focuses on accommodating wildlife-dependent public uses while minimizing non-wildlife-dependent uses, particularly by expanding wildlife observation, viewing, and photography opportunities and reducing the number of special events and interpretive programming.

Chapters

Chapter 1. The Purpose of, and Need for, Action

1.1 Introduction to Patuxent Research Refuge 1-1
1.2 Purpose of, and Need for, the Proposed Action 1-4
1.3 Service and Refuge System: Policies and Mandates Guiding Planning 1-6
1.4 Refuge Establishing Purposes 1-13
1.5 Conservation Plans and Initiatives Guiding the Proposed Action 1-13
1.6 The Comprehensive Conservation Planning Process 1-19

Chapter 2. Affected Environment

2.1 Introduction 2-1
2.2 Physical Environment 2-3
2.3 Habitat Overview 2-15
2.4 Wildlife 2-28
2.5 Federal and State Threatened and Endangered Species 2-38
2.6 Special Management Areas 2-39
2.7 Public Use Resources and Trends 2-40
2.8 Archaeological and Cultural Values 2-52
2.9 Socioeconomic Environment 2-55
2.10 Partnerships 2-59
2.11 Administrative Facilities 2-61

Chapter 3. Alternatives

3.1 Introduction 3-1
3.2 Formulating Alternatives 3-1
3.3 Actions Common to All of the Alternatives 3-3
3.4 Actions Common to Alternatives B and C 3-16
3.5 Alternative A. Current Management (No Action) 3-20
3.6 Alternative B. Forest Restoration and Mixed Public Use (Service-preferred Alternative) 3-50
3.7 Alternative C. Maximize Forest Interior Restoration and Emphasize Wildlife-Dependent Public Use Activities 3-77

Chapter 4. Environmental Consequences

4.1 Introduction 4-1
4.2 Impacts on Air Quality 4-6
4.3 Impacts on Soils 4-10
4.4 Impacts on Hydrology and Water Quality 4-14
4.5 Impacts on Vegetation 4-20
4.6 Impacts on Federally Listed and Recently Delisted Species 4-27
4.7 Impacts on Landbirds 4-28
4.8 Impacts on Open Water and Wetland Bird Species 4-36
4.9 Impacts on Fisheries 4-40

4.10 Impacts on Mammals 4-44
4.11 Impacts on Amphibians and Reptiles 4-47
4.12 Impacts on Invertebrates 4-51
4.13 Impacts on Public Use and Access 4-55
4.14 Impacts on Cultural and Historic Resources 4-58
4.15 Impacts to the Socioeconomic Environment 4-58
4.16 Cumulative Impacts 4-61
4.17 Summary of Environmental Consequences by Alternative 4-74

Chapter 5. Consultation and Coordination with Others
5.1 Introduction 5-1
5.2 Planning to Protect Land and Resources 5-1
5.3 Contact Information 5-2
5.4 Members of the Core Planning Team 5-3

Bibliography
Bibliography Bibl-1

Glossary and Acronyms and Abbreviations
Glossary Glos-1
Acronyms and Abbreviations Glos-8

Appendixes

Appendix A. Suspected or Known Species on Patuxent Research Refuge
Suspected or Known Species on Patuxent Research Refuge A-1

Appendix B. Wilderness Review
Introduction B-1
Wilderness Inventory B-1
Summary of Wilderness Inventory Findings B-6

Appendix C. Findings of Appropriateness and Compatibility Determinations
CD—Wildlife Observation, Photography, Environmental Education, Interpretation C-1
CD—Public Hunting C-9
CD—Public Fishing C-27
FOA and CD—Hiking, Biking, Jogging, and Cross-country Skiing C-37
FOA and CD—Horseback Riding C-47
FOA and CD—Filming and Photography Workshops C-59
FOA and CD—Wildlife Research C-66
FOA and CD—Primitive Camping for Scouts and 4-H Groups C-78
FOA and CD—Dog Training for Waterfowl Hunting Purposes C-86
FOA and CD—Dog Walking C-94

FOA and CD—Search and Rescue Training for Canine Teams C-102
FOA and CD—U.S. Secret Service Training Exercises..... C-109
CD—Baltimore Gas and Electric Powerline Right-of-Way..... C-115
CD—Toro Energy Pipeline Right-of-Way..... C-125
CD—Potomac Electric Power Company Powerline Right-of-Way C-135
CD—Use of North Tract Softball Fields C-148

Appendix D. Refuge Operations Needs and Service Asset Maintenance Management Systems Projects

Refuge Operation Needs and Service Asset Maintenance Management Systems D-1

Appendix E. Memorandum of Agreement between the Service, USGS, and the Maryland Historical Trust Regarding the Demolition of Structures at Patuxent Research Refuge

Memorandum of Agreement between the Service, USGS, and the Maryland Historical Trust Regarding the Demolition of Structures at Patuxent Research Refuge E-1

Appendix F. Staffing Charts

Staffing Charts F-1

Appendix G. Patuxent Research Refuge Impoundment Structured Decision-making Summary Report

1. Introduction G-2
2. Comprehensive Conservation Plan Objectives G-3
3. Objectives for the Wetland Decision Analysis G-6
4. Measuring Objectives G-9
5. Evaluation Measure for the Objectives..... G-11
6. Value Functions for Objectives..... G-14
7. Management Alternatives..... G-16
8. Costs..... G-17
9. Putting it all Together–The Analysis..... G-17
10. Use of SDM Results in the CCP..... G-25

Appendix 1–Workshop Participants G-25

List of Figures

Figure 2-1 Land Use in Anne Arundel and Prince George's Counties 2-5
Figure 2-2 Conceptual Model of Groundwater Flow in the Coastal Plain Aquifer System in Anne Arundel County 2-8
Figure 2-3 Total Population for Anne Arundel and Prince George's Counties 2-55
Figure G-1 Initial Objectives Hierarchy G-7
Figure G-2 Patuxent Research Refuge Wetlands Objectives and Weights G-10

List of Tables

Table 2-1 Land Acquisition History for Patuxent Research Refuge 2-2
Table 2-2 Acres of Patuxent Research Refuge by County 2-3
Table 2-3 Current Acres of Open Water at Patuxent Research Refuge 2-24
Table 2-4 Species of Greatest Conservation Need by Habitat Type 2-28
Table 2-5 Fish Species Identified in Shallow Impoundments 2-33
Table 2-6 Hunting Opportunities by Refuge Tract 2-44
Table 2-7 Visitation for Refuge Public Use Activities 2006 to 2009 2-51
Table 2-8 Regional Environmental Justice Characteristics 2-57
Table 2-9 Minority Population in Anne Arundel and Prince George's Counties 2-57
Table 2-10 Low-income Population in Anne Arundel and Prince George's Counties .. 2-58
Table 2-11 Refuge Staffing and Funding Levels 2-58
Table 3-1 Comparison of Management of Impoundments under each Alternative 3-17
Table 3-2 Current Inventory and Monitoring Activities, Listed in Priority Order 3-23
Table 3-3 Summary of Comparison of Alternatives 3-88
Table 4-1 Regional Context for Impacts Analysis at Patuxent Research Refuge 4-1
Table 4-2 Summary of Environmental Consequences by Alternative 4-74
Table 5-1 List of Planning Meetings 5-1
Table A-1 Suspected or Known Bird Species on Patuxent Research Refuge A-1
Table A-2 Other Suspected or Known Species on Patuxent Research Refuge A-10
Table C-1 Number of Hunter Visits Refugewide and Wildlife Harvested C-11
Table D-1 Current Projects in RONS Database for Patuxent Research Refuge D-1
Table D-2 Current Projects in SAMMS Database for Patuxent Research Refuge D-2

List of Maps

Map 1-1 Refuge Location 1-3
Map 2-1 Regional Conserved Lands Around Patuxent Research Refuge 2-6
Map 2-2 Bird Conservation Region Map 2-17
Map 2-3 View of Patuxent Research Refuge within BCR 30 and Proximity to BCR 292-18
Map 2-4 Named Creeks or Streams from the USGS National Hydrography Dataset on and within 0.1 mile of the Patuxent Research Refuge Approved Boundary 2-26
Map 2-5 Research Natural Areas of Patuxent Research Refuge 2-40
Map 2-6 Public Hunting Opportunities on Patuxent Research Refuge 2-45
Map 2-7 Existing Public Use Opportunities, North 2-49
Map 2-8 Existing Public Use Opportunities, South 2-50
Map 3-1 Existing Habitat 3-21
Map 3-2 Proposed Habitat Management under Alternative B 3-53
Map 3-3 Proposed Public Use under Alternative B, North 3-55
Map 3-4 Proposed Public Use under Alternative B, South 3-56
Map 3-5 Anticipated Habitat under Alternative C 3-79
Map B-1 Wilderness Inventory Study Areas B-7

Chapter 1.

USFWS

Patuxent Research Refuge

The Purpose of, and Need for, Action

1.1 Introduction to Patuxent Research Refuge

1.2 Purpose of, and Need for, the Proposed Action

1.3 Service and Refuge System: Policies and Mandates Guiding Planning

1.4 Refuge Establishing Purposes

1.5 Conservation Plans and Initiatives Guiding the Proposed Action

1.6 The Comprehensive Conservation Planning Process

1.1 Introduction to Patuxent Research Refuge

Patuxent Research Refuge (refuge) was established on December 16, 1936, by Executive Order by President Franklin D. Roosevelt, "To effectuate further the purposes of the Migratory Bird Conservation Act" and "as a wildlife experiment and research refuge." By order of the President, the area was to be known as the Patuxent Research Refuge. Dedicated on June 3, 1939, Secretary of Agriculture Henry A. Wallace stated that, "The chief purpose of this refuge is to assist in the restoration of wildlife - one of our greatest natural resources." The Patuxent Research Refuge mission is, "To help protect and conserve the Nation's wildlife and habitat through research on critical environmental problems and issues." The original refuge has grown from 2,679 acres in 1936 to 12,841 acres today.

The Patuxent Research Refuge is managed by the U.S. Fish and Wildlife Service (USFWS, the Service, our, we), within the U.S. Department of the Interior (the Department, DOI), as part of the National Wildlife Refuge System (Refuge System). The Refuge System maintains the biological integrity, diversity, and environmental health of these natural resources for the benefit of present and future generations.

Patuxent Research Refuge is unique within the Refuge System by having both a research and wildlife conservation mission and by being collocated with the U.S. Geological Survey (USGS) Patuxent Wildlife Research Center. The Patuxent Wildlife Research Center purpose is to develop the scientific information needed to provide the biological foundation for effective conservation and management of the Nation's biological resources and to conduct priority research for Department agencies and other Federal and State partners. The Service Division of Migratory Bird Management is also located at Patuxent Research Refuge.

The refuge lies midway in the highly developed and densely populated Baltimore-Washington, DC Corridor and is east of Interstate 95 and the Baltimore-Washington Parkway (Highway 295; see map 1-1). The Patuxent and Little Patuxent Rivers traverse these large forested areas that provide wildlife habitat not available elsewhere in the Maryland Coastal Plain.

This draft comprehensive conservation plan and environmental assessment (draft CCP/EA) for the refuge combines two documents required by Federal law into one document:

- A CCP, required by the National Wildlife Refuge System Administration Act of 1996, as amended by the National Wildlife Refuge System Improvement Act of 1997 (P.L. 105-57; 111 Stat. 1253; Improvement Act).
- An EA, required by the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq., 83 Stat. 852; NEPA).

Following the public review of this draft CCP/EA, the Service's Northeast Regional Director will decide on the components of a final CCP to guide refuge management

decisions over the next 15 years. The Service will use the final CCP to promote the understanding of, and support for, refuge management among State and Federal agencies, our conservation partners, Tribal governments, local communities, and the public.

This draft CCP/EA is organized in several chapters to outline the history, driving mandates and purposes, and conservation priorities guiding the proposed actions, as well as the affected environment of the refuge and alternatives reviewed in the course of plan development.

Chapter 1, “The Purpose of, and Need for, Action,” explains the purpose of, and need for, preparing a CCP and EA, and introduces the five subsequent chapters and seven appendixes.

Chapter 2, “Affected Environment,” describes the biological and socioeconomic landscape context as well as the physical, biological, and human environments of the refuge.

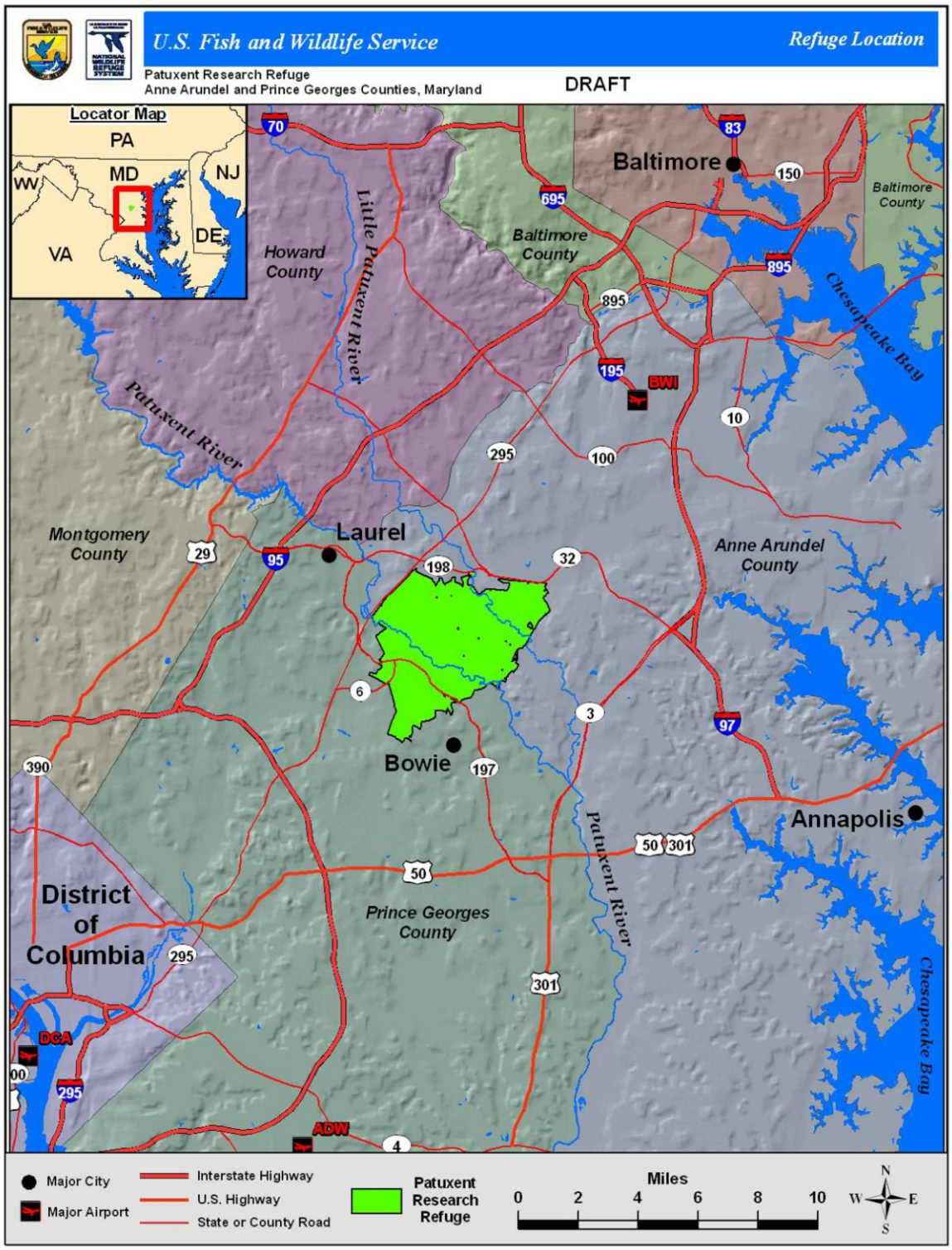
Chapter 3, “Alternatives,” presents three management alternatives and their objectives and strategies for meeting refuge goals and addressing public issues. It also describes the activities that the Service expects to occur regardless of the alternative selected for the final CCP. The range of alternatives analyzed include continuing our present management of the refuge unchanged, expanding restoration of coastal plain habitats found on the refuge, and enhancing habitat management and visitor services with a wider, regional focus.

Chapter 4, “Environmental Consequences,” assesses the environmental effects of implementing each of three management alternatives. It predicts the foreseeable benefits and consequences affecting the socioeconomic, physical, cultural, and biological environments described in chapter 2.

Chapter 5, “Consultation and Coordination with Others,” summarizes how the Service involved the public and our partners in the planning process. Their involvement is vital for the future management of this, and all other, national wildlife refuges. This chapter also includes the list of preparers.

Seven appendixes, a glossary with acronyms, and literature cited section provide additional documentation and references to support our analysis summarized within the report.

Map 1-1. Refuge Location



1.2 Purpose of, and Need for, the Proposed Action

In 1997, Congress passed the National Wildlife Refuge System Improvement Act (Refuge Improvement Act), establishing a unifying mission for the Refuge System. The Refuge Improvement Act highlights six priority public uses that each refuge should evaluate to determine if the uses can be conducted in a manner that is compatible with the purpose of the refuge and the mission of the Refuge System. These six public uses are hunting, fishing, wildlife observation and photography, and environmental education and interpretation. The Refuge Improvement Act requires that all refuges established prior to 1997 prepare a CCP by 2012.

The Service proposes to develop a CCP for the refuge that, in the Service's best professional judgment, best achieves the purposes, vision, and goals of the refuge; contributes to the mission of the Refuge System; adheres to Service policies and other mandates; addresses identified issues of significance; and incorporates sound principles of fish and wildlife science.

NEPA regulations require our evaluation of a reasonable range of alternatives, including a proposed or preferred action and no action. The no action alternative can be either (1) taking no management action, or (2) not changing current management. In this draft plan, alternative A is the latter. All alternatives will be evaluated and compared as to how well they meet the purpose of, and need for, a CCP.

During the planning process, the planning team reviewed existing plans, current management practices, and the landscape context of the refuge to develop the overarching vision and goals for the next 15 years. The *purpose* of adopting a CCP for this refuge is to accomplish the following goals:

Goal 1: Maintain and actively promote Patuxent Research Refuge as an "outdoor laboratory," providing a diversity of wildlife and natural resource research opportunities on the refuge in such areas as landscape conservation, habitat fragmentation, climate change, and other emerging issues, as well as the more traditional types of wildlife research, including inventory and monitoring techniques, land management, and understanding ecological processes. Research that supports the overall Service mission, and evaluates the best methods for protecting natural resources throughout the Refuge System and other land management agencies will be a priority.

Goal 2: Protect, maintain, and restore, where possible, the biological integrity, diversity, and environmental health of forested ecological communities to provide habitat for species of conservation concern, including migratory birds, mammals, amphibians, reptiles, and invertebrates.

Goal 3: Protect, maintain, and restore, where possible, the biological integrity, diversity, and environmental health of refuge aquatic habitats, located within the Patuxent, Little Patuxent, and Anacostia River watersheds, and impoundments, to provide habitat for species of conservation concern, including fish, invertebrates, and plants.

Goal 4: Manage refuge non-forested upland communities to provide ecological structure, composition, and function to support native plants and wildlife, including species of conservation concern. Where appropriate, restore the biological integrity and diversity of these habitats.

Goal 5: Provide high-quality recreation, environmental education, and interpretive programs to enhance refuge visitors' understanding and appreciation of fish and wildlife conservation.

Goal 6: Provide high-quality hunting and fishing experiences for hunters and anglers.

Goal 7: Enhance partnerships with local communities and various organizations to garner support and promote refuge programs and resources.

Steve Noyes

Cash Lake

Several Service policies that provide specific guidance on implementing the Refuge Improvement Act have been developed since the refuge was established. A CCP incorporates those policies, and develops strategic management direction for the refuge for 15 years, by stating clearly the desired future conditions for refuge habitat, wildlife, visitor services, staffing, and facilities; explaining concisely to State agencies, refuge neighbors, visitors, partners, and other stakeholders the reasons for management actions; ensuring that refuge management conforms to the policies and goals of the Refuge System and legal mandates; ensuring that present and future public uses are appropriate and compatible; providing long-term continuity and consistency in management direction; and justifying budget requests for staffing and operation and maintenance funds.

In addition to the needs for a CCP outlined by Service policies and mandates, Patuxent Research Refuge has not completed a large-scale planning effort, although there have been a number of smaller scale planning efforts for the refuge. This CCP effort will provide a comprehensive approach and view of refuge management that builds upon the previous facilities management planning, transportation management planning, and other smaller scale refuge planning efforts.

Project Area

The project location of our proposed action is the Patuxent Research Refuge, which is located in Anne Arundel and Prince George's Counties in the State of Maryland. The Patuxent and Little Patuxent Rivers flow through the site. The regional context of the project area is defined by the interactions of the Baltimore-Washington Corridor and the Chesapeake Bay (map 1-1). The refuge lies within the Western Shore Uplands Region of the Atlantic Coastal Plain Physiographic Province (MGS 2007).

1.3 Service and Refuge System: Policies and Mandates Guiding Planning

The Service and its Mission

The Service mission is, "Working with others, to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people." Congress entrusts to the Service the conservation and protection of these national natural resources: migratory birds and fish, federally listed endangered or threatened species, inter-jurisdictional fish, wetlands, certain marine mammals, and national wildlife refuges. The Service also enforces Federal wildlife laws and international treaties on importing and exporting wildlife, assists states with their fish and wildlife programs, and helps other countries develop conservation programs.

The Service Manual (USFWS 2010) contains the standing and continuing directives on implementing our authorities, responsibilities, and activities. The Service publishes special directives that affect the rights of citizens or the authorities of other agencies separately in the Code of Federal Regulations (CFR); the Service Manual does not duplicate them (see 50 CFR 1–99 at: *http://www.gpoaccess.gov/cfr/index.html*; accessed March 2012).

The National Wildlife Refuge System and its Mission and Policies

The Refuge System, administered by the Service, is the world's largest collection of lands and waters set aside specifically for the conservation of wildlife and the protection of ecosystems. More than 550 national wildlife refuges encompass more than 100 million acres of lands and waters in all 50 States and several island territories. Each year, more than 40 million visitors hunt, fish, observe and photograph wildlife, or participate in environmental education and interpretation on refuges (USFWS 2007).

The Refuge Improvement Act states that the Refuge System must focus on wildlife conservation first. It also states that the mission of the Refuge System, coupled with the purpose(s) for which each refuge was established, will provide the principal management

direction on that refuge. The mission of the Refuge System is, "To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (National Wildlife Refuge System Improvement Act; P.L. 105–57).

The National Wildlife Refuge System Manual (Refuge Manual) contains policy governing the operation and management of the Refuge System that the Service Manual does not cover, including technical information on implementing refuge policies and guidelines on enforcing laws. The Refuge Manual may be accessed at refuge headquarters or online. Policies instrumental in developing this draft CCP/EA are summarized below.

Policy on the National Wildlife Refuge System Mission, Goals, and Purposes
This policy (601 FW 1) sets forth the Refuge System mission noted above, how it relates to the Service mission, and explains the relationship of the Refuge System mission and the goals and purpose(s) of each unit in the Refuge System. In addition, it identifies the following Refuge System goals:

- Conserve a diversity of fish, wildlife, and plants.
- Develop and maintain a network of habitats.
- Conserve those ecosystems, plant communities, and wetlands that are unique within the United States (U.S.).
- Provide and enhance opportunities to participate in compatible, wildlife-dependent recreation.
- Help to foster public understanding and appreciation of the diversity of fish, wildlife, and plants and their habitats.

This policy also establishes management priorities for the Refuge System:

- Conserve fish, wildlife, and plants and their habitats.
- Facilitate compatible wildlife-dependent recreational uses.
- Consider other appropriate and compatible uses.

Policy on Refuge System Planning
This policy (602 FW 1, 2, 3) establishes the requirements and guidance for Refuge System planning, including CCPs and step-down management plans. It states that the Service will manage all refuges in accordance with an approved CCP that, when implemented, will help:

- Achieve refuge purposes.
- Fulfill the Refuge System mission.

- Maintain and, where appropriate, restore the ecological integrity of each refuge and the Refuge System.
- Achieve the goals of the National Wilderness Preservation System and the National Wild and Scenic Rivers System.
- Conform to other applicable laws, mandates, and policies.

That planning policy provides step-by-step directions and identifies the minimum requirements for developing all CCPs. Among them, the Service is to review any existing special designation areas such as wilderness and wild and scenic rivers, specifically address the potential for any new special designations, conduct a wilderness review, and incorporate a summary of that review into each CCP (602 FW 3).

Policy on the Appropriateness of Refuge Uses

Federal law and Service policy provide the direction and planning framework for protecting the Refuge System from inappropriate, incompatible, or harmful human activities and ensuring that visitors can enjoy its lands and waters. This policy (603 FW 1) provides a national framework for determining appropriate refuge uses to prevent or eliminate those that should not occur in the Refuge System. It describes the initial decision process the refuge manager follows when first considering whether to allow a proposed use on a refuge. An appropriate use must meet at least one of the following four conditions:

- The use is a wildlife-dependent recreational use as identified in the Refuge Improvement Act.
- The use contributes to fulfilling the refuge purpose(s), the Refuge System mission, or goals or objectives described in a refuge management plan approved after October 9, 1997, the date the Refuge Improvement Act became law.
- The use follows State regulations for the take of fish and wildlife.
- The use has been found to be appropriate after concluding a specified findings process using 10 criteria.

This policy can be viewed at: *http://www.fws.gov/policy/603fw1.html*; accessed March 2012.

Policy on Compatibility

This policy (603 FW 2) complements the appropriateness policy. Once a refuge manager finds a use appropriate, they conduct further evaluation through a compatibility determination assessment. The direction in 603 FW 2 provides guidelines for determining compatibility of uses and procedures for documentation and periodic review of existing uses. Highlights of the guidance in that chapter follow:

- The Refuge Improvement Act and its regulations require an affirmative finding by the refuge manager on the compatibility of a public use before the Service allows the use on a refuge.

- A compatible use is one, "That will not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuge."
- The act defines six wildlife-dependent uses that are to receive enhanced consideration on refuges: hunting, fishing, wildlife observation and photography, and environmental education and interpretation.
- The refuge manager may authorize those priority uses on a refuge when they are compatible and consistent with public safety.
- When the refuge manager publishes a compatibility determination, it will stipulate the required maximum reevaluation dates: 15 years for wildlife-dependent recreational uses or 10 years for other uses.
- The refuge manager may reevaluate the compatibility of a use at any time: for example, sooner than its mandatory date, or even before the Service completes the CCP process, if new information reveals unacceptable impacts or incompatibility with refuge purposes (603 FW 2.11, 2.12).
- The refuge manager may allow or deny any use, even one that is compatible, based on other considerations such as public safety, policy, or available funding.

USFWS

Dog Walking on the Refuge

Policy on Wildlife-dependent Public Uses

Part 605 chapter 1 of the Service manual presents specific guidance on implementing management of the priority public uses, including the following criteria for a quality, wildlife-dependent recreation program that:

- Promotes safety of participants, other visitors, and facilities.
- Promotes compliance with applicable laws and regulations and responsible behavior.

- Minimizes or eliminates conflict with fish and wildlife population or habitat goals or objectives in an approved plan.
- Minimizes or eliminates conflicts with other compatible wildlife-dependent recreation.
- Minimizes conflicts with neighboring landowners.
- Promotes accessibility and availability to a broad spectrum of the American people.
- Promotes resource stewardship and conservation.
- Promotes public understanding and increases public appreciation of America's natural resources and our role in managing and conserving these resources.
- Provides reliable and reasonable opportunities to experience wildlife.
- Uses facilities that are accessible to people and blend into the natural setting.
- Uses visitor satisfaction to help to define and evaluate programs.

Policy on Maintaining Biological Integrity, Diversity, and Environmental Health
This policy (601 FW 3) provides guidance on maintaining or restoring the biological integrity, diversity, and environmental health of the Refuge System, including the protection of a broad spectrum of fish, wildlife, and habitat resources in refuge ecosystems. It provides refuge managers with a process for evaluating the best management direction to prevent the additional degradation of environmental conditions and restore lost or severely degraded components of the environment. It also provides guidelines for dealing with external threats to the biological integrity, diversity, and environmental health of a refuge and its ecosystem.

Other Mandates
Although Service and Refuge System policy and the purpose(s) of each refuge provide the foundation for its management, other Federal laws, executive orders, treaties, interstate compacts, and regulations on conserving and protecting natural and cultural resources affect how the Service manages refuges. The "Digest of Federal Resource Laws of Interest to the U.S. Fish and Wildlife Service" describes many of them at *http://www.fws.gov/laws/Lawsdigest.html*; accessed March 2012.

Of particular note are the Federal laws that require the Service to identify and preserve its important historic structures, archaeological sites, and artifacts. NEPA mandates our consideration of cultural resources in planning Federal actions. The Refuge Improvement Act requires the CCP for each refuge to identify its archaeological and cultural values. The following highlights some cultural and historic resource protection laws that relate to the development of CCPs.

The Archaeological Resources Protection Act (16 U.S.C. 470aa–470ll; P.L. 96–95) approved October 31, 1979 (93 Stat. 721), largely supplanted the resource protection provisions of the Antiquities Act of 1906 for archaeological items. The act establishes

detailed requirements for issuance of permits for any excavation for, or removal of, archaeological resources from Federal or Native American lands. It also establishes civil and criminal penalties for the unauthorized excavation, removal, or damage of those resources; for any trafficking in those resources removed from Federal or Native American land in violation of any provision of Federal law; and for interstate and foreign commerce in such resources acquired, transported, or received in violation of any state or local law.

The Archaeological and Historic Preservation Act (16 U.S.C. 469–469c; P.L. 86–523) approved June 27, 1960 (74 Stat. 220), as amended by P.L. 93–291, approved May 24, 1974 (88 Stat. 174), carries out the policy established by the Historic Sites Act (see below). It directs Federal agencies to notify the Secretary of the Interior whenever they find that a Federal or federally assisted, licensed, or permitted project may cause the loss or destruction of significant scientific, prehistoric, or archaeological data. The act authorizes the use of appropriated, donated, or transferred funds for the recovery, protection, and preservation of that data.

The Historic Sites, Buildings, and Antiquities Act (16 U.S.C. 461–462, 464–467; 49 Stat. 666) of August 21, 1935, commonly known as the Historic Sites Act, as amended by P.L. 89–249, approved October 9, 1965 (79 Stat. 971), declares it a national policy to preserve historic sites and objects of national significance, including those located on refuges. It provides procedures for designating, acquiring, administering and protecting them. Among other things, National Historic and Natural Landmarks are designated under the authority of this act.

The National Historic Preservation Act of 1966 (16 U.S.C. 470–470b, 470c–470n), P.L. 89–665, approved October 15, 1966 (80 Stat. 915), and repeatedly amended, provides for the preservation of significant historical features (buildings, objects, and sites) through a grant-in-aid program to the states. It establishes a National Register of Historic Places and a program of matching grants under the existing National Trust for Historic Preservation (16 U.S.C. 468–468d). This act establishes an Advisory Council on Historic Preservation, which became a permanent, independent agency in P.L. 94–422, approved September 28, 1976 (90 Stat. 1319). The act created the Historic Preservation Fund. It directs Federal agencies to take into account the effects of their actions on items or sites listed or eligible for listing on the National Register.

USFWS

Old Duvall Bridge Sign

The Service also has a mandate to care for museum properties it owns in the public trust. The most common are archaeological, zoological or botanical collections, historical photographs, historic objects, and art. Each refuge maintains an inventory of its museum property. The Service's Northeast Region museum property coordinator in Hadley, Massachusetts, guides the refuges in caring for that property, and helps us comply with the Native American Grave Protection and Repatriation Act and Federal regulations governing Federal archaeological collections. This program ensures that those collections will remain available to the public for learning and research.

Other Federal resource laws are also important to highlight as they are integral to developing a CCP. The Wilderness Act of 1964 (16 U.S.C. 1131–1136; P.L. 88–577) establishes a National Wilderness Preservation System (NWPS) that is composed of federally owned areas designated by Congress as "wilderness areas." The act directs each agency administering designated wilderness to preserve the wilderness character of areas within the NWPS, and to administer the NWPS for the use and enjoyment of the American people in a way that will leave those areas unimpaired for future use and enjoyment as wilderness. The act also directed the Secretary of the Interior to review every roadless area of 5,000 acres or more and every roadless island (regardless of size) within National Wildlife Refuge and National Park Systems for inclusion in the NWPS. Service planning policy requires that the Service evaluate the potential for wilderness on refuge lands, as appropriate, during the CCP planning process.

The Wild and Scenic Rivers Act of 1968, as amended, selects certain rivers of the Nation possessing remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, preserves them in a free-flowing condition, and protects their local environments. Service planning policy requires that the Service evaluate the potential for wild and scenic rivers designation on refuge lands, as appropriate, during the CCP planning process.

The Coastal Zone Management Act of 1972, as amended, and National Oceanic and Atmospheric Administration (NOAA) regulations (15 CFR part 930) require that Federal actions which are reasonably likely to affect any land or water use, or natural resource of a state's coastal zone be conducted in a manner that is consistent with a state's federally approved Coastal Zone Management Program. During the draft CCP review period, we will be submitting the necessary documentation and application to the Maryland Department of Natural Resources.

On May 12, 2009, President Barack Obama signed the Executive Order (EO) 13508 regarding the Chesapeake Bay Protection and Restoration. The EO declared the bay as a national treasure and required a renewed commitment from Federal agencies to protect and restore the health, heritage, natural resources, and social and economic value of the Nation's largest estuarine ecosystem and the natural sustainability of its watershed. EO 13508 requires the Department to work with other Federal agencies to expand public access to the bay and its rivers from Federal lands, and to conserve landscapes of the watershed.

Chapter 4, "Environmental Consequences," evaluates this plan's compliance with the acts noted above, and with the Federal Water Pollution Control Act (Clean Water Act) of 1972 as amended (33 U.S.C. 1251, et seq.; P.L. 92-500), the Clean Air Act of 1970 as amended (42 U.S.C. 7401 et seq.), and the Endangered Species Act of 1973 (16 U.S.C. 1531–1544), as amended. Finally, the Service designed this draft CCP/EA to comply with NEPA and the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA (40 CFR 1500–1508).

1.4 Refuge Establishing Purposes

Patuxent Research Refuge was established by Executive Order in 1936, "To effectuate further the purposes of the Migratory Bird Conservation Act" and "as a wildlife experiment and research refuge." The Migratory Bird Conservation Act of 1929, 16 U.S.C. 715-715S, was passed to more effectively meet the U.S. migratory bird treaty obligations through the acquisition of land and water for perpetual reservation for birds.

The refuge initially served as a "companion site" to the existing National Agricultural Research Center, which was studying ways to minimize wildlife-related damage to agricultural crops. Patuxent Research Refuge, conversely, was established to explore how wildlife and agriculture could co-exist, to develop wildlife-friendly agricultural practices, and to return marginal cropland back to wildlife habitat. Upon Patuxent Research Refuge's dedication in 1939, while still under ownership by the Department of Agriculture, Secretary Henry Wallace said, "The chief purpose of this refuge is to assist in the restoration of wildlife – one of our greatest natural resources."

1.5 Conservation Plans and Initiatives Guiding the Proposed Action

Important guidance for habitat management and visitor service management at the refuge has already been provided by a series of national, regional, State, and refuge-specific plans and their priorities.

National, Regional, and State Plans

Saving Our Shared Birds, Partners in Flight Tri-national Vision for Landbird Conservation

Saving Our Shared Birds presents, for the first time, a comprehensive conservation assessment of landbirds in Canada, Mexico, and the continental U.S. This tri-national vision encompasses the complete range of many migratory species and highlights the vital links among migrants and highly threatened resident species in Mexico. It points to a set of continent-scale actions necessary to maintain landbird diversity and abundance. This collaborative effort of Partners in Flight (PIF) is the next step in linking the countries of the Western Hemisphere to help species at risk and keep common birds common through voluntary partnerships.

North Atlantic Landscape Conservation Cooperative Operations Plan
The Service is developing a coordinated network of Landscape Conservation Cooperatives (LCCs) across the U.S., in part to address major environmental and human-related factors that limit fish and wildlife populations at the broadest of scales, including developing adaptation strategies in response to climate change. The refuge is located within the North Atlantic LCC. The LCC is using principles of strategic habitat conservation to develop and communicate landscape-scale scientific information to shape conservation across the northeastern U.S. The LCC operations plan (USFWS 2010) outlines the regional threats to conservation, priority species and habitats, as well as active regional partnerships.

The LCC recently completed a year-long effort to identify representative species with support from the University of Massachusetts-Amherst and the U.S. Forest Service. The process included the development of species-habitat databases, cluster and indicator species analyses to group species based on habitat systems and use, and application of filtering criteria. Species experts provided extensive input throughout the process including selecting representative species during three workshops held in May and June 2011.

Mid-Atlantic Coast Bird Conservation Region Implementation Plan (Steinkamp 2008)
The implementation plan for the New England/Mid-Atlantic Bird Conservation Region (BCR 30) identifies the bird species and habitats in greatest need of conservation action in this region and combines regional plans, assessments, and research completed over the past two decades to develop bird conservation efforts. Patuxent Research Refuge is located in BCR 30. Many of the BCR 30 priority species are also species of greatest conservation need within the Maryland Wildlife Diversity Conservation Plan. This plan considers the rankings and the recommendations contained within the BCR plan. The implementation plan can be accessed at:
http://www.acjv.org/BCR_30/BCR30_June_23_2008_final.pdf; accessed November 2011).

Partners-in-Flight Bird Conservation Plan for the Mid-Atlantic Coastal Plain (April 1999)
PIF is a partnership of government agencies, non-governmental organizations, academic researchers, and private industry throughout North America dedicated to reversing the population declines of bird species and "keeping common birds common." The foundation of its long-term strategy is a series of scientifically based bird conservation plans using physiographic areas as planning units.

Patuxent Research Refuge is located within PIF Physiographic Area 44, the Mid-Atlantic Coastal Plain. Many of the priority species for this physiographic area are also priority species of BCR 30 and Maryland species of greatest conservation need. The PIF Bird Conservation Plan for the Mid-Atlantic Coastal Plain can be accessed at:
http://www.blm.gov/wildlife/plan/pl_44_10.pdf; accessed November 2011.

The PIF plan includes population objectives for the following habitat types and associated species of conservation concern on the refuge:

- Forested Wetland Species: Kentucky warbler, Acadian flycatcher, yellow-throated vireo, prothonotary warbler, and Louisiana waterthrush.

  Objectives - Maintain a population of 40,000 prothonotary warblers and a population of 300,000 Acadian flycatchers.

- Mixed Upland Forest Species: cerulean warbler, wood thrush, Kentucky warbler, Acadian flycatcher, worm-eating warbler, eastern wood-pewee, and Louisiana waterthrush.

  Objectives - Maintain enough upland forest to support a population of 800,000 wood thrushes.

- Early Successional Species: prairie warbler, grasshopper sparrows, and white-eyed vireo.

  Objectives - Maintain enough open grasslands to support 100,000 pairs of grasshopper sparrows, and shift the management of open lands less than 10 hectares in size from high-intensity grassland management to low-intensity shrubland management.

Scott Somerstone/USGS

Kentucky warbler

National Audubon Society Important Bird Areas Program

The Important Bird Areas (IBA) Program is an international bird conservation initiative for identification and conservation of the most important places for birds. The program is overseen by a technical review committee representing state and Federal agencies, academic ornithologists, the birding community, and regional biologists. IBA links global and continental bird conservation priorities to local sites providing critical habitat for native bird populations. The Maryland-Washington, DC IBA Program began in 2005 and has identified more than 40 IBAs, including Patuxent Research Refuge. The refuge is noted for supporting one of the most diverse communities of forest-interior dwelling bird species on Maryland's Coastal Plain, and the largest population of eastern whip-poor-will in central Maryland.

USFWS Migratory Bird Program Strategic Plan

The Migratory Bird Program Strategic Plan provides direction for the Service's migratory bird management from 2004 through 2014. The plan contains a vision and recommendations for the Refuge System's place in bird conservation. Strategies are defined for the Service, including the Refuge System, to actively support bird conservation through monitoring, conservation, consultation, and recreation. The habitat management plan, to the extent practical, will use standard monitoring protocols, habitat assessment and management, and promote nature-based recreation and education to forward the vision of the Migratory Bird Program Strategic Plan.

USFWS Birds of Conservation Concern (USFWS 2008)
This report identifies the migratory and non-migratory bird species (beyond those already designated as federally threatened or endangered) that represent the Service's highest conservation priorities and draws attention to species in need of conservation action. The geographic scope includes the U.S. in its entirety, including island territories in the Pacific and Caribbean. Bird species considered for inclusion on lists in this report include nongame birds, gamebirds without hunting seasons, subsistence-hunted nongame birds in Alaska; and Endangered Species Act candidates (proposed endangered or threatened), and recently delisted species. Assessment scores are based on several factors, including population trends, threats, distribution, abundance, and area importance.

Maryland Wildlife Diversity Conservation Plan
Congress established a State Wildlife Grants program in 2001 to provide funds to state wildlife agencies for the conservation of fish and wildlife and their habitats. Each state was charged with developing a comprehensive wildlife conservation plan or strategy by October 2005. State fish and wildlife agencies identified species and habitats in the greatest need of conservation while also addressing the full array of wildlife.

The Maryland Wildlife Diversity Conservation Plan was completed in 2005 and provides a Statewide perspective, including all of Maryland's wildlife diversity and habitats, in a comprehensive approach to long-term wildlife and habitat conservation in the State. The plan identifies 502 species of greatest conservation need in Maryland.

Refuge-specific Plans
A number of other refuge program-specific plans have been consulted in either their draft or final format to help guide development of CCP alternatives. These plans will also be maintained and updated as necessary consistent with the recommendations of the CCP.

Patuxent Research Refuge Draft Habitat Management Plan
The habitat management plan will be completed based upon the goals and objectives presented in the CCP. The habitat management plan will provide specific guidance on managing the habitats for the identified resources of concern at the Patuxent Research Refuge. The plan provides direction for the next 15 years. Subsequent reviews every 5 years and use of adaptive management will assess and modify management activities as research, monitoring, and priorities require.

Visitor Service Review (Russo et al. 2009)
A Service-based review team assessed the public use issues, opportunities, and facilities available at Patuxent Research Refuge in preparation for the refuge's CCP and to develop recommendations to improve the quality of the refuge's visitor services program. The visitor services review recommendations can be used to help develop goals, objectives, and strategies for refuge visitor services planning.

Patuxent Research Refuge Facilities Modernization Program
The facilities modernization program describes infrastructure and building improvements and construction associated with the USGS Patuxent Wildlife Research Center, the

Service Division of Migratory Bird Management, and the refuge. The facilities modernization plan includes construction of an administrative building for the Service Headquarters Division of Migratory Bird Management on the Central Tract, renovation/stabilization of four buildings (Merriam Lab, Merriam Garage, Nelson Lab, and Snowden Hall) on the Central Tract, and correction of critical deferred maintenance and building code deficiencies. The Service and USGS completed an EA, which led to a Finding of No Significant Impact, in support of the program.

Patuxent Fire Management Plan

The fire management plan was completed in 2008 and governs both response to wildfire and use of prescribed fire. The history of fire on the refuge, fuels reduction information, and smoke management are included in the plan.

USFWS

Prescribed Fire on the Refuge

Step-down Plans

The Service Manual, Part 602, Chapter 4 "Refuge Planning Policy," identifies more than 25 step-down management plans that generally are required on refuges. Those plans provide the details necessary to "step-down" general goals and objectives to specific strategies and implementation schedules. Some require annual revisions; others are revised on a 5- to 10-year schedule. Some require additional NEPA analysis, public involvement, and compatibility determinations before they can be implemented.

A number of refuge step-down plans have provided guidance either in their draft or final format, including but not limited to:

- Annual habitat work plan
- Exotic species introduction and management plan

- Grassland prescribed fire plan
- Headquarters mowing plan
- Meadow management, growing season mowing plan
- Savannah prescribed fire plan
- Winter mowing plan
- Impoundment management plan
- Powerline right-of-way vegetation management plan
- North Tract hunting management plan
- Public use management plan
- Fire management plan
- Endangered species plan
- Fisheries resource plan
- Trapping plan
- Waterfowl plan
- Wildlife inventory management plan

Refuge Vision

The planning team developed the following vision statement to provide a guiding philosophy and sense of purpose in the CCP.

Positioned near the center of the Baltimore-Washington Corridor, Patuxent Research Refuge is an island of green within a sea of urban development. This large, contiguous block of forest and wetlands provides a unique opportunity for wildlife research on a landscape and local scale in a natural setting. The refuge and our partners interpret the results of research for the visiting public as a way of connecting people with the natural world. As the first national wildlife refuge established for both wildlife and research, and the home of the U.S. Geological Survey's Patuxent Wildlife Research Center, staff and partners are able to conduct cutting-edge wildlife research and passionate interpretation of the natural world in the shadows of protected historic and cultural resources. The North Tract and the National Wildlife Visitor Center provide opportunities for local children, national decision-makers, and the general public from around the world to develop a conservation ethic and learn about the refuge, the National Wildlife Refuge System, and the importance of science and the benefits that green spaces provide to wildlife and people. Patuxent Research Refuge fosters a sense of connection to natural resources for visitors, researchers, and decision-makers while providing a natural corridor for species that migrate naturally or that may need to move in response to future climatic changes. Pieced together from a variety of past uses and owners, this important component of the green infrastructure of the mid-Atlantic provides improved air and water quality for the surrounding area, connects people with the natural world, and allows for conservation at a landscape scale.

1.6 The Comprehensive Conservation Planning Process

Service policy (602 FW 3) establishes an eight-step planning process that also facilitates compliance with NEPA. The full text of the policy and a detailed description of the planning steps can be viewed at: *http://policy.fws.gov/602fw3.html;* accessed March 2012. The specific process implemented by Patuxent Research Refuge's planning team in developing this draft CCP/EA is described below.

The process seeking public involvement officially began in February 2010 with the submission of the Notice of Intent to the *Federal Register* and delivery of scoping invitations to agency partners. The Notice of Intent was published on Tuesday, March 16, 2010 (Vol. 75, No. 50).

The agency scoping meeting was held on February 23, 2010, from 1 to 3 p.m. at the Maryland Department of Natural Resources office in Annapolis. The meeting was held in a workshop-style format with brief presentations on the CCP process and refuge status, displays of the refuge context, habitat management units, visitor services and facilities, and handouts on the draft vision and goals.

In February, the planning team distributed a newsletter to individuals, organizations, and agencies announcing the planning process and asking people if they wanted to remain on our mailing list. Planning team membership is included in chapter 5.

Scoping activities in February also included public scoping meetings, which were held at the Visitor Center on February 22, 2010, from 2 to 4 p.m. and from 6:30 to 8:30 p.m. The meetings were held in an open house format with brief presentations on the CCP process and refuge status, and included a period for questions and answers, as well as informal discussion, to identify issues and concerns. The planning team provided displays of the refuge context, habitat management units, visitor services and facilities, the past and planned marsh restoration projects, and handouts on the draft vision and goals. The comment period for public scoping ended on March 31, 2010.

A second newsletter was developed by the planning team to inform interested individuals, organizations, and agencies about the range of issues identified throughout the scoping process.

Planning team meetings were held at various intervals through the planning process to work through the draft vision, goals, objectives, strategies, and alternatives for refuge management. Often the meetings focused on specific topics. For example, meetings were held specific to habitat management, land protection, public use management, and grasslands.

The planning team entered into a structured decision-making process to evaluate management of impoundments on Patuxent Research Refuge. The initial meeting for structured decision-making was held in December 2010. Fourteen participants with expertise in impoundment and refuge management contributed to the first meeting, which

consisted of developing lists of primary objectives for impoundment management, factors that influence impoundment decisions (such as waterfowl use, forest fragmentation, biological integrity, and fish populations), invertebrate use, and research and data needs. During subsequent meetings, the team was able to narrow the list of key factors that would differ across impoundments and costs of management decisions. The structured decision-making process included a minimum of one to two meetings per month from December 2010 through August 2011. The impoundment alternatives presented in this CCP represent the culmination of those efforts.

The draft CCP/EA has been made available for a 45-day comment period. We will review all of the comments that we receive and respond to any substantive comments. The final CCP will be developed based upon the draft CCP and any necessary changes.

Issues, Concerns, and Opportunities

The Service defines an issue as, "Any unsettled matter requiring a management decision" (USFWS 2010). Issues can include an "initiative, opportunity, resource management problem, threat to a resource, conflict in use, or a public concern." Issues arise from many sources, including refuge staff, other Service programs, State agencies, other Federal agencies, our partners, neighbors, user groups, or Congress. One of the distinctions among the proposed management alternatives is how each addresses those issues.

From public meeting and planning team discussions, we developed a list of issues, concerns, opportunities, and other items requiring a management decision. We placed them in three categories: key issues, issues outside the scope of this analysis and the EA, and issues considered and not included in alternatives analysis.

Key issues - Key issues are those the Service has the jurisdiction and authority to resolve. The key issues, together with refuge goals, form the basis for developing and comparing the different management alternatives we analyze in chapter 3. The varying alternatives were generated by the wide-ranging opinions on how to address key issues and conform to the goals and objectives. We describe them in detail below.

Issues and concerns outside the scope of this analysis - These topics fall outside the jurisdiction and authority of the Service or were deemed impractical. We discuss them after "Key Issues," below, but this plan does not address them further.

Issues considered and not included in alternatives analysis - These topics were considered by the planning team and reviewed for inclusion in one of our alternatives. Ultimately, we determined that these issues should not be included. We outline our reason to not including them below.

The following summary provides a context for the issues that arose during the scoping process.

Key Issues

We derived the following key issues from public and partner meetings and further team discussions. How they are addressed and how well they support refuge goals primarily distinguishes the three management alternatives in chapter 3.

Biological Program

- Evaluate reforesting areas of the refuge.
- Better understand implications and trade-offs of habitat management on refuge wildlife.
- Identify/address climate change concerns impacting the refuge.

Public Use

- Expand use of the National Wildlife Visitor Center and raise visibility of the Service and Refuge System as a whole.
- Consider extending refuge hours for public access.
- Seek out balance between public use and biology/wildlife.
- Maintain horseback riding as a public use opportunity on North Tract.
- Improve public access to North Tract by increasing parking areas.
- Accommodate other public uses at North Tract during hunting season.
- Consider charging a user fee and/or permit fee to help fund trail projects, etc.
- Complete Wildlife Loop to provide user access to entire loop, and consider various grades of access (auto, horse, bike, or hiker only, or a combination).

Hiking on the Refuge – USFWS

Cultural Resources

- Inventory historic resources on refuge and provide public access to these resources, and highlight historical significance of refuge.

Partnerships and Outreach

- Continue working with local and State organizations in enhancing outreach and funding opportunities in support of refuge mission and goals.
- Develop new partnerships to support refuge mission and goals.
- Meet with other Federal land managers in area to identify issues/opportunities.

Issues and Concerns Outside the Scope of this Analysis

We derived the following concerns and issues from public and partner meetings and further team discussions. The topics listed below will be addressed as a part of a separate planning process to determine if the boundary of the refuge should be expanded and, if so, what the extent should be. A separate land protection plan will be developed through a public process. The plan is discussed generally in this CCP; however, the land protection plan will require a separate environmental analysis.

Ecosystemwide Concerns

- Work with partners to evaluate land protection needs throughout the Patuxent River watershed.
- Consider adding lands to the approved refuge acquisition boundary for conservation purposes.
- Consider easement programs and private lands coordination as additional options.
- Maintain corridor concept when considering additional land protection.

Issues Considered and not Included in Alternatives Analysis

Elimination of Hunting Programs

The planning team reviewed the hunting programs on the refuge and determined that most of the existing hunting programs were effective in maintaining healthy wildlife populations, healthy forest ecosystems, and providing quality public hunting opportunities. Hunting opportunities in the area are limited, so eliminating all hunting opportunities on the refuge would have a detrimental impact on the health of the deer population in the area, habitats, and the public that participates in hunting. We have included minor changes to the hunting programs in each of the alternatives.

Non-motorized Boating Access to the Patuxent and Little Patuxent Rivers

We do not provide access across refuge lands to the Patuxent and Little Patuxent Rivers. A number of individuals requested canoe/kayak access to these rivers. While portions of each of the rivers may be considered navigable, we have not included river access in any of the alternatives. We are concerned about the potential for unexploded ordnance and the impact zone of the shooting ranges for the Little Patuxent River and possible impacts to the endangered species facilities adjacent to the Patuxent River. Also, the Patuxent River is almost entirely located within closed areas and access provisions would pass through the Patuxent Wildlife Research Center, which is also closed to the public.

Orienteering

During scoping and in response to our newsletter about alternatives, we received requests to allow orienteering on the refuge. Traditionally, orienteering takes place off-trail. We have not included these off-trail activities because we are concerned about year-round access to closed areas, safety associated with unexploded ordnance issues, and impacts to wildlife species, including disturbance. We have included virtual geocaching and letterboxing opportunities under alternative B. These activities would be required to use existing trails, roads, and areas open to the public.

Relocation of Powerlines

The refuge manager is working with the Refuge System, Division of Realty, to renew the special use permit for the existing 3-mile-long Pepco transmission line that transects the refuge. Pepco applied for a new permit to operate the transmission line prior to the expiration of the prior permit, but a number of issues, such as the final appraisal, have held up the permit process. We have only analyzed the continued presence and maintenance of the transmission line in this EA. We considered the options of not renewing the powerline permit or requiring that the line be moved underground. The transmission line helps meet electric needs of the surrounding area and is vital to electricity transmission in the region. If we did not renew the permit, Pepco would be forced to relocate the line off-refuge, which could have larger impacts to wildlife as the lines would be built in other undisturbed areas. In addition, the costs associated with such a move would equate to more than $1.1 million per mile with the distance to relocate around the refuge being a minimum of 7 miles along with any land acquisition costs. In the case of underground cables, typically, transmission lines with greater than 135 kilo-volt capacity are very difficult to bury and the costs jump to more than $2 million per mile. Given the nature of the powerlines and agreements that the refuge has established with Pepco regarding vegetation management, we determined that an alternative requiring the removal or burial of the Pepco transmission line would not be feasible given the high cost to the ratepayers and the minimal increase in our ability to meet the CCP/EA purpose and need. Therefore, we have not further analyzed such an alternative.

Decision to Be Made

The Service's Region 5 Director will make the final determination of a preferred alternative to serve as the CCP for Patuxent Research Refuge. This final determination will be based on the Service and Refuge System missions, the purposes for which the refuge was established, other legal mandates, and public and partner responses to this draft CCP/EA. The alternative selected could be the preferred alternative in the draft CCP/EA, the no action alternative, or a combination of actions or alternatives presented. The final decision will identify the desired combination of species protection, habitat management, public use and access, and administration for the refuge.

The Service determined that an EA would be a more appropriate document than an environmental impact statement (EIS) to accompany the CCP. The need to prepare an EIS is a matter of professional judgment requiring consideration of all issues in question. If the EA determines that the CCP will constitute a major Federal action significantly affecting the quality of the human environment, an EIS will then be prepared. If not, a Finding of No Significant Impact (FONSI) is prepared that briefly describes why the proposed action will not have a significant effect on the human environment. The FONSI also certifies that we have met agency compliance requirements and that the CCP, when implemented, will achieve the purposes of the refuge and help fulfill the Refuge System mission. Once the Regional Director has signed the FONSI and we have completed the CCP for the refuge, we will notify the public in the *Federal Register* and implementation can begin.

Chapter 2.

USFWS

Tufted Titmouse

Affected Environment

2.1 Introduction

2.2 Physical Environment

2.3 Habitat Overview

2.4 Wildlife

2.5 Federal and State Threatened and Endangered Species

2.6 Special Management Areas

2.7 Public Use Resources and Trends

2.8 Archaeological and Cultural Values

2.9 Socioeconomic Environment

2.10 Partnerships

2.11 Administrative Facilities

2.1 Introduction

This chapter describes the environmental resources at Patuxent Research Refuge that may be affected through the implementation of the CCP. Except where noted, the resource descriptions and acreage measurements are applicable to the entirety of Patuxent Research Refuge.

Refuge Establishment, Purposes, and Land Acquisition History
On December 16, 1936, President Franklin D. Roosevelt signed Executive Order 7514, which transferred 2,670 acres (1,081 hectares) of land to the U.S. Department of Agriculture to serve “as a wildlife experiment and research refuge” and “to effectuate further the purposes of the Migratory Bird Conservation Act.” The area delineated in the order was located in Anne Arundel and Prince George's Counties, Maryland and was to be known as “the Patuxent Research Refuge.” The location of Patuxent Research Refuge (map 1-1), adjacent to the National Agriculture Research Center at Beltsville, made it an appropriate area, according to Secretary Henry A. Wallace, upon which to conduct "long-time studies on the interrelationships of wildlife with agriculture and forestry.” Secretary Wallace and Dr. Ira N. Gabrielson, Chief of the Biological Survey, envisioned an area where wildlife could be studied in relation to the production of agricultural crops and where lands, poorly suited for agriculture, could be turned back into forests, fields, and meadows to benefit wildlife (Perry 2004) (see tables 2-1 and 2-2 for land acquisition totals).

In 1975, 1,250 acres (506 hectares) of surplus land were transferred from the U.S. Department of Agriculture to Patuxent Research Refuge, giving greater protection to refuge wetlands (Perry 2004).

In 1991, 7,600 acres (3,076 hectares) of land in Anne Arundel County, that were previously part of Fort George G. Meade (Fort Meade), immediately adjacent to the refuge to the north, were transferred to Patuxent Research Refuge as a result of the Military Construction Appropriations Act (U.S. Public Law 101-519). The land had been declared excess by the U.S. Army under the Base Closure and Realignment Act of 1985 (U.S. Public Law 100-526). The transfer was based on the recommendations of a broad-based Fort Meade Coordination Council that had extensively studied the options and voted unanimously for the transfer. The transfer document specified that the intended uses of the property, now called North Tract, were preservation of the land, wildlife research, and compatible public use. In addition, the transfer document stated that the Secretary of the Interior, "Shall provide for the continued use of the property by Federal agencies to the extent such agencies are using it on the date of the enactment of this act.” An additional 500 acres (202 hectares), including three baseball fields, were transferred to the refuge in 1992.

Table 2-1. Land Acquisition History for Patuxent Research Refuge

Acquisition Date	Tract	Acreage	Previous Owner
12/02/1933	4	299.74	Hayden, James R.
01/04/1936	116	242.46	Pickford, Thomas H., et al.
01/10/1936	99	384.22	Kluckhuhn, Fred
02/26/1936	97	588.9	Sparks Jr., Robert W., et al.
03/09/1936	114	383.02	Holst, William H. C.
03/25/1936	125	101.55	The Glatfelter Pulp Wood Co.
04/09/1936	100	89.60	Perkins, Edward, et al.
05/04/1936	177	15.00	Coe, Walker P.C.
05/13/1936	105	78.51	Hance, Jesse Frank
05/19/1936	96	561.43	Hoffman, John P.
05/26/1936	117	108.37	Owens, Eleanor Garner
05/28/1936	112	94.08	Knowles, John W.
06/04/1936	145	404.03	Hopkins, Alice
06/08/1936	123	233.70	Harding, Elizabeth A.
06/11/1936	104	123.88	Knowles, James B.
07/21/1936	120	31.09	Hall, Robert S.
05/17/1938	145	11.87	Hopkins, Alice
03/01/1940	10	7.62	Turner, George H.
03/01/1940	11	2.39	Hanus, Joseph
03/01/1940	12	26.39	Melikin, Louis
03/01/1940	125	28.41	The Glatfelter Pulp Wood Co.
03/01/1940	5	159.09	Anne Arundel County
03/01/1940	6	20.85	Repetti Brothers
03/01/1940	7	55.55	Knight, Harry
03/01/1940	9	131.63	Volkmer, Frank
02/21/1941	14	0.40	Kuhl, Lilly M.
04/18/1963	146	32.40	Potomac Electric Power Co.
07/14/1969	48	64.52	Schaefer, Milton R., et al.
08/13/1969	43	30.26	Harder, Earl S., et al.
10/28/1969	47	11.90	Mitchell, Herman S.
07/03/1970	45	140.23	Schaefer, Millard
07/14/1970	44	25.93	Schaefer, William A.
07/21/1970	50	2.13	Mcmillan, Claude M.
10/01/1970	125	182.38	The Glatfelter Pulp Wood Co.
01/05/1976	131	2.45	Barton
09/30/1991	200	7600.00	Department Of The Army
11/17/1992	200	498.20	Department Of The Army
01/28/1999	178	27.30	Curtis Family Land Trust
03/01/2002	202	21.76	Dose, Jean Hardisty
03/05/2002	203	17.69	Utley, Mildred J.
TOTAL		**12,840.93**	

Table 2-2. Acres of Patuxent Research Refuge by County

County	Acres
Anne Arundel County	8, 557.4
Prince George's County	4,283.5

Patuxent Research Refuge's legislated purposes include:

- 16 U.S.C. 715d, Migratory Bird Conservation Act: "…for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." This purpose is also attached to lands purchased with Migratory Bird Conservation funding.
- Public Law 101-519, 104 Stat. 2247 Defense Base Closure and Realignment Act, November 5, 1990: "... (b) The Secretary of the Interior shall administer the property transferred pursuant to subsection (a) consistent with wildlife conservation purposes and shall provide for the continued use of the property by Federal agencies to the extent such agencies are using it on the date of the enactment of this Act."
- 16 U.S.C. 667b, Transfer … for wildlife conservation purpose: "…can be utilized for wildlife conservation purposes . . . to the Secretary of the Interior if the real property has particular value in carrying out the national migratory bird management program."
- 16 U.S.C. 1534, Land Acquisition: "to conserve fish, wildlife, and plants, including those which are listed as endangered species or threatened species."

Refuge purposes based on executive orders include:

- Executive Order 11724-Federal Property Council, June 27, 1973: "…recreation, conservation, wildlife preservation, and related scientific and educational activities."

2.2 Physical Environment

Regional Setting

Situated between Baltimore, Maryland and Washington, DC, Patuxent Research Refuge provides 12,841 acres (5,197 hectares) of green space in one of the highest densities of development in the U.S. Located just off of the Baltimore-Washington Parkway, the refuge contributes to nearly 28,000 acres of federally owned land in the area. It has been referred to as "the green lungs" of the greater Washington, DC area. This reference to "green lungs" is due to the vast forested acreage secured by the refuge and adjacent Federal land ownerships. Several Federal facilities share a boundary with, or are in close proximity to, the refuge, including Fort Meade, the Rowley Training Center (U.S. Secret Service), National Aeronautics and Space Administration's Goddard Space Flight Center, the Natural Resources Conservation Service's National Plant Materials Center, and the Beltsville Agriculture Research Center.

The refuge is divided into three areas: (1) Central Tract, which includes the USGS Patuxent Wildlife Research Center (PWRC); (2) South Tract, where the National Wildlife Visitor Center (NWVC) is located; and (3) North Tract. The City of Bowie is located southeast of the refuge on Maryland State Highway 197 (MD 197) and the city of Laurel is located northwest of the refuge. MD 197 bisects the Central and South Tracts.

The Central Tract is the original property established in 1936. The Central Tract consists of 2,670 acres (1081 hectares) located in Prince George's and Anne Arundel Counties, and is bordered on the north by the Patuxent River and on the south by MD 197. The eastern boundary is an area of broken forest and meadows running contiguously along property owned by the Washington Suburban Sanitary Commission, Maryland National Capital Parks and Planning Commission, Prince George's County, and a private landowner. The western boundary of the Central Tract is a forested area that abuts the residential Basswood Subdivision of Montpelier Woods and a section of property owned by the Washington Suburban Sanitary Commission.

USFWS

Central Tract, Entrance Road to NWVC

PWRC, 1 of 17 USGS biological research centers, is a leading international research institute for wildlife and applied environmental research, for transmitting research findings to those responsible for managing the Nation's natural resources, and for providing technical assistance in implementing research findings so as to improve natural resource management. Scientists located at Patuxent Research Refuge are responsible for many important advances in natural resource conservation, especially in such areas as migratory birds, wildlife population analysis, waterfowl harvest, habitat management, wetlands, coastal zone and flood plain management, contaminants, endangered species, urban wildlife, ecosystem management, and management of national parks and national wildlife refuges.

PWRC develops and manages national inventory and monitoring programs. It is responsible for the North American Bird Banding Program and leads the development of many other national avian and non-avian wildlife monitoring programs. PWRC's scientific and technical assistance publications, wildlife data bases, and electronic media are used on a national and international scale for managing biological resources (PWRC Web site: *http://www.pwrc.usgs.gov/aboutus/mission.cfm*; accessed January 2012).

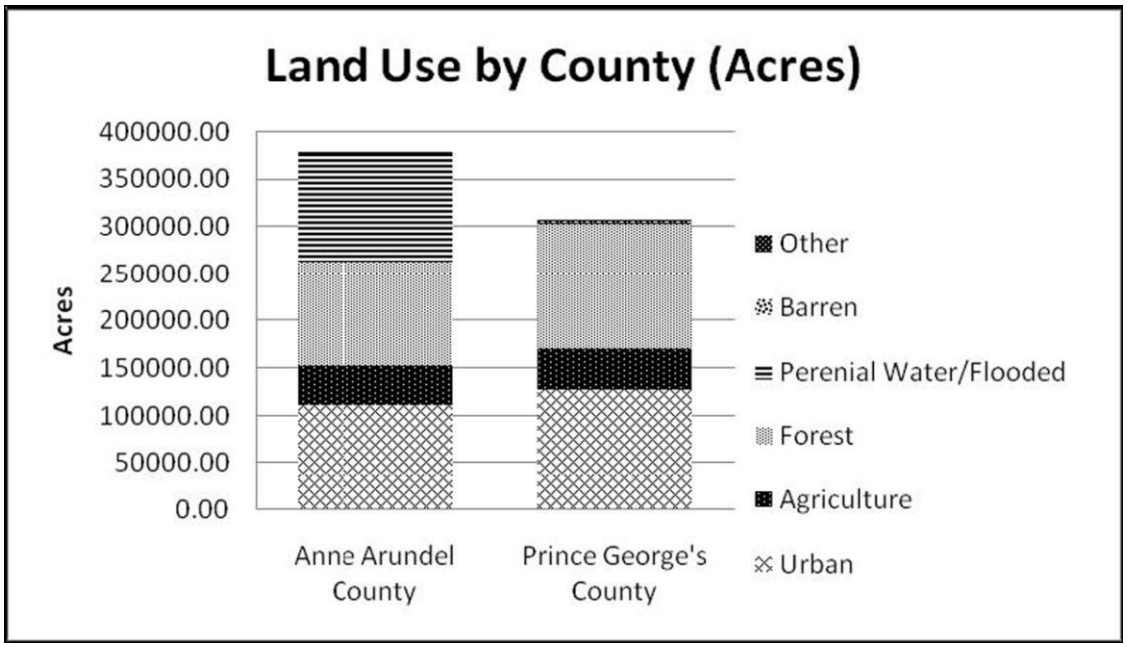
The South Tract, located in Prince George's County, consists of 2,200 acres (890 hectares) and is bordered by the Sandy Hill Landfill (inactive), the Beltsville Agriculture Research Center, and several residential areas. The South Tract houses the NWVC, located at the end of Scarlet Tanager Loop off of Powder Mill Road, and a small enclave of residences and offices located just off of MD 197. In addition, Cash Lake, a prominent seasonal fishing area, is located on the South Tract.

The North Tract consists of 8,100 acres (3,278 hectares) in Anne Arundel County. It is bounded on the north by Maryland Routes 198 and 32, on the west by the Baltimore-Washington Parkway, on the east by AMTRAK train lines, and on the south by the Patuxent River. Historically, the land was cleared for agriculture and then used by the military for extensive small arms, artillery, and tank training. Many open grassland areas remain, as remnants of old firing ranges, paratrooper training sites, and related administrative areas.

Land Use

Land use for Anne Arundel and Prince George's Counties is broken down by the following uses: agricultural, forest, urban, barren, perennial water/flooded, and other (figure 2-1). The total land use for the two counties is predominantly split between urban and forest land uses (35 percent each). Other major land uses include perennial water/flooded (17 percent) and agricultural (12 percent) (Vanasse Hangen Brustlin, Inc. 2010).

Figure 2-1. Land Use in Anne Arundel and Prince George's Counties

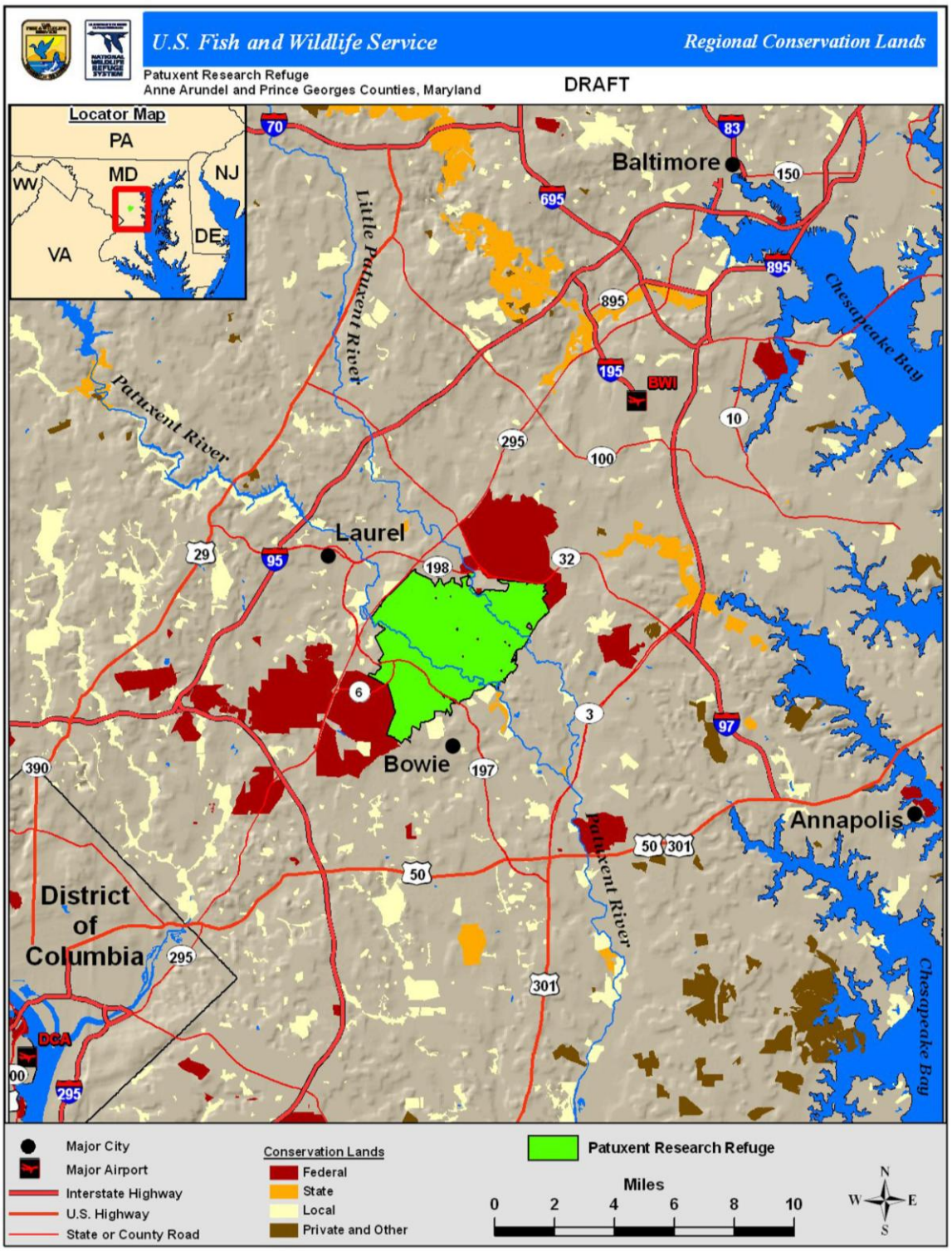


Source: State of Maryland Department of Planning

Regional Protected Lands

A variety of regional parks and protected land are located in Anne Arundel and Prince George's Counties (map 2-1).

Map 2-1. Regional Conserved Lands around Patuxent Research Refuge



Physiography

The refuge is situated in the coastal plain of central Maryland. The refuge is dominated by the Patuxent and Little Patuxent River drainages, approximately six miles below the fall line, which forms the boundary between the Coastal Plain and the Piedmont Physiographic Provinces. Characterized by gently sloping terrain that is typical of coastal plain, the natural landscape is predominantly forested, with the lowest elevations (near 80 feet or 24 meters above sea level) in river bottomlands. Elevation change is minimal, with the highest elevations being about 240 feet (73 meters) above sea level.

Geology and Soils

The predominant soil type in the area is Beltsville silt loam. Beltsville silt loam is a fine soil that has an underlying clay layer and may also have pockets of small gravel. The soil will not drain well if in a flat landscape and drainage ditches must be used to reduce excess surface water. Gravel and borrow pits are also predominant in the area but are well-suited to wildlife habitat (Dyrland et al. 2009).

Underlain by unconsolidated deposits of gravel, sand, silt, and clay, the other major soil types at the refuge are the Christiana-Sunnyside-Beltsville association, the Bibb-Tidal marsh association, and the Sassafrass-Croom association.

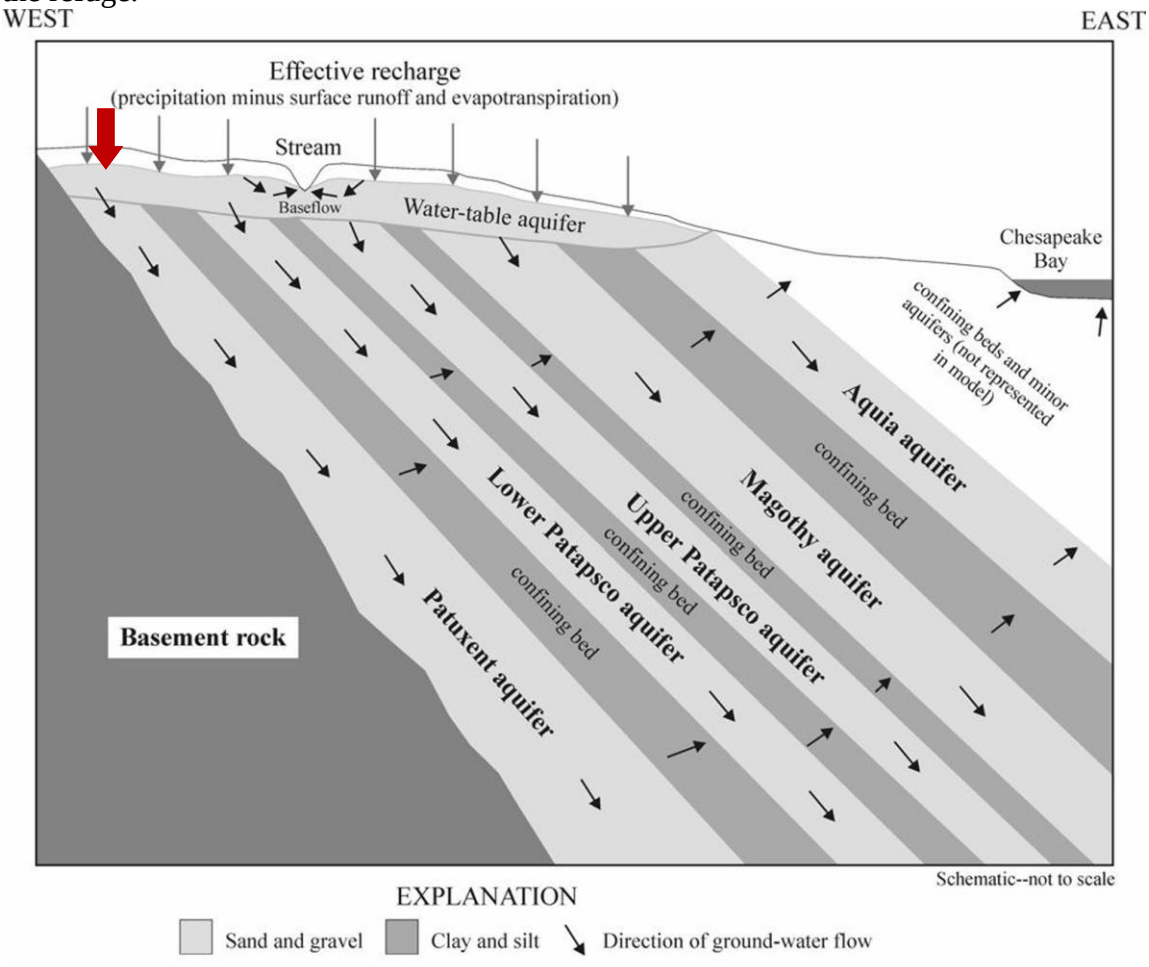
- The Christiana-Sunnyside-Beltsville association is underlain by red clay. The Christiana and Sunnyside soils are well-drained and suitable for deep-rooted vegetation. These soils have generally been put into agricultural production in the region; undisturbed forested areas with these soils are rare. Beltsville soils are less conducive to development and agricultural uses; they contain a restricting subsurface soil layer and consequently have a water table that is parched in wet seasons (Dyrland et al. 2009).
- The Bibb-Tidal marsh association consist mostly alluvial soils of the flood plains found along the Patuxent River and tributaries. Due to frequent flooding, these riparian soils were generally not cleared for farmland and often support intact wildlife habitat (Dyrland et al. 2009).
- Sassafras soils are deep and well-drained while Croom soils are shallow and somewhat excessively drained, with a compact to cemented subsoil (Dyrland et al. 2009).

There are also substantial areas of sandy Evesboro soils on the North Tract. No soil surveys have been performed on the central part of the North Tract, because it is composed of a series of firing ranges and training areas formerly controlled by the Department of Defense (DOD) with unexploded ordnance present. Evesboro soils are sandy and well to somewhat excessively drained (Dyrland et al. 2009).

The refuge overlies the Northern Atlantic Coastal Plain aquifer system. The aquifer is described generally in the USGS groundwater atlas of the U.S. (Trapp and Horn 1997). The Maryland Geological Survey provides more detailed local information on the State's groundwater aquifers. The coastal plain aquifer system is comprised of unconsolidated

gravel, sand, and silt separated by less permeable layers or confining beds. The more permeable sand and gravel deposits are considered aquifers and are used for public water supply (Andreasen 2007). In Anne Arundel County, the aquifers, from shallowest to deepest, are: water-table aquifer, Aquia, Magothy, Patapsco, and Patuxent (figure 2-2). On the refuge, the water-table aquifer includes shallow groundwater adjacent to rivers and wetlands within 30 feet (9 meters) of the ground surface. Water in this aquifer contributes to the water supply of rivers and wetlands on the refuge. Refuge water supply wells tap the Patapsco and Patuxent aquifers, which are about 280 and 500 feet (85 and 152 meters) below ground surface, respectively (Wurster 2010).

Figure 2-2. Conceptual Model of Groundwater Flow in the Coastal Plain Aquifer System in Anne Arundel County (Andreasen 2007). Red arrow identifies approximate location of the refuge.



Climate

The central Maryland climate is characterized by hot, humid summers and relatively mild winters. Weather systems move from west to east and prevailing winds are from the northwest (NRCS 2010). Typical summer months experience warm, moist air moving up from the Gulf of Mexico, while easterly winds bring cooler air over the region. In addition, central Maryland is frequently under a large, high-pressure system known as the

Bermuda high, centered over the Atlantic, bringing a flow of warm, moist air into the State from a southwesterly direction. Typical winter months experience cold, dry air from central Canada that has been moderated by having passed over the Appalachian Mountains. Much of the precipitation in winter is brought in by northeasters, on-shore winds that move ahead of low-pressure systems going northward along the coast. During the cooler months of October through April, prevailing winds are from the northwest (Wildland Fire Associates 2008).

Averages and Records

The yearly average temperature is 55°F (13°C), with an average high temperature of 65°F (18°C) and average low of 44°F (7°C) (NOAA 2004). July is, on average, the hottest month, with an average high temperature of 87°F (31°C). January is, on average, the coldest, with an average high of 41°F (5°C) (NOAA 2004). The highest temperature on record for the region is 105°F (41°C) on August 20, 1983, and the lowest recorded temperature is -15°F (-26°C) on January 18, 1957 (NRCS 2010). The region averages between 180 and 200 frost-free days each year (UMBC 2003).

The area receives on average 42 inches (1067 millimeters) of precipitation per year, with approximately 60 percent of the precipitation falling between April and October (NRCS 2010). Overall precipitation data indicates monthly averages of between 3 inches (76.2 millimeters) and 4 inches (101.6 millimeters) (NOAA 2004). Between 1971 and 2000, the greatest monthly precipitation amounts occurred in September. Precipitation is most variable during the summer months. The average annual snowfall is 18.2 inches (462 millimeters), with January and February being the snowiest months (NOAA 2004). The region averages between 10 and 16 days with at least 1 inch (25 millimeters) of snow cover (NRCS 2010). Also, December 2009 found the area receiving the largest single snowfall in recorded history. The snowiest season on record was the 2009 to 2010 winter with 55.9 inches (*http://www.erh.noaa.gov/lwx/winter/DC-Winters.htm*; accessed March 2012).

USFWS

Flooding at Duvall Bridge

The region's average relative humidity at mid-afternoon is approximately 54 percent, with higher levels of humidity during the night (NRCS 2010). The region experiences sunshine 60 percent of the summer and 50 percent of the winter (NRCS 2010).

Hydrology and Water Quality

The refuge is located within the Patuxent, Little Patuxent and Anacostia River watersheds, which are part of the Chesapeake Bay watershed. Water quality conditions in

the State are monitored and regulated by the Maryland Department of the Environment (MDE) in order to protect, maintain, and improve the quality of surface waters in Maryland, and to ensure compliance with the Federal Clean Water Act. These standards are based on the designated use, water quality criteria to protect designated uses, and anti-degradation criteria for the waterway.

At the heart of the refuge, on the Central Tract and North Tract, lie the channel, tributaries, floodplains, and nontidal wetlands of the Patuxent River. The watersheds of the Patuxent and Little Patuxent Rivers are characterized by rolling hills and gently sloping terrain, with broad valleys and small tributary streams (MDE 2009, Wurster 2010).

Most of the South and Central Tracts are within the watershed of the Tier 2 segment of the Patuxent River; the lack of major development and impervious surfaces ensure that water quality in the adjacent rivers is protected to a certain degree. Tier 2 represents water that is of better quality than that needed for its designated use. Both the Patuxent and Little Patuxent Rivers are designated as impaired in the biological impairments, sediments, nutrients, and metals categories. However, the rivers are not impaired in the toxins and bacteria categories. Just downstream of the refuge, a short segment of the Patuxent River is designated as Tier 2 under Maryland's anti-degradation policy (Vanasse Hangen Brustlin, Inc. 2010).

Section 303(d) of the Clean Water Act requires that each state identify water bodies where water quality standards are not met. MDE develops a list of known, water quality-limited rivers and lakes. Once a water body is listed, MDE either establishes a total maximum daily load for the limiting substances or shows that the water quality standards are being met (MDE 2009, Wurster 2010).

MDE issues national pollutant discharge elimination system permits for any discharges to waters. These permits regulate the quality and quantity of discharges into the receiving waters and are issued to a variety of organizations and businesses, including NWVC. Stormwater and treated wastewater are two examples of discharges regulated under the permit program in Maryland. It is expected that wastewater discharged under these permits will find its way to the Patuxent and Little Patuxent Rivers (Wurster 2010).

The Patuxent and Little Patuxent Rivers are classified as Use I (water contact recreation and aquatic life) and Use I-P (water contact recreation, aquatic life, and public water supply), respectively, by MDE. These classifications are required under section 303(d) of the Clean Water Act and used to determine if the rivers are water-quality impaired. The Patuxent River is considered one of the State's scenic rivers, which is designed to preserve the natural values of the river. Several reports imply the Patuxent and Little Patuxent Rivers are high-priority waters in Maryland (MDE 2007, LimnoTech 2008, MDE 2009, Wurster 2010).

All the largest rivers on the refuge are identified as impaired water bodies in Maryland's 303(d) list. The Patuxent and Little Patuxent Rivers have excessive nutrients and

sediment, while the Little Patuxent may have excessive mercury in its waters. The Little Patuxent, Midway Branch, and Lake Allen are all identified as having impaired aquatic biota populations (Wurster 2010).

The 2010 Chesapeake Bay report card determined the Patuxent River to be of poor overall ecosystem health. For 2010, the Patuxent River region received a D- score, indicating that, since 2009, no improvement in overall health of the region was found. While phytoplankton and benthic communities showed some improvement, overall water quality indicators declined. See Patuxent River report card at: *http://www.eco-check.org/reportcard/chesapeake/2010/summaries/patuxent_river/*; accessed January 2012).

In addition to the Patuxent River, there are a number of standing-water features on the refuge which are man-made impoundments. Impoundments are of three major designs: dammed ravines, excavated basins, and diked ponds (McGilvery 1997). Although some were created inadvertently when roads were constructed across drainages, many were constructed between the 1930s and 1970s and created to reclaim gravel pits and old agricultural fields, while others were created specifically for waterfowl research and management (Wildland Fire Associates 2008, Wurster 2010).

Major impoundments on the refuge include Lake Allen on the North Tract, and Cash Lake and Lake Redington on the South Tract. Lake Allen, 22.77 acres (9 hectares), was created by the army in 1946 and originally called Soldier Lake. This lake was included as part of the Fort Meade land transfer in 1991, and named Lake Allen in honor of the commanding general who supported the land transfer. Lake Allen currently serves as a year-round fishing area for anglers. Lake Redington is 36.04 acres (15 hectares) and was created in 1943 for waterfowl conservation. It also currently serves as an interpretive feature for seasonal tram tours. Cash Lake is 52.73 acres (21 hectares) and was created in 1938 by the Civilian Conservation Corp for public fishing. It currently serves as the only seasonal fishing site for the South Tract. Its dam is considered a high-hazard, due to MD 197 being immediately downstream from the dam's outfall.

USFWS

Cash Lake Fishing Pier

The Patuxent River and Watershed

The Patuxent River is the largest river entirely in the State of Maryland. On the North Tract, over 6 miles (10 kilometers) of the Little Patuxent River lie within the refuge boundary. In several places the Patuxent and Little Patuxent Rivers are braided and thus have multiple shorelines. In addition to these two rivers, the refuge also has over 43 miles (70 kilometers) of streams which feed into the rivers, totaling 68 riparian miles (110 kilometers) (Les Vilchek 2012). The Patuxent River is 115 miles in length and is the longest river contained within the State of Maryland. The Patuxent River drains 612,425 acres of central and southern Maryland, eventually discharging into the Chesapeake Bay north of the mouth of the Potomac River. Three main streams drain into the upper Patuxent River: the Little Patuxent, which drains much of the newly urbanized area of Columbia, Maryland; the Middle Patuxent, which drains agricultural lands in the northern part of its drainage and the outer suburban areas of Columbia in the southern part of its watershed; and the (upper) Patuxent River, which has remained primarily agricultural. Land use in the watershed is mainly forest, with significant urban and agriculture development. Two large metropolitan areas, Baltimore and Washington, border the Patuxent River watershed, which has gone through significant suburban development in the past few decades. Columbia and Laurel have developed along the Interstate 95 corridor, which bisects the upper half of the watershed. The population of the Patuxent River watershed increased by 136 percent between 1970 and 2000 and is projected to grow an additional 22 percent by 2020.Two water supply reservoirs, located upstream of Laurel, Maryland provide water for the Washington, DC metropolitan area.

The watershed also provides important habitat for land and aquatic animals. It supports over 100 fish species and a commercial and recreational blue crab fishery.

The Chesapeake Bay Watershed

The Chesapeake Bay and its tributaries support more than 2,700 plant and animal species, including threatened and endangered species, waterfowl, raptors, neotropical migratory birds, anadromous fish, and commercially important fish and shellfish. Forested uplands are nesting and resting habitat for neotropical migratory birds and coastal wetlands provide valuable wintering grounds for waterfowl. The tributaries within the watershed are spawning grounds for anadromous fish species like striped bass, blueback herring, alewife, American shad, hickory shad, and Atlantic sturgeon. Shallow water areas support submerged aquatic vegetation, underwater plants that provide food and cover for waterfowl, blue crabs and juvenile fish. The open water of the Chesapeake Bay supports striped bass, bluefish, weakfish, American shad, blueback herring, alewife, bay anchovy and Atlantic menhaden. Commercially valuable shellfish, like oysters and clams, live along the bay's bottom. (Chesapeake Bay Coastal Program Web site: *http://www.fws.gov/chesapeakebay/coastpgm.html*; accessed January 2012.)

The Strategy for Protecting and Restoring the Chesapeake Bay Watershed was developed under the Executive Order issued by President Obama in May 2009, which declared the Chesapeake Bay a national treasure and ushered in a new era of shared Federal leadership, action, and accountability. The strategy deepens the Federal commitment to the Chesapeake region, with agencies dedicating unprecedented resources and targeting

actions where they can have the most impact, to ensure that Federal lands and facilities lead by example in environmental stewardship and take a comprehensive, ecosystemwide approach to restoration. Many of the Federal actions will directly support restoration efforts of local governments, nonprofit groups, and citizens, and provide economic benefits across the Chesapeake region. (Executive Order Web site: *http://executiveorder.chesapeakebay.net*; accessed January 2012.)

Air Quality

Air quality conditions in the State of Maryland are monitored and regulated by MDE. Maryland currently operates 26 air monitoring sites around the State and measures ground-level concentrations of criteria pollutants, air toxics, meteorology, visibility, and other research-oriented measurements. The Ambient Air Monitoring Program is responsible for measuring these concentration levels in compliance with the Federal Clean Air Act (Vanasse Hangen Brustlin, Inc. 2010).

An important part of the Clean Air Act is the delineation of National Ambient Air Quality Standards. These standards apply to outdoor air throughout the U.S. and set concentration limits on combustion-related pollutants. Areas that meet the standards are termed attainment areas. Areas that do not meet the standards are termed nonattainment areas.

The refuge falls in the metropolitan Washington, DC and Baltimore regions. These regions are designated as nonattainment areas for ground-level ozone and particulate matter according to Federal health standards. However, the region's ground-level ozone and fine particle pollution levels have continued to show significant improvements since early the 1990s. Carbon dioxide emissions continue to rise and pose a significant air quality challenge for the region (Vanasse Hangen Brustlin, Inc. 2010, MDE Summer 2006 Air Quality Summary).

Contaminants

A number of hazardous substances, unexploded ordnance, and munitions have been associated with the transfer of former military training grounds (North Tract's 8,100 acres) from Fort Meade through the Base Closure and Realignment Act of 1985. Hazardous substances include, but are not limited to, lead, petroleum-based waste, and unexploded ordnance. The refuge has cooperated with the Department of Defense (DOD) in establishing monitoring wells at several locations on the North Tract for continuous, long-term monitoring of ordnance and demolition-related compounds such as cadmium and volatile organic compounds. Groundwater monitoring wells have also been established to monitor contaminants, including trichloroethylene and tetrachloroethylene, potentially moving from Fort Meade sites through underground aquifers underlying refuge property. In general, natural attenuation is an ongoing cleanup strategy for contaminants. An abandoned trap and skeet range may undergo a soil removal action to eliminate lead-contaminated soil. Ordnance is removed as it is encountered in the field by ordnance demolition teams supplied by Fort Meade or other nearby military bases.
The U.S. Environmental Protection Agency (EPA) placed Fort Meade on the national priority list in July 1998, after an evaluation of contamination due to past storage and

disposal of hazardous substances at the defense reutilization and marketing office, closed sanitary landfill, clean fill dump (located on the North Tract), and post laundry facility. Contamination at these sites included solvents, pesticides, polychlorinated biphenyls, heavy metals, waste fuels, and waste oils (URS 2010).

A Federal facility agreement was signed in June 2009 to serve as the master plan between DOD, EPA, and the Service, to provide specific timelines and required actions to resolve contaminant issues between Fort Meade and associated Base Closure and Realignment Act properties, including the North Tract of the refuge. The refuge manager is the point of contact for day-to-day issue and implementation of the agreement. This includes four operable units (areas where contaminant issues remain) on the refuge. While the Service has spent minimal funds for documenting contaminants at a few select locations, all cleanup responsibility for contaminants or ordnance related to former military uses remains the responsibility of the DOD in perpetuity. Soils and waterways in a number of locations within North Tract were contaminated with hazardous substances as a result of handling and disposal techniques that were once considered to be acceptable. In addition to hazardous materials being disposed of on the refuge, munitions and unexploded ordinances remain on the transferred land. The Department of the Interior, the Department of Army, and the EPA are actively involved in cleanup efforts. Investigation, cleanup efforts, and unexploded ordnance sweeps continue throughout the North Tract and are expected to continue into the foreseeable future.

USFWS

Shooting Range at Patuxent Research Refuge

Prior to the transfer of the North Tract to the refuge in 1991, a portion of the area was used as a trap and skeet range by Fort Meade. This use began in the mid-1970s and continued after the land transfer until 1999. In 1999, the range was closed because PWRC research data indicated that birds using the site were exposed to lead. Due to concerns about contamination from the lead shot, soil samples were analyzed for levels of lead, as well three common impurities found in lead shot–antimony, arsenic, and copper.
In 2004, the Service Chesapeake Bay Field Office and the EPA Environmental Response Team compiled an ecological risk assessment for shooting range 17 (Huston and Krest 2004). The primary objective of the assessment was to determine the extent of lead

contamination at the trap and skeet range and the secondary objective was to assess the impact of this contamination on refuge wildlife. The report summarizes findings from soil samples collected from the site in 2003, explains the environmental impacts of the contaminants found, and recommends goals for site remediation. To assess ecological effects on refuge wildlife, the team conducted a soil toxicity test using earthworms, food chain accumulation models, and a lead-shot ingestion probability model. Overall, they found that the site was contaminated with both lead and lead shot, and posed a risk to insectivorous birds, mammals, and gallinaceous birds, which feed primarily on the ground. Fifteen acres of the site exceeded acceptable levels of contamination. The report lists goals for site remediation in terms of acceptable levels of each contaminant. The entire report is available online from the Service Chesapeake Bay Field Office Web site: *http://www.fws.gov/chesapeakebay/pdf/CBFO-C0405.pdf;* accessed January 2012).

Fort Meade Superfund Site
Fort Meade is located northeast of the refuge near Odenton, Maryland and was designated a superfund site in 1998. Several sites on Fort Meade have been added to the national priorities list of serious abandoned hazardous waste sites. Groundwater in the water-table aquifer under the fort is contaminated with carbon tetrachloride, tetrachloroethene, and trichloroethene. Contaminants migrating in the groundwater could discharge into wetlands and streams on the refuge that receive contributions from shallow groundwater. The Department of the Army has installed a network of 12 groundwater monitoring wells on the North Tract to determine if groundwater is also contaminated on the refuge (Wurster 2010).

2.3 Habitat Overview

Background and Landscape Context of the Refuge
About 10,000 acres (4,046 hectares) of the total 12,841 acres (5,197 hectares) are forest of some type. Refuge forests contribute to one of the largest blocks of contiguous forested habitat in the Mid-Atlantic Coastal Plain. Other habitat types include grasslands/old fields, emergent freshwater marshes, shrub and early succession forest communities, and constructed impoundments. The refuge provides habitat for at least 38 mammal species, 55 amphibians and reptiles, 25 orders of insects, 248 bird species, and 55 species of fish (Vanasse Hangen Brustlin, Inc. 2010, Hotchkiss and Stewart 1979, refuge data on file).

To facilitate the development of management objectives and alternatives for key habitats and to communicate these to the public, refuge habitats are classified below in very broad terms, which produced 12 different habitat classifications or cover types. Major dividers in habitat types are upland versus wetland, and impoundment versus naturally occurring wetlands.

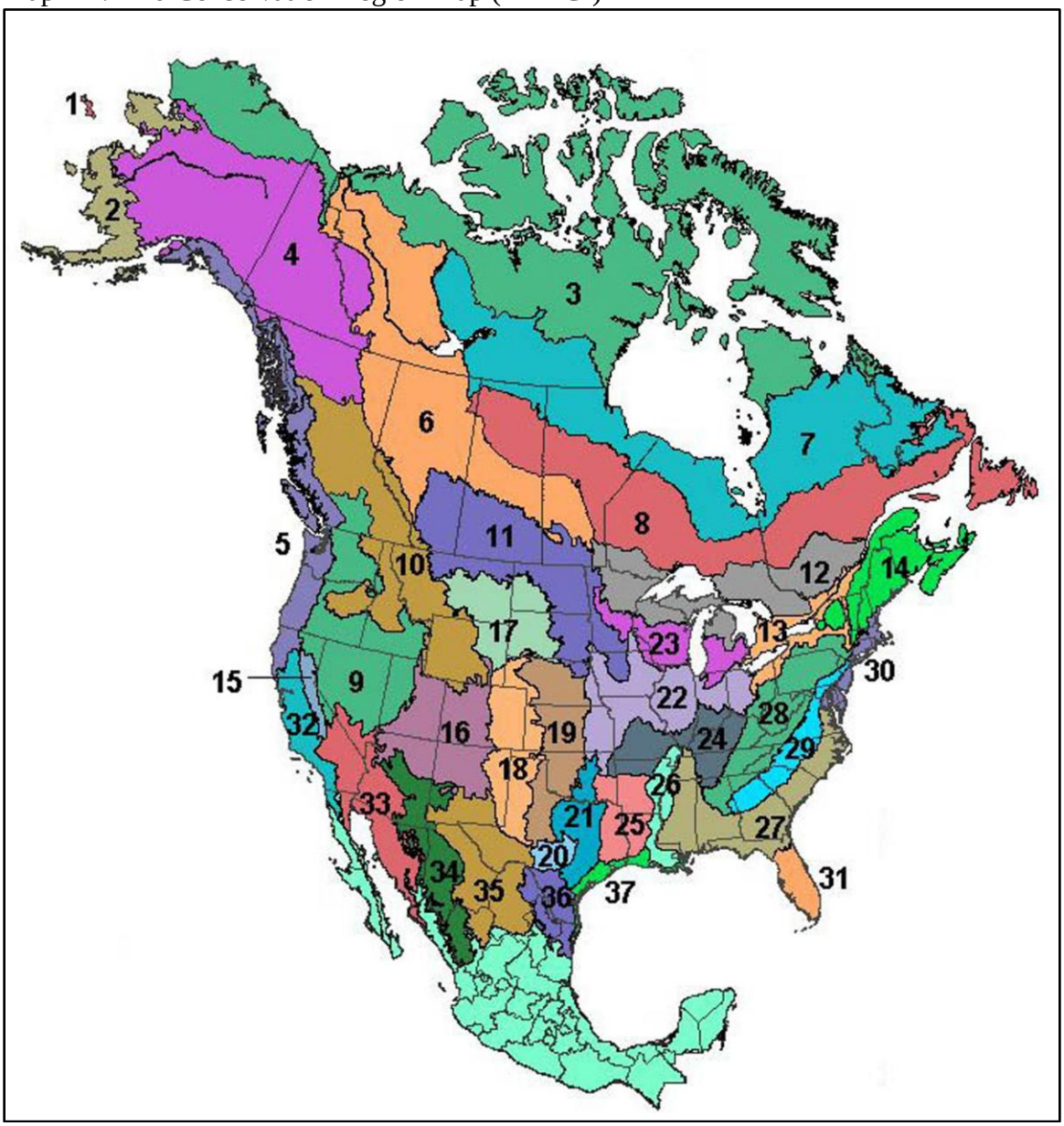
- The general habitat or land cover types for uplands are forest (deciduous, pine, or mixed), oak-pine savannah, shrub-early succession forest, grassland-old field, and administrative-developed.

- The general habitat types for wetlands are floodplain forest and swamp, river and stream, depressional forest and shrub wetlands, and emergent wetlands.
- Some wetlands are impoundments and have various cover types, which include open water, emergent, and shrub and forested wetlands (the latter includes managed green-tree reservoirs).

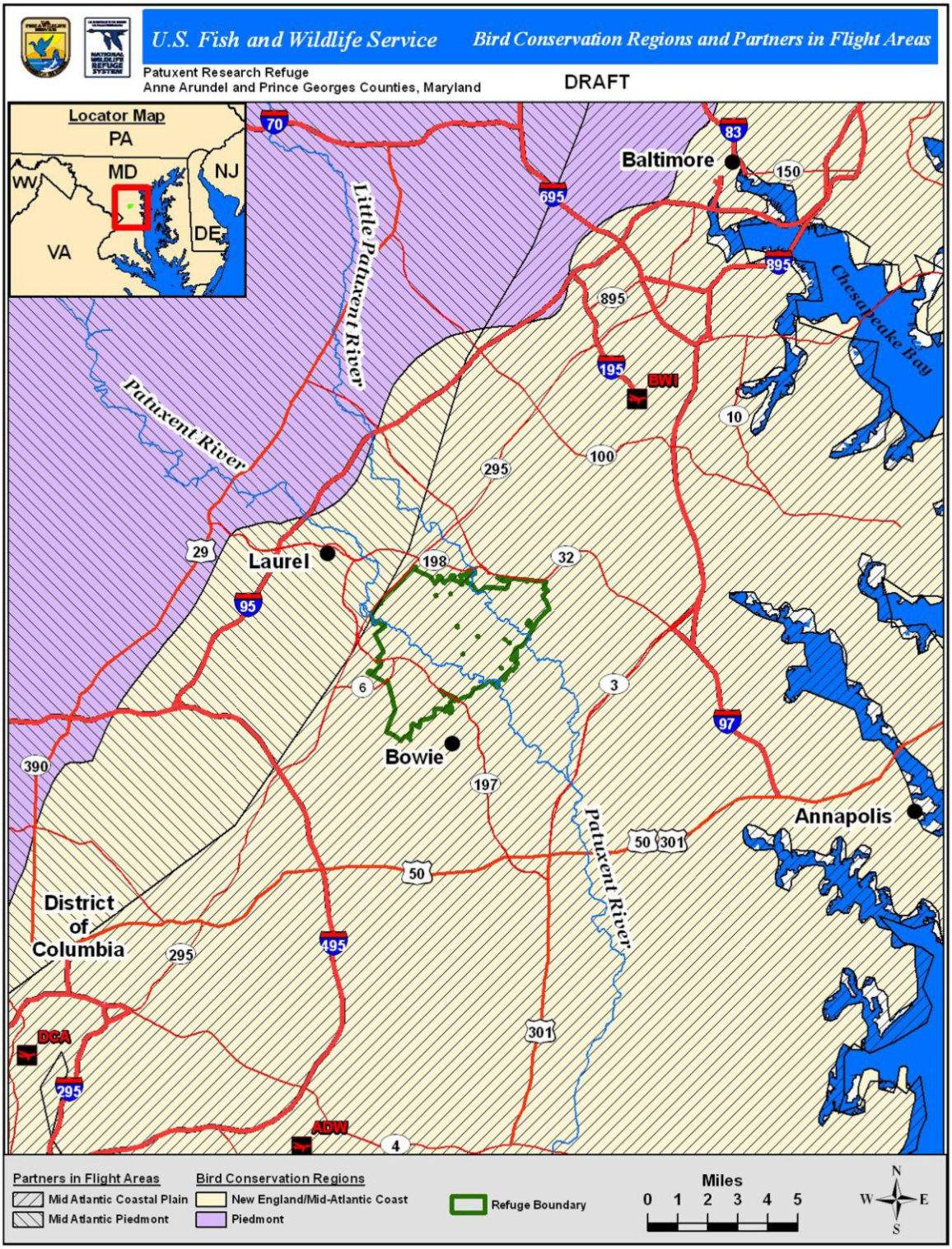
These broad, general habitat types were further classified at much finer scales to identify cohesive natural or altered plant communities. The refuge is located in the Chesapeake Bay Lowlands Ecoregion (Region 60), which encompasses primarily lowlands between the fall line and the Atlantic Coast. Within ecoregions, vegetation communities are characterized and distinctly identified using the National Vegetation Classification System (NVCS). The system was developed by NatureServe, a consortium of Federal and academic partners, and is the Federal standard used for mapping refuge vegetation. The methodology is based on groups of plant community types that tend to co-occur within landscapes with similar ecological processes, substrates (e.g., soils), and/or environmental gradients (e.g., drainage, elevation, climate). A given vegetation classification typically manifests itself in the landscape at tens to thousands of acres and will persist for 50 or more years (Comer et al. 2003). NVCS is based on a relatively fixed hierarchy of floristic units, a measurement of a plant community based on the dominant species in the canopy, including associations and alliances, which are the recommended levels to apply to refuge mapping projects. An association is the most basic floristic vegetation classification unit within the NVCS. It is a plant community of definite floristic composition, a defined range of species composition, diagnostic species, uniform habitat conditions, and physiognomy. An alliance is a group of associations that share floristic characteristics, but is more compositionally and structurally variable, more geographically widespread, and occupies a broader set of habitat conditions (ESA 2004). Additional information on NatureServe, the ecoregions, NVCS, and mapping standards is available online at: *www.esa.org*; accessed January 2012.

The habitat descriptions below are also important for deriving the priority bird species lists for each habitat type. Map 2-2 shows bird conservation regions (BCRs), ecologically distinct regions in North America with similar bird communities, habitats, and resource management issues. The BCR system was developed by the North American Bird Conservation Initiative, a coalition of government agencies, private organizations, and bird initiatives, to standardize and coordinate bird conservation efforts and planning and is the standard used by most refuges in the Refuge System. Patuxent Research Refuge lies within BCR 30, the Mid-Atlantic Coastal Plain; however, the refuge is very close to BCR 29, which includes the piedmont. Map 2-3 below shows a close up view of the proximity of the refuge to this BCR. For more information about BCRs or BCR 30, see: *http://www.acjv.org/BCR_30/BCR30_June_23_2008_final.pdf*; accessed January 2012. For more information about North American Bird Conservation Initiative, see: *http://www.nabci-us.org/about.htm*; accessed January 2012.

Map 2-2. Bird Conservation Region Map (NABCI)



Map 2-3. View of Patuxent Research Refuge within BCR 30 and proximity to BCR 29 (Source: Atlantic Coast Joint Venture)



Upland forest is the predominant habitat type found on the refuge. This habitat type is composed primarily of oaks, such as white (*Quercus alba*), northern red (*Quercus rubra*), and southern red oak *(Quercus falcate)*. Other species include Virginia pine (*Pinus virginiana*), pitch pine (*Pinus rigida*), red maple (*Acer rubrum*), American beech (*Fagus grandifolia*), hackberry (*Celtis occidentalis*), cherry (*Prunus* spp.), walnut (*Juglans nigra*), hickories (*Carya* spp.), and sweetgum (*Liquidambar styraciflua*). Several alliances are included in the upland forests, such as chestnut oak-red oak-mountain laurel, beech-red/white oak-tulip poplar, or white oak-southern red oak-hickory alliances.

The next most predominant habitat type is bottomland or floodplain hardwood forest characterized by river birch (*Betula nigra*), green ash (*Fraxinus pennsylvanica*), sycamore (*Plantanus occidentalis*), pin oak (*Quercus palustris*), swamp white oak (*Quercus bicolor*), willow oak (*Quercus sphellos*), black oak (*Quercus velutina*), red maple, black gum (*Nyssa sylvatica*), sweetgum, yellow poplar (*Liriodendron tulipifera*), bald cypress (*Taxiodium distichum*), American elm (*Ulmus Americana)*, sweetbay magnolia (*Magnolia virginiana*), and includes several alliances.

Information about big tree species on the refuge can be obtained at: *http://www.pwrc.usgs.gov/history/herbarium/bigtree.htm*; accessed January 2012.

Much of the land that is now forested is a result of gradual reforestation as lands were retired from agricultural use. Distribution of various species has changed significantly through this process. A notable change has been the invasion of cleared and cut-over areas by conifers. Virginia pine, pitch pine, and loblolly pine (*Pinus taeda*) dominate many of the drier areas. However, it is possible that this is a reversion to a pine-barren community of pitch pine that once ranged from southern New Jersey across northern Delaware and across northern/central Maryland. Early succession species such as tulip poplar (*Liriodendron tulipifera*), red maple, and sweetgum, have invaded more mesic to wet sites. Total plant species for the refuge were assembled from historical data (Hotchkiss and Stewart 1979), recent updates by USGS biologists (Perry and Bond 2011), and new collections in 2011 by volunteer William Harms, which provided 18 new species. The refuge has 985 total plant species including 554 herbs/forbs, 209 graminoids, 165 trees/shrubs, 65 sedges, and 39 vines.

Habitat Types-Uplands

Administrative/Developed

This includes buildings, facilities, parking lots, roads, yards or lawns adjacent to buildings, and any areas that are kept mowed for administrative or maintenance purposes.

Grasslands/Old Fields

This classification represents priority habitats that are being managed for grassland or old field-dependent species of conservation concern. There are many scattered sites throughout the refuge that are in grass cover, but because of their small size (less than 25 acres or 10 hectares), linear or narrow configuration, and closed-canopy setting, would not be appropriate for the investment of resources required to manage as grassland habitat and thus are not defined as grasslands. Old fields are essentially grasslands that have

advanced somewhat in natural succession and contain scattered young trees and a substantial forb component. Refuge grasslands result from continued mowing of past agricultural lands, arrest the natural succession to forest. Some of the open areas are in old field stage, trending toward shrub or early succession forest. Open fields undergoing early succession toward forest are characterized by exotic tall meadow fescue (*Festuca arundinacea*) and *Sericea lespedeza*, which dominates in many areas. Other invasives include mile-a-minute (*Persicaria perfoliata*), Bradford pear (*Pyrus calleryana*), and autumn olive (*Elaeagnus umbellate*). Dense monocultural stands of sweetgum and black locust (*Robinia pseudoacacia*) are encroaching and reducing open acreage in many meadow areas. Other common native species include broomsedge (*Andropogen virginicus*), blackberry species (*Rubus* spp.), goldenrods (*Solidago* spp.), ragweed (*Ambrosia altissimifolia*), many species of asters or composites, Queen Anne's lace (*Daucus carota*), yarrow (*Achillea millefolium*), and a variety of panic grasses (*Panicum spp*.) (Wildland Fire Associates 2008, staff).

The potential for refuge grasslands to support conservation bird species depends on size and configuration. For the majority of grasslands and old fields on the refuge, this would include generalist species more tolerant of woody encroachment and small, linear sizes, such as the field sparrow (*Spizella pusilla*), eastern towhee (*Pipilo erythrophthalmus*), prairie warbler (*Dendroica discolor*), eastern kingbird *(Tyrannus tyrannus)*, brown thrasher (*Toxostoma rufum*), orchard oriole (*Icterus spurious*), and indigo bunting (*Passerina cyanea*). Grasshopper sparrow (*Ammodramus savannarum*) and eastern meadowlark (*Sturnella magna*), area-sensitive, grassland-obligate species, generally nest only in the largest field on the North Tract, but have occasionally been observed in other fields on the refuge. American woodcock (*Scolopax minor*) will use the open grasslands for aerial displays in late winter and spring. Grasslands and old fields adjacent to hardwood forest are attractive to box turtles (*Terrapene carolinus*) and are an essential arrangement for forest bats of conservation concern, such as eastern red bat (*Lasurius borealis*), little brown myotis (*Myotis lucifugus*), and tri-colored bat (*Perimyotis subflavus*).

USFWS

Refuge Grassland

Currently there are 95 mowed fields, approximately 535 acres (217 hectares) on the refuge. Twenty-three of the fields are located on the South Tract and range from less than 0.1 to 5.1 acres and average 1.2 acres (.5 hectares); the 61 Central Tract fields range from 0.3 to 21.5 acres and average 5.5 acres (2.2 hectares); and the 11 North Tract fields range from 3.3 to 90.9 acres and average 31.3 acres (12.7 hectares) (Haglen 2010).

Oak-Pine Savannahs

On the North Tract, there are some areas of fire-influenced barrens or deep sand, well-drained soils now dominated by young, thick scrub growth of Virginia pine or pitch pine, and several species of oaks, such as scrub oak (*Quercus ilicifolia*), post (*Quercus stellata*), willow, sand hickory (*Carya pallid*), and blackjack oak (*Quercus marilandica*). These areas are located primarily along the Patuxent River and may represent a remnant pine barren or savannah. Understory species include little bluestem (*Schizachyrium scoparium*) and Opuntia cactus (Drs. Mathew Perry and Charles Davis, personal communication). Prescribed fire will be considered for use as a management tool to help perpetuate these rare communities (Wildland Fire Associates 2008). Current acreage is about 132 (53 hectares), but this is an estimate based on sandy soils, not vegetation.

Shrub and Early Successional Forests

Shrub and small trees dominate this transitional habitat type that may persist in either an upland or floodplain (palustrine) setting for up to 20 years depending on site potential. Species composition varies, depending on location and the species composition of adjacent habitats. The refuge contains relatively small proportions of this habitat type. Sweetgum, maple, black cherry (*Prunus serotina*), oaks, and tulip poplar tend to be the most common tree species to dominate the scattered pockets and fringe areas of early succession forest. Nonnative invasive species such as Bradford pear, autumn olive, and Chinese lespedeza (*Lespedeza cuneata*) are problematic where old fields abut forest. Most of the acreage of shrub habitat (approximately 223 acres/90 hectares) is located in the two powerline right-of-ways, where it is likely to be maintained.

Upland Deciduous, Pine, and Mixed Forests

Deciduous forests contain a variety of hardwood species depending on the age and hydrology of the forest. Mature climax species for this area would be dominated by oaks, such as white, chestnut (*Quercus prinus*), southern and northern red (*Quercus rubra*), and, on drier sites, post, scrub, blackjack, and willow. Hickories, such as mockernut (*Carya tomentosa*) and bitternut (*Carya cordiformis*), share the canopy in mature, climax forests. But since most of these forests have been logged (oaks, hickories, and walnut were much sought-after) and fire has not been present on the landscape, non-fire adapted species are also common, such as beech (*Fagus grandifolia*), maple, tulip poplar, and sweetgum. Common mid-story and small trees in these forests include dogwood (*Cornus* spp.), hornbeam (*Carpinus* spp.), pawpaw (*Asimina triloba*), spicebush (*Lindera benzoin*), mountain laurel (*Kalmia latifolia*), arrowwood (*Viburnum dentatum),* and sassafras (*Sassafras albidum*). On very dry soils one finds heath communities comprised of blueberries and huckleberries (*Vaccinium spp.*), and wild azalea (*Rhododendron cansecens*). Such forests may also contain perched vernal pools (these are vernal pools that lie in a depression in an otherwise elevated upland area, are fed by sheet flow, and have a tendency to dry out). Large blocks of unfragmented, undisturbed deciduous forest also benefit amphibians that depend on forested vernal pools such as wood frog (*Lithobates sylvatica*), spotted salamander (*Ambystoma maculatum*), box turtles, and other forest-dependent reptiles such as hog-nosed snake (*Heterodon platirhinos*).

Pine forests are generally pure pine stands on dry soils and may be relatively open in the understory, but sometimes contain short stature red-cedar, blueberry, and other acid soil-tolerant species. Pure stands of Virginia and pitch pine are limited on the refuge and generally colonized from previous disturbance. A mix of dry oak-pine forests support the upland chorus frogs, native bee species and regionally rare invertebrates such as darkling beetle species (*Coleoptera: Tenebrionidae* family) and tiger beetles (*Coleoptera: Cicindelidae* family). Several species of native and rare plants were collected from this general area in historic times and are likely to still be found or may readily recolonize from seed bank within the refuge's sandy soils including those in the milkweed, goldenrod, and sunflower families (Droege et al. 2009). Some such species are *Asclepias verticillata, L., Desmodium ochroleucum M.A. Curtis ex Canby, Heilanthemum bicknellii Fern., Lespedeza stuevei Nutt., Matelea carolinensis (Jacq.) Woods., Rhynchosia tomentosa L, Polygala polygama Walt.,* and *Schwalbea americana L*.

Mixed forests are composed of many of the same deciduous species described above and include scattered individuals or small stands of pine species native to this area such as pitch pine, Virginia pine, loblolly pine, and some shortleaf pine (*Pinus echinata*), near the northern limits of its range. As with deciduous forest communities, topography and soil moisture, texture, and pH play a large role in the distribution of species, so pockets of heath communities may be present as well as small, acidic seepages and bogs, and vernal pools.

The total area of these combined forest types is about 8,242 acres (3,335 hectares).

Habitat Types-Wetlands

Floodplain: Forests, Swamps, and Shrub Wetlands

These wetland types comprise about 2,018 acres (817 hectares) of refuge property. Floodplain forests can be found within, or adjacent to, the river and stream floodplains and are also called hardwood bottomland forest. They are not permanently flooded, but may have standing water after heavy rain or flood events. Tree species include beech, tulip poplar, black gum, willow oak, red maple, American sycamore, American elm, green ash, and river birch (*Betula nigra*). Bald cypress has been documented on the refuge. Shrubs include spicebush, viburnums, sweet pepperbush (*Clethra alnifolia*), and deciduous holly (*Ilex decidua*).

Swamps are forested wetlands with a mostly closed canopy, possibly dominated by small shrubs, and remain more or less permanently flooded with standing water. Dominant tree species include green ash, red maple, and black gum. Shrub species include speckled alder (*Alnus incana*), winterberry (*Ilex verticillata*), black haw (*Viburnum prunifolium*), and black willow (*Salix nigra*). A complex variety of herbaceous species may comprise the understory, including lizardtail (Saururus cernuus *L.*) and cutgrass (*Leerzia oryzides*). There is an estimated 1,946 acres (787 hectares) of floodplain forest and swamps throughout the refuge.

The floodplain shrub wetlands are relatively small, scattered, and generally interspersed with or bordering the forested canopy. The acreage of this type is only about 73 acres (30

hectares). Typical shrub species are less than 20 feet (6 meters) tall and may include alders (*Alnus* spp.), willows (*Salix* spp.), buttonbush (*Cephalanthus occidentalis*), red osier dogwood (*Cornus stolonifera*), spirea (*Spiraea tomentosa*), and young trees of species such as red maple.

Depressional Forest and Shrub Wetlands

Depressional wetlands include the small scattered bogs, seepages, vernal pools, and perennially wet areas that are not in the floodplain. Some are completely in forested and closed canopy and some are in semi-open or open canopy and dominated by shrubs. The depressional forest acreage is about 752 acres (304 hectares), while the open canopy and depressional shrub wetland acres are relatively small, about 6 acres, and tend to be scattered throughout or paralleling upland habitats. Tree and shrub species of these two habitat types largely reflect those found in the floodplain, but with higher dominance of more versatile upland species that can tolerate short periods of flooding or have root access to well-drained soils.

Coastal plain bogs or coastal plain acidic or alkaline seeps are a rare natural plant community type in Maryland characterized by sphagnum mosses, carnivorous plants, sedges, orchids, and insects such as the minute bog beetle (*Microsporus politus* or *Microsporus texanus*) and elfin skimmer *(Nannothemis bella)*. A few open habitat sphagnum bogs are documented in powerline right-of-ways. These sites support many species that have become rare in the State (Simmons and Strong 2001).

Magnolia bogs are enlarged springs or seeps that usually form on a slope where a perched water table intersects the ground surface above an impervious clay lens, rock, or soil. These persist in closed-canopy forest environments and are easily identified by the prevalence of native sweetbay magnolia. Sphagnum moss is a dominant groundcover because of the permanently saturated, acidic conditions throughout the bog (pH 4.2 to 5.0) (Simmons and Strong 2001). This habitat type also supports a variety of herbaceous plants that tolerate shade, such as ferns and skunk cabbage. Magnolia bogs have become increasingly rare and those that are surviving have degraded throughout their range because of extensive development of the gravel terraces that surround the bogs, which destroys or severely depletes their water supply (Simmons and Strong 2001). One such bog has been identified on the lower southeast portion of the North Tract.

USFWS

Water Lily

Emergent Wetlands

The refuge has just over 107 acres (43 hectares) of this open-canopy floodplain habitat type consisting of seasonally flooded herbaceous meadows and permanently flooded wetlands. Some woody shrub communities may also be present. This habitat type occurs

naturally in scattered areas along refuge creek drainages but is also found in the shallower portions of refuge impoundments and lakes as well. Characteristic emergent herbaceous species includes narrow-leaved cattail (*Typha angustifolia L.*), Juncus species, arrow arum (*Pelrandra virginica*), wild rice, pickerel weed (*Pontederia cordata L.*), spatterdock (*Nuphar avdenar*), water lily (*Nuphar avdenar*), and duck potato (*Saggitaria lancifolia*). Characteristic shrub vegetation includes species such as wax myrtle (*Myrica cerifera*) (sandy soil edges), buttonbush, groundsel tree (*Baccharis halimifolia*), alder, elderberry (*Sambucus spp*.), winterberry, and hibiscus (*Hibiscus rosa-sinensis*).

Impounded Wetlands

Total acreage of the refuge's 61 impoundments is between 553 acres and 575 acres (224 hectares and 233 hectares), 4 percent of the refuge area. Impoundments take on various forms and meaning depending on how they were created and their location, typography, and hydrological regime. Some are true impoundments which are excavated, have water control structures, or man-made blockages; others are former gravel pits, natural river oxbows, or were created unintentionally by road beds. Water depth, hydro-period, and context influence vegetation in the impoundment. Some impoundments are open water, wetland shrub, emergent, or forested but for management purposes, these areas are called impoundments. Constructed impoundments were created primarily between 1940 and 1970. This period mirrored the Service's management emphasis on the restoration of continental waterfowl populations and restoration of abandoned farmland into wildlife habitats. Many of these impoundments were used in early waterfowl research. A number of them are located on the floodplain and may impact floodplain functionality. Almost half of the impoundments lack water control capability (USFWS-HMP).

Current acreages of impoundments according to cover type are as follows: depressional forested wetland, 28 acres (11 hectares); depressional shrub wetland, 0.23 acres (.09 hectares); emergent wetland, 64 acres (26 hectares); floodplain forest and swamp, 57 acres (30 hectares); floodplain shrub wetland, 42 acres (17 hectares); and open water, 363 acres (147 hectares). Table 2-3 lists the areas of open water and their acreages. Depending on situational context and depth, the impoundments may be open water, emergent, shrub, or forested.

Table 2-3. Current Acres of Open Water at Patuxent Research Refuge

Pond	Acres	Pond	Acres	Pond	Acres
Millrace	58	Greentree Reservoir	6.4	Salamander	1.6
Cash Lake	54	Hance 2	6.2	Fire Control Pond	1.6
Knowles 1	43	Wood Duck Pond	5.9	Sundew Pond	1.6
Lake Redington	35	Shaefer Farm Pond	5.8	Bluegill	1.4
Beaver Valley	30	WSSC	5.8	Old Gravel Pit Pond	1.4
Shaefer Lake	24	Uhler 2	5.5	Goose Pond	1.2
Lake Allen	20	Bullfrog	5.0	Peeper Pond	1.0
Knowles 2	19	Telegraph Swamp	4.7	Farm Pond	0.88
Shangri-La	19	Kingfisher	4.5	Gravel Pit Pond	0.86
Knowles 3	16	Telegraph Swamp	4.2	Clay Pit Pond	0.76

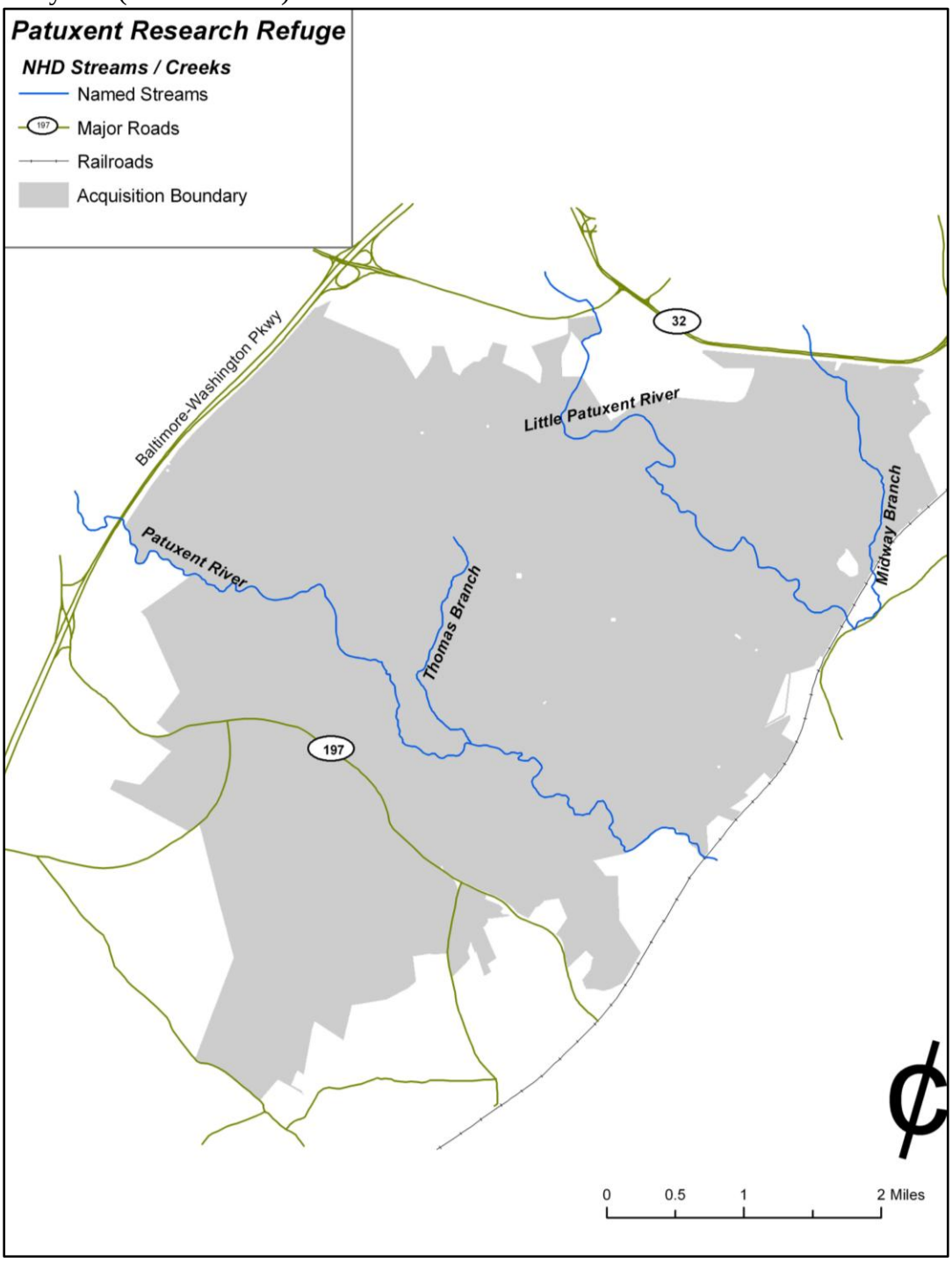
Pond	Acres	Pond	Acres	Pond	Acres
Duvall 1	15	Mabbott Pond	4.1	Bailey Bridge Marsh	0.73
K-Swamp	15	Mallard Pond	4.0	Borrow Pit 2	0.72
Patuxent Marsh	14	Range Pond	3.7	Shaefer Farm Pond	0.72
Wood Duck Pond	13	New Swamp	3.7	Mitigation Pond	0.65
Powerline Swamp	13	New Marsh	3.3	Spillway	0.53
Hobbs Pond	11	Midway Branch	2.9	Rieve's Pond	0.51
Shaefer Farm Pond	9.8	Merganser Pond	2.7	Dragonfly Pond	0.50
Blue Heron	9.2	Cattail Pond	2.7	Borrow Pit 3	0.49
Snowden Pond	8.2	WSSC	2.3	Borrow Pit 1	0.47
Rogue Harbor	8.2	Shaefer Farm Pond	2.2	End. Species Reservoir	0.40
Duvall 2	7.7	Midway	2.1	Treatment Lagoon	0.32
Hance 1	7.5	Shaefer Farm Pond	1.9	Shaefer Farm Pond	0.31
New Marsh	7.1	Treatment Ponds	1.8	Shaefer Farm Pond	0.29
Uhler 1	6.5	Harding Spring Pond	1.7	Fire Trail Pond	0.17

Coastal Plain Streams and Rivers

Silt, sand, small cobble, and gravel are the dominant substrate materials in this habitat, in addition to woody debris and aquatic vegetation, and can be found in the tributaries and small streams traversing the refuge. All stream types (including side channels of the rivers) are included in this habitat type from the national hydrography dataset except the Patuxent and Little Patuxent Rivers proper (L. Vilcheck's personal communication 8/16/2011).

The Patuxent Research Refuge protects approximately 17 miles of the Patuxent, Little Patuxent, Midway Branch, and Thomas Branch Creeks as delineated from the national hydrography dataset and in GIS delineation (Vilchek 2012; map 2-4). The Patuxent River is considered one of the State's scenic rivers, so designated to preserve the natural values of the river. Several reports imply the Patuxent and Little Patuxent Rivers are high priority waters in Maryland (Wurster 2010). The rivers are largely shaded as they course through forested habitats in braided or single run reaches and have a silty or sandy substrate with some pool and riffle sequences and gravel bars. Large woody debris both encumbers migration and provides spawning areas for migratory fish. The Little Patuxent, Midway Branch, and Lake Allen are all identified as having impaired aquatic biota populations. This is corroborated as well by the assessment reports prepared for Anne Arundel County (LimnoTech 2008, Victoria and Markusic 2009). The Patuxent and Little Patuxent suffer from excessive nutrients and sediment, while the Little Patuxent may have excessive mercury in its waters. Sources of impairment point to deficient buffers, bank erosion, and obstructions, but not all sources are from onsite causes (Limnotech 2008, Victoria and Markusic 2009). Land-use changes over the past 300 years have resulted in high sedimentation and silting in the rivers. The upper Patuxent water flow is controlled by the water releases of the Rocky Gorge Reservoir, constructed in 1954. River flow has been reduced since dam construction, which influences sediment transport (Wurster 2010).

Map 2-4. Named Creeks or Streams from the USGS National Hydrography Dataset on and within 0.1 mile of the Patuxent Research Refuge Approved Boundary, Laurel, Maryland (Wurster 2010).



Invasive Species

Invasive plant species of particular concern on the refuge are Chinese lespedeza, mile-a-minute (*Persicaria perfoliata*), Japanese stilt grass (*Microstegium vimineum*), garlic mustard (*Alliaria petiolata*), and spotted knapweed (*Centaurea maculosa*). Some other invasive species are well established or are poised to create challenges in the near future, and will require concerted planning and treatment effort with partners. These include Bradford pear, Japanese honeysuckle (*Lonicera japonica*), autumn olive, Japanese wisteria (*Wisteria floribunda*), tree of heaven (*Ailanthus altissima*), oriental bittersweet (Celastrus orbiculatus Thunb.), multiflora rose (*Rosa multiflora*), lesser celandine (*Ranunculus ficaria*), and hydrilla (*Hydrilla verticillata*) in some of the lakes and impoundments. A persistent stand of *phragmites* (*Phragmites australis*) chokes the sewage treatment ponds on the South Tract and several small, scattered stands line ditches and wetland edges.

Invasive animal species of concern include nonnative crayfish, such as virile crayfish (*Orconectes virile*), red swamp crayfish (*Procambarus clarkia*), rusty crayfish *(Orconectes rusticus*), European starlings (*Sturnus vulgaris*), house sparrows (*Passer domesticus*), and feral cats. In some instances it is known how a particular invasive species became established on refuge property; for example, Chinese lespedeza was originally used in agricultural lands to assist with erosion control and as a food source for quail, Bradford pear was introduced as an ornamental species and invasive nonnative crayfish were introduced to Maryland streams as fishing bait.

Natural and Current Role of Fire

Pre-settlement Fires

Both naturally occurring (lightning-caused) fires and fires associated with the activities of Native Americans and European colonists (Patterson and Sassman 1988) have historically influenced vegetation in the eastern U.S. Naturally occurring fire is infrequent in the Northeast (including the Mid-Atlantic); however, human-set fire has historically, dramatically impacted the ecology of the region. Native peoples occupying the Mid-Atlantic from the Pleistocene era until the time of European contact employed fire regularly to improve game habitat, facilitate travel, reduce insect pests, remove cover for potential enemies, and enhance berry production. At the time of European contact, the forest landscape in much of the eastern U.S. contained open stands, shaped by short-interval, low-intensity fires. Grasslands and prairies were common in areas as far east as Ohio, Pennsylvania, and Virginia, primarily as a result of introduced or naturally occurring fire. Open areas had been created and maintained for agricultural use, and as a result of gathering and clearing for firewood. Fire, as applied by Native Americans to eastern ecosystems, largely ended at the time of European settlement. Naturally occurring fires were also suppressed. Subsequent changes in fire regimes had profound ecological effects on forests (Abrams 1996) and grasslands (Tyndall 1992, Latham et al. 1996, Askins 1997) in the eastern U.S. In the absence of periodic fire, landscapes in the east changed rapidly from grasslands to woodlands and dense forests. The absence of fires allowed for the development of dense forest undergrowth. Changes in forest ecology and land-use practices also changed the nature of the fires that occurred. Heavier fuel loadings and a lack of periodic burns to reduce fuel build-up, changed the eastern U.S.

fires from frequent, low-intensity fires to less-frequent, higher-intensity fires. Fire protection and prevention accompanied increasing settlement and urbanization. An end to burning also coincided with conversion of lands for agriculture or residential development, resulting in large-scale fragmentation and loss of habitat. Remaining fire-influenced natural communities have undergone major changes in vegetation structure, including loss of biological richness and invasion by nonnative plants (Vogl 1974, Ladd 1997, Wildland Fire Associates 2008).

Fire Season and Occurrence

Historically, the fire season for the eastern U.S. began in the early spring, before green-up, with the passage of dry, cold fronts. This was followed by a period of nonactivity due to green-up, which continued through much of the summer and then resumed in the fall with the curing of grasses and deciduous vegetation. Weather-related events, primarily drought, have occasionally resulted in breaks in this pattern. Drought and the accumulation of fuels as a result of insect infestation or storm damage are the primary potential contributors to wildfire on the refuge.

Historical documentation of wildfire occurrence on the refuge is minimal. Nevertheless, it is likely that fire historically influenced forest habitats in the Mid-Atlantic (Frost 1998) including areas of the inner coastal plain (Komarek 1968). Frost (1998) estimated that fire frequency in pre-settlement, central Maryland occurred at intervals of every 7 to 12 years. In addition to natural fire occurrence, Tyndall (1992) noted that there is considerable historical evidence of Native American burning in Maryland (Wildland Fire Associates 2008).

2.4 Wildlife

Species of Greatest Conservation Need

The following outlines species of greatest conservation need as listed in the Maryland Wildlife Diversity Conservation Plan.

Fifty-four species of invertebrates, birds, reptiles and amphibians listed as species of greatest conservation need are found in the refuge's floodplain forests. Twenty-eight are priority bird species listed in either the BCR 30 or PIF 44 implementation plans. Forty-one species of invertebrates, birds, reptiles and amphibians listed as species of greatest conservation need are found in the refuge's upland forests. Twenty-one are priority bird species listed in either the BCR 30 or PIF 44 implementation plans.

Nine species of birds listed as species of greatest conservation need are found in the refuge's shrub habitats. Six are priority bird species listed in either the BCR 30 or PIF 44 implementation plans.

Table 2-4. Species of Greatest Conservation Need by Habitat Type

Habitat Type	Invertebrates	Birds	Amphibians and Reptiles	Mammals	Total
Grasslands	0	14	0	1	15

Habitat Type	Invertebrates	Birds	Amphibians and Reptiles	Mammals	Total
Floodplain	24	27	3	0	54
Upland	1	39	1	0	41
Shrub/Scrub	0	9	0	0	9
Streams/Rivers	22	4	3	0	29
Savannah	0	1	0	0	1
Emergent Wetlands	8	6	0	0	14
Impounded Wetlands	22	21	0	0	43

Invertebrates

Since the establishment of the refuge Central Tract, at least 1,222 species of invertebrates in 131 families have been identified on the refuge. At least 1,171 species of anthropods in 114 families and about 29 species of aquatic invertebrates have been identified.

At least 115 species of Odonata (86 species of dragonflies and 29 species of damselflies) in 10 families have been documented on the refuge. Fifty-three of these possess a global or State ranking in Maryland's natural heritage program. State-listed endangered and threatened species include Martha's pennant (*Celithemis martha*), slender baskettail (*Epitheca costailis*), robust baskettail (*Epitheca spinosa*), little blue dragonlet (*Erythrodiplax miniscula*), elfin skimmer, southern sprite (*Nehalennia integricollis*), Appalachian snaketail (*Ophiogomphus incurvatus incurvatus*), spadderdock darner (*Rhinoaeschna mutata*), treetop emerald (*Somatochlora provocans*), green-striped darner (*Aeshna verticalis*), double-ringed pennant (*Celithemis verna*), arrowhead spiketail (*Cordulegaster oblique*), taper-tailed darner (*Gomphaeschna antilope*), rapids clubtail (*Gomphus quadricolor*), sable clubtail (*Gomphus rogersi*), Selys' sunfly (*Helocordulia selysii*), yellow-sided skimmer (*Libellula flavida*), sphagnum sprite (*Nehalennia graclis*), fine-lined emerald (*Somatochlora filosa*), and Laura's clubtail (*Stylurus laurae*) (Orr 1996).

There are 85 species of butterflies that have been documented on the refuge and there are also 19 potential species that may be found on the refuge. Nine species that had once been considered potential species have been documented on the refuge and include two subspecies of spring azure (*Celastrina ladon ladon* and *C. landon negleta),* hackberry emperor *(Asterocanmpa celtis),* Baltimore checkerspot *(Euphydryas phaeton*), compton tortoiseshell (*Nymphalis vaualbum*), confused cloudywing (*Thorybes confuses*), Delaware skipper (*Anatrytone logan*), hobomok skipper (*Poanes hobomok*), long dash (*Polites mystic*), and whirlabout (*Polites vibex*) (Martin 2001, 1996). The Baltimore checkerspot is a State-listed rare and imperiled species and, although documented in the past, its continued presence is uncertain. The abundance of moth species is reflective of the heavy forest cover with at least 264 species recorded in 20 families (Ferguson 1992, 1994, 1996).

Native bees and wasps are important pollinators and warrant conservation attention. At least 155 bee species and 23 wasp species are documented (Droege personal communication). About 18 regionally rare native bees are likely or suspected to occur in the sandy soils of the oak-pine savannah restoration area, based on discoveries in similar habitat types found locally (Droege et al. 2009).

Beetles are well-represented on the refuge, with 333 species in 19 families. Some rare darkling beetles in the Tenebrionid family have been observed in sandy soil areas of the North Tract, as well as several species of tiger beetles (Droege et al. 2009; refuge data on file).

Spiders total about 19 species and include wolf spiders (*Hogna aspersa*), orb weavers (*Araneus* spp.), and nursery web (*Pisaurina mira*) spiders. At least 83 species of flies, midges, and gnats, and two species of mosquitoes have been identified (Patuxent Research Refuge Master Species List 2012, refuge data on file).

USFWS

Emerald Tiger Beetle

Amphibians and Reptiles

Refugewide, there are 53 documented species of reptiles and amphibians on the refuge; 17 snakes, 5 lizards, 8 turtles, 13 frogs and toads, and 10 salamander species. For a complete list of known amphibian and reptile species, please refer to the refuge species list (Hotchkiss and Stewart 1979, E. Grant 2011 personal communication).

The status of populations of vernal-pool breeding amphibians is the focus of a long-term monitoring program, initiated in its current form in 2004. Each spring, 65 vernal pools are visited to determine the occupancy of wood frog and spotted salamander egg masses. Egg masses of wood frogs and spotted salamanders are easily distinguished due to the time of deposition, gross morphology, and because they have high detection probabilities (Crouch and Paton 2000, Grant et al. 2005). Anuran call count surveys have been conducted since the early 2000s (E. Grant 2011 personal communication).

Stream salamanders were sampled in 2003 to 2004 on the refuge, though the number of sites and visits were too small for formal analysis. Species detected during these and others surveys include northern two-lined salamander (*Eurycea bislineata*), long-tailed salamander (*E. longicauda*), and northern dusky salamander (*Desmognathus fuscus*) (E. Grant 2011 personal communication).

Based on data from amphibian occupancy trends on Patuxent Research Refuge from 2004 to 2010, wood frog occupancy declined in 2008 to 2009, but rebounded to near the regional average in recent years, while spotted salamander occupancy closely tracks the regional average. The recommendation is to continue monitoring existing vernal pool sites (Grant 2011 refuge files). Approximately 43 percent of amphibian species are in decline, with one in three species in threat of extinction. Emerging infectious diseases are

partly responsible for some of these declines such as chytidiomycosis (chytrid) and amphibian ranaviral disease, the latter accounting for the majority of the die-offs. The extent to which these diseases affect amphibians on study refuges is still being determined. Samples taken on the refuge in 2011 during multiple, refugewide die-off events are being analyzed. Sampling will continue at all occupied vernal pools 30 and 60 days after breeding activity (Grant 2011).

Other amphibian species encountered on the refuge include northern cricket frog (*Acris crepitans*), gray treefrog (*Hyla versicolor*), pickerel frog (*Lithobates palustris*), southern leopard frog (*Lithobates sphenocephalus*), green frog (*Lithobates clamitans*), American bullfrog *(Lithobates catesbeiana*), American toad (*Anaryxus americanus*), Fowler's toad (*Anaryxus fowleri*), spring peeper (*Pseudacris crucifer*), upland chorus frog (*Pseudacris feriarum*), marbled salamander (*Ambystoma opacum*), four-toed salamander (*Hemidactylium scutatum*), and eastern newt (*Notopthalmus virdescens*) (E. Grant 2011 personal communication).

Birds

Since refuge establishment, over 270 species of birds have been recorded on the refuge. However, with the closure of a nearby landfill in the past decade, approximately 27 species of gulls and shorebirds have disappeared, bringing the most current total to 248 species of birds in 48 families. Of these, there are a few that are extremely rare or may no longer be present, such as Henslow's sparrow (*Ammodramus henslowii*) and cerulean warbler *(Dendroica cerulean)*. Increasing forest fragmentation in the area due to escalating urban development in central Maryland and northern Virginia has negatively impacted many populations of neotropical migratory birds. The refuge is one of the largest forested areas in the Mid-Atlantic region and provides critical breeding habitat and an important nesting area for these species (refuge bird data, USGS bird data on file, Wildland Fire Associates 2008).

Ohio DNR

Cerulean Warbler

To develop a list of bird species and priority birds for the CCP habitat goals and objectives, observations from breeding bird surveys, Christmas bird counts, spring and fall mist netting operations, integrated waterbird monitoring and management, long-term waterbird surveys, and evening woodcock and whip-poor-will surveys are used. We then consulted the list of priority birds provided in the BCR 30 plan and the species of greatest conservation need identified in the Maryland State wildlife action plan. In this way, a subset of priority bird species for the refuge could be identified. Some of the birds associated with each habitat type may not be breeders, but use the refuge during winter or migration. It is expected that the refuge's proximity to BCR 29 may result in birds from that region occasionally occurring on the refuge. For refuge planning purposes, we used only BCR 30. Please refer to the complete bird species list for the refuge in appendix A.

Fish

The refuge is home to at least 55 species of fish in 12 families. The majority of species found are those inhabiting bottomland pools and impoundments, rather than clear-running water and include species such as bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*), catfish (*Ictalurus nebulosus)*, black crappie (*Pomoxis nigromaculatus*), white crappie (*Pomoxis annularis*), chain pickerel (*Esox niger*), shad (*Alosa sapidissima*), carp (*Cyprinus carpio*), and yellow perch (*Perca flavescens*) (Hotchkiss and Stewart 1979, USFWS 1989, MD DNR 1995, Freeman 1997). Blueback herring (*Alosa aestivalis*) have not been discovered on the refuge but they are documented upstream in Howard County (Richards 1994). This anadromous fish would have had to swim through the refuge at some point to get to the Howard County portion of the Patuxent River; the same holds true for hickory shad (*Alosa mediocris*) and white crappie, which occur both up and downstream of the refuge (Fort Meade 1997).

Other species that have been documented in the past include least brook lamprey (*Lampetra aepyptera*), sea lamprey (*Petromyzon marinus*), American eel (*Anguilla rostrata*), alewife (*Alosa pseudoharengus*), eastern mudminnow (*Umbra pygmaea*), redfin pickerel (*Esox americanus*), rosyside dace (*Clinostomus funduloides*), cutlips minnow (*Exoglossum maxillingua*), silvery minnow (*Hybognathus nuchalis*), river chub (*Nocomis micropogon*), golden shiner (*Notemigonus crysoleucas*), comely shiner (*Notropis amoenus*), satinfin shiner (*Cyprinella analostana*), common shiner (*Notropis cornutus*), spottail shiner (*Notropis hudsonius*), swallowtail shiner (*Notropis procne*), blacknose dace (*Rhinichthys atratulus*), languase dace (*Rhinichthys cataractae*), fallfish (*Semotilus corporalis*), white sucker (*Gatostomus commersoni*), creek chubsucker (*Erimyzon oblongus*), northern hog sucker (*Hypentelium nigricans*), short-head redhorse (*Mozostoma macrolepidotum*), white catfish (*Ictalurus catus*), brown bullhead *(Ameiurus nebulosus),* channel catfish (*Ictalurus punctatus*), tadpole madtom (*Noturus gyrinus*), margined madtom (*Notorus insignis*), mosquito fish (*Gambusia affinis holbrooki),* pirate perch (*Aphredoderus sayanus*), bluespotted sunfish (*Enneacanthus gloriosus*), redbreast sunfish (*Lepomis auritus*), green sunfish (*Lepomis cyanellus*), pumpkinseed (*Lepomis gibbosus*), warmouth (*Lepomis gulosus*), Johnny darter (*Ehteostoma nigrum*), glassy darter (*Ehteostoma vitreum*), stripe back darter (*Petclna notogramma*), and shield darter (*Percina peltata*) (Hotchkiss and Stewart 1979, Freeman 1997).

Duane Raver/USFWS

Pumpkinseed

In early November 2011, with the assistance of the Maryland Fisheries Resource Office and Chesapeake Bay Field Office, fish samplings were conducted in the shallow impoundments of the refuge using back-pack shockers. No new species were discovered from previous surveys. Species identified from this survey are listed in table 2-5.

Table 2-5. Fish Species Identified in Shallow Impoundments

Common Name	Scientific Name
Black crappie	*Pomoxis nigromaculatus*
Bluegill	*Lepomis macrochirus*
Bluespotted sunfish	*Enneacanthus gloriosus*
Brown bullhead	*Ameiurus nebulosus*
Eastern mosquitofish	*Gambusia holbrooki*
Eastern mudminnow	*Umbra pygmaea*
Green sunfish	*Lepomis cyanellus*
Largemouth bass	*Micropterus salmoides*
Pumpkinseed	*Lepomis gibbosus*
Satinfin shiner	*Cyprinella analostana*
Warmouth	*Lepomis gulosus*
Golden shiner	*Notemigonus crysoleucas*
American eel	*Anguilla rostrata*
Pickerel spp.	*Esox spp.*

Mammals

At least 38 species of mammals in 13 families are known to inhabit the refuge (Hotchkiss and Stewart 1979, refuge surveys and unpublished data). Of these, the eastern harvest mouse (*Reithdrodontomys humulis*) may no longer be present as it might be locally extirpated. A pilot survey for bats was conducted on the refuge in September 2010; no new species were identified.

While not officially documented, coyotes *(Canis latrans var.)* have been infrequently observed by hunters on the refuge.

Priority Species of Concern in Refuge Habitats

Floodplain Forest and Swamps and Depressional Wetlands

Eastern red bat – Typically occupies forest habitat with canopies 4 to 19 feet (1.5 to 6 meters) above the ground and open underneath for summer roosting.

Little brown bat (*Myotis lucifugus*) – Roosts in trees but forages over water.

Prothonotary warbler (*Protonotaria citrea*) – Inhabits mature deciduous floodplain and riverine and swamp forests (DeGraaf et al. 1980, Christman 1984). This secondary cavity nester (uses existing cavities) is the only cavity-nesting warbler in the western hemisphere. Trees must be mature enough to accommodate suitably sized cavities. This species prefers nest trees in or near standing water. They are present during breeding and migration.

Acadian flycatcher (*Empidonax virescens*) – Typically occupies moist deciduous forests along streams or rivers, often building nests in twigs or branches that overhang the water. This species also occurs within the entire gradient of forested wetlands and is generally associated with closed-canopy forests with an open understory. They are present on the refuge during breeding and migration.

Cerulean warbler – This is a species of high conservation concern and requires extensive mature hardwood forests with a broken, structurally diverse canopy. Coastal plain populations typically use mature hardwoods associated with the floodplain (Lynch 1981, Robbins and Blom 1996). This species nests and forages within the upper portions of the canopy, utilizes some of the largest trees available, and appears to have one of the largest forest area requirements among the priority species (Robbins et al. 1992). They may be present on the refuge during breeding and migration. The refuge does not lie at the core of this species range, but a few cerulean warblers were consistently observed during the breeding season in large, mature trees along the Patuxent River, although not in recent years (J. Fallon 2011 personal communication).

Kentucky warbler (*Geothlypis formosaformosus*) – Prefers moist deciduous forests with a well-developed understory and dense ground cover (McDonald 1998). Breeding Kentucky warblers formerly were scattered through the Patuxent River floodplain, but now are mostly restricted to scattered locations on the North Tract (D. Dawson, personal communication). They are present on the refuge during breeding and migration.

Louisiana waterthrush (*Parkesia motacilla*) – Occupies moist deciduous forests along streams and will also utilize forested wetlands, placing nests along stream banks or amongst the roots of upturned trees. Forages in or along moving water, gleaning insects from the surface of rocks, mud, or water (Hamel 1992, Mattsson et al. 2009). They are present on the refuge during breeding and migration.

Rusty Blackbird – Dave Menke

Rusty blackbird (*Euphagus carolinus*) – Uses forested wetlands and bogs, often wading to feed on aquatic life. This species also flocks with other blackbird species in open fields in winter and is considered to be a rapidly declining species. They are present on the refuge during winter.

<u>Upland Deciduous, Pine, and Mixed Forests and Associated Forested Wetlands</u>
Silver-haired bat (*Lasionycteris noctivagans*) – Migrates through the refuge, seeking out shelter in loose bark, rock crevices, clumps of leaves, tree cavities, and occasionally man-made structures such as sheds and outbuildings.

Eastern spadefoot *(Scaphiopus holbrookii*) – Requires vernal pools for breeding and foraging habitat.

Eastern box turtle (*Terrapene carolina*) – Requires large blocks of unfragmented forest, preferring upland mixed hardwood forest juxtaposed with early succession, grassy openings for basking and foraging on herbaceous vegetation.

Acadian flycatcher – Typically occupies moist deciduous forests along streams or rivers, but also occurs in upland forests. It is generally associated with closed-canopy forests with an open understory. They are present on the refuge during breeding and migration.

Eastern whip-poor-will (*Caprimulgus vociferus*) – Nests in mature deciduous forest, and forages in forest openings, including roadways and powerline right-of-ways, on moth species, especially if the openings are backlit by moonlight (Wilson and Watts 2008). Patuxent is designated as an important bird area as it contains the most significant population of this declining species in Maryland.

Scarlet tanager (*Piranga olivacea*) – Requires a forested patch size of at least 250 contiguous acres (101 hectares). High-suitability forest habitat would be 70 percent forested in a 2,500-acre (1,000-hectare) block (Rosenberg et al. 1999). This species is a mature canopy forager and breeder.

Yellow-throated vireo (*Vireo flavifrons*) – Prefers open forest and forested edge habitat, while requiring large blocks of mature mixed deciduous forest to breed successfully.

Cerulean warbler – This is a species of high conservation concern and requires extensive mature hardwood forests with a broken, structurally diverse canopy. Coastal plain populations typically use mature hardwoods associated with the floodplain (Lynch 1981, Robbins and Blom 1996). This species nests and forages within the upper portions of the canopy, utilizes some of the largest trees available, and appears to have one of the largest forest area requirements among the priority species (Robbins et al. 1992). They may be present on the refuge during breeding and migration. The refuge does not lie at the core of this specie's range, but a few cerulean warblers were consistently observed during the breeding season in large, mature trees along the Patuxent River, although not in recent years (J. Fallon 2011 personal communication).

Eastern wood-pewee (*Contopus virens*) – Utilizes the entire gradient of forestlands that occur within the Mid-Atlantic Coastal Plain. Across their entire range, pewees have been shown to reach higher densities within dry, compared to moist, forests (Bond 1957, PIF Bird Conservation Plan - Mid-Atlantic Coastal Plain 40 Robbins et al. 1989, Murray and Stauffer 1995). This species generally prefers forests with a relatively open canopy or forests with canopy gaps (Best and Stauffer 1986) and with relatively low shrub cover (Crawford et al. 1981). Patch size does not appear to be an important factor in habitat selection (Blake and Karr 1987, Robbins et al. 1989). They are present on the refuge during breeding and migration.

Louisiana waterthrush – Occupies moist deciduous forests along streams and will also utilize forested wetlands. The species also requires moderate to sparse vegetation along moving water. They are present on the refuge during breeding and migration.

Wood thrush (*Hylocichla mustelina*) – One of the key indicator species for the entire gradient of upland forests from hardwood-dominated to pine-dominated. They are present on the refuge during breeding and migration, foraging on or near the ground and nesting in small trees or in the lower canopy.

Wood Thrush – Steve Maslowski

Worm-eating warbler (*Helmitheros vermivorum*) – Requires dense understory vegetation for breeding. This species is generally associated with dry, well-drained hardwood forests, often with steep slopes (typically more than 20 degrees) (Hall 1983, Greenberg 1987). They are present on the refuge during breeding, mostly on the North Tract, and migration.

Emergent and Shrub Wetlands, and Coastal Plain Bogs

American black duck (*Anas rubripes*) – Nests within a variety of habitats, including uplands near water and freshwater marshes. They are present on the refuge year-round.

Least bittern (*Ixobrychus exilis*) – This is an elusive marsh bird of conservation concern in most Atlantic states. This species is present on the refuge during breeding and winters in the south. It requires freshwater or brackish marshes with tall emergent vegetation dense enough to camouflage its nest. This species' nests are attached to vegetation just above high water level.

Any plants that are characteristically associated with the open and forested bogs would be targeted for conservation. This includes such species as spatulate-leaved and round-leaved sundew (*Drosera intermedia* and *Drosera rotundifolia*), white-fringed orchid (*Blephariglottis blephariglottis*), and swamp pink (*Hibiscus palustris*). Animals include the minute bog beetle and elfin skimmer, which are two rare species associated with bogs and wetlands. The minute bog beetle is not documented on the refuge, but most live exclusively on sphaghum bogs and seeps and it is expected in coastal plain bogs and marshes of Maryland (MD DNR *http://www.dnr.state.md.us/wildlife/Plants_Wildlife/bogs.asp*; accessed January 2012).

The elfin skimmer is a small damselfly that favors more open bogs, preying on the insects that specialize on bog plantlife. It has been documented on the refuge (Orr 1996).

Shrub and Early Successional Forests

American woodcock – Utilizes early successional forests for breeding and foraging, and grassy openings near forest edge for territorial display flight. It is considered a species of conservation concern due to its preferred habitat needs and because it is a game species. It feeds on invertebrates, especially earthworms. This species is present on the refuge during breeding and may winter on the refuge as well.

Brown thrasher – Brown thrashers occur in dense woody vegetation associated with shrub thickets, hedgerows, forest edges, or mid-successional forests (Graber et al. 1970, James 1971, Shugart and James 1973, Temple et al. 1979, Stauffer and Best 1980, Faanes 1983). On the refuge, they also use the shrub habitats maintained on the powerline right-of-ways. They are present on the refuge year-round, although generally quite rare in winter.

Eastern towhee – Prefers brush, tangles, thickets along forest edge, and hedgerows. On the refuge, towhees also use the shrub habitats maintained on the powerline right-of-ways. The species is present on the refuge year-round.

Field sparrow – Utilizes successional stages with moderate to substantial intrusion by woody shrubs and saplings (Watts 1999). On the refuge, they also use the shrub habitats maintained on the powerline right-of-ways. This species is present on the refuge year-round.

Gray catbird (*Dumetella carolinensis*) – Prefers brush, tangles, vines, and thickets along forest edges and dense shrub habitat. On the refuge, they predominantly use the shrub habitats maintained on the powerline right-of-ways. It is present on the refuge during the breeding season and migration, and rarely during the winter.

Prairie warbler – Utilizes successional stages with moderate to substantial intrusion by woody shrubs and saplings (Watts 1999). On the refuge, prairie warblers also use the shrub habitats maintained on the powerline right-of-ways. This species is present on the refuge during breeding and migration.

Prairie Warbler – Bill Thompson

<u>Grasslands and Old Field Habitats</u>
Migrating and wintering birds of conservation concern include savannah sparrow *(Passerculus sandwichensis*), swamp sparrow *(Melospiza georgiana),* bobolink (*Dolichonyx oryzivorus*), and dickcissel *(Spiza americana).* Breeding species include yellow–breasted chat *(Icteria virens*), eastern kingbird, and field sparrow.

<u>Coastal Plain River and Stream Habitats</u>
American shad (*Alosa sapidissima*) – Can travel hundreds of miles upstream to spawn. Blockages on spawning rivers by dams and other impediments, degradation of water quality, and overfishing have depleted stocks of American shad. Presently, the Susquehanna, Nanticoke, and Patuxent Rivers are the primary systems that support viable American shad stocks in Maryland. Spawning occurs in areas where the bottom substrate often consists of sand, silt, and muck (MD DNR 2007).

American brook lamprey (*Lampetra appendix*) – Threatened in Maryland and found within slow-moving, warm-water streams with forested edges on the coastal plain (south of I-95) in Maryland. Adults spawn (make a nest in gravel then lay and fertilize eggs) in late March or early April and die soon after. The eggs hatch into larvae, called ammoecetes. Lamprey may exist as an ammoecete for up to seven years, feeding on algae, before undergoing metamorphosis into its adult form during late summer. Spawning occurs soon after metamorphosis (MD DNR 2010).

Glassy darter – Suitable habitat consists of 1st- to 3rd-order streams with gravel and sand substrates (Killen 1992). This species is excluded from areas when development increases siltation (MD DNR 2005b). Historically, glassy darter ranged from North Carolina to the Patuxent River watershed (Lee et al. 1980).

Triangle floater (*Alasmidonta undulata*) – The triangle floater is a State-endangered freshwater mussel. Freshwater mussels are the most imperiled aquatic taxa in Maryland, and this particular mussel is only known to exist in a handful of locations within seven river basins, including the nearby Patapsco River basin. The triangle floater is commonly found in flowing water, where it occupies a wide range of substrate and flow conditions. Its preferred habitats include low-gradient river reaches with sand and gravel substrates and low to moderate water velocities. It has been found in streams smaller than 16 feet wide (5 meters) and rivers wider than 328 feet (100 meters) (Nedeau 2007). Because they are so sensitive to pollution, their presence in a water body is a good indicator of clean water.

Native crayfish – Spiny-cheeked crayfish (*Oronectes limosus*), once widespread in Altantic watersheds, is being displaced by the invading rusty crayfish. Spiny-cheeked crayfish inhabit clear streams that are 33 to 328 feetwide (10 to 100 meters) with silt, cobble, gravel, and sand substrates. Individuals are often found in shallow depressions in pools and have rarely been captured where silt is absent from the substrate (see the International Union for Conservation of Nature Red List at: *http://www.iucnredlist.org/apps/redlist/details/153764/0/print#sectionHabitat*; accessed January 2012*)*.

<u>Oak-Pine Savannah</u>
Species would include those that are associated with dry, sandy, well-drained soils and are adapted to relatively poor soils. In this area some rare Tenebrionid beetles (darkling beetle species) have been discovered, as well as several species of native bees and lepidopterans. Bird species that favor early succession forest and shrub described above will be primary beneficiaries of this habitat (Droege et al. 2009).

2.5 Federal and State Threatened and Endangered Species

The Federal list of endangered species includes two plants that may occur on the refuge: sensitive joint vetch (*Aeschynomene virginica*) and sandplain gerardia (*Agalinis acuta*). Sensitive joint vetch is documented in both Prince George's and Anne Arundel Counties and its local distribution range encompasses the refuge (ECOS 2011).

On the State list, there are 29 animal and 151 plant species listed as rare, threatened, or endangered in Prince George's County. Ten of the animal species are threatened or endangered, as are eighty-five plant species for the county (MD DNR 2010).

There are 11 animal and 124 plant species listed by the State of Maryland as rare, threatened, or endangered in Anne Arundel County.

There is a high diversity of dragonflies and damselflies (Odonata) on the refuge, several of which are State-threatened or rare species. At least eight species of these Odonata are listed on Prince George's County list, such as elfin skimmer and sable clubtail (MD DNR 2010). Other State-listed insects that are likely for the refuge include green-patterned tiger beetle (*Cicindela ocellata rectilatera*), red-legged purse spider (*Sphodros rufipes*), and a noctuid moth. Listed amphibians and reptiles include eastern tiger salamander (*Ambystoma tigrinum*), northern map turtle, (*Graptemys geographica*), and red-bellied water snake (*Nerodia erythrogaster*). However, these species have not been documented on the refuge. Mammals include southern pygmy shrew (*Sorex hoyi winnemana*) and eastern harvest mouse. Fish include stripeback (*Percina notogramma*) and glassy darter. Birds include American and least bittern (breeding), and sora (*Porzana Carolina*) (migration) (MD DNR 2010).

The formerly federally listed American bald eagle (*Haliaeetus leucocephalus)* is occasionally observed on the refuge and nests nearby on the Beltsville Agricultural Research Center and further down the Patuxent River.

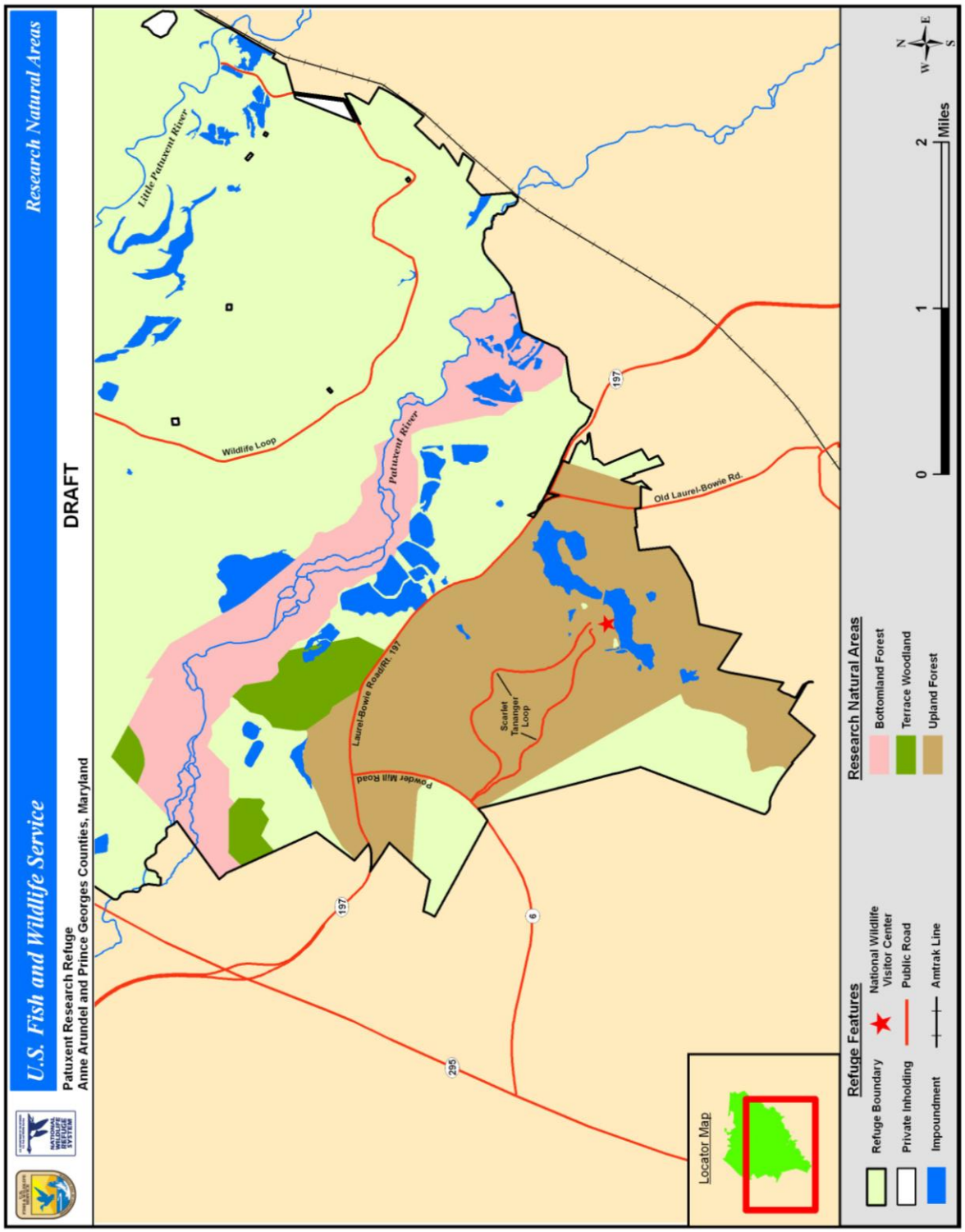
The complete list of State rare, threatened, or endangered, animal and plant species for Prince George's and Anne Arundel Counties, compiled by the Maryland Wildlife and Heritage Service in 2010 can be found on the Maryland Department of Natural Resources (MD DNR) Web site at: *http://www.dnr.state.md.us/wildlife/Plants_Wildlife/espaa.asp*; accessed February 2012.

2.6 Special Management Areas

Wilderness
There is no congressionally designated wilderness on the refuge. The refuge has completed a wilderness review (appendix B) as a part of this CCP process.

Research Natural Areas
The Service administratively designates research natural areas, which are part of a national network of reserved areas under various ownerships. While there are no specific restrictions on uses or management of research natural areas, they are intended to serve as examples of significant natural ecosystems, compared with those influenced by man, to provide educational and research areas for scientists, and to serve as gene pools and preserves for rare and endangered species of plants and animals. Research natural areas established at the refuge include bottomland forest (1,000 acres), terrace woodland (250 acres), and upland forest (1,700 acres) (map 2-5).

Map 2-5. Research Natural Areas of Patuxent Research Refuge



2.7 Public Use Resources and Trends

Public Use Facilities

National Wildlife Visitor Center

The NWVC is one of the largest science and environmental education centers operated by the Department. NWVC is designed to provide visitors with knowledge and appreciation of the role of wildlife research and management in preserving natural resources. It features interactive exhibits which focus on global environmental issues, migratory bird studies, habitats, endangered species, the tools and techniques used by scientists, and the role of the Refuge System in wildlife conservation. A viewing pod, with a large picture window overlooking Lake Redington, offers spotting scopes and binoculars for visitors to see waterfowl and other wildlife.

USFWS

National Wildlife Visitor Center

A large auditorium and meeting rooms accommodate scientific conferences and meetings, teacher workshops, lectures, and traveling displays. *Wildlife Images*, a bookstore operated by the Friends of Patuxent (a nonprofit cooperating association) offers a variety of conservation gifts, books, and other educational materials. NWVC grounds offer seasonal tram tours, wildlife management demonstration areas, and outdoor education sites for school classes. A schoolyard habitat adjacent to NWVC highlights conservation landscaping practices and provides an additional outdoor learning space. It is open daily from 9 a.m. until 4:30 p.m., Monday to Saturday. Wildlife observation trails are open daily from sunrise to 4:30 p.m. Both the NWVC and grounds are closed on Federal holidays.

Visitor Contact Station

The Visitor Contact Station is located at the entrance to North Tract. All visitors must check in to receive an access pass. Visitors are also provided with an orientation to the refuge, including what activities are allowed, public use opportunities, and relevant seasonal information. A schedule of monthly activities and events is available at NWVC

and online at: *http://www.fws.gov/northeast/patuxent/vcdefault.html*; last accessed March 2012.

Meade Natural Heritage Association Hunting Control Station
The Meade Natural Heritage Association Hunting Control Station is located on Bald Eagle Drive. At the control station, hunters can purchase permits, sign-in and sign-out on hunt visits, and record information on the animals harvested.

North Tract Environmental Education Classroom
At the North Tract, an environmental education classroom is located along Wildlife Loop. Throughout the year, a variety of staff and volunteer-led environmental education and interpretive programs are held here. A schedule of monthly activities and events is available at the Visitor Contact Station and online at: *http://www.fws.gov/northeast/patuxent/ntedu.html*; accessed January 2012.

Wildlife-dependent Priority Public Uses
The National Wildlife Refuge System Administration Act, as amended, lists six priority public uses on refuges that are to receive enhanced consideration over all other general public uses in planning and management – hunting, fishing, wildlife observation and photography, and environmental education and interpretation. When found compatible, these priority wildlife-dependent recreational uses are to be strongly encouraged (see chapter 1, section on compatibility determinations and findings of appropriateness). All six priority uses are offered at the refuge.

North Tract
The North Tract offers a variety of wildlife-related recreational activities including wildlife observation and photography, fishing, hiking, bicycling, horseback riding, and cross-country skiing. Hunting opportunities include migratory game birds, upland game, white-tailed deer, and a spring wild turkey hunt. North Tract offers over 20 miles of roads and trails, as well as six fishing areas. In 1991, the Service obtained the North Tract from Fort Meade. The Department of the Army formerly used the property for military training and, although it has been swept, unexploded ordnance is still present. All visitors to North Tract must check in at the Visitor Contact Station to receive an access pass and to receive information, including the potential of encountering unexploded ordnance and refuge regulations. The North Tract is open daily, except Federal holidays, from 8 a.m. to 4 p.m. (unless otherwise posted).

USFWS

Visitor Contact Station

South Tract

The South Tract is the site of NWVC, hiking trails, and Cash Lake fishing area. Wildlife observation and photography occur on nearly five miles of nature trails and at several wildlife viewing areas. Environmental education and interpretive programs are offered on a regular basis. White-tailed deer hunting is offered seasonally as well. The South Tract is open daily, except Federal holidays, from sunrise to 4:30 p.m. (unless otherwise posted).

Wildlife Conservation Interpretive Tram

Guided electric tram tours, operated by the Friends of Patuxent, are offered seasonally from early spring to late fall. Visitors can purchase tram tickets for a nominal fee at the *Wildlife Images* bookstore in the lobby of NWVC. The tour begins at NWVC and travels through a variety of habitats surrounding Lake Redington. As the tram encounters different habitats, the on-board interpreter discusses each habitat and its wildlife inhabitants, how habitats change, and the threats encountered by native plants and wildlife. The tour also describes the refuge's wildlife conservation efforts and the research conducted by the PWRC. The tour concludes at the NWVC with an overview of practical conservation efforts that visitors can pursue to help protect wildlife and their habitats.

USFWS

Wildlife Conservation Interpretive Tram

Hunting

The refuge's hunting program is administered by a cooperating association, the Meade Natural Heritage Association. The refuge administers the hunt in accordance with the refuge-specific regulations found at 50 CFR 32.39. The refuge provides hunting opportunities for migratory game bird, upland game, white-tailed deer, and spring wild turkey (map 2-6). Hunting is permitted from September through January, based on Maryland State hunting seasons, and in April and May for the spring wild turkey hunt. Hunters can purchase the appropriate refuge hunting permits through the Meade Natural Heritage Association at the North Tract's hunting control station on Bald Eagle Drive. In addition to purchasing a refuge hunting permit, all hunters must possess a valid Maryland State hunting license, verification of completion of a hunter safety course, and Maryland State shooters qualification card. Additional information, such as State and Federal migratory bird hunting and muzzleloader stamps, etc., may be required to participate in certain hunts. All hunters must comply with all State and Federal hunting regulations and laws. Additional information about the refuge hunt is available by phone at 301/317-3825 (301/317-3819 during the hunting season).

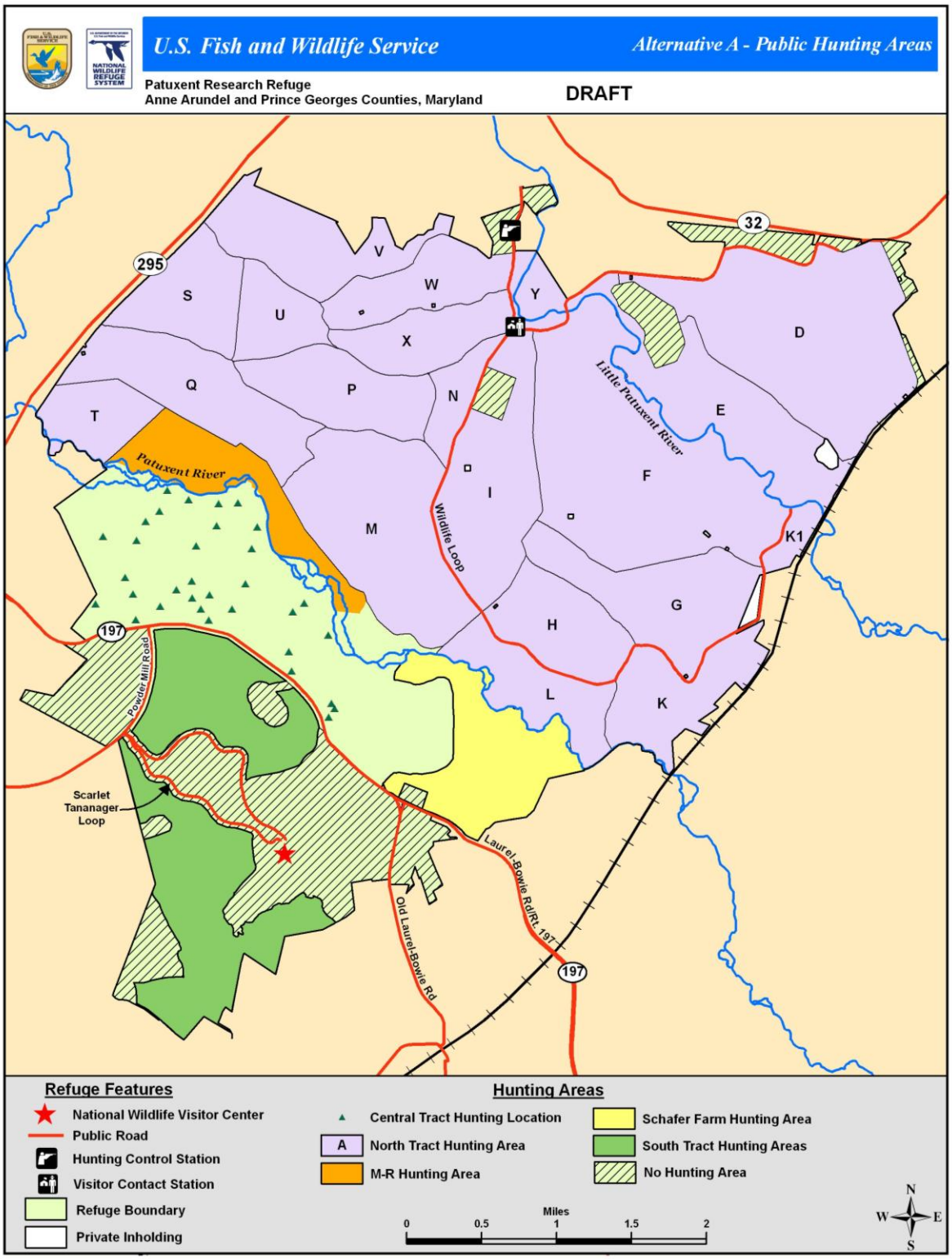
Hunting Opportunities by Refuge Tract

A variety of hunting opportunities are offered on each tract of the refuge (table 2-6). Please read the latest refuge hunting regulations (50 CFR 32.39) and the annual hunt plan for more information on each species, including hunting locations, lottery information, season lengths, and bag limits. Hunting regulations are available onsite and are posted online at: *http://www.fws.gov/northeast/patuxent/MNHA.html*; accessed January 2012.

Table 2-6. Hunting Opportunities Offered on each Tract at Patuxent Research Refuge

Tract	Species/Season
South	Deer (bow/crossbow/shotgun)
Central	Deer (bow/crossbow/shotgun) Spring wild turkey (youth/hunters with disabilities/general hunters)
North	Deer (bow/crossbow/muzzleloader/firearms) Youth deer (bow/firearms) Canada goose Mourning dove Duck Junior duck day Rabbit Woodchuck Gray squirrel Spring wild turkey (youth/hunters with disabilities/general hunters)

Map 2-6. Public Hunting Opportunities on Patuxent Research Refuge



Fishing

The North and South Tracts offer recreational fishing opportunities in seven designated fishing areas. Year-round fishing is permitted at the North Tract, while seasonal fishing is available on the South Tract. Common fish species on both tracts include bluegill, largemouth bass, catfish, black and white crappie, pickerel, shad, chub, carp, and yellow perch.

Anglers wishing to fish on the refuge must have a current Maryland nontidal fishing license and a seasonal refuge fishing permit. Refuge fishing permits are free and available at NWVC (starting in June, daily from 9 a.m. to 4 p.m., except Federal holidays) or at the North Tract Visitor Contact Station (daily from 8:30 a.m. to 3:30 p.m., except Federal holidays). The refuge prohibits the use of lead sinkers in all fishing areas and encourages anglers to catch and release all fish species. Anglers are permitted to use non-motorized boats on Cash Lake. Freshwater fishing and boating laws of the State of Maryland apply except as further restricted in refuge regulations.

Cash Lake Fishing Area

Cash Lake, universally accessible, is open for fishing from mid-June to mid-October. Summer hours are 6 a.m. to 8 p.m., while fall hours are 7 a.m. to 6:30 p.m. (unless otherwise posted). Common fish species at Cash Lake include bluegill, largemouth bass, catfish, black and white crappie, pickerel, shad, chub, carp, and yellow perch. Fishing is permitted from the fishing pier and shorelines on both sides of pier to posted signs along the shoreline. Boating is only allowed at Cash Lake to facilitate fishing. Electric motors must be less than four horsepower; gasoline motors are not permitted.

North Tract Fishing Areas

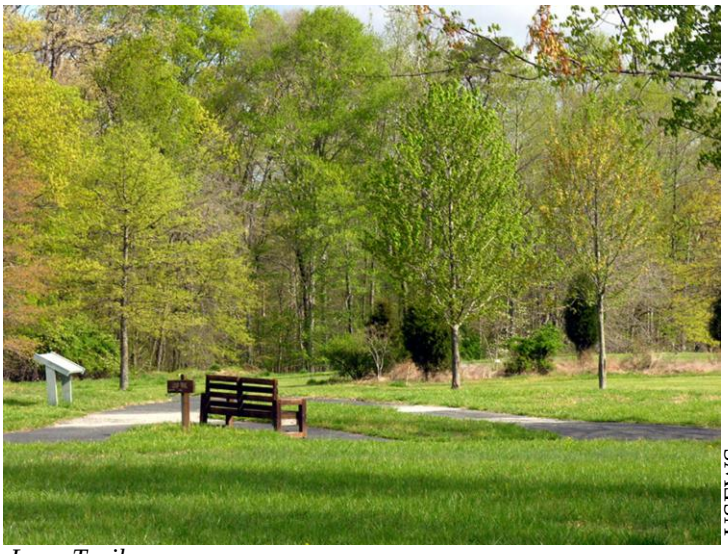
The North Tract offers year-round recreational fishing during the tract's hours of operation. Boats are prohibited on the North Tract. Universally accessible fishing is offered at Lake Allen, New Marsh, and the south side of Bailey Bridge.

- Lake Allen is a 13-acre (5-hectare) lake with shoreline access for fishing.
- Rieve's Pond is a spring-fed pond, open to foot-traffic only, and accessible via Kingfisher Road.
- New Marsh is a 5-acre (2-hectare) wetland complex with three ponds located off of Wildlife Loop.
- Cattail Pond and Bailey Bridge Marsh are located near the southeast corner of Wildlife Loop and offer opportunities to catch panfish and largemouth bass. Anglers are allowed to fish on the south side of Bailey Bridge and downstream only.
- Lower Little Patuxent River is downstream of Bailey Bridge and gives anglers the opportunity to fish the river for smallmouth bass, bluegill, and catfish. Wading is only allowed while fishing in this stretch of the river (approximately 500 yards).

More information on fishing at Patuxent Refuge is available online at: *http://www.fws.gov/northeast/patuxent/fishing_refuge.html*; accessed January 2012.

Wildlife Observation and Photography

Over 23 miles of trails and roads on the refuge offer extensive and diverse wildlife observation and photography opportunities for hikers, joggers, and cyclists (map 2-7 and 2-8). Visitors in automobiles can enjoy wildlife observation and photography along North Tract's Wildlife Loop and the South Tract's entrance and exit roads. Designated North Tract trails also offer bicycling, horseback riding, and cross-country skiing in order to facilitate observation of the refuge's wildlife. Wildlife-viewing areas on the South Tract and in the NWVC viewing pod offer relaxing opportunities to glimpse and photograph beavers, dragonflies, waterfowl, waterbirds, and other wildlife. A wildlife art show and sale, held each year by the Friends of Patuxent, showcases photography and the arts, while benefitting the PWRC and Patuxent Research Refuge missions. The art show and sale also accommodates the Maryland's black bear conservation stamp contest and the Maryland migratory game bird stamp contest.



USFWS

Loop Trail

North Tract Trails and Wildlife Viewing Blinds

- Wildlife Loop (8 miles) is a paved scenic roadway originating at the Visitor Contact Station, and winding through upland meadow and forest habitat. Automobiles, hiking, bicycling, horseback riding, and cross-country skiing are permitted on the road. The wildlife viewing area, which includes a 35-acre wetland created by the Baltimore Gas and Electric Company, is located on the Wildlife Loop and provides scenic overlooks and opportunities to view wildlife such as waterfowl, shorebirds, raptors, and songbirds. Several wildlife exhibits and spotting scopes are also located at the wildlife viewing area.

- Little Patuxent River Trail (.75 miles) is a hiking-only trail starting at the Visitor Contact Station and meandering through bottomland hardwood forest habitat, with overlooks of the Little Patuxent River.

- Forest Trail (2.5 miles) is a loop-trail originating near the Visitor Contact Station. The hiking-only trail travels through a second-growth hardwood forest.

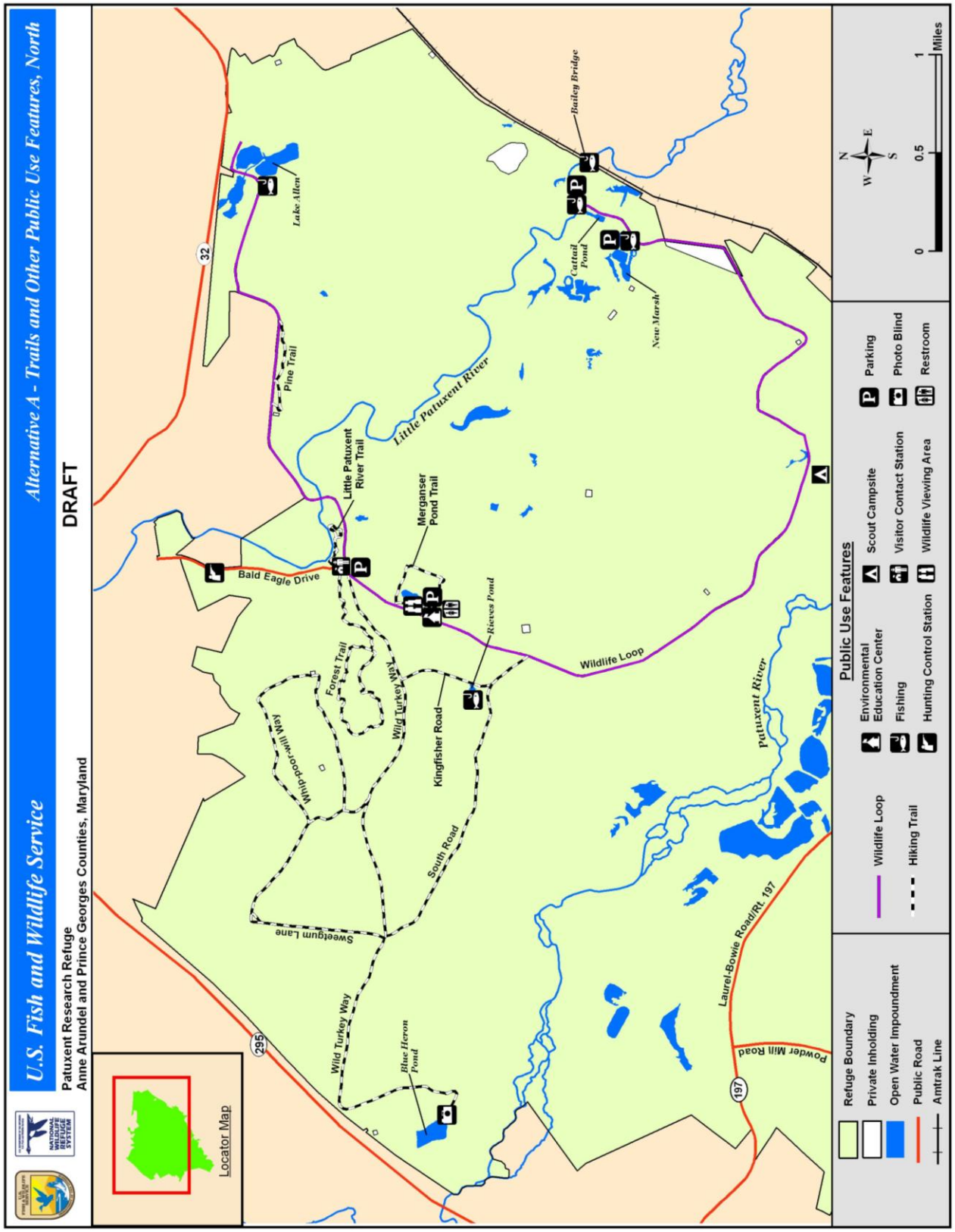
- Pine Trail (.75 miles) provides wildlife-viewing opportunities for hikers, cross-country skiers, and horseback riders. The trail links Wildlife Loop with the St. Peter's Church Cemetery.

- The Multi-use Trails (total 9.2 miles) allow hiking, bicycling, horseback riding, and cross-country skiing and include South Road, Wild Turkey Way, Sweetgum Lane, Whip-poor-will Way, and Kingfisher Road. These interconnected gravel and dirt roads cross a variety of different habitats in the western portion of North Tract, providing excellent wildlife observation opportunities.
- Blue Heron Pond Blind is an accessible blind located at the end of Wild Turkey Way. This blind overlooks Blue Heron Pond and its surrounding area and provides views of waterfowl, dragonflies, butterflies, and other wildlife.
- Merganser Pond Trail (.87 miles) is a loop trail around Merganser Pond located at the wildlife viewing area. The hiking-only trail travels by a green-tree reservoir, an open meadow, and Merganser Pond.

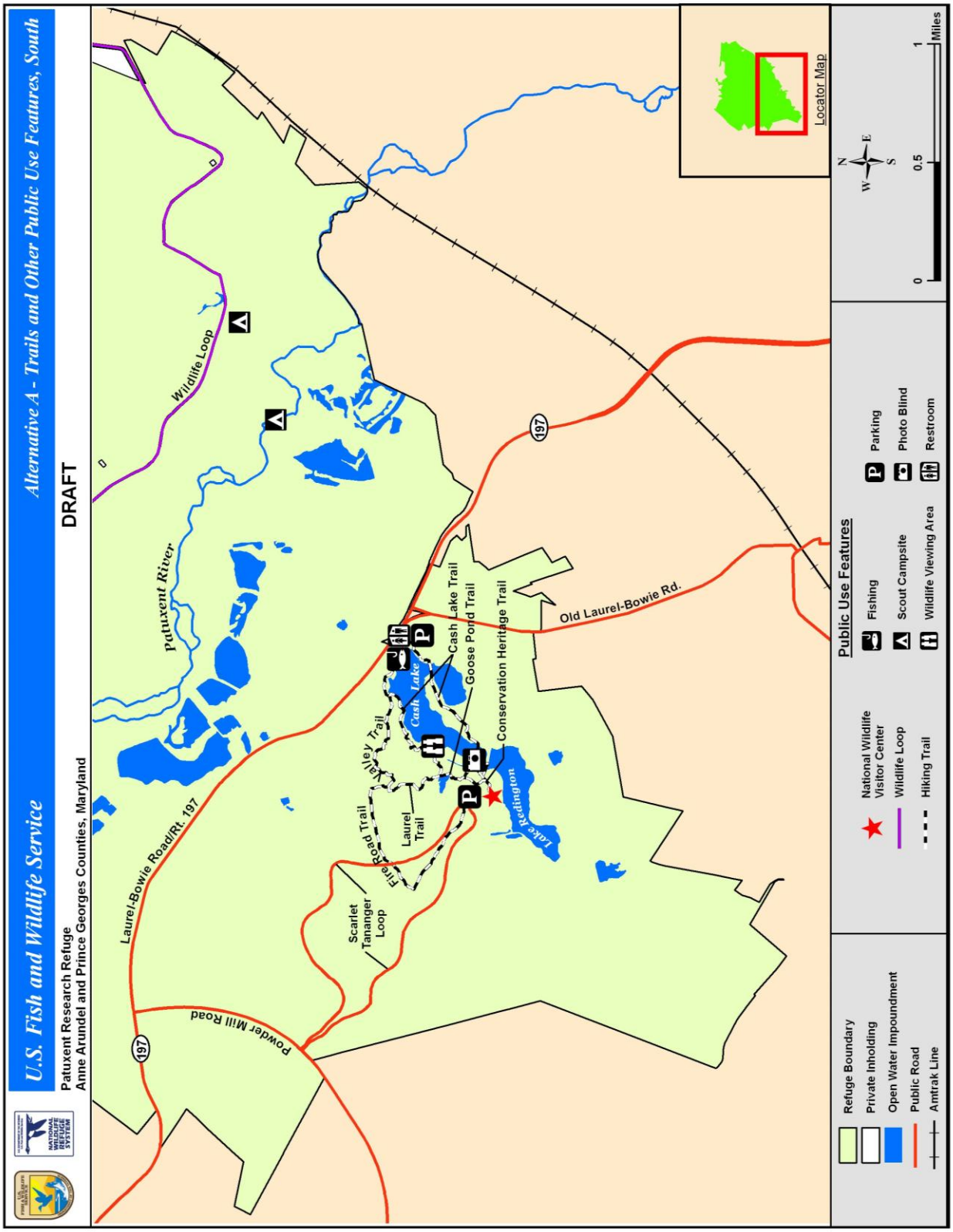
South Tract Trails and Wildlife-viewing Blinds

- Loop Trail (0.3 miles) is an Americans with Disabilities Act (ADA)-accessible paved trail starting at NWVC that offers views of Lake Redington and Cash Lake. The trail runs along a meadow and man-made wetland and provides access to other trails and a boardwalk with an accessible wildlife observation blind. This trail was recently renamed the Conservation Heritage Loop Trail, with several prominent conservationists throughout the nation's history featured on interpretive signs.
- Goose Pond Trail (0.2 miles) connects from the Conservation Heritage Loop Trail and leads to the Cash Lake and Laurel Trails. The trail parallels a forest edge and then wanders through a forested wetland to a pond offering waterfowl viewing. An outdoor environmental area for educational groups is also located along the trail.
- Cash Lake Trail (1.4 miles) begins at the intersection of Goose Pond and Laurel Trail and connects to the Valley Trail. The trail loops around the 53-acre Cash Lake impoundment. On the south side of the lake, floating walkways provide access to a peninsula. An accessible wildlife viewing blind near the impoundment's headwaters offers views of waterbirds and waterfowl. The southern portion of the trail is closed seasonally to prevent disturbance to nesting and wintering waterfowl.
- Valley Trail (0.6 miles) connects the Cash Lake and Laurel Trails. The trail follows a gully through a woodland valley, winding through predominantly oak and beech hardwood forest.
- Fire Road Trail (0.9 miles) begins at the back edge of the NWVC parking lot and leads to the intersection of the Valley and Laurel Trails. The trail follows an old fire road through pine and hardwood forest.
- Laurel Trail (0.4 miles) connects the Goose Pond, Valley, and Fire Road Trails. The mountain laurel-lined trail is dedicated to Chandler S. Robbins, a migratory bird researcher (now retired) at the USGS PWRC.

Map 2-7. Existing Public Use Opportunities, North



Map 2-8. Existing Public Use Opportunities, South



Environmental Education and Interpretation

Staff and volunteers offer guided bird and nature walks, as well as other environmental education programs throughout the year at both the North and South Tracts. A diverse range of educational and interpretive programs, from puppet shows and summer camps for children to birding and plant identification workshops for adults, are offered. The refuge also hosts on and offsite educational programs for teachers and schoolchildren. Several hundred interpretive and educational programs are offered throughout the year, both on and offsite. Announcements of upcoming programs and special events are posted at refuge contact facilities, in local newspapers and on the Web site at: *http://www.fws.gov/northeast/patuxent/ntedu.html*; accessed January 2012). A monthly announcement listserv is also maintained which reaches approximately 3,400 subscribers.

Non-wildlife-dependent Public Uses

As discussed in chapter 3, we have permitted certain Federal agencies to continue their use of shooting ranges on the North Tract. Other non-wildlife-dependent uses which occur on the refuge include jogging, horseback riding, scout camping, bicycling, cross country skiing, and dog training.

Scout Camping

There are two primitive, seasonal (March 1 to June 30) scout campsites located off Wildlife Loop in the southern portion of North Tract. Based on a nationwide memorandum of agreement, these sites are only for use by the Boy and Girl Scouts of America and 4-H clubs. Both sites are first-come, first-served and equipped with accessible toilets and fire rings.

Horseback Riding

The North Tract allows horseback riding to facilitate wildlife observation on over 18 miles of trails. North Tract trails open to horseback riding include the Wildlife Loop, the multi-use trails, and trails at Lake Allen and Rieve's Pond.

Cross Country Skiing

The North Tract allows cross-country skiing to facilitate wildlife observation on over 18 miles of trails. North Tract trails open to cross-country skiing include the Wildlife Loop, the multi-use trails, and the trails at Lake Allen and Rieve's Pond.

Table 2-7 shows the number of visitors that participated in specific refuge public use activities from 2006 to 2009.

Table 2-7. Visitation for Refuge Public Use Activities 2006 to 2009

Public Use Activity	Number of Visitors		
	2006-2007	2007-2008	2008-2009
Onsite talks	9,882	7,035	9,796
Offsite talks	2,621	4,577	2,889
Total interpretation	12,503	11,612	12,685
Teachers onsite	1,901	84	215
Teachers offsite	470	2,010	71

Public Use Activity	Number of Visitors		
	2006-2007	2007-2008	2008-2009
Students onsite	6,523	2,515	4,177
Students offsite	782	3,694	1,578
Total environmental education	9,676	8,303	6,041
Facilitated by hiking	18,607	18,957	24,118
Facilitated by auto	59,824	38,991	51,660
Total wildlife observation	78,431	57,948	75,778
Total wildlife photography	16,939	13,356	18,362
Waterfowl hunting	474	375	348
Migratory bird hunting	68	91	43
Upland game hunting	90	207	246
Big game hunting	5,184	4,928	5,119
Total hunting	6,086	5,601	5,756
Total freshwater fishing	4,899	3,136	3,357
Bicycling	3,373	4,413	4,403
Shooting ranges	24,333	22,083	27,180
Baseball fields	1,555	17,014	16,384
Horseback riding	109	120	134
Cross-country skiing	0	0	1
Dog training	5	0	1
Jogging	398	1,499	1,489
Scout camping	219	278	266
Special events	4,841	3,972	4,441
National Wildlife Visitor Center	48,013	25,188	38,095
North Tract Visitor Contact Station	9,477	8,202	7,809
Hunter control station	6,086	5,601	5,756
Total visitor centers	63,576	38,991	51,660
TOTAL VISITATION	**223,070**	**178,045**	**223,399**

2.8 Archaeological and Cultural Values

The Service seeks to preserve and manage the refuge's cultural and archaeological resources that have contributed to and have the potential to advance our understanding of State, regional, and national prehistory and history. A total of 41 archaeological sites registered with the Maryland Historical Trust and Service are present within the refuge. Prehistoric archaeological resources date from the Early Archaic through Late Woodland periods. Native American archaeological resources dating to other time periods (e.g., Pre-Clovis, Paleo-Indian, Contact periods) may exist within the refuge. Historic sites include occupations dating from the 17th century to the 20th century (Richard Grubb and Associates 2011).

Summary of Prehistoric Archaeological Resources

There are 41 known archaeological sites with prehistoric components within the refuge. Surface collecting of plowed fields and other exposed ground surfaces in the mid-20th

century resulted in the recovery of prehistoric stone artifacts and prehistoric pottery within the refuge. The surface collected artifacts from the Central and North Tracts provided items for a display that was located on the refuge.

The prehistoric archaeological resources within the refuge date from the Early Archaic period to the Late Woodland period. Pre-Clovis and Paleo-Indian artifacts have not been found on the refuge. However, a Clovis point was found by an avocational archaeologist in the general vicinity of the refuge (MacCord n.d.) and Clovis points have been found within the Patuxent River Watershed (Curry 1978, Steponaitis 1980). Prehistoric archaeological resources have been found on a variety of geomorphological settings on the refuge.

Most of the prehistoric resources consist of low density lithic scatters. Several prehistoric sites contain relatively large quantities of artifacts suggesting these sites may not represent short term resource procurement sites. The larger sites are multi-component surface or plowzone sites. Buried occupational surfaces (i.e., buried A-horizon contain cultural material) have not been found in the refuge. Prehistoric features have not been found at any site within the refuge. Most of the prehistoric artifacts have been found in the plow zone or from surface collecting, limiting interpretation of prehistoric activities within the refuge. The stone tools, cores, and debitage indicate that lithic reduction activities were one of the primary onsite activities within the refuge. The recovery of ground stone tools such as adzes and axes from the refuge reflects woodworking or other heavy duty activities. The chipped stone tools were likely used for hunting, cutting, scraping, and other processing activities. Fire-cracked-rock has been found at several refuge sites, which reflects hearth related activities. A drilled gorget fragment from the refuge may be indicative of ritual or other activities. The abundance of ceramics at one site suggests onsite activities included the storage or preparation of food.

The prehistoric sites and artifact assemblage from the refuge provide insights into the types of occupations and activities conducted within the refuge. Extensive excavations (i.e., Phase III data recoveries) and specialized analysis (e.g., residue analysis, micro-wear analysis, ecofact analysis, and radiocarbon dating) have not been conducted within the refuge. Therefore, interpretations of prehistoric lifeways within the refuge are limited. However, archaeological investigations conducted in the vicinity of the refuge provide comparative data and can be used to provide insight into prehistoric lifeways.

In summary, the prehistoric archaeological resources within the refuge reflect over 9,000 years of occupation. A diversity of artifacts and sites has been documented.

Summary of Known and Potential Historic Sites

Most of the historic archaeological resources within the Patuxent Research Refuge are detailed in Pousson (1987) for the Central and South Tracts and within Joseph et al. (1991) for the North Tract. A 2004 report by McGill and Persall also presented information on several cemeteries located within the North Tract.

A history of the Patuxent forks region notes that there were two cemeteries (possibly a family cemetery and a separate slave cemetery) on both the Anderson and Mullikan farms (Dulaney 1948). This suggests that additional burials may be expected beyond the known locations of the Mullikan Cemetery (also known as Cemetery No. 17) and that burials may also be present at the complex known as the Anderson Family Homestead. Additional unknown cemeteries may be associated with the known church sites (Joseph et al. 1991).

Also located within the Refuge is Snowden Hall. The Snowden-family manor house was first built at this location circa 1700. Destroyed by fire, it was rebuilt circa 1812 or 1815 as a one- or a one-and-one-half story brick cottage (Morley 1948; Reed 2002). It was expanded to a full two stories ca. 1856, when then-occupant John Snowden was married. Single-story brick wings were added to the north and south elevations of the building in 1938 when the structure was rehabilitated for use as the Refuge headquarters (Reed 2002). Snowden Hall was damaged during an earthquake in 2011. Refuge staff do not use the building currently.

USFWS

Snowden Hall

Not previously discussed in earlier reports is the location of a ford indicated on the 1861 Martenet map that crosses the Patuxent River near what is now the Duvall Bridge (also known as the Griffith's mill bridge). Fords across both the Patuxent and the Little Patuxent Rivers were commonly used, and were established in areas with shallow water and a gravel bottom. "These fords were great mileage savers and were useful for carriages, buggies and people on horseback. Automobiles proved to be a different story" (Dulaney 1948). If present, remains of these fords may be significant; in the case of the Duvall Ford, it may be a contributing element to the Duvall Mill Historic District.

Historic Districts

There are three National Register eligible historic districts identified within the refuge:

- Duvall Mill Historic District, which includes resources significant to the history of Prince George's County and not associated with the development of the refuge.

- Patuxent Research Refuge Historic District, which includes resources significant to the development of the refuge.
- South Tract Forest Service Historic District, which includes resources significant to the development of the Forest Service research area within the Beltsville Agricultural Research Center.

Cemeteries

The North Tract includes 10 Fort Meade inholdings that are historic cemeteries, totaling approximately 3.4 acres. These have headstones dating back to the 1700s, with some as recent as 1969 (Hileman 1998). They include graves and headstones of former landowners and their extended families. Fort Meade is responsible for their management and preservation, although the refuge does minimal cosmetic maintenance, such as fence repair, tree removal, etc., as the public's perception is that the refuge owns these plots.

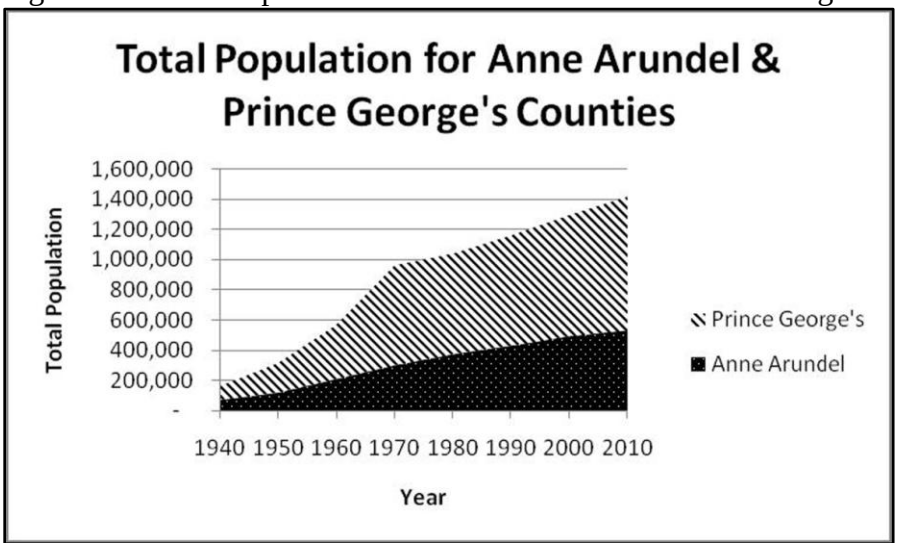
Four of the ten cemeteries were part of the former Fort Meade lands transferred to the refuge in 1991 and 1992. These are the John Penn Cemetery, and three others that are unknown/unmarked. The refuge performs minimal custodial work at the John Penn site.

2.9 Socioeconomic Environment

Demographic Profile

According to U.S. Census, the 2010 populations for Prince George's and Anne Arundel Counties were 863,420 and 537,656. This is a 7.7 percent increase in population for Prince George's County and a 9.8 percent increase in population for Anne Arundel County from 2000 to 2010. This large increase can be attributed to the counties' close proximity to the Washington, DC and Baltimore, Maryland metro areas. Figure 2-3 shows that the combined population for the two counties has grown steadily since 1940, from 157,865 to 1,291,171 in 2000 (Vanasse Hangen Brustlin, Inc. 2010).

Figure 2-3. Total Population for Anne Arundel and Prince George's Counties



An analysis of the population for the two counties broken into age groups shows the 35 to 54 age group to be the largest, comprising 31 percent of the total population. The 5 to 17 and 25 to 34 age groups were the next largest at 19 and 17 percent, respectively (Vanasse Hangen Brustlin 2010).

Socioeconomic and Community Profiles

Households

The 2000 U.S. Census showed that there were 465,404 households in the Anne Arundel and Prince George's Counties. Prince George's County held the largest number of households at 286,650. The average household size for the two localities was 1.67 persons. Of the households, 329,488 or 71 percent were classified as "family." Of those, 36 percent were two-person households, 25 percent were three-person, 21 percent were four-person, and 16 percent were five or more person households. Of the households, 87,126 were considered "non-family," with 79 percent being one-person households.

Migration

In 2000, 54 percent of the population in the two counties lived in the same house in which they lived in 1995. Of the remaining 46 percent of the population, 50 percent moved within the same county, 13 percent had moved from a different county in the same State, 28 percent had moved from a different state, and 3 percent were immigrants.

Education

According to the 2000 U.S. Census, Anne Arundel and Prince Georges Counties have 86 percent and 85 percent of their population, respectively, aged 25 and older who have completed high school (or equivalent).

Employment

Of the population 16 years and over, 29 percent were not in the labor force in 2000. The percent of women not in the labor force was greater than the percent of men (33 percent of women, 25 percent of men). Of the total population aged 16 years and over in the labor force, 93 percent were employed. According to the Maryland Department of Labor, in 2007 Anne Arundel County had an unemployment rate of 3.2 percent while Prince George's County had a higher rate of 4.0 percent. The greatest percentages of employment in the area are in the Federal/State/local government and the trade, transportation, and utilities industries.

Income

According to the Maryland Department of Planning, the weighted average (weighted average was based on relative county population) of median household income for Anne Arundel and Prince George's Counties as reported in 2006 was $73,900. In comparison, the overall Washington, DC area's median income is $79,000.

Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority and Low Income Populations, requires Federal agencies to identify and address potential disproportionately high and adverse human health or environmental effects of its

programs, policies, and activities on minority populations and low-income populations (EO 12898). The Presidential memorandum accompanying this Executive Order further directs Federal agencies to improve opportunities for community input and the accessibility of meetings, documents, and notices (CEQ 1997). To facilitate this, Federal agencies should also consider if a significant portion of the affected community is linguistically isolated and provide translated documents and other appropriate outreach materials.

In creating table 2-8, we used the following definitions:

- Minority population includes persons who are members of the following groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic.
- Low-income population includes persons living below the poverty line.
- Linguistically isolated population includes persons who identified as speaking English less than "very well."

Table 2-8. Regional Environmental Justice Characteristics

Environmental Justice Population	Washington, DC/Baltimore, MD	Anne Arundel County, MD	Prince George's County, MD
Minority Population (as percent of total population	37.0	20.8	71.9
Linguistically Isolated Population (as percent of total population)	6.8	3.0	7.9
Low-income Population (as percent of total population)	8.3	4.5	7.4

Source: USCB (2010)

Minority Populations

Minority populations represent 52.4 percent of the two counties' total population combined. However, Prince George's County has a much higher percentage of minority populations than does Anne Arundel County, 73 percent compared to 18.7 percent (table 2-9).

Table 2-9. Minority Population in Anne Arundel and Prince George's Counties

County	Minority Population	Percent of Total Population
Anne Arundel County	91,763	18.7
Prince George's County	584,741	73.0
TOTAL	**676,504**	**52.4**

Source: 2000 U.S. Census

Low Income

The low-income population for Anne Arundel and Prince George's Counties represents 6.7 percent of the two counties' population. Prince George's County has a higher

percentage of low-income population than does Anne Arundel, 7.7 percent compared to 5.1 percent (table 2-10).

Table 2-10. Low-income Population in Anne Arundel and Prince George's Counties

County	Population Below Poverty	Percent of Total Population
Anne Arundel County	24,335	5.1
Prince George's County	60, 196	7.7
TOTAL	**84,531**	**6.7**

Source: 2000 U.S. Census

Real Property

Patuxent Research Refuge owns all real property assets located on the refuge, totaling approximately $324 million. These assets include office buildings, residences, storage sheds, garages, roads, bridges, dams, dikes, wells, animal colonies, and wastewater treatment systems. Portions of the North Tract are privately owned inholdings consisting of small historic family cemeteries, ranging from one-tenth of an acre to one-quarter of an acre in size, and a 12.6 acre DOD clean fill dump. DOD plans to transfer the property to the refuge once the site is clean. Fort Meade owns and maintains most of the cemeteries.

Current Staff and Budget

The refuge is currently managed by a staff of 23 professionals, including 20 permanent employees and 3 supporting temporary employees. Table 2-11 shows staffing and funding levels from 2007 to 2011.

Table 2-11. Refuge Staffing and Funding Levels

Fiscal Year	Annual Budget	Annual Budget Plus Additional Regionally Funded Projects	Permanent Staff
2007	$3,912,494	$4,340,795	20.4
2008	$3,607,753	$9,814,249	21.7
2009	$2,932,935	$3,069,085	21.4
2010	$3,969,517	$8,511,736*	22.4
2011	$3,512,120	$3,630,537	21.4

*One-time ARRA funding

The largest portion of funds in the annual budget is salary and benefit costs for refuge staff. Fluctuations in funding reflect appropriations for special projects or new construction. Most of the larger maintenance project-related funding is appropriated and documented via the Service Asset Maintenance Management System (SAMMS). This system is used to identify and appropriate funding for maintenance and construction projects (rehabilitation, repair, and replacement) for existing facilities. SAMMS documents existing asset conditions and helps prioritize the projects that are identified. SAMMS is divided into four major components:

- Property inventories
- Comprehensive condition assessments
- Budget planning
- Management reporting system

Refuge managers use SAMMS as a facility management tool to establish short- and long-term management goals over a multi-year period. Funding for future non-maintenance projects and programs is received largely through the Refuge Operation and Needs System (RONS). This system is used to identify, justify, and prioritize future projects and programs. These projects are formally articulated via an approved CCP for the refuge. If a CCP does not exist for the given refuge, projects identified under RONS must comply with various short- and long-term goals for that refuge as approved by the Service and the Department of the Interior.

Volunteer Program

The refuge has a very active, engaged volunteer program. As of fiscal year 2010, 156 volunteers were recorded, with 106 of those being active volunteers and 50 of those as one-time volunteers. A total of 28,140 volunteers hours were contributed for fiscal year 2010.

2.10 Partnerships

Friends of Patuxent

The Friends of Patuxent Wildlife Research Center and Patuxent Research Refuge, Inc. (Friends) is an all-volunteer nonprofit organization. The Friends were established in 1991 to support the refuge and the USGS PWRC. Through volunteering and fundraising, the Friends help support the refuge's educational programs, exhibits, and outreach and PWRC's research on endangered species, environmental contaminants, and migratory birds. The Friends also seek and administer research grants from concerned foundations, organizations, and individual donors. Their most notable contributions are described below.

- Wildlife Conservation Interpretation Tram is operated by the Friends to help raise funds to support the refuge and PWRC. The interpretive tram runs in a loop from the NWVC from early spring through late fall.
- Wildlife Images Bookstore is operated by the Friends to help raise funds to support the refuge and PWRC. The store is located in the lobby of the NWVC and offers a variety of wildlife-themed books, clothing, posters, and other items.

- The Patuxent Wildlife Art Show and Sale is an annual fundraiser featuring a wide variety of wildlife art on display and for sale. All profits are donated to the refuge and PWRC.
- Adopt-a-Whooper Program allows individuals to "adopt" a whooping crane egg, adult, breeding pair, or brood of chicks. Funds raised are donated to support the PWRC's research and captive propagation of the federally endangered whooping crane.

Whooping Crane – USFWS

For more information on the Friends group, visit their Web site at: *http://friendsofpatuxent.org/;* accessed January 2012.

Meade Natural Heritage Association

The Meade Natural Heritage Association, established in 1991, is an incorporated, nonprofit organization that is dedicated to the purpose of wildlife conservation, management, and to promote and support outdoor sporting activities. The volunteer staff of the association, in cooperation with refuge officials, manages the hunt program for upland game, waterfowl, and white-tailed deer through a permit system. Hunting is permitted from September through January, based on Maryland State hunting seasons, and in April and May for the spring wild turkey hunt. By using a daily sign-in system, weapon qualifications for deer hunters, hunter education classes, and hunter density limits in each hunting area, association personnel strive to provide the safest and highest quality outdoor experience to the outdoor sportsperson. Coordination of hunting activities, permit sales, and daily sign-in and harvest recording are performed at the hunt control station located at the North Tract.

For more information on the Meade Natural Heritage Association, visit their Web site at: *http://www.mnha.net/;* accessed January 2012.

Both the Friends and the Meade Natural Heritage Association provide support by funding volunteers and purchasing equipment and food during many refuge events and volunteer recognition dinners and picnics, and providing extra volunteer help for our events from their memberships or partners. Both organizations also produce newsletters and maintain active Web sites (Russo et al. 2009).

All Partnerships

The refuge has many partnerships with local, State, and national organizations. Partnerships are an important part of management that allows the refuge to engage and gain support from a number of different groups to receive funding and resources to accomplish refuge goals, while also fostering good community relations. For fiscal year 2010, refuge staff completed 30 partnership projects. Examples of these projects include, but are not limited to:

- Beltsville Agriculture Research Center assisted with invasive species control by supplying equipment and applicators.
- Bass Pro supplied fishing supplies for our kid's fishing day.
- DOD Wounded Warriors program introduced or reintroduced wounded soldiers to fishing.
- Ducks Unlimited helped develop endangered species/mitigation impoundments.

USFWS

Wounded Military Visitation Day Fishing

2.11 Administrative Facilities

The refuge has an unusually high amount of infrastructure, much of it supporting Federal entities located onsite. It is the work location for the USGS PWRC, which employs approximately 150 people onsite, and the Service Division of Migratory Bird Management, which employs approximately 45 people onsite. An interagency work group has identified approximately $110 million of new construction, adaptive reuse/modifications of historic-eligible structures, utility upgrades, and demolition of unneeded assets to allow the refuge and research center to meet their respective missions to the fullest extent possible. The facilities modernization program plan details these needs and proposes a phased funding approach. This additional staff necessitates a high amount of infrastructure (offices, animal colonies, labs, mailing facilities, etc.) and impacts refuge assets.

The National Security Agency also operates several shooting ranges on the North Tract of the refuge for various Federal and State law enforcement agencies. The zone of impact from the short and long-distance shooting range is approximately 2,900 acres (1,174 hectares). The range facilities include a Range Control Office, classrooms, practical exercise buildings, a brass recycling room, multiple storage sheds and con ex boxes, and the range facilities themselves (target frames, shooting stations, berms, etc.).

Chapter 3.

USFWS

Ailanthus Webworm Moth

Alternatives

3.1 Introduction

3.2 Formulating Alternatives

3.3 Actions Common to All of the Alternatives

3.4 Actions Common to Alternatives B and C

3.5 Alternative A. Current Management (No Action)

3.6 Alternative B. Forest Restoration and Mixed Public Use (Service-preferred Alternative)

3.7 Alternative C. Maximize Forest Interior Restoration and Emphasize Wildlife-dependent Public Use Activities

3.1 Introduction

This chapter describes our process for formulating alternatives, the actions that are common to all of the alternatives, the actions or alternatives we considered (but did not fully develop), and the three alternatives we analyzed in detail. At the end of this chapter, table 3-3 compares how each of the alternatives addresses key issues, supports major programs, and achieves refuge goals.

3.2 Formulating Alternatives

Relating Goals, Objectives, and Strategies
The refuge goals developed are intentionally broad, descriptive statements of the desired future condition of refuge resources. Goals articulate the principal elements of the refuge purposes and our vision statement, and provide a foundation for developing specific management objectives and strategies. All of the alternatives analyzed address the same goals.

The objectives are essentially incremental steps toward achieving a goal; they further define management targets in measurable terms. Typically, they vary among the alternatives, and provide the basis for determining strategies that are more detailed, monitor refuge accomplishments, and evaluate our successes. “Writing Refuge Management Goals and Objectives: A Handbook” (USFWS 2004) recommends writing SMART objectives that possess five characteristics: specific, measurable, achievable, results-oriented, and time/fixed. A rationale accompanies each objective to explain its context and importance. The objectives outlined in the alternative selected for the final CCP will guide the future development of refuge step-down plans, which we describe later in this chapter.

Strategies are the specific or combined actions, tools, or techniques we may use to achieve the objectives. The list of strategies in each objective represents the potential suite of actions we may implement. We will evaluate most of them further as to how, when, and where we should implement them when we write our refuge step-down plans. We will measure our successes by how well our strategies achieve our objectives and goals.

Developing Alternatives, Including the No Action Alternative
Over the course of several months, the core planning team, refuge staff, and partners held meetings and conference calls to identify a wide range of possible management objectives and strategies that could achieve our goals. After these were initially developed, the process of designing detailed management alternatives began. Each management alternative is intended as an alignment of complementary objectives and strategies designed to meet refuge purposes, vision, and goals, and the Refuge System mission and goals, while responding to the issues and opportunities that arose during the planning process.

Beginning in 2010, we gathered information about refuge habitats and species, combined with refuge, State, regional and national priorities. We used that information to develop lists of priority resources of concern to help guide our alternatives development. The resources of concern are described in each of the rationales for the objectives under each alternative. By focusing on the resources of concern, we were able to narrow our focus to the alternatives that are presented in this chapter. There are an infinite number of ways that we could arrange possible habitats on the refuge. Alternative B provides a high amount of forest restoration, which is proposed as the area that the refuge can provide the greatest conservation benefit. Alternative B also balances other habitat types that would benefit other priority species as well as a range of habitat types for potential research projects.

Objectives were formed into three management alternatives and were evaluated as to how well they would fulfill the refuge purposes. In this chapter, we fully analyze the three alternatives that characterize different ways of managing the refuge over the next 15 years. As required by NEPA, we believe they represent a reasonable range of alternatives for achieving the refuge purpose, vision, and goals, and addressing the issues described in chapter 1. Unless otherwise noted, refuge staff would implement all actions.

Alternative A addresses the NEPA requirement of a “no action” alternative, which we define as continuing current management. It describes our existing management priorities and activities, and serves as a baseline for comparing and contrasting alternatives B and C. To better understand the scope and context embodied within the various alternatives, please see Chapter 2, “Affected Environment,” for detailed descriptions of current refuge resources and programs.

Many of the objectives in alternative A do not strictly follow the guidance in the Service goals and objectives handbook, because we are describing current management decisions and activities that we established prior to that guidance. Those activities evolved from a variety of formal and informal management decisions and planning documents. Thus, the objectives in alternative A are fewer and more subjective than are those in alternatives B or C.

Alternative B, the Service-preferred alternative, combines the actions we believe would achieve most effectively the refuge purposes, vision, and goals, and respond to public issues. It emphasizes the management of specific refuge habitats to support focal species whose habitat needs benefit other species of conservation concern in the Chesapeake Bay region. In particular, it emphasizes forest biodiversity and ecosystem function. This includes the restoration of a number of impoundments and grasslands to forested areas to support forest interior dwelling bird species and other forest-dependent species. The planning team reviewed landscape plans, the State wildlife action plan, and regional bird conservation plans and determined that Patuxent Research Refuge could make the biggest contribution to breeding migratory forest birds. By focusing on forest restoration and maintaining some of the impoundments and grasslands, alternative B provides the best conservation benefit across all of the habitat goals. In addition, alternative B would enhance our present visitor services programs in a manner that addresses the national and

regional Service policies and mandates of the refuge. It strives to provide opportunities for wildlife-dependent public uses found to be compatible and additional non-priority public uses that offer opportunities to introduce others to the Refuge System in general and Patuxent Research Refuge in particular.

Alternative C proposes that the refuge begin a path towards maximizing interior forested habitat. This would require active management to restore a majority of impoundments and grasslands into forested areas and would support forest interior dwelling species, in addition to other species of conservation concern identified in the draft habitat management plan. Alternative C also focuses on accommodating wildlife-dependent uses while minimizing non-wildlife-dependent uses.

Steve Noyes

Valley Trail

3.3 Actions Common to All of the Alternatives

All of the alternatives share some common actions. Some are required by law or policy, or represent actions that have undergone previous NEPA analysis, public review, agency review, and approval. Others may be administrative actions that do not require public review, but that we want to highlight in this public document.

All of the following actions are current practices or policies that would continue under all alternatives:

- Coordinate with USGS to house and support research efforts and encourage basic and applied scientific work on the refuge that furthers the goals of Service and

USGS in coordination with refuge management (e.g., propagation of endangered species).

- Use an adaptive management approach where appropriate.
- Develop a separate land protection plan with public and agency involvement in compliance with Service policy and NEPA.
- Monitor and control invasive species.
- Monitor and abate diseases affecting wildlife and plant health.
- Continue existing projects managed by outside programs.
- Protect cultural resources, including National Register of Historic Places-eligible buildings and historic districts.
- Complete findings of appropriate use and compatibility determinations.
- Provide quality wildlife-dependent recreation programs.
- Provide non-wildlife-dependent activities.
- Provide refuge staffing and administration.
- Conduct Wild and Scenic Rivers and Wilderness Reviews.

Biological and Ecological Research and Investigations

In establishing the refuge in 1936, Executive Order 7514 stipulated: "….in order to effectuate further the purposes of the Migratory Bird Conservation Act, it is ordered that all lands acquired….are hereby reserved and set apart….as a wildlife experiment and research refuge." While research has evolved through the years, it inherently remains of a nature that addresses national and international questions about wildlife conservation. In addition, much of the research has direct application to the Refuge System and other land management and conservation agencies.

The refuge works under a memorandum of agreement (MOA) with USGS PWRC that identifies the coordination of priority research between the two agencies. The MOA specifically defines priority research as, "Those projects that are considered important to: Agencies of the Department of the Interior, the U.S. Fish and Wildlife Service, the National Wildlife Refuge System, and State Fish and Game Agencies, and that address important management issues or demonstrate techniques for management of species and/or habitats" (MOA July 28, 2000/FWS Agreement No 1448-50181-97-H-006).

In addition, the Refuge Manual and the Service Manual both contain guidance on conducting and facilitating biological and ecological research and investigations on refuges. In 1982, the Service published three objectives in the Refuge Manual for supporting research on units of the Refuge System (4 RM 6.2):

1) Promote new information and improve the basis for, and quality of, refuge and other Service management decisions.

2) Expand the body of scientific knowledge about fish and wildlife, their habitats, the use of these resources, appropriate resource management, and the environment in general.
3) Provide the opportunity for students and others to learn the principles of field research.

In 2006, the Service Manual provided supplemental guidance on the appropriateness of research on refuges: "We actively encourage cooperative natural and cultural research activities that address our management needs. We also encourage research related to the management of priority general public uses. Such research activities are generally appropriate. However, we must review all research activities to decide if they are appropriate or not as defined in section 1.11. Research that directly benefits refuge management has priority over other research" (603 FW 1.10D (4)).

Just as all refuge management activities on the refuge should be compatible with its primary purpose, which is to conduct research, all research projects should be consistent with an approved finding of appropriateness and compatibility determination. Research projects may also contribute to a specific need identified by the refuge or the Service. As we note in chapter 2, we have allowed many research projects that meet these criteria. We expect additional opportunities to arise under any of the alternatives proposed in this draft CCP. Special use permits will be issued for all research projects we allow. In addition, we will employ the following general strategies to further activities under this goal:

- Encourage and support the use of Patuxent Research Refuge's lands for the purpose of conducting wildlife research that addresses important questions of a national and international nature.
- Seek qualified researchers and funding to help answer refuge-specific management questions.
- Participate in appropriate multi-refuge studies conducted in partnership with the USGS or other research entities.
- Facilitate appropriate and compatible research by providing access and utilization of the refuge as a location for ongoing research.
- Promote the refuge as a stable area where long-term studies have thrived, and where opportunities for additional long-term studies that address emerging environmental and conservation issues can be accommodated.
- Provide an outlet for dissemination of biological and ecological scientific information through use of the NWVC as a site for symposia, conferences, and open houses.

Adaptive Management

All of the alternatives will employ an adaptive management approach for improving resource management by learning from management outcomes. To provide guidance on

policy and procedures for implementing adaptive management in departmental agencies, an intra-departmental working group developed a technical guidebook to assist managers and practitioners (Williams et al. 2007). It defines adaptive management, the conditions under which we should consider using it, the process for implementing it in a structured framework, and evaluating its effectiveness (Williams et al. 2007). In the guidebook, adaptive management is defined as, "A decision process that promotes flexible decision-making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood."

Harding Spring Pond Outlet - USFWS

At the refuge level, monitoring key resources and management actions and outcomes will be important to implementing an adaptive management process. Forest restoration and management, invasive species, and impoundment management activities are examples of refuge programs or activities where an adaptive management approach will be implemented. The refuge manager will be responsible for changing management actions and strategies if they do not produce the desired conditions. Significant changes from what we present in our final CCP may warrant additional NEPA analysis and public comment. Minor changes will not, but we will document them in our project evaluation or annual reports.

Protecting Land

In July 2011, the Director approved a preliminary project proposal that starts the process for exploring land protection options in southern Maryland and detailed planning for a potential Refuge System expansion that could include six focus areas in three relatively intact Chesapeake Bay river landscapes. This includes portions of the Lower Potomac River and the entire Patuxent River and South River watersheds. The focus of the planning process will begin with the following focus areas: Patuxent River, South River, Mattawoman Creek, Nanjemoy Creek, Zekiah Swamp, and McIntosh Run. We would build upon existing conserved lands to enhance and strengthen the ecosystem function of rivers and migratory corridors.

The initial description of the project includes up to 40,000 acres (16,187 hectares) within an approved refuge acquisition boundary. Following the CCP, the refuge will develop a separate land protection plan with public and agency involvement in compliance with Service policy and NEPA. The Service's role will involve working with the Chesapeake Bay Field Office and other Federal, State, local, and nongovernmental organization

partners to target conservation efforts, acquire conservation easements, and acquire property. If we decide to increase the lands of the refuge we will amend the CCP to guide the management of these new lands. The ultimate objective is to employ the combined land conservation and management strength of all partners to conserve and link the exceptional wildlife and public use values in the internationally recognized Chesapeake Bay watershed.

Managing Invasive Species

The permanent protection of land is the keystone of wildlife and habitat conservation. Land protected by the Refuge System will be available forever to support fish, wildlife, and plants. We can restore, enhance, or maintain the land we own to provide optimal conditions for Federal trust resources such as threatened or endangered species and those species whose populations are in decline.

The establishment and spread of invasive species, particularly invasive plants, is a significant problem that reaches across all habitat types. For the purposes of this discussion, we use the definition of invasive species contained in the Service Manual (620 FW 1.4E), "Invasive species are alien species whose introduction does or is likely to cause economic or environmental harm, or harm to human health. Alien species, or non-indigenous species, are species that are not native to a particular ecosystem. We are prohibited by Executive Order, law, and policy from authorizing, funding, or carrying out actions that are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere."

Guidance on managing invasive species on refuges appears in the Service Manual (620 FW 1.7G). The following actions, define our general strategies on the refuge:

- Manage invasive species to improve or stabilize biotic communities to minimize unacceptable change to ecosystem structure and function and to prevent new and expanded infestations of invasive species.
- Conduct refuge habitat management to prevent, control, or eradicate invasive species using techniques described through an integrated pest management plan, or other similar management plan. The plan will comprehensively evaluate all potential integrated management options, including defining threshold of risk levels that will initiate the implementation of management actions.
- Evaluate native habitat management activities with respect to their potential to accidentally introduce or increase the spread of invasive species and modify our habitat management operations to prevent increasing invasive species populations.
- Refuge integrated pest management planning addresses the abilities and limitations of potential techniques including chemical, biological, mechanical, and cultural techniques.
- Manage invasive species on refuges under the guidance of the National Strategy for Invasive Species Management (USFWS 2003) and within the context of

applicable policy.

The following actions define our specific strategies for the refuge:

- Continue to promote research into biological control alternatives.
- Continue the treatment of the most problematic species ranked in management priority based on the extent to which the species is established on the refuge, their potential to negatively impact sensitive or priority refuge plant communities by virtue of their proximity to these resources, and the degree of management difficulty involved in controlling the species.
- Maintain early-detection and rapid-response readiness regarding new invasions.
- Maintain accessibility to affected areas for control and monitoring.
- Continue and increase efforts to involve the community in promoting awareness of invasive species issues and seek assistance for control programs on- and off-refuge.

Monitoring and Abating Wildlife and Plant Diseases

The Service has not yet published its manual chapter on disease prevention and control. In the meantime, we derive guidance on this topic from the Refuge Manual and specific directives from the Director of the Fish and Wildlife Service or the Secretary of the Interior. The Refuge Manual (7 RM 17.3) lists three objectives for the prevention and control of disease:

1) Provide for the early detection and identification of disease mortality when it occurs.
2) Manage wildlife populations and habitats to minimize the likelihood of the contraction and contagion of disease.
3) Minimize the losses of wildlife from outbreaks of disease.

Currently, the refuge partners with MD DNR for deer disease monitoring. Samples from deer harvested on the refuge are taken for chronic wasting disease and epizootic hemorrhagic disease. Aerial pellet drops for raccoon rabies control is also conducted on the refuge in conjunction with the State. Emerald ash borer traps are distributed throughout the refuge and monitored by MD DNR's forestry division.

USGS also conducts monitoring and research on the refuge related to a variety of wildlife and plant diseases. Recent onsite studies conducted by USGS include Cache Valley disease as related to mosquitoes and a recent die-off of wood frogs related to chytrid fungus.

Other efforts include monitoring for Rana virus, avian influenza, West Nile virus, and a variety of oak diseases (sudden oak death, gypsy moth, and oak wilt) and other tree-related diseases.

Continuing Existing Projects Managed by Outside Programs

Fort Meade Groundwater Monitoring

A number of hazardous substances, unexploded ordnance, and munitions have been associated with the transfer of former military trainings grounds (North Tract's 8,100 acres/3,278 hectares) from Fort Meade through the Base Realignment and Closure Act. Hazardous substances include, but are not limited to, lead, petroleum-based waste, and unexploded ordnance. The refuge has cooperated with DOD in establishing monitoring wells at several locations on the North Tract for continuous long-term monitoring of ordnance and demolition-related compounds such as cadmium and volatile organic compounds. Groundwater monitoring wells have also been established to monitor contaminants moving from Fort Meade sites through underground aquifers underlying refuge property, including trichloroethylene and perchloroethylene (URS 2010). In total, 12 groundwater monitoring wells have been installed on North Tract by Fort Meade.

Unexploded Ordnance Sweeps and Removal

An abandoned trap and skeet range may undergo a soil removal action to eliminate lead-contaminated soil. Ordnance is removed as it is encountered in the field by ordnance demolition teams supplied by Fort Meade or other nearby military bases (URS 2010).

Cemetery Maintenance

The North Tract includes 10 Fort Meade inholdings that are historic cemeteries, totaling approximately 3.4 acres. These have headstones dating back to the 1700s, with some in use as recently as 1969 (Hileman 1998). They include graves and headstones of former landowners and their extended families. Since Fort Meade owns the cemeteries, they are responsible for management and preservation, although the refuge does minimal cosmetic maintenance such as fence repair, tree removal, etc., as the public's perception is that the refuge owns these plots.

Four of the ten cemeteries were part of the former Fort Meade lands transferred to the refuge in 1991 and 1992. These are the John Penn Cemetery, and three others that are unmarked. The refuge performs minimal custodial work at the John Penn site.

USFWS

North Tract Cemetery

Baltimore Gas and Electric (BG&E) and Potomac Electric Power Company (Pepco) Right-of-Ways

BG&E manages 5.5 miles (9 kilometers) of powerline right-of-ways through the refuge's North Tract. Pepco manages 3.5 miles (6 kilometers) of powerline right-of-way on the refuge, which crosses the Central and South Tracts. The refuge has competed compatibility determinations for the BG&E right-of-way, which is included in appendix C. PEPCO applied to renew the right-of-way prior its expiration in 2010; however, the application is still pending. As a part of the permitting process, we will issue a new compatibility determination that will include any needed environmental and policy compliance measures.

Protecting Cultural Resources

As a Federal land management agency, we are responsible for locating and protecting all historic resources, specifically, archaeological sites and historic structures eligible for listing or already listed on the National Register of Historic Places. That applies not only to refuge land, but to land affected by refuge activities, and to any museum properties.

The refuge contains archaeological resources that have and may contribute to the understanding of State, regional, and national prehistory and history. A total of 41 archaeological sites registered with the Maryland Historical Trust and the Service are present within the refuge boundary (Grubb 2011). Additionally, three registered historic districts are contained within the refuge boundary. See chapter 2 for more information.

In July 2011, a MOA was signed between the Service, USGS, and Maryland Historical Trust to facilitate treatment of 51 previously identified, historic-eligible structures on the Central and South Tracts. The MOA allowed for the retention or adaptive reuse of 16 of those structures and the demolition of 35 of those structures. Eleven of the demolition-ready assets were removed in 2011. The MOA also mandated a series of actions to mitigate the impact of demolition of the structures, and included commitments by the Service to develop a short documentary film, an interactive display, and brochure that interpret the importance of their cumulative history at Patuxent Research Refuge. These mitigating efforts were completed in September 2011.

Under all the alternatives, we will evaluate the potential for our management activities to impact archaeological and historical resources as required, and will consult with the Service's regional archaeologists and the State Historic Preservation Office to ensure compliance with Section 106 of the National Historic Preservation Act and any other applicable laws and regulations, regardless of the alternative implemented. That compliance may require any or all of the following: a State historic preservation records survey, literature survey, or field survey.

Appropriateness and Compatibility Determinations

Chapter 1 describes the requirements for determinations of appropriateness and compatibility. Appendix C includes appropriateness and compatibility determinations consistent with implementing alternative B, the Service-preferred alternative. All existing findings of appropriateness and compatibility determinations will be updated for the

alternative selected under the final CCP. These activities would be evaluated based on whether or not they contribute to meeting or facilitating refuge purposes, goals, and objectives. As noted above, hunting, fishing, wildlife observation and photography, and environmental education and interpretation, when compatible, are the priority wildlife-dependent, public uses of the Refuge System. According to Service Manual 605 FW 1, these uses should receive preferential consideration in refuge planning and management before the refuge manager analyzes other public uses for appropriateness and compatibility.

Wildlife-dependent Recreation

The Refuge System Improvement Act of 1997 designated six priority public uses on national wildlife refuges: hunting, fishing, wildlife observation, photography, environmental education, and interpretation. Per the general guidelines for wildlife-dependent recreation (Fish and Wildlife Service Manual 605 FW 1), we will continue to use the following criteria for quality, wildlife-dependent recreation in developing refuge programs. According to Service policy, a quality and wildlife-dependent recreation opportunity:

- Promotes safety of participants, other visitors, and facilities.
- Promotes compliance with applicable laws and regulations and responsible behavior.
- Minimizes or eliminates conflict with fish and wildlife population or habitat goals or objectives in an approved plan.
- Minimizes or eliminates conflicts with other compatible wildlife-dependent recreation.
- Minimizes conflicts with neighboring landowners.
- Promotes accessibility and availability to a broad spectrum of the American people.
- Promotes resource stewardship and conservation.
- Promotes public understanding and increases public appreciation of America's natural resources and our role in managing and conserving these resources.
- Provides reliable and reasonable opportunities to experience wildlife.
- Uses facilities that are accessible to people and blend into the natural setting.
- Uses visitor satisfaction to help to define and evaluate programs.

The refuge supports all of the six priority public uses. In 2006, the region 5 visitor services program assessed all of the refuges to determine what the most appropriate areas of emphasis for wildlife dependent public uses should be. That team identified environmental education and interpretation for Patuxent Research Refuge. A formal visitor survey in conjunction with USGS was conducted from 2010 to 2011 to analyze visitor use in relation to local economic benefits. The results of this survey have not yet

been compiled. However, staff and volunteer observations indicate that most visitors to the refuge engage in some form of wildlife-dependent recreation. As with many refuge programs, our partners, Friends of Patuxent, and volunteers will continue to help us expand these priority public use programs.

Under all alternatives, the refuge would continue to allow deer, turkey, and waterfowl hunting according to refuge and State regulations, because the hunt program has been effective at providing quality hunting opportunities and maintaining healthy populations of hunted species. Minor changes to hunt areas, days, and small game species may be pursued under each of the alternatives, but the refuge would continue to work with the Meade Natural Heritage Association (MNHA) to manage hunting on the refuge.

Non-wildlife-dependent Activities

Some activities have been ongoing and have been reviewed under previous appropriateness findings and compatibility determinations. The CCP policy requires that we reevaluate all uses during the CCP process. The ongoing uses include research and monitoring, jogging, hiking, dog walking, cross country skiing, horseback riding, search and rescue, dog training, secret service training, and bicycling. Other non-wildlife-dependent uses include softball fields, primitive scout camping, and shooting ranges.

Current compatibility determinations for non-wildlife-dependent activities have been completed, as necessary, and can be found in appendix C.

Shooting Range Management

Under any alternative, the refuge will continue its efforts to minimize impacts from the ten active shooting ranges located on the North Tract. These ranges are on the property the Service received from the DOD in 1991 and 1992, as part of the Base Realignment and Closure Act of 1988, and we provide for continued use of each range, to the extent that certain Federal agencies used it, when this use is consistent with the paramount purposes of the refuge for wildlife conservation (Pub. L. 101-519, Sec. 126(b) (Nov. 5, 1990):

> "The Secretary of the Interior shall administer the property transferred pursuant to subsection (a) consistent with wildlife conservation purposes and shall provide for the continued use of the property by Federal agencies to the extent such agencies are using it on the date of the enactment of this Act, including activities of the Department of Defense that are consistent with the recommendations of the Base Realignment and Closure Commission."

In 1990, PWRC Director, Harold O'Connor issued an initial determination that ongoing uses by other Federal agencies were compatible with ongoing and proposed research at the PWRC.

The shooting ranges are managed by the National Security Agency (NSA), through a special use permit issued by the refuge. They are used by 18,000 to 24,000 shooters a year. There are multiple issues with the ranges, including the negative impact on other

refuge operations and public use, reducing opportunities for wildlife research, and potential contamination from the deposition of lead and other heavy metals.

The compatibility determination that is referenced above is out of date and requires site investigations and analyses to comply with existing Service policy regarding compatibility determinations. Since the transfer of the North Tract to the Service, we have been issuing a special use permit that is renewed on a 5-year interval. Beginning in 2012, we will begin issuing the permit on a 2-year interval with the intent of completing a compatibility determination, including any necessary stipulations to maintain compatibility, within 10 years of completion of the CCP. We anticipate that information about direct and indirect impacts to wildlife, habitat, contamination, and other refuge uses will need to be gathered during that time. We will require the Federal agencies using each range to fund the required contaminant studies. The refuge has worked with NSA, the U.S. Secret Service and many of the other range users to coordinate schedules, and reduce impacts to refuge operations. This coordination will continue, and we plan to increase analysis and implementation of options that may help minimize or eliminate some of the management issues. These strategies may include bullet traps, field-of-fire shutters, bullet recycling rules, reconfiguration of active ranges, decontamination of closed ranges and possible range relocation (on or off refuge). The expectation is that the costs associated with any strategies that are implemented will be borne by the primary users.

Ballfields on the North Tract

The NSA operates four softball fields at the entrance to the North Tract. The fields are located on refuge land and were in operation at the time that the land was transferred to the Service. The NSA manages softball leagues that include 36 teams and occur from April through August. We have previously issued a special use permit to NSA for the operation of the fields. When the lands were transferred, Congress expected that Federal uses of the land would be allowed to continue as long as they are consistent with wildlife conservation. As a part of our review of all refuge uses as required in our CCP process, we have determined that the use of ballfields is not compatible with the purposes for which the refuge was established. After the 2012 league season, the ballfields would be closed and restored to natural conditions (16 U.S.C. 668dd(d)(3)(B)(vi)).

Refuge Staffing and Administration

Our proposals in this document do not constitute a commitment for staffing increases or funding for operations, maintenance, or future land acquisition. Congress determines our annual budgets, which our headquarters and regional offices distribute to the field stations. Chapter 2 presents our levels of staffing, operating, and maintenance funds for the refuge over the last 5 years.

Permanent Staffing and Operational Budgets

In all the alternatives, our aim is to sustain levels of annual funding and staffing that allow us to achieve refuge purposes, as interpreted by the goals, objectives, and strategies that we will establish in the final CCP.

In all the alternatives, we would seek to fill any currently approved, but vacant, positions,

which we believe are necessary to accomplish our highest priority projects. Alternatives B and C also propose additional staff to support maintenance, law enforcement, and visitor services programs. We identify our recommended priority order for new staffing in the RONS tables in appendix D.

Facilities Construction and Maintenance

The refuge has an unusually high amount of infrastructure, much of it supporting other Federal entities located onsite. It is the headquarters for the USGS PWRC, which employs approximately 150 people onsite. The Service Division of Migratory Bird Management also employs approximately 45 people onsite. This additional staff necessitates a high amount of infrastructure (offices, animal colonies, labs, mailing facilities, etc.) and impacts refuge assets which are further described below.

USFWS

NWVC Side Entrance

The refuge manages the NWVC, one of the largest science and environmental education centers operated by DOI, the North Tract Visitor Contact Station, MNHA Hunting Control Station, and the North Tract environmental education classroom, plus outdoor education sites that include an environmental education pavilion and schoolyard habitat (for more information on these facilities and grounds, please refer to chapter 2).

The presence on the refuge of USGS PWRC, one of the country's premier biological research centers, enables a capability found nowhere else in DOI to support the research needs of its land management bureaus. The refuge's land base and animal research facilities enable scientists to work on the propagation of endangered species, the most notable recent example being the whooping crane. Collocation onsite with the Service Division of Migratory Bird Management enables USGS PWRC to more effectively support research and monitoring activities including the National Bird Banding Laboratory, Breeding Bird Survey, North American Waterfowl Harvest Management Program, and numerous studies of migratory birds. USGS scientists use the refuge as a laboratory for studies that generate results that are used at refuges across the country.

Until 1994, the Service directed both PWRC and refuge management activities on the refuge. In 1994, all DOI biological research functions were separated from the Service, transferred to the newly established National Biological Service, and to USGS a few years later. The transfer resulted in the organizational separation of PWRC and the refuge. The biological research functions are now administered by USGS, which is headquartered in Reston, Virginia. The refuge management functions

remain the responsibility of the Service. The lands, buildings, and infrastructure are the sole property of the Service. A MOA between the Service and USGS, established and signed in 2000, outlines the administration, operations, and maintenance of facilities of the refuge and of PWRC (MOA July 2000). The MOA also includes a list of all of the buildings on the refuge and designates which are proposed for demolition or retention (appendix E).

In addition to a multitude of facilities, the refuge has 13.68 miles (22 kilometers) of paved public roads, 3.97 miles (6 kilometers) of gravel public roads, and 6.38 miles (10 kilometers) of administrative roads.

The activities at the refuge and PWRC require g-of-the-art laboratory space, animal handling facilities, and staff quarters. The separate but interrelated needs lead to complex facility issues, largely as the result of the number and age of the facilities (many of the facilities were constructed in the late 1930s, and most of the newer assets were constructed prior to the mid-1960s), and the collocated functions. Facility issues include facility operations and maintenance, many historic and cultural resource considerations (refuge facilities encompass three historic districts), highly specific and technical research facilities requirements, and complex coordination of activities between the two agencies.

Given the many facilities and infrastructure challenges facing the refuge, a facilities modernization plan has been developed to ensure that renovation, construction, demolition, and other proposed activities and priorities fit appropriately within the bureaus' missions and DOI asset management principles. To address these requirements, the bureaus developed strategic priorities for the modernization of DOI assets on the refuge. These include:

- Consolidation of resources and facilities on to the Central Tract of the refuge, resulting in an overall reduced and more economical footprint.
- Conversion to publicly owned and maintained utility services.
- Reforestation of a portion of the South Tract.
- Relocation to the refuge of USGS staff currently housed in offices on the Beltsville Agricultural Research Center.
- Collocation of Service and USGS.
- Improvement of the work environment for DOI workforce.
- Renovation of animal research assets.
- Energy efficiency and green building design (Dyrland et al. 2009).

Wild and Scenic River Review

As discussed in chapter 1, we are required to review river segments that cross the refuge as to their potential for inclusion in the National Wild and Scenic River System. As a first

step, we reviewed the National Rivers Inventory. The inventory is a listing of more than 3,400 free-flowing river segments in the U.S. that are believed to possess one or more "outstandingly remarkable" natural or cultural values judged to be of more than local or regional significance. Patuxent Research Refuge does not include any river segments that are on the inventory and the nearest river segment is a section of the Patuxent River approximately 20 miles downstream.

As stated earlier, the refuge includes sections of the Patuxent and Little Patuxent Rivers. The sections of river through the refuge are impacted by former military operations, management access roads, and altered hydrology from on and off stream impoundments. In addition, the river segments are too short in length to effectively manage for wild and scenic characteristics. Therefore, we do not recommend that these sections of the Patuxent and Little Patuxent Rivers be included in the National Wild and Scenic River System.

Wilderness Review

As discussed in chapter 1, we are also required to review refuge lands and waters for inclusion in the National Wilderness Preservation System. The Wilderness Review is included as appendix B. The CCP planning team found that each of the three Wilderness Inventory Areas that were examined and therefore, the entire Patuxent Research Refuge do not meet the minimum criteria for wilderness as identified in Section 2(c) of the Wilderness Act. While there are ecological and historic values on the refuge, these do not, in and of themselves, warrant wilderness recommendation. In summary, Patuxent Research Refuge does not qualify as a Wilderness Study Area, and will not be considered further for wilderness designation in this CCP.

3.4 Actions Common to Alternatives B and C

In addition to the comprehensive framework that was developed and is underway, alternatives B and C identify specific actions to improve facilities and address visitor use issues. Common to alternatives B and C are the following:

- Expand hours for South Tract trails and grounds from dawn to dusk.
- Utilize green technology to update NWVC and modify building structure and grounds to be more wildlife friendly (e.g., window screening to reduce bird strikes).
- Update and modify the Wisdom of Wildness exhibits.
- Construct additional space for environmental education and interpretation classes.
- Collaborate with Fort Meade and other stakeholders on a comprehensive redesign of the shooting ranges on the North Tract, including design and operational protocols, to reduce the deposition and accumulations of lead ammunition into areas D, E, and F, and protect the health of wildlife and safety of users of those areas; assess the quantity and distribution of lead deposition; study the feasibility and implementation of cleanup; and consider range by range renovations (bullet

traps, berm enhancement, “no-sky” shooting stations, etc.) if a comprehensive rehabilitation is not possible. In addition, pursue range renovations to reduce impact zone, recycle spent ammunition, clean up lead, and further implement EPA’s best management practices for outdoor ranges. We will revise the current 5-year special use permit length to a 2-year special use permit. If necessary, we will perform additional NEPA analysis and public involvement to implement any changes in range operation.

- Obtain funding from the DOD for all needed remediation (such as soil sifting, phyto-remediation, phosphate immobilization) excavation of hot spots, and disposal of accumulated lead-based ammunition on soils and streams in areas D, E, F, G, H, I, and J on the North Tract.
- Assess the cause of poor revegetation in former firing range area NT-7 (e.g., result of soil type and soil contamination).

Impoundment Management

Under alternatives B and C, refuge staff along with partners within the Service, MD DNR, and PWRC examined the management of impoundments across the refuge. Table 3-1 compares the management of the impoundments included in that process for all of the alternatives.

Table 3-1. Comparison of Management of Impoundments under each Alternative

<table>
<tr><th>Impoundment</th><th>Alternative A</th><th>Alternative B</th><th>Alternative C</th></tr>
<tr><td>Bailey Bridge Marsh</td><td>Open Water (0.7 acres)</td><td colspan="2">Floodplain Forest and Swamp (0.7 acres)</td></tr>
<tr><td>Bluegill</td><td>Open Water (1.4 acres)</td><td colspan="2">Deciduous, Pine, and Mixed Forest (1.4 acres)</td></tr>
<tr><td>Borrow Pit 1</td><td colspan="2">Open Water (0.5 acres)</td><td>Deciduous, Pine, and Mixed Forest (0.5 acres)</td></tr>
<tr><td>Borrow Pit 2</td><td colspan="2">Open Water (0.7 acres)</td><td>Deciduous, Pine, and Mixed Forest (0.7 acres)</td></tr>
<tr><td rowspan="2">Borrow Pit 3</td><td colspan="2">Depressional Forested Wetland (0.3 acres)</td><td rowspan="2">Deciduous, Pine, and Mixed Forest (0.5 acres)</td></tr>
<tr><td colspan="2">Emergent Wetland (0.2 acres)</td></tr>
<tr><td rowspan="3">Bullfrog</td><td colspan="2">Floodplain Shrub Wetland (1.3 acres)</td><td>Floodplain Forest and Swamp (1.9 acres)</td></tr>
<tr><td colspan="2" rowspan="2">Open Water (5.7 acres)</td><td>Floodplain Shrub Wetland (1.3 acres)</td></tr>
<tr><td>Open Water (3.8 acres)</td></tr>
<tr><td rowspan="2">Clay Pit Pond</td><td colspan="3">Depressional Forested Wetland (0.1 acres)</td></tr>
<tr><td colspan="3">Open Water (0.7 acres)</td></tr>
</table>

Impoundment	Alternative A	Alternative B	Alternative C
Dragonfly Pond	Open Water (0.5 acres)		
Duvall 1	Open Water (15.0 acres)	Floodplain Forest and Swamp (15.0 acres)	Open Water (15.0 acres)
Duvall 2	Floodplain Forest and Swamp (1.0 acres)	Floodplain Forest and Swamp (7.7 acres)	
	Floodplain Shrub Wetland (0.3 acres)		
	Open Water (6.4 acres)		
Fire Control Pond	Depressional Forested Wetland (0.2 acres)		Depressional Forested Wetland (1.6 acres)
	Emergent Wetland (0.5 acres)		
	Open Water (0.8 acres)		
Goose Pond	Open Water (1.2 acres)	Deciduous, Pine, and Mixed Forest (1.2 acres)	
Gravel Pit Pond	Open Water (0.9 acres)		Floodplain Forest and Swamp (0.9)
Hance 1	Floodplain Shrub Wetland (2.7 acres)	Floodplain Forest and Swamp (7.4 acres)	
	Open Water (4.7 acres)		
Hance 2	Emergent Wetland (1.5 acres)	Floodplain Forest and Swamp (6.2 acres)	
	Floodplain Shrub Wetland (1.5 acres)		
	Open Water (3.2 acres)		
Harding Spring Pond	Open Water (1.7 acres)	Deciduous, Pine, and Mixed Forest (1.7 acres)	Open Water (1.7 acres)
Hobbs Pond	Open Water (10.8 acres)	Floodplain Forest and Swamp (10.8 acres)	
Kingfisher	Open Water (4.5 acres)		
Knowles 1	Floodplain Shrub Wetland (4.2 acres)	Floodplain Forest and Swamp (43.2 acres)	
	Open Water (39.0 acres)		
Knowles 2	Floodplain Forest and Swamp (0.2 acres)	Floodplain Forest and Swamp (19.3 acres)	
	Floodplain Shrub Wetland (7.3 acres)		
	Open Water (11.8 acres)		
Knowles 3	Floodplain Forest and Swamp (1.7 acres)	Floodplain Forest and Swamp (15.8 acres)	

Impoundment	Alternative A	Alternative B	Alternative C
	Floodplain Shrub Wetland (6.5 acres)		
	Open Water (7.6 acres)		
Lake Redington	Open Water (35.4 acres)		Deciduous, Pine, and Mixed Forest (35.4 acres)
Mabbott Pond	Deciduous, Pine, and Mixed Forest (4.1 acres)	Open Water (4.1 acres)	Deciduous, Pine, and Mixed Forest (4.1 acres)
Mallard Pond	Floodplain Forest and Swamp (0.4 acres)		Floodplain Forest and Swamp (4.0 acres)
	Open Water (3.7 acres)		
Millrace	Emergent Wetland (40.8 acres)	Floodplain Forest and Swamp (60.0 acres)	
	Floodplain Shrub Wetland (7.4 acres)		
	Open Water (11.8 acres)		
Old Gravel Pit Pond	Open Water (1.4 acres)		
Patuxent Marsh	Emergent Wetland (2.1 acres)	Floodplain Forest and Swamp (13.9 acres)	
	Floodplain Forest and Swamp (10.0 acres)		
	Floodplain Shrub Wetland (0.5 acres)		
	Open Water (1.2 acres)		
Salamander	Depressional Forested Wetland (0.1 acres)		
	Depressional Shrub Wetland (0.2 acres)		
	Open Water (1.3 acres)		
Shafer Farm Pond	Floodplain Forest and Swamp (1.6 acres)		
	Floodplain Shrub Wetland (0.3 acres)		
	Open Water (16.8 acres)		
Shafer Lake	Open Water (24.0 acres)		
Snowden Pond	Open Water (8.3 acres)	Depressional Forested Wetland (8.3 acres)	Open Water (8.3 acres)
Sundew Pond	Open Water (1.6 acres)		
Telegraph Swamp	Depressional Forested Wetland (4.7 acres)		
	Floodplain Forest and Swamp (4.2 acres)		

Under either alternative, we would acquire any necessary permits and approvals and would consult with any appropriate agencies before beginning work to alter any of the wetlands. In general, the work would change the type of wetland and would not result in an overall loss of wetlands (e.g., emergent wetland to forested wetland). Alternatives B and C propose changes to some of the impoundments on the refuge. In each case, we would accomplish the impoundment conversion through opening water control structures, replacing culverts, or other non-construction means of removing barriers to natural hydrologic conditions. Major construction or earth moving activities are not anticipated as a part of these actions.

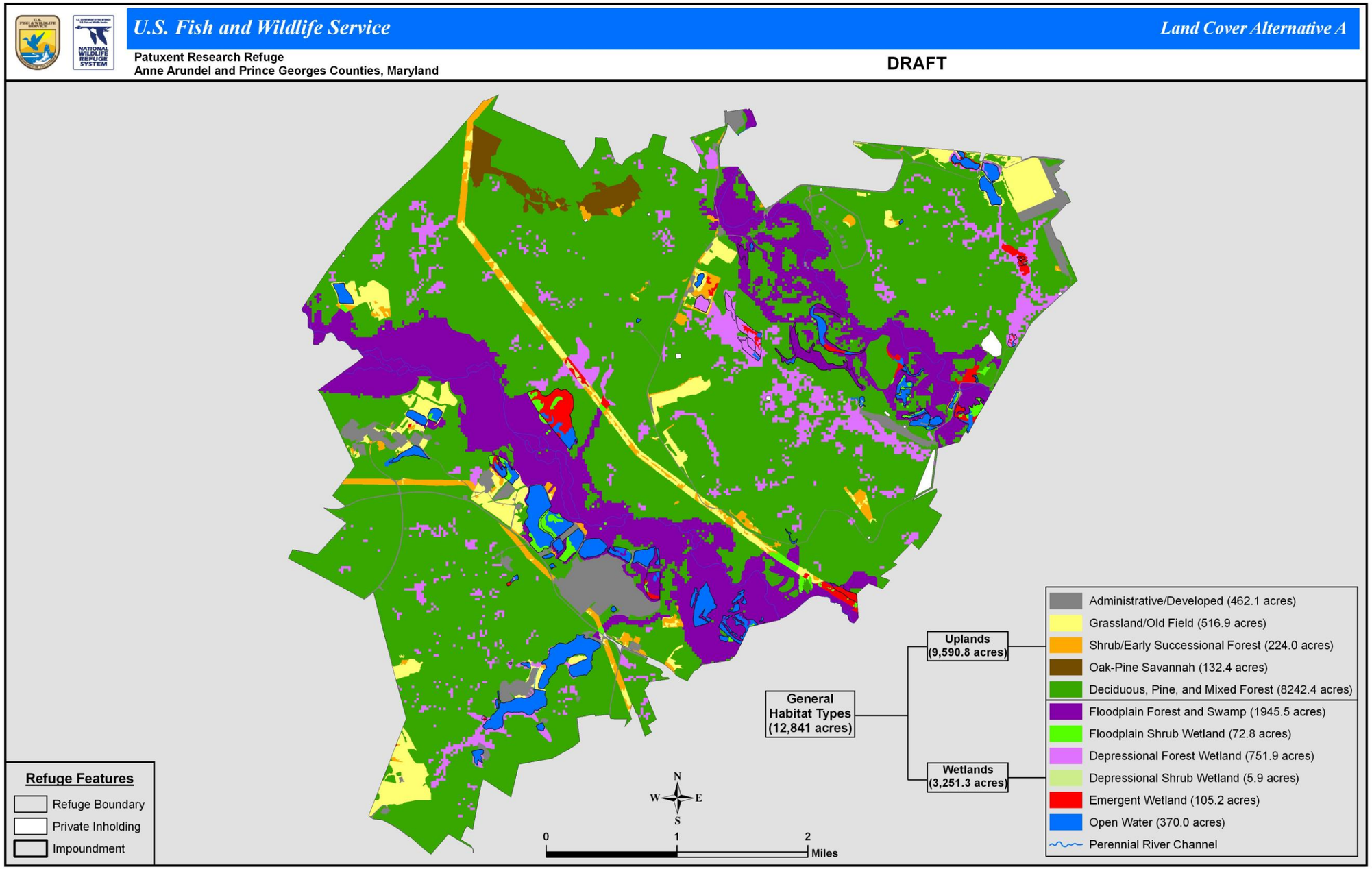
3.5 Alternative A. Current Management (No Action)

In addition to the actions common to all, this alternative describes our current refuge programs on 12,841 acres (5,197 hectares) for habitat management, fish and wildlife inventories and monitoring, administrative infrastructure and staffing, and visitor services. Although we intend this alternative to describe a snapshot in time of current management actions, we include activities we have put in motion but not yet brought to their final, desired state. It highlights predominant management efforts but is not inclusive of every kind of management.

Habitat Management

This chapter presents the existing refuge habitat types and management shown in map 3-1. Under current management, we would continue to manage for and maintain a diversity of habitats, including forests, forested wetlands, pine-oak savannah, grasslands, and scrub-shrub on the refuge. The refuge would continue to maintain 516 acres (209 hectares) of grasslands through seasonal mowing, prescribed fire, and herbicide application, while allowing for a few fields (less than 25 acres total) to revert to forest. The refuge would continue to manage 61 impoundments (total 553 acres/224 hectares.). A variety of early successional habitats, including grassland and scrub-shrub habitats, would be managed for within the 5.5-mile (9 kilometer) BG&E right-of-way and within the 3.5 mile (6 kilometer) Pepco right-of-way. The refuge would continue to manage for 2,775 acres (1,123 hectares) of floodplain forest and associated wetlands, and 8,300 acres (3,359 hectares) of upland forest and their associated wetlands. The refuge would maintain 50 acres (20 hectares) of savannah habitat through fire and mechanical management.

Map 3-1. Existing Habitat



Inventories and Monitoring

Under current management, baseline surveys and monitoring of selected management actions and wildlife populations occur. Ongoing inventories and monitoring include, but are not limited to, breeding bird, whip-poor-will, and woodcock surveys; spring frog and toad call counts; marsh bird, migratory and wintering waterfowl surveys; bat and white-tailed deer surveys; and blue bird and kestrel nest box monitoring. Invasive species monitoring and mapping also occurs. We would continue this level of monitoring and inventory, modifying existing protocols, adding new ones, and dropping old ones as necessary to gain information to inform adaptive management decisions (table 3-2).

As with all of our activities, the degree to which we can conduct monitoring and inventories depends on the availability of resources, including refuge funding and staff, and the contributions of partners and volunteers.

In addition to monitoring conducted by the Service, USGS is involved in multiple long-term monitoring studies that include, but are not limited to, box turtle, salamander, and frog surveys; native bee and pollinator surveys; operation of a banding station during the spring and fall migration periods, and during the nesting season for the monitoring avian productivity and survival program (administered by the Institute for Bird Populations); participation in the annual Bowie Christmas Bird Count, and occasional surveys of breeding bird distribution across the refuge and red-shouldered hawk and blue bird surveys.

Table 3-2. Current Inventory and Monitoring Activities, Listed in Priority Order

Survey	Season	Location	Staff Time Per Survey	Annual Staff Time	Reports	Duration	Coordinator
Waterbird survey	Year-round	All impoundments and wetlands in the refuge	0.10	7.0	Waterbird Census	Since 1989	Refuge volunteer
Waterfowl production monitoring	Breeding season (March to June)	All impoundments and wetlands in the refuge	0.07	5.5	Waterfowl Production Summary	Since 1997	Refuge volunteer
Invasive plant survey	Growing season (April to September)	Refugewide	0.20	12.0		Since 2005	Refuge biologist
Anuran call count survey	Late Feb. to mid-June, every other Thursday	Selected impoundments and wetlands in the refuge	0.07	3.5		Since 1999	Refuge biologist
Woodcock survey	Mid-Feb. to first week of May, every Monday	Selected locations in North Tract of the refuge	0.02	2.0		Since 1999	Refuge volunteer
Aerial detection survey for	Mid-June to early July	Refugewide	0.01	0.5		Since 2000	Forester, US Forest Service

Survey	Season	Location	Staff Time Per Survey	Annual Staff Time	Reports	Duration	Coordinator
gypsy moth							
Vascular plant inventory in North Tract	Growing season (April to September)	North Tract of the Refuge	0.02	2.0		Since Fall 2010	Refuge volunteer
Harvest data collection	Hunting season, Sept. 1 to Jan. 31 + spring turkey hunt	Refugewide	0.05	10.0		Since 1994	Refuge biologist
Acoustic bat survey	Two nights, late June	Refugewide	0.02	2.0		Initiated in 2010	Refuge biologist
Wood duck nest box monitoring	Breeding season (March to June)	All impoundments and wetlands in the refuge	0.01	2.0	Waterfowl Production Summary	Since 1997	Refuge volunteer
Whip-poor-will survey	Second week of May to end of July	Selected locations in North Tract of the refuge	0.02	2.0		Since 2000	Refuge volunteer
Songbird nest box monitoring	April to early August	Refugewide	0.01	1.0		Since 1993	Refuge volunteer
Deer survey	Two evenings in March	Refugewide	0.005	0.5		Since 1999	Refuge biologist
Raptor next box monitoring	April to early August	North and Central Tracts	0.005	0.0		Since 1997	Refuge volunteer

Visitor Services

The refuge has a highly active visitor use program that supports the six priority public uses – environmental education and interpretation, hunting, fishing, and wildlife observation and photography. The following provides a brief summary of visitor use activities that occur on the refuge. The types of visitor service programs we provide would continue under the current management alternative.

The refuge would continue to provide exceptional environmental education and interpretive programs throughout the year. Staff would continue to update environmental education programs to reflect State learning standards, in addition to meeting Washington, DC learning requirements. Volunteers and staff would continue to provide a “meet and greet” to visiting school and youth groups and to provide assistance to those groups during their visit. Teacher, scout, and Jr. Duck Stamp workshops would continue to be offered and would run in accordance with teacher learning requirements.

Interpretation efforts would continue to focus on maintaining existing access points and infrastructure, including trails, parking, and interpretive exhibits, kiosks, printed materials, the refuge Web page, and signage. The refuge would continue to maintain and

utilize outdoor education areas such as the schoolyard habitat and would continue to offer multiple special events and a series of five to six multi-day youth camps. The refuge would continue to provide wildlife observation and photography opportunities, to host the Friend's annual art show and sale and the display of wildlife art work in the Hollingsworth Gallery, and to support the Junior Duck Stamp program and Maryland Black Bear Conservation Stamp program.

The refuge would continue to provide hunting opportunities for upland game, migratory game birds, and white-tailed deer from September through January, or according to State seasons. Select days in April and May would continue for wild turkey hunting. The refuge would also continue to provide fishing opportunities at established sites, in accordance with State regulations.

Refuge Staff and Volunteers - USFWS

The refuge would continue to provide a wide variety of volunteer opportunities and encourage community involvement. Volunteer opportunities cover a vast array of activities and literally keep the refuge going. The refuge would continue to maintain a quality internship program for both biological and environmental education/interpretation internships throughout the year; coordinate volunteer activities between PWRC, MNHA, and the refuge; and promote community relations and recruit volunteers through outreach.

Refuge Administration

In this alternative, refuge staffing would remain at 25 positions for the refuge, all of which would be stationed on the refuge. Refuge staff are spread throughout the refuge with the majority of visitor services staff stationed at NWVC and at the North Tract Visitor Contact Station. Administrative staff, refuge law enforcement, maintenance, and biological staff are stationed on the Central Tract campus area of the refuge. We would maintain our present visitor services facilities as funds and staffing permit, but would construct no new ones.

In the discussion that follows, we describe in detail the goals, objectives, and strategies that we would implement under alternative A.

Existing visitor services infrastructure and opportunities are presented in maps 2-7 and 2-8.

Goals, Objectives, and Strategies under Alternative A

Goal 1: Maintain and actively promote Patuxent Research Refuge as an "outdoor laboratory," providing a diversity of wildlife and natural resource research opportunities on the refuge in such areas as landscape conservation, habitat fragmentation, climate change, and other emerging issues, as well as the more traditional types of wildlife research, including inventory and monitoring techniques, land management, and understanding ecological processes. Research that supports the overall Service mission, and evaluates the best methods for protecting natural resources throughout the Refuge System and other land management agencies will be a priority.

Objective 1.1 Inventory and Monitoring

Conduct high-priority inventory and monitoring (survey) activities that evaluate resource management and public use activities to facilitate adaptive management. Patuxent Research Refuge staff and USGS staff developed a definition of priority research in an MOA for joint management issues. Priority research addresses important management issues and demonstrates proper wildlife management techniques.

Strategies

- Implement the draft inventory and monitoring plan developed for the refuge (22 surveys in fiscal year 2011).

Monitoring Elements

- Track the number of inventory and monitoring surveys conducted annually.
- Update the inventory and monitoring plan as additional resources of concern may be identified.

Rationale

Inventorying and monitoring of refuge resources will allow us to know if key wildlife and habitat objectives are being met. Data derived from inventory and monitoring efforts will be used to assess past management actions and potentially drive management actions to be taken in both the short and the long-term. Inventory and monitoring efforts may change, as the need to know about certain species may change.

Some long-term inventory and monitoring activities may be continued to provide a continuity of data on various species (e.g., waterfowl, waterbirds, etc.) over time, particularly as the data may pertain to climate change and other landscape-scale impacts.

Objective 1.2 Research and Scientific Assessments (Local, National, and International)

Facilitate research of a local, national, and international nature that benefits wildlife on refuge lands as well as all other natural areas. Facilitate scientific assessments to provide baseline information to expand knowledge regarding landscape-scale natural resource issues and to determine the status of onsite refuge resources to better inform resource management decisions.

Strategies

Continue to:

- Implement, conduct, and support wildlife/natural resource-related research projects from a broad range of researchers including USGS, other Federal agencies, universities, agencies of the State of Maryland, and independent researchers (33 studies in fiscal year 2011).
- Provide a secure land base for captive animal colonies, endangered species propagation, contaminant studies, etc.

Monitoring Elements

- Track the number of special use permits issued annually for research purposes.
- Track the number of multi-year research projects authorized over time.
- Track the number of reports, proceedings, and results published annually.

Rationale

This objective goes to the heart of why the refuge exists. The refuge was initially established in 1936 to serve as a wildlife experiment station and has since served as the site of multiple nationally and internationally significant breakthroughs in wildlife science. The PWRC has been a leading international research institution for wildlife and applied environmental research located on the refuge since its inception. The partnership, with the refuge providing the "outdoor lab" and secure locations for research and PWRC providing the research capability has been recognized internationally for its contributions to wildlife science.

The synergy achieved by allowing multiple partners and multiple entities and agencies to conduct their research essentially side by side is immeasurable. Facilitating multiple research opportunities for a variety of parties should remain paramount at Patuxent Research Refuge for the foreseeable future.

Goal 2: Protect, maintain, and restore, where possible, the biological integrity, diversity, and environmental health of forested ecological communities to provide habitat for species of conservation concern, including migratory birds, mammals, amphibians, reptiles, and invertebrates.

Objective 2.1 Floodplain Forest and Swamp, Depressional Forest, and Depressional Shrub Wetlands

Maintain the biological integrity of 1,920 (777 hectares) of native floodplain forest and shrub and the 729 acres (295 hectares) of depressional forest and shrub with 80 percent closed canopy and less than 10 percent invasive nonnative species along the Patuxent and Little Patuxent Rivers. Floodplain and depressional forest communities should be dominated by native riparian species common for this area, possess a well-developed under- and mid-story of native shrubs or recruiting trees, and provide functioning ecosystems and high water quality for breeding, migratory, and wintering habitat for bird species of conservation concern, including prothonotary warbler, Kentucky warbler, Louisiana waterthrush, rusty blackbird, and other forest-dependent species such as wood

frog, spotted turtle, eastern forest bats, and native insects. Total acreage under this alternative is 2,649.5 acres (1,072 hectares).

Strategies

- Control and reduce nonnative invasive species annually by using chemical, biological, or mechanical methods to increase native plant species diversity and richness.
- Prevent new invasive species from becoming established by utilizing early detection rapid response techniques to address invasive species populations through the appropriate control measures.
- Evaluate and adjust the white-tailed deer hunt program as necessary to meet native vegetation objectives. Coordinate management efforts with the MD DNR deer management program.

Monitoring Elements

- Conduct appropriate monitoring and survey programs to measure success with respect to objectives. The results may trigger adjustments to management strategies, or a reevaluation or refinement of objectives. Examples of monitoring or surveys may include:
    - Monitor invasive species prevention and control efforts through a combination of plant identification, inventories, and mapping.
    - Continue landbird surveys and migration counts to evaluate achievement of the objective for breeding and migrating birds.

Rationale

This habitat supports the greatest diversity of species within the refuge. Fifty-four species of invertebrates, birds, reptiles, and amphibians listed as species of greatest conservation need in the Maryland Wildlife Diversity Conservation Plan are found in the refuge's floodplain forests. Twenty-eight are priority bird species listed in either the BCR 30 or PIF 44 implementation plans.

These floodplain forests provide both nesting and migration habitat for bird species listed by regional conservation plans, including BCR 30 Implementation Plan, PIF 44 Bird Conservation Plan, the Maryland Wildlife Diversity Conservation Plan, and international plans like Saving Our Shared Birds and PIF Tri-National Vision for Landbird Conservation. High-priority nesting passerine birds common to these plans includes Acadian flycatcher, cerulean warbler, Kentucky warbler, Louisiana waterthrush, and prothonotary warbler. Other bird species benefiting from provision of this habitat types include migrating and nesting passerines such as Bicknell's thrush (*Catharus bicknelli*), black-and-white warbler (*Mniotilta varia*), black-billed cuckoo (*Coccyzus erythropthalmus*), blackburnian warbler (*Dendroica fusca*), black-throated blue warbler (*Dendroica caerulescens*), black-throated green warbler (*Dendroica virens*), blue-headed vireo (*Vireo solitaries*), broad-winged hawk (*Buteo platypterus*), brown creeper (*Certhia americana*), Canada warbler (*Wilsonia canadensis*), golden-crowned kinglet (*Regulus satrapa*), hairy woodpecker (*Picoides villosus*), hermit thrush (*Catharus guttatus*),

hooded warbler (*Wilsonia citrine*), magnolia warbler (*Dendroica magnolia*), northern parula (*Parula americana*), pileated woodpecker (*Dryocopus pileatus*), red-eyed vireo (*Vireo olivaceus*), red-headed woodpecker (*Melanerpes erythrocephalus*), red-shouldered hawk (*Buteo lineatus*), scarlet tanager, veery (*Catharus fuscescens*), wood thrush, worm-eating warbler, and yellow-throated vireo.

Pileated Woodpecker – Charles Warren/NBII

The refuge contains the largest forested block in Maryland's Western Coastal Plain, and the Washington-Baltimore Corridor and is surrounded by a heavily urbanized landscape. Floodplain forest communities have a well-developed and variable forest composition and structure with canopy and sub-canopy trees, understory shrubs, and a diverse ground cover. Frequency, duration, and severity of flooding vary seasonally and yearly, contributing to a rich diversity of species, vertical and horizontal structure, and ground cover, along with forest age, soils, elevation, slope, and disturbance frequency. Isolated local weather events impact small areas or individual trees and result in downed trees, snags, and broken branches.

Within this forest, several important small forested wetlands are found. Located on the broad flats between drainage streams, these wetlands are small, mostly closed canopy upland depression swamps. Magnolia bogs, a unique seepage wetland complex, are one example of the scattered, small (less than 25 acres), nontidal shrub wetlands found on the refuge. Small (less than 0.5 acre) vernal pools occur in low areas or as depressions or isolated floodwaters, backwaters of old beaver impoundments, old sinkholes, depressions created by military activity, or as perched spring or seep-fed basins.

Objective 2.2 Upland Deciduous, Pine, and Mixed Forest and Associated Wetlands
Maintain 8,242 acres (3,335 hectares) of native, mature upland forest communities with 80 percent closed canopy and less than 10 percent invasive species containing a diverse age structure and developed understory and midstory to provide breeding and migration winter habitat for whip-poor-will, scarlet tanager, cerulean warbler, eastern wood-pewee, wood thrush, worm-eating warbler, and yellow-throated vireo, and to benefit other forest-dependent species such as eastern forest bat (*Vespadelus pumilus*), eastern spadefoot toad, eastern chorus frog, eastern box turtle, hog-nosed snake, and native insects. Upland forest communities should be dominated by native tree species common to this area, such as American beech, hickories, tulip poplar, dogwood, persimmon (*Diospyros virginiana*), and upland oaks (northern and southern red oak, white oak, blackjack, post oak), and possess diverse shrub and herbaceous plant associations.

Strategies

- Control and reduce nonnative invasive species annually by using chemical, biological, or mechanical methods to increase native plant species diversity and richness.
- Prevent new invasive species from becoming established by utilizing early detection rapid response techniques to address invasive species populations through the appropriate control measure.
- Evaluate and adjust the white-tailed deer hunt program as necessary to meet native vegetation objectives. Coordinate management efforts with the MD DNR deer management program.

Monitoring Elements

- Conduct appropriate monitoring and survey programs to measure success with respect to objectives. The results may trigger adjustments to management strategies, or a reevaluation or refinement of objectives. Examples of monitoring or surveys may include:
    - Monitor invasive species prevention and control efforts through a combination of plant identification, inventories and mapping.
    - Continue landbird surveys and migration counts to evaluate achievement of the objective for breeding and migrating birds.

Rationale

This habitat supports the second highest diversity of species within the refuge. Fifty species of mammals, birds, reptiles, and amphibians listed as species of greatest conservation need in the Maryland Wildlife Diversity Conservation Plan are found in the refuge's upland forests. Forty-one are priority bird species listed by regional conservation plans, including the BCR 30 Implementation Plan, PIF 44 Bird Conservation Plan, and the Maryland Wildlife Diversity Conservation Plan, as well as international plans like Saving Our Shared Birds and Partners in Flight Tri-National Vision for Landbird Conservation. In addition to the priority nesting birds, other species that will benefit from the preservation of large blocks of such forest include migrating or nesting birds such as American redstart (*Setophaga ruticilla*), barred owl (*Strix varia*), Bicknell's thrush, black-and-white warbler, black-billed cuckoo, black-throated blue warbler, black-throated green warbler, broad-winged hawk, brown creeper, Canada warbler, dark-eyed junco (*Junco hyemalis*), eastern towhee, hairy woodpecker, hooded warbler, Kentucky warbler, least flycatcher (*Empidonax minimus*), northern parula, ovenbird (*Seiurus aurocapillus*), pileated woodpecker, red-eyed vireo, red-headed woodpecker, red-shouldered hawk, sharp-shinned hawk (*Accipiter striatus*), summer tanager (*Piranga rubra*), and veery.

Refuge upland forests are comprised of mesic deciduous and dry oak-pine forests. Mesic deciduous forests typically are an assortment of hardwoods in moist habitats, while dry oak-pine forests typically are found on more droughty, infertile soils. Most of the refuge's upland forests are mesic deciduous and many of the current pine forests are early successional mesic deciduous forests and reflect past timber management practices.

Upland forest communities have a well-developed and variable forest composition and structure with canopy and sub-canopy trees, understory shrubs, and a diverse ground cover. A rich diversity of species, vertical and horizontal structure, and ground cover result from age, soils, elevation, and slope. Isolated local weather events impact small areas or individual trees and result in downed trees, snags, and broken branches.

Within this forest, several important small forested wetlands are found. Located on the broad flats between drainage streams, these wetlands are small, mostly closed canopy upland depression swamps. Magnolia bogs, a unique seepage wetland complex, are one example of the scattered, small (less than 25 acre), nontidal shrub wetlands found on the refuge. Small (less than 0.5 acre) vernal pools and sphagnum bogs occur in low areas or as depressions or as isolated floodwaters, backwaters of old beaver impoundments, old sinkholes, depressions created by military activity, or as perched spring or seep-fed basins.

Objective 2.3 Oak-Pine Savannah

Continue to maintain 50 acres (20 hectares) of savannah habitat consisting of an open canopy dominated by native hardwoods (primarily oaks), and an understory dominated by native grasses such as broom sedge (*Carex scoparia*), little bluestem, and forbs such as asters and other composites for the benefit of rare darkling and tiger beetle species, upland chorus frog, native bees, Indian skipper (*Hesperia sassacus*) and other pollinators, and sandy barren plant communities.

Strategies

- Mechanically thin dense and stagnating pine stands to open up the understory and permit light penetration for germination of understory species associated with this habitat type and to release residual trees.
- Conduct prescribed fires to reduce debris from thinning and to maintain the open and early succession understory.
- Monitor and control invasive plant species such mile-a-minute weed, tree of heaven, sweetgum, black locust, and wisteria that are poised to overtake newly opened areas.

Rationale

In 1995, Warren E. Steiner, Jr., an entomologist with the Smithsonian Institution's Museum of Natural History, discovered sandy barrens on the North Tract. These small narrow barrens or deserts are located on deep sandy soils primarily on the northeastern side of the Patuxent River where the prevailing winds have deposited sand from marine and alluvial deposits exposed and reworked by the river (Droege et al. 2009). Since 1995, Steiner has identified 64 species of rare darkling beetles in the family *Trenebrionidae* in these sandy barrens. This diversity of species represents a distinct assemblage not found in any other habitat. In some cases, Patuxent Research Refuge represents the only known areas where some of these species can be found between the New Jersey pine barrens and the Carolina sandhills. The area also contains rare plants associated with this community

type. In 1996, USGS biologist Sam Droege also identified one of the few populations of chorus frog in this area. This species also depends on open, early succession habitat.

In 2001, Steiner, Droege and biologist Holly Obrecht, became concerned that increasing dominance of Virginia pine would shade out the sandy dry openings and threaten the survival of these specialized plants and insects unless action was taken to substantially reduce the pine canopy (Obrecht 2005 unpublished and Droege 1996 unpublished). An east-west orientation is recommended to capture the maximum amount of sunshine hours with least amount of shading cast by adjacent tall forest. A narrow, north-south orientation would result in long shadows cast by rising and setting sun angles for extended periods of time onto the savannah restoration acres, creating favorable growing conditions for competing forb and tree species, such as sweetgum, tulip poplar, and red maple.

Goal 3: Protect, maintain, and restore, where possible, the biological integrity, diversity, and environmental health of refuge aquatic habitats, located within the Patuxent, Little Patuxent, and Anacostia River watersheds, and impoundments, to provide habitat for species of conservation concern, including fish, invertebrates, and plants.

Objective 3.1 Coastal Plain River and Coastal Plain Stream Habitats
Maintain and protect the quality aquatic habitat of the approximately 68 riparian miles (109 kilometers) of Patuxent, Little Patuxent, and Anacostia River watersheds within the refuge, as well as their associated perennial streams, to provide spawning, nursery, foraging, and cover habitat for aquatic resources of conservation concern such as American brook lamprey, American eel, American and hickory shad, alewife, blueback herring, comely shiner, glassy darter, stripeback darter, and the State-endangered triangle floater. Provide quality foraging habitat for eastern forest bats, spotted turtle, and insectivorous birds such as prothonotary warbler and Louisiana waterthrush.

<u>Strategies</u>

- Provide opportunities for water sampling to occur via MD DNR and Anne Arundel and Prince George's Counties.

<u>Monitoring Elements</u>

- Conduct appropriate monitoring and survey programs to measure success with respect to objectives. The results may trigger adjustments to management strategies, or a reevaluation or a refinement of objectives. Examples of monitoring or surveys may include:
    - Monitor invasive species prevention and control efforts through identification, inventories, and mapping.

<u>Rationale</u>
Both stream and river habitat provides spawning, nursery, migration, and year-round habitat to many fish species that are rare, threatened, or endangered in Maryland or important economically and recreationally. Thirteen species of fish and four mussels

listed as species of greatest conservation need in the Maryland Wildlife Diversity Conservation Plan are found in the refuge's coastal plain river and stream habitat. Two species are classified as endangered, three as threatened, and one as rare by Maryland. Five fish species are interjurisdictional or trust species. High-priority fish include American brook lamprey, American eel, American and hickory shad, blueback herring, comely shiner, glassy darter, and stripeback darter.

Duane Raver/USFWS

Blueback Herring

An overall stream health assessment for the refuge has not been completed. Assessments of the refuge's stream health surveys conducted on the North Tract found the benthic index of biological integrity moderately to severely impaired. Forty-seven percent of the sites sampled have pH levels associated with fish stress and one-third had stream stability issues (Anne Arundel County 2009).

The environmental quality of coastal plain streams in Maryland is fair, based on a combined biotic index utilizing fish and benthic macroinvertebrate communities as indicators (MD DNR 2005c). Forty-eight percent were severely degraded and only twenty percent were considered minimally impaired. Fifty-four percent of fish species are estimated to be lost from Maryland's coastal plain stream habitats (MD DNR 2005b). Coastal plain rivers are impacted by the degradation of streams and sedimentation and nitrogen enrichment from agriculture and urbanization. Dams and other stream blockages reduce upstream access to spawning habitats by migratory fishes. Other studies have shown degraded water quality from agriculture and urbanization in the Little Patuxent and Patuxent River watersheds (MD DNR 2001, Howard County 2002). Neither the Little Patuxent or Patuxent River meets water quality or other natural resource goals and both are classified as priority 1 systems (Howard County 2002).

The National Fish Habitat Action Plan outlines management strategies to guide aquatic habitat management on the refuge. Restoration efforts by local, county, State, and regional organizations within the Little Patuxent and Patuxent River watersheds support components of strategy 2 (restoring natural flow and habitat variability to streams and rivers). Removal of impoundments and other fish barriers along the refuge's tributary streams supports strategy 3 (reconnecting fragmented river systems and spawning/nursery habitats).

The refuge must embrace an active role in coordination and technical assistance of watershed efforts to improve aquatic health and fisheries on the refuge and within the watersheds. The geographic location midway between the Piedmont and Coastal Plain Provinces and the refuge's wildlife and research mission are ideal for this role.

Coastal plain rivers and streams are low gradient (less than one percent). Streams contain runs, glides, pools, and gravel riffles with silt, sand, gravel, and small cobble substrates.

Rivers are pool/glide systems with sand and silt substrates. Woody debris and aquatic vegetation provide habitat for fishes and stream insects, and control stream bank erosion. Exchange of organic material and refuge for aquatic species during periods of high flows is provided by river connectivity to the adjacent floodplain (MDNR 2005).

In the spring of 2011, biological stream monitoring was conducted on the some streams on the refuge within Anne Arundel County. This included sampling of the benthic invertebrates and physical attributes and water chemistry of the streams and abiotic parameters of catchment areas in 16 random sites of two primary sampling units of the Big and Little Patuxent Rivers on the refuge. Interestingly, seven sites had depressed biological stream communities relative to available habitat quality and the least impaired communities were found in stream types typically associated with unstable bank conditions. This suggests that there are point source inputs being channeled to the streams. Over one-third of the sites had instability problems associated with their stream type, and this could be significantly larger since extensive portions of the North Tract were not sampled at all. All sites sampled showed some pH depression. The refuge needs to identify sources of impairment and investigate upstream drainage areas contributing contaminants from agricultural and landscaping activities. Heavy metal detection would also be an important investigation for North Tract streams within the surface danger and impacts zones of the firing ranges. Biological communities may still be trying to recover and reestablish from past military and past agricultural practices, as these have been shown to have severe impacts on benthic macroinvertebrates elsewhere (Victoria 2009).

Objective 3.2 Impoundments of Open Water, Emergent, Shrub, and Forested Wetlands

Manage the current 553 acres (224 hectares) in 65 impoundments of open water, emergent, shrub and forest wetlands, or green tree reservoirs to provide habitat for migratory bird species of conservation concern, including American black duck, solitary sandpiper (*Tringa solitaria*), green heron (*Butorides virescens*), greater (*Tringa melanoleuca*) and lesser yellowlegs (*Tringa flavipes*), and also to benefit other species of conservation concern, such as least bittern and elfin skimmer, and aquatic reptiles and amphibians.

Strategies

- Provide a mix of shallow water (less than 6 inches water depth) and mudflats to provide foraging habitat from mid-April to mid-May for migrating shorebirds and wading birds.
- Maintain approximately 50 percent open water and floating vegetation coverage, initiating draw down by June 21 when floating vegetation coverage of pond lily, water shield, and spatter dock exceeds 50 percent, then re-flooding to 6 to 12 inches depth immediately after first frost or by the end of October.
- Provide seeds and roots of red-rooted sedge (*Cyperus erythrorhizos*), barnyard grass (*Echinochloa spp*.), and smartweed (*Polygonum lapathifolium*) for waterfowl during peak migration in mid-November by re-flooding to 6 to 12 inches of water depth immediately after first frost or by the end of October.

- Provide forested wetlands with a mostly closed to semi-open canopy along the reaches of gently sloping streams with a vegetation mosaic of small shrubs and trees including black gum, swamp azalea (*Rhododendron viscosum*), sweetbay magnolia, highbush blueberry (*Vaccinium corymbosum*), and dwarf huckleberry (*Gaylussacia dumosa*) with open, sedge, and graminoid-dominated patches.
- Manage Patuxent Pond and the Green Tree Reservoir at the wildlife viewing area as green tree reservoirs by initiating draw down annually from leaf out in April to full leaf drop in November, then allowing refill to provide wintering waterfowl habitat.
- Control and reduce nonnative invasive species annually using chemical, biological, or mechanical methods to increase native plant species diversity and richness.
- Prevent new invasive species from becoming established by utilizing early detection rapid response techniques to address invasive species populations through the appropriate control measure.

Monitoring Elements

- Conduct appropriate monitoring and survey programs to measure success with respect to objectives. The results may trigger adjustments to management strategies, or a reevaluation or a refinement of objectives. Examples of monitoring or surveys may include:
    - Monitor effects of invasive species prevention and control efforts through a combination of plant identification, inventories, and mapping.
    - Monitor native plant community response to management actions.
    - Conduct inventories and monitoring of shorebird, waterfowl, waterbird, and wading bird use and abundance within the impoundments. Utilize data to document the ongoing effectiveness of water level management activities and adjust management protocols as necessary.

Rationale

Although creating habitat for research and wildlife purposes was the original objective for many of the impoundments, impacts to hydrology, stream flow, floodplain function, fisheries, forested wetlands, and other resources were not envisioned or assessed in the past. The biological contribution of these impoundments to the refuge's goals and objectives is unclear. The Refuge Improvement Act and the Biological Integrity Policy requires the Service to evaluate impoundment management and its contribution toward achieving the refuge's goals and objectives.

Waterbird-use data indicate the refuge's impoundments provide limited migration and nesting habitat, although they receive regular use during winter by ring-necked ducks (*Aythya collaris*), hooded mergansers (*Lophodytes cucullatus*), and occasional other species. Some bird species listed as species of greatest conservation need in the Maryland Wildlife Diversity Conservation Plan or as priority bird species in the BCR 30 and PIF 44 implementation plans do occur but in small numbers.

Canada geese comprised 54 percent of the mean 249,233 annual waterfowl-use days during 2007 to 2009. Wood duck (*Aix sponsa*), ring-necked duck, and mallard were 39 percent and American black duck 3 percent. In the same period, an average of 245 Canada geese and 393 wood ducks were produced annually. Production by other species was negligible. Canada geese production days, and probably a significant portion of the use days, consist of nuisance, resident Canada geese flocks and not the migrating Atlantic coast population of management concern.

Shorebird and wading bird-use days were low during the same period (3,455 and 5,202, respectively). Killdeer comprised 68 percent and common snipe (*Gallinago delicata*), solitary sandpiper (*Tringa solitaria*), and spotted sandpipers (*Actitis macularius*) were 24 percent of the shorebird use. Great blue heron (*Ardea herodias*) comprised 62 percent and green heron and great egret (*Ardea alba*) accounted for 37 percent of the wading bird-use days. Use by other species was negligible.

Objective 3.3 Emergent Wetlands (Freshwater, Nontidal)
Maintain the biological integrity of approximately 42 acres (18 hectares) of naturally occurring freshwater emergent wetlands and open bogs in native vegetation such narrowleaf cattail (*Typha angustifolia*), sedges, wetland grasses, pipeworts, arrow arum, pickerelweed, bur-reeds, arrowheads, smartweeds, spike-rushes (*Elocharis obicis*), asters and composites, and more persistent species such as swamp rose (*Hibiscus moscheutos*) and hibiscus to benefit priority wetland bird species of concern, such as American black duck and least bittern.

Strategies

- Monitor and control for invasive plant species.
- Observe best management practices for riparian zones to enhance water quality and flood management, such as maintaining at least 300 feet (91 meters) of forested buffer for soil erosion prevention measures.
- Promote and encourage growth of native tree and shrub species along riparian zone of emergent wetlands.

Mark Wilson

American Black Duck

Monitoring Elements

- Survey and map invasive species, particularly those that are stand- replacing and have the potential to alter the hydrology, such as phragmites.

Rationale

Emergent freshwater wetlands are the most productive habitat types, the source of the most abundant primary production, where plants convert energy into biomass that can be consumed or used by animals and other life supporting functions. Primary production in inland marshes is estimated conservatively at about 1,000 grams per square meter per year (Mitch and Gosselink 1993). Relatively few plants are adapted to complete submersion of their root systems in water, yet the high conversion rate by these plants contributes to important ecosystem functions such as filtering nutrients, providing clean water, and taking up carbon. The interspersion of emergent plant communities and small pockets of open water is prime habitat for spawning fish, ephemeral insects, breeding, migrating, and wintering waterfowl and wading birds, aquatic turtles, and insects with close associations with their host plants. The plankton and submerged phyto-plankton are important food sources for small minnows and other organisms, which in turn are prey for larger fish. The varying depths in such wetlands provide a diversity of annual and perennial seed producing plants such as wild rice, water millet, duckweed, duck potato, arrow arum, pickerel weed, hibiscus, buttonbush, marsh marigold (*Caltha palustris*), marsh milkweed (*Asclepias incarnata*), and polygonum species. These are essential food sources for many species of wetland birds. Emergent wetlands, when juxtaposed with forest habitats, are vital foraging grounds for native bats and aerial-foraging insectivorous birds (Mitch and Gosselink 1993).

Goal 4: Manage refuge non-forested upland communities to provide ecological structure, composition, and function to support native plants and wildlife, including species of conservation concern. Where appropriate, restore the biological integrity and diversity of these habitats.

Objective 4.1 Shrub and Early Succession Forest Habitat

Continue to provide up to 224 acres (99 hectares) currently in shrub and early succession forest habitat in the 5.5-mile (9-kilometer) BG&E powerline right-of-way and up to 70 acres (28 hectares) in the 3.5-mile (6-kilometer) Pepco powerline right-of-way and in scattered pockets and small fields throughout the refuge. Shrub habitat will be maintained in short-stature (less than 10 feet), moderate-density (50 to 75 percent) woody shrub and early succession herbaceous cover comprised of berry, seed, nectar-producing native species for breeding bird species of conservation concern, such as brown thrasher, field sparrow (*Spizella pusilla*), prairie warbler, eastern towhee, yellow-breasted chat (*Icteria virens*), and gray catbird; migratory and wintering habitat for a variety of bird species; and foraging habitat for eastern forest bats, whip-poor-will, native pollinators and other insects.

Strategies

- Maintain vegetation to heights less than 10 feet above ground level in the area of maximum conductor sag between towers. Prune vegetation and apply herbicides to tall-growing tree species encroaching in the right-of-way.
- Provide berry-producing trees, shrubs, and vines, such as dogwood, viburnums, Amelanchier, hollies, blueberry, sumac, and grape for migrating birds, nectaries,

and overwintering cover for pollinators, especially lepidopterans (moth and butterfly species) for whip-poor-will and bats.

- Encourage native herbaceous species such as milkweeds, asters and other composites, and broomsedge and other native grasses.
- On moist soils, encourage early succession trees and shrubs such as alder, dogwood, spicebush, sassafrass, and viburnums for feeding, daytime cover, and nesting for American woodcock.
- Control and reduce nonnative invasive species by at least 10 percent utilizing chemical, biological, or mechanical methods to increase native plant species diversity and richness. Prevent new invasive species from becoming established by utilizing early detection rapid response techniques to address invasive species populations through the appropriate control measure.
- Continue the successful partnership with BG&E and Pepco and encourage similar management by other landowners.

USFWS

Powerline Right-of-way on the Refuge

Monitoring Elements

- Conduct appropriate monitoring and survey programs to measure success with respect to objectives. The results may trigger adjustments to management strategies, or a reevaluation or a refinement of objectives. Examples of monitoring or surveys may include:
    - Monitor effects of invasive species prevention and control efforts through a combination of plant identification, inventories, and mapping.

- Conduct landbird surveys and migration surveys to evaluate achievement of the objective for breeding and migrating birds.
- Conduct surveys for whip-poor-will, woodcock, bat, and lepidopterans and other insects to evaluate contribution of edge habitat in supporting these species.

Rationale

Nine species of birds listed as species of greatest conservation need in the Maryland Wildlife Diversity Conservation Plan are found in the refuge's shrub habitats. Six are priority bird species listed in either the BCR 30 or PIF 44 implementation plans.

Bats and whip-poor-will are forest edge-dependent species, relying on increased aerial insect abundance afforded by a diverse shrub, herbaceous, and grass community. Such areas also provide foraging habitat for migrating swallows and purple martins, and foraging and resting habitat for thousands of migrating songbirds. The refuge possesses the most significant known population of whip-poor-will in Central Maryland. The American woodcock also benefits from early succession habitat, particularly in the form of early succession forest on moist soils where there is a higher abundance of food (primarily earthworms) in close proximity to forest cover.

Historically, early successional forest was estimated to be 5 percent of the land area in Maryland (Frieswyk 2001). The refuge's scrub-shrub habitat is early successional forest dominated by shrubs and small trees. Shrub occurs as managed powerline right-of-ways, succession on lands cleared of timber, and natural forest canopy openings from natural disturbances. Natural disturbances vary over time and result from wind, ice storms, fire, beavers, tree senescence, insect outbreaks, and pathogens.

Objective 4.2 Grasslands and Old Fields

Maintain existing 517 acres (209 hectares) of grassland dominated by 70 percent native cool and warm season grasses, up to 25 percent forbs, and up to 5 percent shrub cover to provide breeding, migrating, and winter cover and forage for grassland bird species of conservation concern, including eastern meadowlark, eastern kingbird, field sparrow, savannah sparrow, swamp sparrow, and monarch butterfly and grasshopper sparrow, and to benefit native pollinating insects.

Strategies

- Mow, burn, and use selective herbicide treatments to set back succession and improve percentage coverage of grass.
- Provide open habitat adjacent to nearby perches for foraging passerine birds, including the eastern kingbird.
- The mowing regime staggers a three to five year rotation to provide a variety of old field habitat and to ensure overwintering cover for native insects, small mammals, and birds. Mow on August 15 or later to avoid injury to ground nesting birds.

- Control and reduce nonnative invasive species annually by utilizing chemical, biological, or mechanical methods to increase native plant species diversity and richness.
- Encourage native stands of milkweed, asters, and other composite flowering plants for pollinating insects.
- Prevent new invasive species from becoming established by utilizing early detection rapid response techniques to address invasive species populations through the appropriate control measure.

Monitoring Elements

- Conduct appropriate monitoring and survey programs to measure success with respect to objectives. The results may trigger adjustments to management strategies, or a reevaluation or a refinement of objectives. Examples of monitoring or surveys may include:
    - Monitor effects of invasive species prevention and control efforts through a combination of plant identification, inventories, and mapping.
    - Evaluate achievement of the objective for migrating birds. Continue to conduct landbird surveys and migration counts. Include habitat measurements in those surveys.
    - Evaluate grasslands for grassland-dependent songbirds, conduct periodic vegetation surveys at landbird point counts for height, density measurements, and species composition or grass-forb ratio.
    - Conduct baseline inventories of lepidopterans and other pollinator and insect species to determine species richness, to assess the value of refuge grassland habitat for rare species, and to inform management options commensurate with bird objectives.

Rationale

Although significant grasslands occurred in northern Maryland and nearby Pennsylvania (Mayre 1920, Mayre 1955, MD DNR 2005a), it is unlikely that grasslands occurred to any extent in the coastal plain. A review of natural disturbances conducted in the Mid-Atlantic Coastal Plain suggests that large-scale disturbances were extremely rare (Nature Conservancy 2002) and it's unlikely that Native Americans maintained grassland on the refuge.

The refuge's grasslands consist of 95 parcels totaling 515 to 535 acres (208 to 217 hectares) of mowed agricultural fields and abandoned military ranges/administrative areas that would become forested habitat, if not mowed. Only six mowed fields are greater than 25 acres (10 hectares), a minimum size recommended for nesting obligate grassland birds that are area-and configuration-sensitive, such as the grasshopper sparrow. Those fields are linear in shape, greatly reducing their value to breeding obligate grasslands birds. Forty-nine parcels are less than five acres. These small grassland parcels increase forest hard edge, reduce the value of adjacent forests to forest dwelling birds by fragmenting the forest, and have limited potential to host breeding birds, although they

likely receive use during the non-breeding period by a variety of bird species . These small and scattered grasslands are not significant in a landscape perspective. Small openings in proximity to forest are valuable for whip-poor-will, bats, and box turtles.

Although the refuge's grassland habitat provide limited value to breeding grassland obligate species, they benefit breeding species that are more tolerant of old field succession, such as field sparrow, dickcissel, yellow-breasted chat, indigo bunting, eastern kingbird, orchard oriole, blue grosbeak (*Passerina caerulea*), American woodcock, northern bobwhite (*Colinus virginianus*), and wild turkey, as well as wintering species such as swamp sparrow, song sparrow, and short-term migratory visitors such as bobolink. Some bird species listed as species of greatest conservation need in the Maryland Wildlife Diversity Conservation Plan or as priority bird species in the BCR 30 and PIF 44 implementation plans may occur in small numbers but specific, intensive surveys to detect these species have been limited in recent decades.

Goal 5: Provide high-quality recreation, environmental education, and interpretive programs to enhance refuge visitors' understanding and appreciation of fish and wildlife conservation.

Objective 5.1 Wildlife Observation and Photography
Provide high-quality opportunities for wildlife observation and photography on the refuge.

Strategies

- Maintain observation towers and areas, trails (25 miles/40 kilometers), wildlife drive, viewing blinds, and wildlife and nature photo gallery.

Monitoring Elements

- Complete annual evaluation that summarizes wildlife observation and photography opportunities provided on the refuge (number of opportunities, events) and document their utilization (number of visits, type of activity, and number of participants engaged).
- Solicit informal participant feedback and take note of repeat visitors.

Rationale
The refuge currently offers numerous opportunities for wildlife observation and photography, including accessible roads, trails, boardwalks, three photo blinds throughout the North and South Tracts, and an electric tram tour on the South Tract. The refuge also accommodates photo classes and exhibits, and lends out binoculars to visitors.

Objective 5.2 Interpretation
Promote a stewardship ethic and instill a sense of wonder and appreciation of natural resources, wildlife and research in visitors by providing engaging interpretive programs and activities for visitors of all abilities, ages, and community groups.

Strategies

Continue to:

- Offer a variety of seasonally related monthly interpretive programs year-round by reservation. These programs are offered free of charge with the exception of tram tours or when otherwise stated. (The refuge offered 353 interpretive programs with 9,761 total participants in fiscal year 2010 – this total includes tram tours.)
- Offer interpreter-led tram tours from mid-March through mid-November, with increased hours of operation during the summer months.
- Charge a nominal fee for tram tours for the general public tours; reserved tours can be arranged for a group fee and accommodate schools and other organized groups. Tram tours operated by the Friends of Patuxent.
- Utilize outreach tools to enhance visitation and participation at interpretive programs and special events.
- Offer current opportunities for interpretive programs, updating them as demand dictates.
- Maintain and utilize outdoor exploration areas, such as schoolyard habitat.
- Offer major special events (seven offered in fiscal year 2010).
- Offer summer series of five to six multi-day youth camps, including one-week day camp for underserved youth.
- Offer periodic, guided tours to the Central Tract and the Whooping Crane Observatory.

Monitoring Elements

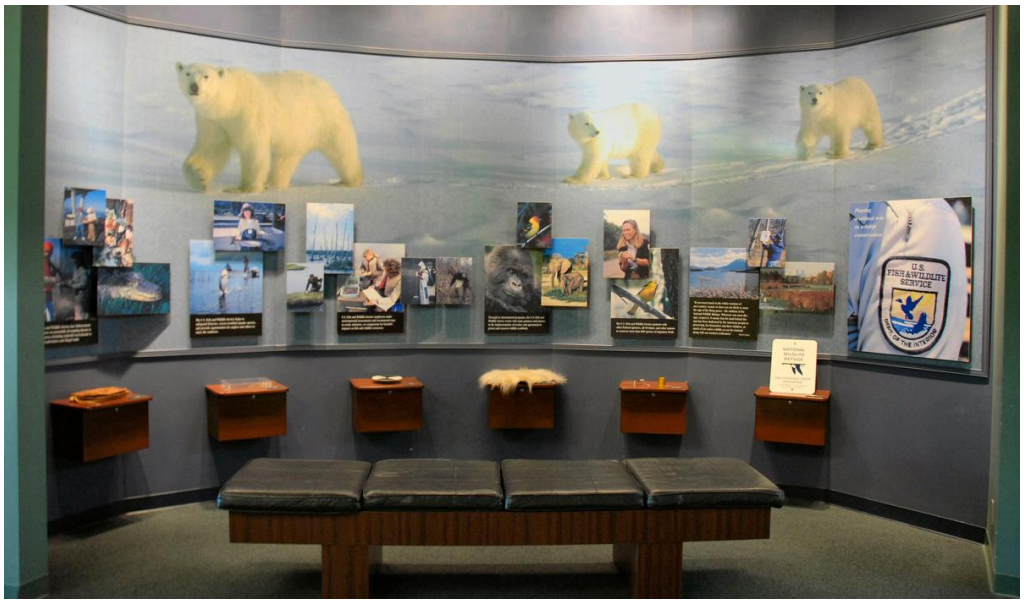
- Complete an annual evaluation that summarizes interpretive opportunities provided both on and offsite (number of opportunities and events) and document their utilization (number of visits, type of activity, and number of participants engaged).
- Solicit informal participant feedback and take note of repeat visitors.

Rationale

The Refuge Improvement Act identifies environmental interpretation as one of the six priority public uses. Environmental interpretation includes activities, talks, publications, events, programs, audio-visual media, signs, and exhibits that convey key messages about natural and cultural resources to visitors, but that do not address a specific educational curriculum requirement. It provides opportunities for visitors to make their own connections to nature and wildlife, which invites participation in resource stewardship and helps refuge visitors understand their relationships to, and impacts on, those resources.

Interpretation has been identified as an area of emphasis for the refuge. Interpretation of natural resources creates an opportunity to connect the hearts and minds of visitors with

places, objects, and resources that refuges strive to protect. Interpretive programs provide visitors with intellectual and emotional opportunities to connect with natural and cultural resources. Interpretive programs at the refuge include, but are not limited to, interactive tram tours, monthly interpretive programs, special events, publications, audio-visual media, signs, and exhibits. Through participation in the refuge's interpretive programs, we hope that visitors will understand their relationships to and impacts on our natural resources, and will join us as stewards of the land.



USFWS

Display at the NWVC

Objective 5.3 Environmental Education

Promote a stewardship ethic through environmental education with students, teachers, scout leaders, and organized community groups to understand and appreciate ecological relationships and the role of refuges nationwide and the role of Patuxent Research Refuge. (There were 14,736 environmental education participants both on and offsite for fiscal year 2010, including students, teachers, scout leaders and other educators).

<u>Strategies</u>

Continue to:

- Offer naturalist-led and self-guided programs for school and scout groups year-round.
- Offer teacher workshops year-round, designed to meet Maryland State outcomes and with opportunities for Maryland State Department of Education credits.
- Accommodate requests from neighboring school communities and other organizations to participate in onsite environmental education program.
- Offer current environmental education opportunities both onsite and offsite (approximately ten per year offsite).
- Maintain and utilize outdoor exploration areas such as schoolyard habitat.

- Provide workshop opportunities for scouts and scout leaders to meet advancement requirements.
- Provide scout program links to scout leaders.
- Support Federal Junior Duck Stamp Program administered by the MD DNR.

Monitoring Elements

- Complete annual evaluation that summarizes environmental education opportunities provided both on and offsite (number of opportunities and events) and document their utilization (number of visits, type of activity, and number of participants engaged).
- Solicit informal participant feedback and take note of repeat visitors.

Rationale

The Refuge Improvement Act also identifies environmental education as a priority public use on refuges. Environmental education teaches students the history and importance of conservation and ecological principles, and scientific knowledge of our nation's natural resources. In doing so, we can help develop a citizen base that has the awareness, knowledge, attitudes, skills, motivation, and commitment to work cooperatively toward the conservation of our Nation's environmental resources.

Environmental education has been identified as an area of emphasis for the refuge. As one of the largest science and environmental education centers in DOI, NWVC offers unique educational opportunities for school groups, scouts, youth groups, etc. NWVC exhibits are designed to provide visitors with greater knowledge and appreciation of the environmental problems affecting our planet and the role wildlife research plays in preserving the earth's natural resources. The environmental education program is also designed with that thought in mind. Programs strive to instill a general appreciation and understanding of natural resources and environmental concepts, with the ultimate goal of environmental stewardship. By using both indoor and outdoor resources, the environmental education team is able to provide opportunities and curriculum designed to meet the needs of the diverse ethnic and multi-cultural youth population that visit the refuge.

Objective 5.4 Non-wildlife-dependent Public Uses

Allow non-wildlife-dependent uses when they are appropriate and compatible.

Strategies

Continue to:

- Allow horseback riding on North Tract.
- Allow jogging on North and South Tracts.
- Allow bicycling on the North Tract.
- Allow cross-country skiing on North and South Tracts.

- Allow hiking on North and South Tracts.
- Allow dog walking with current stipulations on North and South Tracts.
- Allow search and rescue training via special use permit on the North and South Tracts.
- Provide primitive camping opportunities for scout and 4H groups on the North Tract pursuant to Nationwide memoranda of agreement with those organizations.
- Allow limited dog training in designated areas on the North Tract.

Monitoring Elements

- Continue to track other visitor uses through Visitor Contact Station check-in/access pass.
- Solicit informal participant feedback and take note of repeat visitors.

Rationale

The refuge manages firing range and softball field use through special use permits in which the daily oversight and maintenance is delegated to National Security Agency for the ranges and the Civilian Welfare Fund for the softball fields. Due to these agreements, no additional staff or costs are incurred by the refuge.

We propose to continue to allow jogging, bicycling, cross-country skiing, horseback riding, and dog walking to provide compatible recreational opportunities for visitors to enjoy the refuge and to gain a better understanding and appreciation for fish and wildlife, ecology and the relationships of plant and animal populations within various ecosystems, wildlife management, the refuge, and the Refuge System. Although these uses are not priority public uses, they do support wildlife observation which is a priority public use.

Goal 6: Provide high-quality hunting and fishing experiences for hunters and anglers.

Objective 6.1 Hunting

Provide safe, high-quality hunting opportunities on the refuge.

Strategies

- Continue to provide hunting opportunities for upland game, migratory game birds, and white-tailed deer from September through January, and select days in April and May for wild turkey hunt (Obrecht 1992).
- Within 3 years, complete a new refuge hunt plan along with any necessary associated NEPA compliance.
- Assess effectiveness of quality deer management for hunting and maintaining healthy deer populations and revise regulations as needed.
- Area X on the North Tract is currently open with a 50-yard (150-foot) buffer and the wildlife viewing area is currently open except during firearms season. Close Area W on the North Tract every other week to allow hiking on Forest Trail.

Monitoring Elements

- Complete annual evaluation that summarizes hunting opportunities (types of hunts and seasons) and documents their utilization (number of visits, type of activity, and number of participants engaged).
- Compile and analyze harvest data to document trends in use and variations in hunt seasons, and to better understand impacts to wildlife and habitats.
- Solicit informal participant feedback and take note of repeat visitors.

Rationale

Hunting on the refuge is guided by hunting regulations that are updated annually. The hunt program is administered in conjunction with MNHA. Regulations are jointly reviewed by the association and refuge staff annually, and clarified as needed. Hunting is permitted only during established Maryland hunting seasons (typically September through January). Current hunting includes opportunities for upland game, waterfowl, and white-tailed deer (bow, muzzleloader, and shotgun). The majority of the hunting occurs on North Tract. MNHA conducts daily hunt control operations, including permit sales, daily sign-ins, and harvest recording. The majority of North Tract remains closed to general public use during the hunt season. There are also hunting opportunities on the South Tract for white-tailed deer and lottery hunt opportunities on the Central Tract for white-tailed deer. The refuge's hunt program has the distinction of being one of the largest Federal public use hunting programs in terms of season length, variety of hunts, and numbers of hunter days.

Objective 6.2 Fishing

Provide high-quality fishing opportunities at established sites and according to State regulations.

Strategies

- Continue to provide year-round fishing opportunities at North Tract, which includes Lake Allen, New Marsh, Cattail Pond, Rieve's Pond, Bailey Bridge Marsh, and the Little Patuxent River areas.
- Continue to provide fishing opportunities seasonally on the South Tract at Cash Lake (June to October).
- Continue to improve quality of fishing through vegetation management, which may include temporary impoundment draw-downs and herbicide treatments.

Monitoring Elements

- Complete annual evaluation that summarizes fishing opportunities (through seasonal permits issued and special use/group permits issued).
- Collect and analyze creel reports that are voluntarily contributed by anglers.
- Collect angler data through check-in and staff/volunteer observation.
- Solicit informal participant feedback and take note of repeat visitors.

USFWS

Kids' Fishing Day

Rationale

The refuge provides opportunities for fishing on both the North and South Tracts. However, fishing is limited on North Tract due to closures during the hunting season and when firing ranges are active. A kids' fishing day is offered annually on the South Tract. Kids' fishing day allows not only for youth to experience a traditional recreational activity, but also for the public to engage with refuge staff and volunteers while participating in a priority public use.

Goal 7: Enhance partnerships with local communities and various organizations to garner support and promote refuge programs and resources.

Objective 7.1 Volunteer Opportunities

Provide a wide variety of volunteer opportunities to support the refuge and to encourage community involvement and support of refuges and natural resources.

Strategies

Continue to:

- Maintain the current volunteer program to assist the refuge in all aspects of day-to-day operations (28, 140 total volunteer hours for fiscal year 2010).
- Maintain quality internship program (currently 12 to 15 interns annually).
- Promote organized group participation (e.g., Scout groups) for one-time volunteer projects.
- Maintain coordination between PWRC, MNHA, and the refuge.
- Provide volunteer award and recognition programs/events.

Monitoring Elements

- Maintain volunteer hours through online program which documents volunteer activities that occurred, location, and duration.
- Continue to solicit feedback from volunteers regarding refuge programs.

Rationale

The refuge's volunteer program delivers a significant contribution of over 30,000 hours through the participation of 250 volunteers. The refuge's active volunteer numbers remain fairly consistent at around 120. The volunteers help run NWVC and the Visitor

Contact Station, maintain refuge grounds, and support wildlife management. On-the-job training is provided until volunteers feel comfortable operating the information desks on their own. Volunteers receive a half hour customer service training during volunteer orientation. The majority of the volunteers are age 55 or above. Internship opportunities for environmental education/interpretation and wildlife biology positions are available through the majority of the year. The volunteers sign in and out themselves and keep a log of their hours via an online program. Volunteers are recognized at an awards event and are also thanked at an annual picnic.

Objective 7.2 Outreach
Foster community relations and recruit visitors through outreach and community involvement.

Strategies

- Send notices and press releases to local media and partners about upcoming events and programs.
- Participate with an information table and/or activities at community events such as Bowiefest, Montpelier festivals, and others.
- Participate in events/programs of neighboring county conference and visitors' bureaus.
- Participate in tourism and educational events of the Maryland Tourism Council.
- Participate in meetings/events of local chambers of commerce.
- Participate in events/promotions sponsored by the Maryland Tourism industry, such as the annual calendar of events, marketing opportunities, etc.
- Participate in events/promotions of other community organizations, such as the Prince George's History Consortium, Anacostia Trails Heritage Area, etc.
- Allow above partners to utilize meeting space for events/meetings.
- Continue to publicize NWVC through rack card distribution service to motels and attractions.
- Continue to fund attraction signs on nearby highways (through the State Highway Administration).
- Continue to maintain and update the Web site.
- Encourage Friends and staff to utilize social media to publicize refuge events and programs.
- Continue to maintain email listserv (3,828 members in 2010).

Monitoring Elements

- Track number of outreach contacts.
- Solicit informal feedback from partners.

Rationale

Outreach is two-way communication between the Service and the public to establish mutual understanding, promote involvement, and influence attitudes and actions, with the goal of improving joint stewardship of our natural resources. Outreach includes, but is not limited to:

- Congressional relations
- Corporate relations
- News media relations
- Relations with constituent groups
- Community relations
- State and local government relations
- Relations with State wildlife agencies
- Environmental education and interpretive activities
- Public involvement
- Traditional public information such as speeches, open houses, etc.
- Information products, such as brochures, leaflets, exhibits, slide shows, videos, public service announcements, etc.

Refuge Staffing, Facilities, and Grounds Necessary to Implement Alternative A

- Maintain current staff (as shown in the existing staffing chart dated April 29, 2010 in appendix F).
- Continue to work with youth and student employment programs.
- Maintain existing buildings and facilities.
- Continue to make temporary housing available (at assessed fair market value) to field assistants or visiting scientists.
- Guide Central Tract facility usage and maintenance with the facilities modernization program.
- Continue NWVC hours of operation from 9 a.m. to 4:30 p.m. daily (except Federal holidays) for building and sunrise to 4:30 p.m. daily (except Federal holidays) for trails and grounds.
- Continue Visitor Contact Station hours of operation from 8 a.m. to 4 p.m. daily (except Federal holidays).
- Continue to issue keys or cards to open refuge gates to researchers needing to access field sites outside of regular hours.
- Continue to provide conference facilities for scientific, educational, agency, and partner-related information exchange.

3.6 Alternative B. Forest Restoration and Mixed Public Use (Service-preferred Alternative)

Alternative B combines the actions we believe most effectively achieve the refuge purposes, vision, and goals, and respond to public issues. It emphasizes the management of specific refuge habitats to support focal species whose habitat needs benefit other species of conservation concern in the Chesapeake Bay region. In particular, we emphasize increasing forest acreage by allowing smaller fields and openings to reforest and promoting a mix of forest restoration in conjunction with active management of diverse habitat types. This includes the restoration of a number of impoundments and grasslands to forested areas to support forest interior dwelling bird species. In addition, alternative B would enhance our present visitor services programs in a manner that addresses the national and regional Service policies and the mandates of the refuge. It strives to strike a balance between wildlife-dependent and non-wildlife-dependent uses found to be compatible on the refuge.

Habitat Management
Under alternative B, habitat management would expand forested areas throughout the refuge. This alternative includes the restoration of approximately 478 acres (193 hectares) to forest. The land under the proposed reforestation currently exists as impoundments or grassland areas. Reforesting impoundments and grassland areas would benefit forest interior dwelling species by increasing the acreage of interior, contiguous forest surrounded by highly urbanized areas. It would also improve water quality as related to the Patuxent and Little Patuxent Rivers, and ultimately the Chesapeake Bay watershed.

A pine-oak savannah, indicated by soil type and an assemblage of rare fauna, would be maintained to promote this rare, native habitat type and support species such as the darkling beetle and tiger beetle. Grasslands of suitable size for obligate grassland nesting birds and open-field generalist would be provided. Impoundments that support fishing or important amphibian breeding areas would also be maintained. Of the 553 acres of impoundments, only 357 acres were considered for potential conversion in the structured decision-making process, because we did not include impoundments that would require extensive filling or that were heavily used for recreation. Habitat types and management proposed under alternative B are displayed in map 3-2.

Inventory and Monitoring
Under this alternative, we would improve our monitoring and inventory efforts to better inform and support these goals and alternatives, the effectiveness of habitat management, habitat adaptation to climate change, and to ensure we have the necessary resources to accomplish them. We would target any alterations or additions to these ongoing surveys that would help us better understand the implications of our management actions and ways to improve our efficiency and effectiveness. We would also continue to seek ways to reduce our management costs for establishing and maintaining monitoring protocols.

We would strengthen partnerships with USGS and other agencies, State partners, academic institutions, nonprofit organizations, and volunteers in the conservation

USFWS

Refuge Bird Banding

community to obtain needed information on habitat quality, wildlife use, and impacts relevant to CCP goals and objectives and for more current baseline data. Through these endeavors we would be able to expand our biological inventories and monitoring projects to better understand species composition and utilization of the refuge, particularly in response to reforestation efforts.

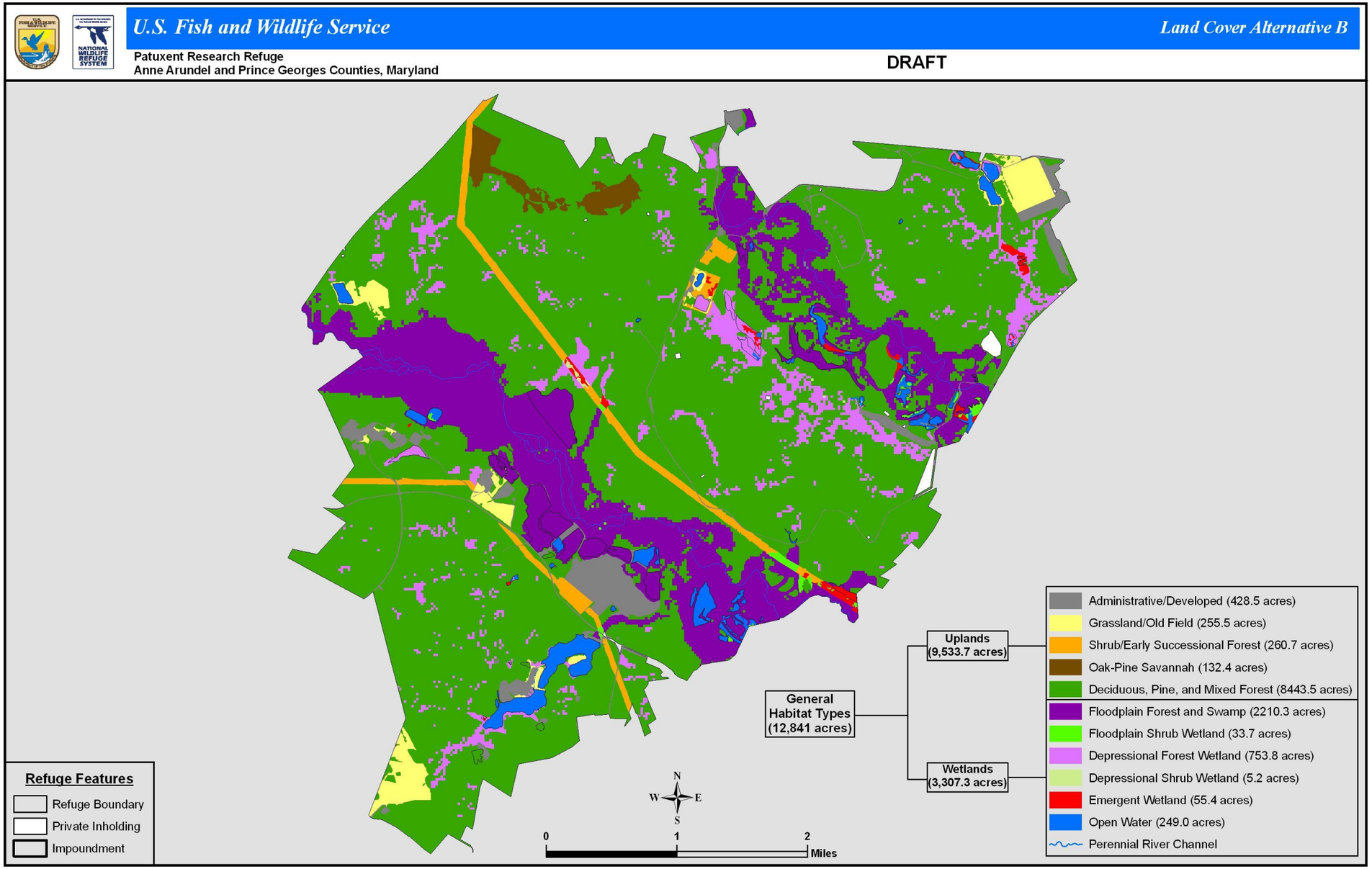
Visitor Services

Under alternative B, we would strive to increase wildlife-dependent public use opportunities and allow for appropriate, compatible non-wildlife-dependent uses (maps 3-3 and 3-4). We would promote high quality hunting and fishing programs through improved habitat management strategies. In addition, we would expand wildlife observation, viewing, and photography opportunities and initiate new interpretive programs and environmental education opportunities both on and offsite.

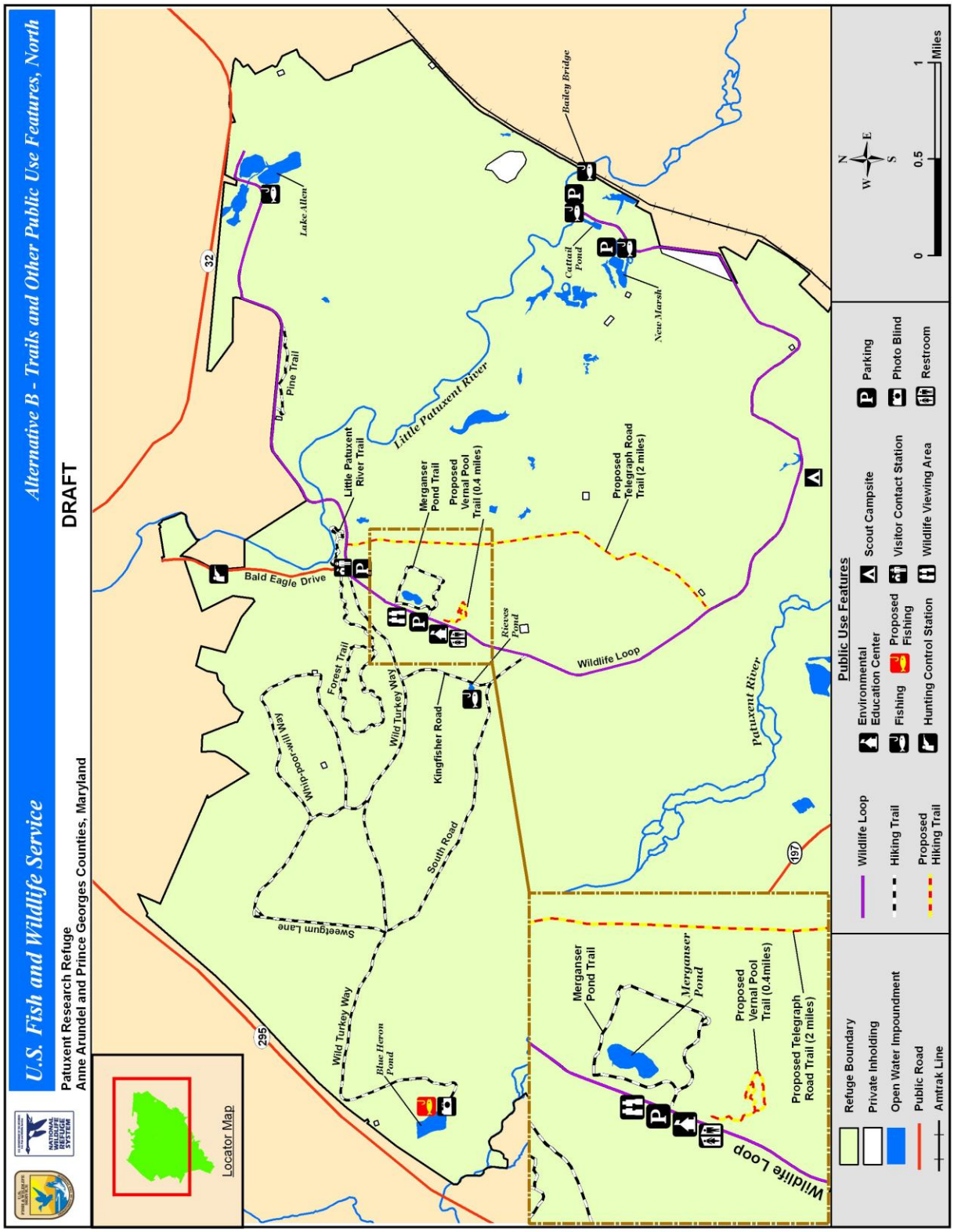
Refuge Administration

Under this alternative, we would expand refuge staff to support habitat management efforts, facilities maintenance, and visitor use. As identified in the 2009 Refuge System staffing model, we propose to fill five positions, which include two maintenance workers (grounds and buildings), one contracting officer, one law enforcement officer, and one visitor services park ranger. There is some degree of flexibility to alter these proposed positions as priorities and/or needs change. In order to fill the positions identified, permanent sources of funding would need to exist.

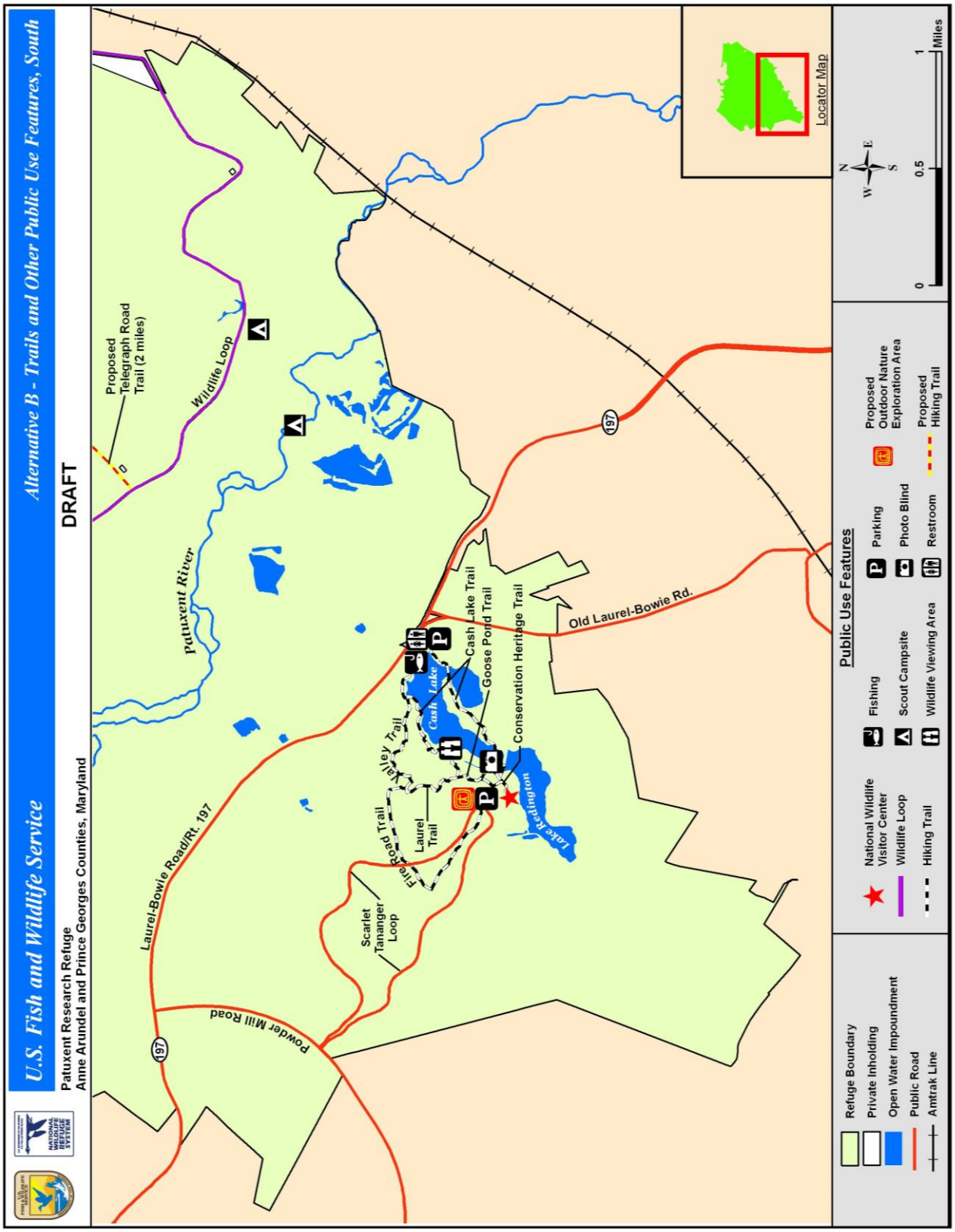
Map 3-2. Anticipated Habitat under Alternative B



Map 3-3. Proposed Public Use under Alternative B, North



Map 3-4. Proposed Public Use under Alternative B, South



Goals, Objectives, and Strategies under Alternative B

Goal 1: Maintain and actively promote Patuxent Research Refuge as an "outdoor laboratory," providing a diversity of wildlife and natural resource research opportunities on the refuge in such areas as landscape conservation, habitat fragmentation, climate change, and other emerging issues, as well as the more traditional types of wildlife research, including inventory and monitoring techniques, land management, and understanding ecological processes. Research that supports the overall Service mission, and evaluates the best methods for protecting natural resources throughout the Refuge System and other land management agencies will be a priority.

Objective 1.1 Inventory and Monitoring

Conduct high-priority inventory and monitoring (survey) activities that evaluate resource management and public use activities to facilitate adaptive management.

<u>Strategies same as alternative A, plus:</u>

- Develop and strengthen partnerships with USGS and other agencies, State partners, academic institutions, nonprofit organizations, and volunteers in the conservation community to obtain needed information on habitat quality, wildlife use, and impacts relevant to CCP goals and objectives. Examples may include:
    - Identify sections and conduct feasibility study and options for floodplain stream restoration.
    - Understand the contribution and importance of refuge forests to pollinator species (their contribution to forest health on the refuge and Mid-Atlantic Coastal Plain).
    - Design a monitoring protocol for assessing succession of the savannah restoration.
    - Estimate and model deer population and habitat response to adaptive deer harvesting.
    - Monitor bat and amphibian use and health in eastern forest habitats and disease.
    - Monitor forest disease.

<u>Monitoring Elements and Rationale same as alternative A</u>

Objective 1.2 Research and Scientific Assessments (Local, National, and International)

Facilitate research of a local, national, and international nature that benefits wildlife on refuge lands as well as all other natural areas. Facilitate scientific assessments to provide baseline information to expand knowledge regarding landscape-scale natural resource issues and to determine the status of onsite refuge resources to better inform resource management decisions.

Strategies same as alternative A, plus:

- Work with PWRC and partners to facilitate long-term research studies focused on landscape-scale issues such as climate change, habitat fragmentation, urban impacts to wildlife, and ecosystem services derived from the refuge and surrounding natural lands.
- Continue to provide gate keys or cards to researchers who need to access refuge field sites outside of refuge daily open hours.
- Reduce hunting hours during some week day mornings (except during the deer firearms season) to encourage and allow researcher access to the North Tract during the hunting season.
- Work with PWRC to develop refuge-based collaborative research opportunities. Examples may include:
    - Assess lead deposition and other impacts to forest and wildlife beyond firing ranges.
    - Assess raccoon population size, density, and predation upon ground-nesting birds, turtles.
    - Assess bat breeding, migrating, and wintering diversity, distribution, seasonal hibernating, and maternal roosting and foraging habitats.
    - Assess the effects of right-of-way management on priority species of birds dependent on shrub habitat, important pollinators, and deer foraging response.
    - Assess refuge fish population and fish passage for migratory fish.
    - Monitor amphibian disease, such as chytrid fungus impacts on wood frog populations.

Monitoring Elements and Rationale same as alternative A

Goal 2: Protect, maintain, and restore, where possible, the biological integrity, diversity, and environmental health of forested ecological communities to provide habitat for species of conservation concern, including migratory birds, mammals, amphibians, reptiles, and invertebrates.

Objective 2.1 Floodplain Forest and Swamp, to also include Depressional Forests and Shrub Wetlands

In addition to alternative A, provide approximately 72 additional acres (29 hectares) of floodplain forest and depressional forest and shrub wetlands along the Patuxent and Little Patuxent Rivers, totaling about 2,722 acres (1,102 hectares).

Strategies same as alternative A, plus:

- Restore forests through natural succession, whenever possible, primarily from conversion of scattered pockets of small, wet meadows, including meadows around Uhler marshes (approximately 34 acres or 14 hectares) and similar areas.

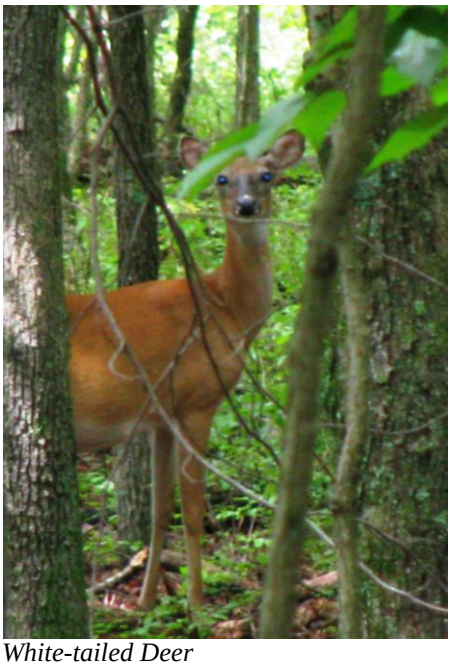
Seventy-two acres will be gained as a result of restoring 17 impoundments to natural hydrology or green tree reservoir.

- Maximize forest interior, which is the forested area greater than 300 feet (91 meters) from the forest edge. Restore forests into large contiguous forested polygons, as close to 500 acres (202 hectares) as possible, and in shapes that maximize forest interior habitat. Restore gaps, openings, and peninsulas in existing forested areas to decrease forest edge and maximize forest interior.
- Consider a range of active forest management when objectives cannot be achieved through natural processes, such as uneven-age forest management (single tree and group selection) to create a multi-structured, multi-aged forest, and mechanical and herbicidal treatments to reduce undesirable species and create snag and cavity trees. Plant desirable flora on sites as needed.
- Reduce white-tailed deer population to encourage natural redevelopment of mid and understory vegetation where depleted due to herbivory or intense scouring from flooding.
- Explore remediation for steeply down-cut streambanks.
- Review and evaluate transportation needs for management purposes and public access. Close and restore unnecessary roads and adjacent berms/ditches to forested habitat.
- Maintain roads to ensure safe passage for vehicles at posted speeds. Road width and footprint should be constrained to the minimum width needed to allow vehicle passage, vegetation management actions to facilitate water flow from road surface to drainage facilities where they exist, and to protect paved surfaces from tree root damage. Forest habitat should not impinge upon drainage ditch or culvert flow.
- Ensure all stream crossings do not impact stream hydrology or aquatic resources.
- Conduct a timber cruise and forest health assessment with special attention to indications of forest pests and disease.
- Support ongoing big-tree surveys and conduct native plant surveys and plant mapping on the refuge.
- Protect areas containing rare native plant communities.

<u>Monitoring Elements same as alternative A, plus:</u>

- Develop long-term forest monitoring surveys to evaluate species, community, and structure changes from various environmental stressors, including air and water quality and climate change.
- Conduct acoustical bat monitoring surveys to determine species diversity and composition during breeding and migration.

- Determine the effectiveness of the white-tailed deer management program by evaluating species composition, abundance, diversity, and regeneration of native shrubs and forbs.
- Inventory and map floodplain forest communities and forested wetlands and incorporate the maps and data sets into the Patuxent Research Refuge Geographic Information System.
- Identify and map areas of concentration of amphibians of concern, such as wood frog, salamanders, and vernal pools to ensure their conservation and protection. Maintain vigilance for chytrid fungus and enact measurements to prevent spread of fungus between vernal pools.


USFWS

White-tailed Deer

Some metrics to consider for management or evaluation of floodplain forest habitat for priority species:

- Dense underbrush along streams and nesting snags (average height of 3 to 6 feet and a diameter at breast height of at least 6 inches) for prothonotary warbler.
- Closed forest canopy (greater than 80 percent), sparse herbaceous canopy cover (less than 25 percent), and sparse to moderate shrub canopy cover (75 percent) for Louisiana waterthrush.
- A slightly open canopy, dense understory, and well-developed ground cover for Kentucky warbler.
- Canopies 5 to 20 feet (1.5 to 6 meters) above the ground and open underneath for summer roosting of eastern red bats.

Rationale same as alternative A

Objective 2.2 Upland Deciduous, Pine, and Mixed Forest and Associated Wetlands
In addition to alternative A, restore 201 additional acres (81 hectares) of upland forest with an emphasis on large block management (500 acres/202 hectares or larger) and reduced fragmentation to further support area-sensitive, breeding, forest-dwelling species such as scarlet tanager, woodthrush, and box turtle, totaling approximately 8,443 acres (3,417 hectares).

Strategies same as alternative A, plus:

- Restore forests through natural succession whenever possible. Maximize forest interior, which is the forested area greater than 300 feet (91 meters) from the forest edge. Restore forests into large contiguous forested polygons, as close to

500 acres (202 hectares) as possible, and in shapes that maximize forest interior habitat. These additional acres of upland forest would come from the conversion of scattered grassy areas that were administratively managed or early successional old fields that are shrubby and too small to manage. This includes 8.5 acres gained from impoundment restoration. Restore gaps, openings, and peninsulas in existing forested areas to decrease forest edge and maximize forest interior.

- Consider a range of active forest management when objectives cannot be achieved through natural processes, such as uneven-age forest management (single tree and group selection), to create a multi-structured, multi-aged forest and mechanical and herbicidal treatments to reduce undesirable species and create snag and cavity trees. Plant desirable flora onsite as needed.
- Avoid dense, monoculture pine forests, as the distribution of breeding cerulean warblers has been negatively correlated with percent canopy cover by coniferous trees (Robbins et al. 1989).
- Reduce white-tailed deer population to encourage natural redevelopment of mid and understory vegetation where depleted due to herbivory or intense scouring from flooding.
- Explore remediation for steeply down-cut streambanks.
- Scout for and control stand-replacing invasive plant species that threaten to overtake intact healthy forest communities.
- Maintain roads to ensure safe passage for vehicles at posted speeds. Road width and footprint should be constrained to the minimum width needed to allow vehicle passage, vegetation management actions to facilitate water flow from road surface to drainage facilities where they exist, and to protect paved surfaces from tree root damage. Forest habitat should not impinge upon drainage ditch or culvert flow.
- Ensure all stream crossings do not impact stream hydrology or aquatic resources.
- Conduct a timber cruise and forest health assessment with special attention to indications of forest pests and disease.
- Support ongoing big tree surveys and conduct native plant surveys and plant mapping on the refuge.
- Protect areas containing rare native plant communities.

<u>Monitoring Elements same as alternative A, plus:</u>

- Develop long-term forest monitoring surveys to evaluate species, community, and structure changes from various environmental stressors, including air and water quality and climate change.
- Conduct acoustical bat monitoring surveys to determine species diversity and composition during breeding and migration.

- Determine the effectiveness of the white-tail deer management program by evaluating species composition, abundance, diversity, and regeneration of native shrubs and forbs. Develop an improved deer population assessment and monitoring technique.
- Inventory and map floodplain forest communities and forested wetlands and incorporate the maps and data sets into the Patuxent Research Refuge Geographic Information System.
- Identify and map areas of concentration of amphibians and reptiles of conservation concern, particularly wood frogs, spotted turtle, eastern box turtle, and vernal pools to ensure their conservation and protection. Maintain vigilance for chytrid fungus and implement measures to prevent spread of fungus between vernal pools.
- Monitor for gypsy moth and oak diseases.

Some metrics to consider for management or evaluation of upland forest habitat for priority species:

- Closed canopy and dense understory.
- Forest canopy cover (greater than 85 to 90 percent, not less than 65 percent), large trees (greater than 12 inches diameter at breast height) and subcanopy cover (65 to 70 percent, not less than 45 percent) for cerulean warblers.
- Incomplete or sparse canopy layer with understories to 15 to 20.5 feet (5 to 6 meters) height.
- Minimum snag densities of 8 per acre for silver-haired bat roosts.

Rationale same as alternative A

Objective 2.3 Oak Pine Savannah
In addition to alternative A, increase savannah habitat up to 135 acres (55 hectares).

Strategies

- This increase of 85 acres (34 hectares) comes from the NT-8 (Drop Zone), approximately 40 acres (16 hectares), and areas in the northwest section of North Tract that have been identified for clearing, thinning, and burning to create the savannah.
- Mechanically thin dense and stagnating pine stands to open up the understory and permit light penetration for germination of understory species associated with this habitat type and to release residual trees.
- Conduct prescribed fires to reduce accumulated debris from thinning operations, maintain the open understory, and promote a fire-adapted native woodland community.

- Conduct a soil survey (at finer resolution than that provided by the USDA Soil Survey) to delineate the extent of the deep sandy soils formations associated with the savannah habitats along the Patuxent River. Savannah restoration and maintenance should be confined to appropriate soil types.
- Prevent invasive plant species such mile-a-minute weed, Chinese lespedeza, Japanese honeysuckle, sweetgum, tulip poplar, red maple, and black locust that are poised to overtake newly opened areas. Scout for, and eradicate, parent trees of such species along perimeter.

Monitoring Elements

- Conduct visual assessments annually to determine extent of invasion of deciduous, stand-replacing pioneer species such as sweetgum and black locust.
- Conduct bee, beetle, and other pollinator/insect surveys.
- Conduct vegetation surveys that measure percent canopy cover of upper canopy species such as oaks and pines and understory cover such as grasses and forbs and heath shrubs.

Rationale same as alternative A

Goal 3: Protect, maintain, and restore, where possible, the biological integrity, diversity, and environmental health of refuge aquatic habitats, including the Patuxent, Little Patuxent, and Anacostia River Watersheds, and impoundments, to provide habitat for species of conservation concern, including fish, invertebrates, and plants.

Objective 3.1 Coastal Plain River and Coastal Plain Stream Habitats
In addition to alternative A, restore biological integrity and water quality of impaired stream segments.

Strategies

- Provide a variety of substrates including:
    - Pea gravel for spawning American brook lamprey
    - Fine sand and muck for American brook lamprey larvae
    - Stony riffles for spawning stripeback darter
    - Gravel, sand, and detritus for spawning alewife
    - Streams with a pH greater than 6.4, turbidity less than 15 NTU, and depths less than 20 inches for glassy darter
- Establish monitoring sites utilizing MD DNR index of biological integrity to assess and inventory habitat parameters, particularly those affecting the anadromous species, glassy darter, and stripeback darter.
- Identify stream reaches with glassy darters, and conduct abiotic stream quality measurements such as pH, NTU, and water depths.
- Coordinate with MD DNR and utilize MD DNR Index of Biological Integrity to assess and inventory biological, chemical, and physical parameters affecting

riverine and stream habitat on the refuge. Develop a long-term database to identify environmental stressors, including climate change, to assess the efficacy of habitat restoration; evaluate stressors to floodplain function, including roads and impoundments; and evaluate stressors to stream water quality, flows, and fish passage from refuge structures, including buildings, culverts, impoundments, parking lots, roads, and runoff waters. Restore or mitigate where possible.

- Participate in local, county, State, and Federal partnerships in the Patuxent, Little Patuxent, and Anacostia River watersheds to improve biological, chemical, and physical components of stream and river health.
- Prevent new invasive species from becoming established by utilizing early detection rapid response techniques to address invasive species populations through the appropriate control measure.
- Restore floodplain function where possible.
- Coordinate with MD DNR to evaluate options to provide fish passage at Cash Lake. Cash Lake has been identified by MD DNR as the 135th most important blockage of over 800 blockages within Maryland. Assess fish passage capability of permanent streams leading to river and prioritize areas for removal of obstruction and restoration for passage.
- Identify and restore impaired reaches of streams degraded by cutbank erosion, downcutting, turbidity, biodegredation, pollution, and detachment from groundwater table; restore floodplain function where possible. Conduct stream walks to identify problem areas, accessibility issues, and threatened plant communities or other threatened resources. Collaborate with State partners, the Chesapeake Bay Field Office, and stream restoration professionals to target priority areas (locations where corrective measures will yield the most benefit). Identify worst affected reaches with highest potential for benthic recovery.

Bailey Bridge - USFWS

- Identify and retrofit any undersize culverts on the refuge. Replace culverts with bottomless arches where feasible and affordable.
- Widen vegetation buffers where necessary and reduce impervious surfaces near heavily impacted areas through natural establishment or plantings.

- Continue water quality assessment for physical and chemical properties (heavy metals, oxygen, and pH) to determine suitability for passage and nursery habitat for interjurisdictional and trust fish species.

Monitoring Elements same as alternative A, plus:

- Conduct periodic surveys along appropriate reaches for triangle floater.
- Investigate contamination from lead deposition.
- Establish long-term monitoring stations for biotic and abiotic water quality parameters at refuge inflow and outflow points on Patuxent and Little Patuxent Rivers.
- Conduct stream walks to identify new sources of degradation and to check function of remediating structures or devices such as replaced culverts, bottomless arches, and bank stabilization works. Conduct periodic aquatic invertebrate surveys.

Rationale same as alternative A

Objective 3.2 Impoundments of Open Water, Emergent, Shrub, and Forested Wetlands

Restore the natural hydrology or manage as green tree reservoirs up to 212 acres (86 hectares) of impoundments, resulting in approximately 129 acres (52 hectares) less of open water, 44 acres (18 hectares) less of emergent wetlands, and 31 acres (13 hectares) less of floodplain shrub wetlands. This action will result in approximately 197 more acres (80 hectares) of floodplain or depressional forest and about 9 more acres of upland forest. Impoundments selected for restoration to natural hydrology are based on maximizing conservation values for species of concern described in alternative A.

Strategies

- Remove or permanently open water control structures to permit return of natural hydrological flow or floodplain flooding based on topography and placement relative to stream input. The additional 197 acres are gained from impounded areas versus the 72 acres gained in objective 1.1, which are acres from un-impounded areas.
- Allow natural succession to restore impoundments to natural vegetation.
- Convert select impoundments to green tree reservoirs, which will move the refuge closer towards biological integrity, diversity, and environmental health goals and provide for needs of waterfowl and amphibians through manipulation of the annual hydrological cycle.
- Conduct stream walks to identify problem areas, accessibility issues, and threatened plant communities or other threatened resources. Widen vegetation buffers where necessary and reduce impervious surfaces near heavily impacted areas through natural establishment or plantings. Identify and restore impaired

reaches of refuge streams impacted by cutbank erosion, downcutting, turbidity, biodegradation, pollution, and detachment from groundwater table.

Monitoring Elements

- Periodically check water control structures to ensure functionality and capacity to drain impoundment and serve as conduit to natural streams and floodplain.
- Monitor for invasive wetland species such as phragmites, Japanese knotweed (*Polygonum cuspidatum*), and lesser celandine.
- Conduct benthic soil sampling prior to drainage to learn composition of potentially toxic substances sequestered from previous land uses.
- Monitor success of conversion to green tree reservoir on targeted impoundments.

Rationale

The restoration of impoundments to forest would move the refuge closer to achieving ecological integrity. Ecological integrity has been defined as allowing natural processes that shape ecosystems to occur, along with provision of the biological communities that should normally be found within a site.

To achieve greater ecological integrity of the refuge landscape, each artificial wetland was evaluated as to its deviation from a natural hydrological regime and vegetation communities that are not a part of the North Atlantic Coastal Plain Stream and River Ecological System (CES 203.070).

The refuge's draft habitat management plan has identified that the refuge can make a significant contribution toward supporting forest interior dwelling species. The draft plan also identified that many of the refuge's artificial wetlands are contributing to forest fragmentation that adversely impacts forest interior dwelling species, while at the same time they provide little contribution to waterfowl and waterbirds (SDM Draft May 2011).

Objective 3.3 Emergent Wetlands (Freshwater, Nontidal)

Same as alternative A, but total acreage may potentially be reduced to 36 acres (15 hectares) because of actions to adjacent impoundments.

Strategies, Monitoring Elements, and Rationale same as alternative A

Goal 4: Manage refuge non-forested upland communities to provide ecological structure, composition, and function to support native plants and wildlife, including species of conservation concern. Where appropriate, restore the biological integrity and diversity of these habitats.

Objective 4.1 Shrub/Early Succession Forest Habitat

In addition to alternative A, allow 75 acres to become shrub habitat, totaling 300 acres (121 hectares) overall.

Strategies same as alternative A, plus:

- Confine shrub habitat management to the 200 acres (81 hectares) in the BG&E right-of-way and up to 70 acres (28 hectares) in the Pepco right-of-way and to selected smaller fields (less than 25 acres) next to forest. Existing early succession or shrub habitats that are very small (less than 20 acres/8 hectares) and surrounded by forest will be allowed to undergo natural succession.
- Create new habitat in large blocks (greater than 25 acres), adjacent to grassland or other habitats, and without gaps, openings, and peninsulas into existing forested areas to reduce forest edge and maximize forest interior, which is the forested area greater than 300 feet (91 meters) from the forest edge.

Monitoring Elements same as alternative A, plus:

- Include metrics that measure plant response to management, such as percent cover, vegetation height-density, and dominant species composition.

Rationale same as alternative A

Objective 4.2 Grasslands/Old Fields

Reduce grassy, early succession cover to 255 acres (103 hectares) and allow balance to revert to forest or shrub habitat. Of this acreage, approximately 205 acres (83 hectares) of selected fields will be managed as priority grassland habitat for 80 percent use by priority breeding generalist species such as field sparrow, eastern meadowlark, eastern kingbird, and monarch butterfly, and to provide migrating and wintering cover and food for bobolink, savannah and swamp sparrow, overwintering insects, and foraging bats. Potentially 50 acres (20 hectares) of mowed areas around buildings and facilities will be maintained for administrative purposes, environmental education, public use, or public viewing in a less-intensive management regime. Wherever possible, permit native grasses, forbs, and some shrubs to establish and provide food and cover throughout the year. Priority grasslands shall be maintained in short- to medium-stature in large, nonlinear blocks greater than 25 acres (10 hectares), dominated by 70 percent native cool and warm season grasses, up to 25 percent native forbs such as milkweeds and asters, and up to five percent shrub cover.

Strategies

- Priority grasslands were identified based on size and configuration. The 205 acres (83 hectares) of priority grassland habitats is comprised of the powerline right-of-way near duck pens at 25 acres (10 hectares), Range 1 at 67 acres (27 hectares), NT-10 (field by Blue Heron Pond) at 28 acres (11 hectares), and the retiring crop fields on South Tract at 85 acres (34 hectares).
- Consolidate North Tract grassland management to a limited number of larger fields (greater than 25 acres) in close proximity to already open land and with minimal forest fragmentation.
- Allow small fields (less than 25 acres) to revert to forest habitat, unless mowing is required for administrative purposes, environmental education, public use, or public viewing. Grassland blocks, less than 25 acres (10 hectares), are subject to

intense edge effects and are difficult to maintain. Small, scattered pockets of grassy areas and fields that are too small to manage, which include NT-1, Range 9 and Range 10, grasslands around wildlife viewing area, horse stable, and dog training fields are among those that would be allowed to revert to forest.

- Use prescribed fire, selective herbicide, selective mowing, and planting to provide short- to medium-height bunch grasses interspersed with patches of bare ground, shallow litter layer, scattered forbs, and few shrubs for foraging, nesting, and winter cover.
- Plant and encourage a mix of flowering native species for pollinating insects.
- Initiate a mowing regime that staggers mow sections in a rotation to ensure old field habitat for overwintering insects and seed sources. Mow on August 15 or later to avoid ground nesting birds.
- Control and reduce nonnative invasive species, annually utilizing chemical, biological, or mechanical methods to increase native plant species diversity and richness.
- Prevent new invasive species from becoming established by utilizing early detection rapid response techniques to address invasive species populations through the appropriate control measure.
- Assess the value of refuge grassland habitat for rare butterflies and other pollinators to develop management options commensurate with bird objectives.

USFWS

Juvenal's Duskywing

Monitoring Elements

- Monitor effects of invasive species prevention and control efforts through a combination of plant identification, inventories, and mapping.
- Conduct point count surveys at a density to detect 80 percent use of fields by breeding grassland birds. Conduct migration and winter surveys.
- Conduct periodic vegetation surveys at landbird point counts for height, density measurements, and species composition or grass-forb ratio.
- Conduct baseline inventories of butterflies and other pollinator species to determine species composition.

Rationale

Although significant grasslands occurred in northern Maryland and nearby Pennsylvania (Mayre 1920, Mayre 1955, MD DNR 2005a), it is unlikely that grasslands occurred to any extent in the coastal plain. A review of natural disturbances conducted in the Mid-

Atlantic Coastal Plain suggests that large-scale disturbances are extremely rare (Nature Conservancy 2002) and it's unlikely that Native Americans maintained grassland on the refuge.

The refuge's grasslands consist of 95 parcels totaling 515 to 535 acres (208 to 217 hectares) of mowed agricultural fields and abandoned military ranges/administrative areas that would become forested habitat, if not mowed. Only six mowed fields are greater than 25 acres (10 hectares), a minimum size recommended for nesting obligate grassland birds that are area-and configuration-sensitive, such as the grasshopper sparrow. Those fields are linear in shape, greatly reducing their value to breeding obligate grasslands birds. Forty-nine parcels are less than five acres. The grassland parcels increase forest hard edge, reduce the value of adjacent forests to forest dwelling birds by fragmenting the forest, and have limited obligate grassland bird species nesting potential. These small and scattered grasslands are not significant in a landscape perspective. Small openings in proximity to forest are valuable for whip-poor-will, bats, and box turtles.

Although the refuge's grassland habitat provide limited value to breeding grassland obligate species, they benefit breeding species that are more tolerant of old field succession, such as field sparrow, dickcissel, yellow-breasted chat, indigo bunting, eastern kingbird, orchard oriole, blue grosbeak, and non-migratory northern bobwhite and wild turkey, and migratory wintering bird species such as savannah sparrow, swamp sparrow, American woodcock, and short-term migratory visitors such as bobolink. Some bird species listed as species of greatest conservation need in the Maryland Wildlife Diversity Conservation Plan or as priority bird species in the BCR 30 and PIF 44 implementation plans may occur in small numbers but specific, intensive surveys to detect these species suites have been limited in recent decades.

Fields that are linear in shape maximize forest edge and minimize grassland interior. Field size and perimeter-to-interior (or edge-to-interior) ratio is important criteria for determining whether a given field is potentially suitable for breeding grassland-dependent birds. If grassland patches are too small in size or too linear in shape, there is greater potential for adverse edge effects, such as predation or nest parasitism, as well as woody or invasive plant encroachment. The nesting potential of grassland bird species on these small patch grasslands is limited. A hard forest edge also reduces the habitat values associated with adjacent forested lands for forest birds. An ideal grassland patch would be large enough to accommodate a buffer zone of approximately 300 feet (91 meters) around the edge and provide ample effective interior for the target species nesting territories. Vickery et al. (1999) recommends conserving grassland patches of 250 acres (101 hectares) or more to benefit more area-sensitive species. Watts et al. (1997) determined that grassland patches of less than 25 acres (10 hectares) are better suited for shrub-dependent birds. The value of these areas for wintering and migrating birds and pollinators is unknown.

Goal 5: Provide high-quality recreation, environmental education, and interpretive programs to enhance refuge visitors' understanding and appreciation of fish and wildlife conservation.

Objective 5.1 Wildlife Observation and Photography
Provide high-quality opportunities for wildlife observation and photography on the refuge by expanding facilities.

Strategies same as alternative A, plus:

- Create two additional trails at North Tract (Telegraph Road 2.5 miles/ 4km and Vernal Pool Trail 1.25 miles/ 2km).
- Create opportunities for photo exhibits with local photo clubs.
- Construct new observation tower at the wildlife viewing area on the North Tract and remove existing tower.
- Designate and develop an additional outdoor nature exploration area for visitors on the South Tract.

Monitoring Elements same as alternative A

Rationale
Wildlife observation and photography are two of the six priority public uses required by the Refuge Improvement Act to receive enhanced consideration on refuges. The refuge provides opportunities to view and photograph wildlife in natural settings at nature trails and overlooks (map 3-5). The refuge has historically been a popular birding site and has been recognized as an Important Bird Area by the National Audubon Society. The refuge is a stopover point for migratory waterfowl and attracts hundreds of thousands of birds during migration. The refuge's diverse habitat also attracts songbirds, shorebirds, raptors, marsh birds, reptiles, amphibians and mammals.

USFWS

Birdwatching on the Refuge

Providing a high-quality wildlife observation and photography on the refuge promotes visitor appreciation and support for refuge programs. According to Service policy (605 FW 4 and 5; USFWS 2011), the guiding principles for these two programs include:

- Provide safe, enjoyable, and accessible wildlife viewing opportunities and facilities.
- Promote visitor understanding of, and increase visitor appreciation for, America's natural resources.
- Provide opportunities for quality recreational and educational experiences consistent with criteria describing quality found in 605 FW 1.6.
- Minimize conflict with visitors participating in other compatible wildlife-dependent recreation activities.

The refuge currently offers numerous opportunities for wildlife observation and photography. The refuge provides handicapped-accessible roads, trails, boardwalks, three photo blinds, and an electric tram tour on the South Tract. The refuge accommodates photo classes and exhibits and lends out binoculars to visitors.

The proposed trails on the North Tract would follow existing disturbed areas. The Telegraph Trail would follow the former Telegraph Road. The Vernal Pool Trail, which has been closed since 2010, would be re-established under this alternative by clearing trees that have fallen across a number of sections of the former trail. Since previously disturbed areas are available to meet needs for additional trails, we did not look at other trail location alternatives. The range of alternatives in this case is to either have the trails or not. We viewed construction of trails through undisturbed vegetation and soils to be unwarranted.

Objective 5.2 Interpretation
Promote a stewardship ethic and instill a sense of wonder and appreciation of natural resources, wildlife, and research in visitors by providing engaging interpretive programs and activities for visitors of all abilities, ages, and community groups.

<u>Strategies same as alternative A, plus:</u>

- Increase the quality and diversity of interpretive monthly program opportunities by developing four to six new or revised interpretive programs annually.
- Create and offer limited historical/interpretive guided tours on the Central and North Tracts.
- Promote more hands-on, physically active outdoor activities.

<u>Monitoring Elements and Rationale same as alternative A</u>

Objective 5.3 Environmental Education
Promote a stewardship ethic through environmental education with students, teachers, scout leaders, and organized community groups to understand and appreciate ecological

relationships and the role of refuges Nationwide and understand the role of Patuxent Research Refuge.

Strategies same as alternative A, plus:

- Offer a schoolyard habitat-related teacher workshop series in accordance with local and State education standards.
- Increase refuge staff/volunteer involvement by ten percent by providing offsite conservation-related programs to local schools with emphasis on Jr. Duck Stamp curricula.
- Increase refuge staff/volunteer led scout workshop opportunities by 10 percent over 15 years.
- Incorporate additional climate change and research related information into workshops/programs particularly by partnering with other educational facilities/programs.
- Explore grant and sponsorship opportunities for transportation to public programs (with focus on transportation for underserved audiences).
- Increase number of visiting school groups by 10 percent over 15 years.
- Increase number of teacher workshops offered by 20 percent over 15 years.
- Expand teacher workshop programs and curricula in accordance with Washington, DC and Virginia learning outcomes.
- Explore credit opportunities for Washington, DC and Virginia schools.

Monitoring Elements and Rationale same as alternative A

Objective 5.4 Non-wildlife-dependent Public Uses
Support non-wildlife-dependent uses when deemed to be an appropriate use and compatible with the refuge purpose and mission of the Refuge System.

Strategies same as alternative A, plus:

- Continue to allow horseback riding at the North Tract.
- Allow limited virtual and no-impact geocaching along designated trails, if found compatible at the North and South Tracts.
- Allow waterfowl related dog training with hunting permit in designated areas at North Tract (Cattail Pond and New Marsh), while prohibiting all dog training that is not hunting related.

Monitoring Elements and Rationale same as alternative A

Goal 6: Provide high-quality hunting and fishing experiences for hunters and anglers.

Objective 6.1 Hunting
Provide robust and diverse, quality hunting opportunities to hunters of all ages while promoting hunter and visitor safety, wildlife health, and increasing other public use opportunities.

Strategies same as alternative A, plus:

- Increase specialty hunts/organized hunts for youth and persons with disabilities.
- Assess effectiveness of quality deer management for hunting and maintaining healthy deer populations and revise regulations as needed.
- Reduce hunting hours on some week days to allow researchers and the non-hunting public greater access to the North Tract during the hunting season.

Monitoring Elements same as alternative A

Rationale
Hunting is one of the six priority public uses required by the Refuge Improvement Act to receive enhanced consideration on refuges. Hunting is a popular and traditional activity in the area and a management tool to keep wildlife populations at healthy numbers to maintain healthy habitats. When managed appropriately, hunting can instill a unique understanding and appreciation of wildlife, their behavior, and their habitat needs.

Providing a high-quality hunt on the refuge promotes visitor appreciation and support for refuge programs. The Service defines a quality hunting experience as one that achieves the following (605 FW 2; USFWS 2011):

- Manage wildlife populations consistent with the Refuge System, specific management plans approved after 1997, and to the extent practicable, State fish and wildlife conservation plans.
- Promote visitor understanding of, and increase visitor appreciation for, America's natural resources.
- Provide opportunities for quality recreation and interpretive experiences consistent with criteria describing quality found in 605 FW 1.6 (USFWS 2011).
- Encourage participation in hunting to help preserve it as a tradition deeply rooted in America's natural heritage and conservation history.
- Minimize conflicts with visitors participating in other compatible wildlife-dependent recreational activities.

Hunting on the refuge is guided by hunting guidelines that are updated annually. The hunt program is administered in conjunction with MNHA. Guidelines are jointly reviewed by MNHA and refuge staff annually, and clarified as needed. Hunting is typically permitted only during established Maryland hunting seasons (typically

September through January). Current hunting includes opportunities for upland game, waterfowl, and white-tailed deer (bow, muzzleloader, and shotgun).

USFWS

North Tract Hunter Contact Station

The majority of the hunting occurs on North Tract. MNHA conducts daily hunt control operations, including permit sales, daily sign-ins, and harvest recording. The majority of North Tract will remain closed to general public use during firearms and shotgun seasons. There are also hunting opportunities on the South Tract for white-tailed deer and lottery style hunt opportunities on the Central Tract for white-tailed deer. The refuge's hunt program has the distinction of being one of the largest Federal public use hunting programs in terms of season length, variety of hunts, and numbers of hunters use days.

Objective 6.2 Fishing
Provide additional fishing opportunities to anglers of all ages while promoting angler and visitor safety, and wildlife health.

Strategies same as alternative A, plus:

- Open Blue Heron Pond to fishing access via hiking and biking. Allow vehicular access to Blue Heron Pond for visitors with impaired mobility.
- Expand calendar days for fishing on the South Tract at Cash Lake to start in mid-March (contingent on harvest population surveys).
- Expand fishing hours at North Tract (contingent on operating hours changing).
- Evaluate potential new fishing areas at North Tract (upstream of Bailey Bridge and Wood duck Pond).
- Assess fish populations refugewide to ensure biological integrity and health in accordance with providing a quality fishing experience.
- Expand North Tract events to include youth fishing activities.

Monitoring Elements same as alternative A

Rationale
The Refuge Improvement Act identifies fishing as one of the six priority, wildlife-dependent public uses. It states, "Compatible wildlife-dependent recreation is a legitimate and appropriate general public use of the [Refuge] System."

Providing high-quality fishing opportunities on the refuge promotes visitor appreciation and support for refuge programs. According to Service policy (605 FW 3; USFWS 2011), the guiding principles for our fishing program include the following:

- Effectively maintain healthy and diverse fish communities and aquatic ecosystems through the use of scientific management techniques.
- Promote visitor understanding of, and increase visitor appreciation for, America's natural resources.
- Provide opportunities for quality recreational and educational experiences consistent with criteria describing quality found in 605 FW 1.6 (USFWS 2011).
- Encourage participation in this tradition deeply rooted in America's natural heritage and conservation history.
- Minimize conflicts with visitors participating in other compatible, wildlife-dependent recreational activities.

As with hunting, we recognize fishing as a healthy, traditional outdoor pastime. It, too, promotes public understanding and appreciation of natural resources and their management on all lands and waters in the Refuge System. The refuge provides opportunities for fishing on both the North and South Tracts. However, fishing is limited on North Tract due to closures during the hunting season and when firing ranges are active. A kids' fishing day is offered annually on the South Tract. Kids' fishing day allows not only for youth to experience a traditional recreational activity, but also for the public to engage with refuge staff and volunteers while participating in a priority public use.

Goal 7: Enhance partnerships with local communities and various organizations to garner support and promote refuge programs and resources.

Objective 7.1 Volunteer Opportunities
Provide a wide variety of high-quality volunteer opportunities to support Patuxent Research Refuge and PWRC and to encourage community involvement and support of refuges and natural resources.

<u>Strategies same as alternative A, plus:</u>

- Increase participation with youth volunteers and youth community service organizations by 10 percent over 15 years.
- Accommodate two to four service related organizations per year for work projects.
- Organize/implement a refugewide project database outlining possible volunteer projects (identify seasonality of work, age appropriateness, etc.).
- Better integrate volunteer opportunities with PWRC, MNHA, and Friends of Patuxent.

- Encourage/recruit diverse volunteer workforce.
- Increase volunteer recognition, award, social, and interactive opportunities.

Monitoring Elements and Rationale same as alternative A

Objective 7.2 Outreach
Continue to foster community relations and recruit visitors through outreach and community involvement.

Strategies same as alternative A, plus:

- Increase outreach referenced above by at least ten percent per category.
- Reactivate speakers' bureau.
- Investigate highway radio announcement opportunities (on special frequency).
- Reorganize refuge Web site to make site more user-friendly and be in accordance with Service guidelines.
- Increase media partner mailings and communications for events and develop target mailing lists for events.
- Actively participate in social media.

Monitoring Elements and Rationale same as alternative A

Refuge Staffing, Facilities, and Grounds Necessary to Implement Alternative B

- In addition to 2010 staffing org chart, the following positions were identified in 2009 Refuge System staffing model as a need for the refuge:
    - WG-09 Maintenance Worker – Grounds (FEM)
    - WG-09 Maintenance Worker – Buildings (FEM)
    - GS-12 Contracting Officer (BMA)
    - LE-11 Law Enforcement Officer (RLE)
    - GS-11 Visitor Services (VCS)
- Continue NWVC hours of operation from 9 a.m. to 4:30 p.m. daily, including most Federal holidays (except Thanksgiving, Christmas, and New Year's Day).
- Expand hours of operation for South Tract trails and grounds from dawn to dusk.
- Utilize green technology to update NWVC and modify building structure and grounds to be more wildlife friendly (e.g., window screening to reduce bird strikes).
- Update and modify the Wisdom of Wildness exhibits.

- Construct additional space for environmental education and interpretation classes and storage on South Tract.
- Continue to allow scientific, educational, and agency partners to use conference facilities for information exchange.

3.7 Alternative C. Maximize Forest Interior Restoration and Emphasize Wildlife-Dependent Public Use Activities

Habitat Management
Under alternative C, habitat management would maximize forest interior areas throughout the refuge (map 3-5). This alternative includes the restoration of 767 acres (310 hectares) to forest. The land under the proposed reforestation currently exists as impoundments or grassland areas. Reforesting impoundments and grassland areas would benefit forest interior dwelling species by creating larger pockets of contiguous forest surrounded by a highly urbanized area. It would also improve water quality as related to the Patuxent River and Little Patuxent River, and ultimately the Chesapeake Bay watershed.

An oak-pine savannah habitat, as indicated by soil type and an assemblage of rare fauna, would be maintained to promote this rare and native habitat type and support species such as the darkling beetle and tiger beetle. Impoundments that support fishing would also be maintained. Approximately 280 acres (113 hectares) of shrub and early successional forest habitat would be maintained in the powerline right-of-ways. Grasslands/old field habitats would be allowed to reforest, except where maintaining open field is mandated for other purposes.

Of the 553 acres of impoundments, only 357 acres were considered for potential conversion in the structured decision-making process. The additional acreage was not included because some of the impoundments do not lend themselves to restoration (i.e., they are used extensively for public use) or restoration would be cost-prohibitive.

Inventory and Monitoring
As with alternatives A and B, we would continue existing monitoring and inventory efforts as long as we have the necessary resources and as long as they continue to provide useful information that will inform us about the quality of forest health and diversity and ecosystem function (including water resources); the status of forest interior, shrub, and grassland/savannah priority species; effectiveness of habitat management; and habitat adaptation to climate change. We would target any alterations or additions to these ongoing surveys toward helping us understand better the implications of our management actions and ways to improve our efficiency and effectiveness. We would also continue to seek ways to reduce our management costs for establishing and maintaining monitoring protocols.

Visitor Services
Under alternative C, we would maintain a mix of visitor use that is compatible with maximizing forest interior habitats. We would expand wildlife observation, viewing, and

photography opportunities. We would reduce the number of special events and interpretive programming both on and offsite. We would also explore the implementation of a recreational use fee for programs and activities.

We would eliminate the January hunt season refugewide, with the exception of firearms season for deer, but we may reserve the option to implement special deer hunts to ensure attainments of population management goals for forest health. In addition, we would explore closure of areas to hunting to accommodate other public uses.

We would also reduce or eliminate non-wildlife-dependent uses.

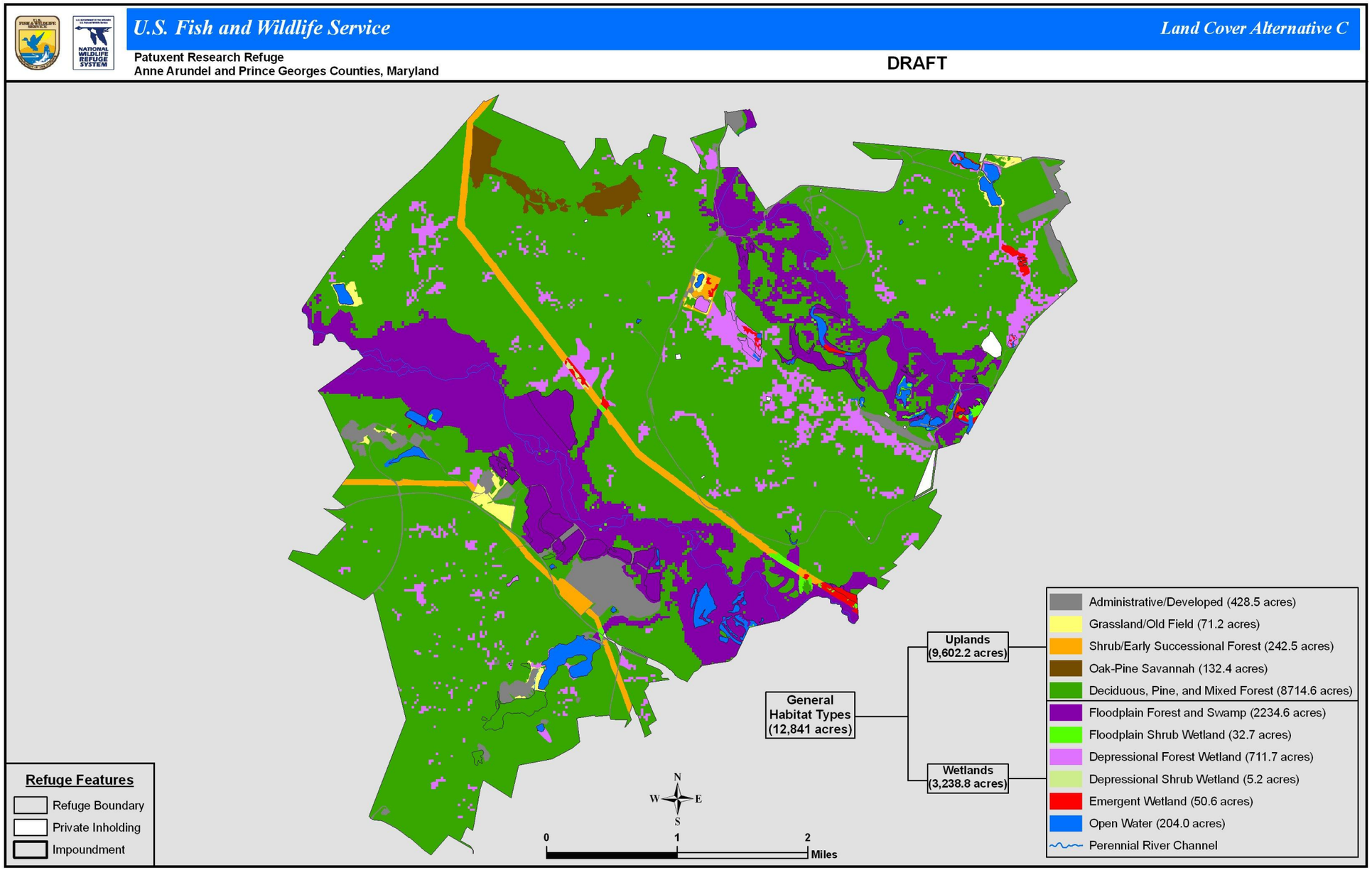
Refuge Staff - USFWS

Refuge Administration

Under this alternative, we would expand refuge staff to support habitat management efforts, facilities maintenance, and visitor use. As identified in the 2009 Refuge System staffing model, we propose to fill five positions which include: two maintenance workers (grounds and buildings), one contracting officer, one law enforcement officer, and one visitor services park ranger. In addition to the positions identified in the staffing model, we would propose to fill one forester position to address the increased role of forest management. In order to fill the positions identified, permanent sources of funding would need to exist.

In addition to staffing, we would continue to update and maintain facilities as identified in the Facilities Modernization Program. Proposed staffing charts can be viewed in appendix F.

Map 3-5. Anticipated Habitat under Alternative C



Goals, Objectives, and Strategies under Alternative C

Goal 1: Maintain and actively promote Patuxent Research Refuge as an "outdoor laboratory," providing a diversity of wildlife and natural resource research opportunities on the refuge in such areas as landscape conservation, habitat fragmentation, climate change, and other emerging issues, as well as the more traditional types of wildlife research, including inventory and monitoring techniques, land management, and understanding ecological processes. Research that supports the overall Service mission, and evaluates the best methods for protecting natural resources throughout the Refuge System and other land management agencies will be a priority.

Objective 1.1 Inventory and Monitoring

Conduct high-priority inventory and monitoring (survey) activities that evaluate resource management and public use activities to facilitate adaptive management.

Strategies, Monitoring Elements, and Rationale are the same as alternative B

Objective 1.2 Research and Scientific Assessments (Local, National, and International)

Facilitate research of a local, national, and international nature that benefits wildlife on refuge lands as well as all other natural areas. Facilitate scientific assessments to provide baseline information to expand knowledge regarding the status of refuge resources to better inform resource management decisions.

Strategies, Monitoring Elements, and Rationale are the same as alternative B

Goal 2: Protect, maintain, and restore, where possible, the biological integrity, diversity, and environmental health of forested ecological communities to provide habitat for species of conservation concern, including migratory birds, mammals, amphibians, reptiles, and invertebrates.

Objective 2.1 Floodplain Forest and Swamp, including Depressional Forests and Shrub Wetlands

In addition to alternative A, provide approximately 42 additional acres (17 hectares) of floodplain or depressional forest and shrub wetlands along the Patuxent and Little Patuxent Rivers, totaling 2,691 acres (1,089 hectares).

Strategies

- Restore forests through natural succession, whenever possible, primarily from conversion of scattered pockets of small, wet meadows, including meadows around Uhler marshes (approximately 34 acres or 14 hectares) and similar areas. Also, 42 acres will be gained in this objective as a result of restoring 19 impoundments to natural hydrology or green tree reservoirs.

Monitoring Elements and Rationale are the same as alternative B

Objective 2.2 Upland Deciduous, Pine, and Mixed Forest and Associated Wetlands

In addition to alternative A, restore an additional 475 acres (192 hectares) of native upland forest habitat, totaling about 8,717 acres (3,527 hectares).

Strategies

- Acreage would primarily come from conversion of grassland habitats which would incorporate the 205 acres (83 hectares) of priority grassland habitats comprised of the powerline right-of-way near the duck pens at 25 acres (10 hectares), Range 1 at 67 acres (27 hectares), NT-10 (field by Blue Heron Pond) at 28 acres (11 hectares), the retiring crop fields on South Tract at 85 acres (34 hectares), and includes 43.9 acres gained from impoundment restoration. Additional acreage will come from conversion of administratively mowed grassy areas and scattered pockets of grasslands that are too small to manage.

Monitoring Elements and Rationale are the same as alternative B

Objective 2.3 Oak-Pine Savannah
Strategies, Monitoring Elements, and Rationale are the same as alternative B

Goal 3: Protect, maintain, and restore, where possible, the biological integrity, diversity, and environmental health of refuge aquatic habitats, located within the Patuxent, Little Patuxent, and Anacostia River watersheds, and impoundments, to provide habitat for species of conservation concern, including fish, invertebrates, and plants.

Objective 3.1 Coastal Plain River and Coastal Plain Stream Habitats
Strategies, Monitoring Elements, and Rationale are the same as alternative B

Objective 3.2 Impoundments of Open Water, Emergent, Shrub, and Forest
Restore the natural hydrology or manage as green tree reservoirs up to 240 acres (97 hectares) of impoundments, resulting in approximately 167 acres (68 hectares) less of open water, 44 acres (18 hectares) less of emergent wetlands, and 31 acres (13 hectares) less of floodplain shrub wetlands. This action will result in approximately 200 acres (81 hectares) of floodplain or depressional forest and about 40 acres of upland forest. Impoundments selected for restoration to natural hydrology are based on maximizing conservation values for forest interior dwelling species of concern described in alternative A.

Strategies

- Acreage comes from impoundments targeted for conversion through the structured decision-making process. Refer to the structured decision-making table in appendix G to see conversion of acreage. The 200 acres comes from manipulations to 19 impoundments, versus 42 acres gained in objective 1.1, which are unimpounded areas.

Monitoring Elements and Rationale are the same as alternative B

Objective 3.3 Emergent Wetlands (Freshwater, Nontidal)
Same as alternative A, but total acreage may potentially be reduced to 32 acres (13 hectares) because of actions to adjacent impoundments.

Strategies, Monitoring Elements, and Rationale are the same as alternative B

Goal 4: Manage refuge non-forested upland communities to provide ecological structure, composition, and function to support native plants and wildlife, including species of conservation concern. Where appropriate, restore the biological integrity and diversity of these habitats.

Objective 4.1 Shrub/Early Successional Forest Habitat
In addition to alternative A, allow 20 to 30 acres (8 to 12 hectares) of shrub habitat in North Tract revert to forest, resulting in only 270 to 280 acres (109 to 113 ha) of shrub habitat overall.

Strategies

- The reduced acreage in this alternative comes from allowing field NT-1, which is about 22 to 30 acres, to revert to forest instead of maintain as shrub habitat.

Monitoring Elements and Rationale are the same as alternative B

Objective 4.2 Grassland/Old fields
Reduce grassy, early successional cover to about 70 to 75 acres (28 to 30 hectares). About 185 acres (75 hectares) of priority grassland habitat will be converted to mixed hardwood forest dominated by oaks and other native canopy species. Under this alternative, the remaining grassy, early successional acres around buildings and facilities will be maintained for administrative purposes, environmental education, public use, or public viewing in a less-intensive management regime wherever possible to permits native grasses, forbs, and some shrubs to establish and provide food and cover throughout the year.

Strategies

- To achieve this objective, all but 20 to 25 of the 205 acres of the priority grasslands would be converted to forest. The 20 to 25 acres by the duck pens and the 50 acres of administratively mowed grassy areas would still be maintained.
- Acreage to reforest will come from conversion of small, scattered pockets of grassy areas and fields that are too small to manage, which include NT-1, Range 9, and Range 10, grasslands around wildlife viewing area, horse stable, and dog training fields. These areas have been identified in alternative C map.
- Implement a less-intensive mowing regime in larger grassland areas near buildings and facilities that need to be kept relatively short. In these areas, use selective herbicide, rotational and selective mowing, and supplemental planting to

provide short- to medium-height bunch grasses interspersed with patches of bare ground, shallow litter layer, scattered forbs, and few shrubs for foraging, nesting, and winter cover. Plant and encourage a mix of flowering native species where feasible for pollinating insects. Follow Bayscape principles.

- Limit grassland management to only large fields (approximately 50 fields) on the North Tract which are in close proximity to similarly open lands. Allow the 84 fields (363 acres/147 hectares) in the Central and South Tracts to revert to forest habitat (unless mowing is required for administrative purposes, environmental education, public use, or public viewing). Grassland blocks less than 25 acres increase forest edge and fragment forests. All Central or South Tracts are less than 25 acres.
- Control and reduce nonnative invasive species by ten percent utilizing chemical, biological, or mechanical methods to increase native plant species diversity and richness.
- Prevent new invasive species from becoming established by utilizing early detection rapid response techniques to address invasive species populations through the appropriate control.

Monitoring Elements

- Monitor effects of invasive species prevention and control efforts through a combination of plant identification, inventories, and mapping
- Evaluate achievement of the objective for migrating birds. Continue to conduct landbird surveys and migration counts. Include habitat measurement in those surveys.
- Conduct baseline inventories of butterflies and other pollinator species to determine species composition.

Rationale is the same as alternative B

Goal 5: Provide high-quality recreation, environmental education, and interpretive programs to enhance refuge visitors' understanding and appreciation of fish and wildlife conservation.

Objective 5.1 Wildlife Observation and Photography
Provide additional opportunities for wildlife observation and photography on the refuge.

Strategies, Monitoring Elements, and Rationale are the same as alternative B

Objective 5.2 Interpretation
Promote a stewardship ethic and instill a sense of wonder and appreciation of natural resources, wildlife, and research in visitors by providing engaging interpretive programs and activities for visitors of all abilities, ages, and community groups.

Strategies different from alternative B

- Explore fee options for refuge entry, programs, and activities to allow refuge staff to develop new interpretive and education programs.
- Reduce the number of special events offered at the refuge to allow refuge staff to focus on habitat management and provision of wildlife observation, interpretation, environmental education, photography, hunting, and fishing opportunities.

Monitoring Elements and Rationale are the same as alternative B

Objective 5.3 Environmental Education
Promote a stewardship ethic through environmental education with students, teachers, and organized community groups to understand and appreciate ecological relationships and the role of refuges nationwide and understand the role of Patuxent Research Refuge.

Strategies same as A, plus:

- Offer schoolyard habitat related teacher workshop series in accordance with local and State education standards.
- Increase involvement in offsite conservation-related programs to local schools and number of visiting schools by 10 percent over 15 years.

Habitat Camp - USFWS

- Explore grant and sponsorship opportunities for student transportation to public programs.
- Increase number of teacher workshops. Increase number offered by 20 percent over 15 years.

Monitoring Elements

- Complete annual evaluation that summarizes environmental education opportunities provided both on and offsite (number of opportunities and events) and document their utilization (number of visits, type of activity, and number of participants engaged).

Rationale
Environmental education is priority public use and has been identified as an area of emphasis for the refuge. As one of the largest science and environmental education centers in the DOI, NWVC offers unique educational opportunities for school groups, scouts, youth groups etc. NWVC exhibits are designed to provide visitors with greater knowledge and appreciation of the environmental problems affecting our planet and the role wildlife research plays in preserving the earth's natural resources. Programs strive to

instill a general appreciation and understanding of natural resources and environmental concepts, with the ultimate goal of environmental stewardship. By using both indoor and outdoor resources, the environmental education team is able to provide opportunities and curriculum designed to meet the needs of the diverse ethnic and multi-cultural youth population that visit the refuge.

Objective 5.4 Non-Wildlife-Dependent Public Uses
Reduce or eliminate non-wildlife-dependent public uses of the refuge to reduce impacts to wildlife species from disturbance and to focus on allowing only the six wildlife-dependent public uses explicitly mentioned in the Refuge Improvement Act.

Strategies different from alternative B

- Prohibit horseback riding.
- Prohibit dog walking and waterfowl training.
- Prohibit search and rescue training.
- Implement a fee program for primitive camping opportunities.

Monitoring Elements

- Continue to track visitor uses through the Visitor Contact Station check-in/access pass.
- Solicit informal participant feedback and take note of repeat visitors.

Rationale
Non-wildlife-dependent public uses that have occurred on the refuge include bicycling, jogging, cross-country skiing, and hiking. Under alternative C, we would eliminate all of the above referenced activities. Under this alternative, we would focus on reducing dispersed recreational activities and focus any non-wildlife-dependent public uses at NWVC and Visitor Contact Station.

Implementing a fee program for primitive camping opportunities will help defray the administrative costs of allowing this use. It will also make last-minute cancellations less likely.

Goal 6: Provide high-quality hunting and fishing experiences for hunters and anglers.

Objective 6.1 Hunting
Provide robust and diverse hunting opportunities to hunters of all ages while promoting hunter and visitor safety, and wildlife health and increasing other public use opportunities.

Strategies same as alternative B, plus:

- Keep Little Patuxent River trail open during hunting with 50-yard (150-feet) buffer.

- Evaluate the need to close some hunt areas seasonally to allow for other permitted uses (e.g., Area N for fishing access at Rieve's Pond).
- Eliminate January hunt season refugewide with the exception of January deer firearms season.

Monitoring Elements and Rationale are the same as alternative B

Objective 6.2 Fishing
Provide additional fishing opportunities to anglers of all ages while promoting angler and visitor safety and wildlife health.

Strategies, Monitoring Elements, and Rationale are the same as alternative B

Goal 7: Enhance partnerships with local communities and various organizations to garner support and promote refuge programs and resources.

Objective 7.1 Volunteer Opportunities
Provide a wide variety of high-quality volunteer opportunities to support the refuge and to encourage community involvement and support of refuges and natural resources.

Strategies, Monitoring Elements, and Rationale are the same as alternative B

Objective 7.2 Outreach
Continue to foster community relations and recruit visitors through outreach and community involvement.

Strategies, Monitoring Elements, and Rationale are the same as alternative B

Refuge Staffing, Facilities, and Grounds Necessary to Implement Alternative C
Strategies same as alternative B, plus:

- In addition to 2010 staffing org chart, the following positions were identified in 2009 Refuge System staffing model as a need for the refuge:
    - WG-09 Maintenance Worker – Grounds (FEM)
    - WG-09 Maintenance Worker – Buildings (FEM)
    - GS-12 Contracting Officer (BMA)
    - LE-11 Law Enforcement Officer (RLE)
    - GS-11 Visitor Services (VCS)
- In addition to the positions listed above, a forester position (GS-09) would be needed to address the increased role of forest management.
- Increase weekend seasonal hours of operation for NWVC and Visitor Contact Station, including most Federal holidays (except Thanksgiving, Christmas, and New Year's Day).

Table 3-3. Summary of Comparison of Alternatives

Common to All Alternatives
• Continue to acquire land within the approved acquisition boundary. • Maintain current facilities and/or implement provisions of the facilities modernization plan. • Monitor and control nonnative invasive species. • Develop a separate land protection plan with public and agency involvement in compliance with Service policy and NEPA. • Protect cultural resources, including National Register of Historic Places eligible buildings and historic district. • Coordinate with USGS to house and support research efforts; encourage basic and applied scientific work on the refuge that furthers the goals of Service and USGS in coordination with refuge management (e.g., propagation of endangered species). • Work with Fort Meade to ensure protection of cemeteries that are surrounded by refuge lands.

Refuge Resource or Program	Alternative A Current Management	Alternative B Preferred Alternative	Alternative C Maximize Forest Interior
Goal 1: Maintain and actively promote Patuxent Research Refuge as an "outdoor laboratory," providing a diversity of wildlife and natural resource research opportunities on the refuge in such areas as landscape conservation, habitat fragmentation, climate change, and other emerging issues, as well as the more traditional types of wildlife research, including inventory and monitoring techniques, land management, and understanding ecological processes. Research that supports the overall Service mission, and evaluates the best methods for protecting natural resources throughout the National Wildlife Refuge System and other land management agencies will be a priority.			
Inventory and Monitoring	**Objective 1.1:** Conduct high-priority inventory and monitoring (survey) activities that evaluate resource management and public use activities to facilitate adaptive management.	**Objective 1.1:** Conduct high-priority inventory and monitoring (survey) activities that evaluate resource management and public use activities to facilitate adaptive management.	**Objective 1.1:** Conduct high-priority inventory and monitoring (survey) activities that evaluate resource management and public use activities to facilitate adaptive management.
Research and Scientific Assessments (Local, National, and International)	**Objective 1.2:** Facilitate research of a local, national, and international nature that benefits wildlife on refuge lands as well as all other natural areas. Facilitate scientific assessments to provide baseline information to expand knowledge	**Objective 1.2:** Facilitate research of a local, national, and international nature that benefits wildlife on refuge lands as well as all other natural areas. Facilitate scientific assessments to provide baseline information to	**Objective 1.2:** Facilitate research of a local, national, and international nature that benefits wildlife on refuge lands as well as all other natural areas. Facilitate scientific assessments to provide baseline information to

Refuge Resource or Program	Alternative A Current Management	Alternative B Preferred Alternative	Alternative C Maximize Forest Interior
	regarding landscape-scale natural resource issues and to determine the status of onsite refuge resources to better inform resource management decisions.	expand knowledge regarding landscape-scale natural resource issues and to determine the status of onsite refuge resources to better inform resource management decisions.	expand knowledge regarding the status of refuge resources to better inform resource management decisions.
Goal 2: Protect, maintain, and restore, where possible, the biological integrity, diversity, and environmental health of forested ecological communities to provide habitat for species of conservation concern, including migratory birds, mammals, amphibians, reptiles, and invertebrates.			
Floodplain Forest and Swamp, Depressional Forest, and Depressional Shrub Wetlands	**Objective 2.1:** Maintain the biological integrity of 2,018 acres (817 ha) of native floodplain forest and the 757 acres (306 ha) of depressional forest and shrub with 80 percent closed canopy and less than 10 percent invasive nonnative species along the Patuxent and Little Patuxent Rivers.	**Objective 2.1:** In addition to alternative A, restore the biological integrity and natural hydrology of approximately 255 additional acres (91 ha) of floodplain or depressional forest along the Patuxent and Little Patuxent Rivers, totaling about 3,030 acres (1,226 ha).	**Objective 2.1:** In addition to alternative A, restore the biological integrity of 235 acres (95 ha) of native floodplain or depressional forest communities along the Patuxent and Little Patuxent Rivers, totaling 3,010 acres (1,218 ha).
Upland Deciduous, Pine, and Mixed Forest and Associated Wetlands	**Objective 2.2:** Maintain 8,242 acres (3,335 ha) of native, mature upland forest communities with 80 percent closed canopy and less than 10 percent invasive species containing a diverse age structure and developed understory and midstory to provide breeding, migratory, and winter habitat for whip-poor-will (near forest edge), scarlet tanager, cerulean warbler, eastern wood-pewee, wood thrush, worm-eating	**Objective 2.2:** In addition to alternative A, restore 191.5 acres (78 ha) of upland forest with an emphasis on large block management (500 acres or larger) and reduced fragmentation to further support area-sensitive, breeding, forest-dwelling species such as scarlet tanager, woodthrush, and box turtle.	**Objective 2.2:** In addition to alternative B, restore 465 acres (188 ha) of native upland forest habitat, totaling about 8,707 acres (3,524 ha).

Refuge Resource or Program	Alternative A Current Management	Alternative B Preferred Alternative	Alternative C Maximize Forest Interior
	warbler, and yellow-throated vireo, and also to benefit other forest-dependent species such as eastern forest bats, eastern spadefoot toad, eastern chorus frog, eastern box turtle, hog-nosed snake, and native insects.		
Oak-Pine Savannah	**Objective 2.3:** Maintain 50 acres (20 ha) of savannah habitat consisting of an open over-story canopy dominated by native hardwoods (primarily oaks), and an understory dominated by native grasses such as broom sedge, little bluestem, and forbs such as asters and other composites for the benefit of rare darkling and tiger beetle species, upland chorus frog, native bees, Indian skipper and other pollinators, and sandy barren plant communities.	**Objective 2.3:** In addition to alternative A, increase savannah habitat up to 135 acres (55 ha).	**Objective 2.3:** Same as alternative B.
Goal 3: Protect, maintain, and restore, where possible, the biological integrity, diversity, and environmental health of refuge aquatic habitats, including the Patuxent, Little Patuxent, and Anacostia River watersheds, and impoundments, to provide habitat for species of conservation concern, including fish, invertebrates, and plants.			
Coastal Plain River and Coastal Plain Stream Habitats	**Objective 3.1:** Maintain and protect the quality aquatic habitat of the approximately 68 riparian miles (109 km) of Patuxent, Little Patuxent, and Anacostia River watersheds within the refuge, as well as their	**Objective 3.1:** In addition to alternative A, restore biological integrity and water quality of impaired stream segments.	**Objective 3.1:** Same as alternative B.

Refuge Resource or Program	Alternative A Current Management	Alternative B Preferred Alternative	Alternative C Maximize Forest Interior
	associated perennial streams, to provide spawning, nursery, foraging, and cover habitat for aquatic resources of conservation concern such as American brook lamprey, American eel, American and hickory shad, alewife, blueback herring, comely shiner, glassy darter, stripeback darter, and the State-endangered triangle floater. Provide quality foraging habitat for eastern forest bats, spotted turtle, and insectivorous birds such as whip-poor-will and prothonotary warbler.		
Impound-ments of Open Water, Emergent, Shrub, and Forest	**Objective 3.2:** Manage the current 553 acres (224 ha) in 61 impoundments of open water, emergent, shrub and forest wetlands, or green tree reservoirs to provide habitat for migratory bird species of conservation concern, including American black duck, solitary sandpiper, green heron, greater and lesser yellowlegs, and also to benefit other species of conservation concern, such as least bittern and elfin skimmer, and aquatic reptiles and amphibians.	**Objective 3.2:** Of the 342 acres targeted for potential conversion in the structured decision making process, 210 acres (85 ha) would be converted to bottomland or depressional forest resulting in approximately 343 acres (139 ha) of impounded wetlands. Impoundments selected for restoration to natural hydrology are based on maximizing conservation values for species of concern described in alternative A.	**Objective 3.2:** Of the 342 acres (138 ha) of impoundments targeted for potential conversion in the structured decision-making process, convert an additional 29 acres (97 ha) of impoundments to floodplain bottomland or depressional forest. This would result in approximately 314 acres (127 ha) of impounded wetlands, including those not targeted for restoration.
Emergent Wetlands	**Objective 3.3:** Maintain the biological integrity of	**Objective 3.3:** Same as alternative A.	**Objective 3.3:** Same as alternative B.

Refuge Resource or Program	Alternative A Current Management	Alternative B Preferred Alternative	Alternative C Maximize Forest Interior
(freshwater, non-tidal)	44 acres (18 ha) of naturally occurring freshwater emergent wetlands and open bogs in native vegetation such as narrowleaf cattail, sedges, wetland grasses, pipeworts, arrow arum, pickerelweed, bur-reeds, arrowheads, smartweeds, spike-rushes, asters and composites, and more persistent species such as swamp rose, hibiscus to benefit priority wetland bird species of concern, such as American black duck and least bittern.		
Goal 4: Manage refuge non-forested upland communities to provide ecological structure, composition, and function to support native plants and wildlife, including species of conservation concern. Where appropriate, restore the biological integrity and diversity of these habitats.			
Shrub/Early Succession Forest Habitat	**Objective 4.1:** Continue to provide up to 200 acres (81 ha) of shrub and early succession forest habitat in the 5.5-mile (9-km) BG&E powerline and up to 70 acres (28 ha) in the 3.5-mile (6-km) Pepco powerline right-of-ways in short-stature (less than 10 feet), moderate-density (50 to 75 percent) woody shrub and early succession herbaceous cover comprised of berry, seed, nectar-producing native species for breeding bird species of conservation concern, such as brown thrasher, field sparrow,	**Objective 4.1:** In addition to alternative A, allow 40 to 50 acres (16 to 20 ha) of grassland in small pockets and border zones (less than 25 acres) next to forest to convert to shrub habitat, totaling approximately 310 to 320 acres (125 to 130 ha).	**Objective 4.1:** Same as alternative A, with an additional 20 acres (8 ha) of shrub habitat, totaling about 290 acres (117 ha).

Refuge Resource or Program	Alternative A Current Management	Alternative B Preferred Alternative	Alternative C Maximize Forest Interior
	prairie warbler, eastern towhee, yellow-breasted chat, and gray catbird; migratory and wintering habitat for blue-winged warbler and American woodcock; and foraging habitat for eastern forest bats, whip-poor-will, native pollinators, and other insects.		
Grasslands/ Old Fields	**Objective 4.2:** Maintain existing 515 to 535 acres (208 to 217 ha) of grassland dominated by 70 percent native cool and warm season grasses, up to 25 percent forbs, and up to 5 percent shrub cover to provide breeding, migrating, and winter cover and forage for grassland bird species of conservation concern; including eastern meadowlark, eastern kingbird, field sparrow, savannah sparrow, swamp sparrow, and monarch butterfly and grasshopper sparrow and to benefit native pollinating insects. Allow the remaining fields (less than 25 acres) to revert to forest habitat, unless mowing is required for administrative purposes, environmental education, public use, or public viewing.	**Objective 4.2:** Reduce grasslands by about 150 acres (61 ha), providing approximately 205 acres (83 ha) of priority managed grassland habitat in short- to medium-stature grasslands in large, nonlinear blocks greater than 25 acres (10 ha), dominated by 70 percent native cool and warm season grasses, up to 25 percent native forbs such as milkweeds and asters, and up to five percent shrub cover, for 80 percent use by priority breeding generalist species such as field sparrow, eastern meadowlark, eastern kingbird, and monarch butterfly, and to provide migrating and wintering cover and food for bobolink, savannah and swamp sparrow, overwintering insects, and foraging bats. This results in 385 total acres	**Objective 4.2:** All priority grassland habitat (205 acres/83 ha), and the many small fields in grass cover (150 acres/61 ha) will be converted to mixed hardwood forest dominated by oaks and other native canopy species. Approximately 180 acres (73 ha) of mowed areas around buildings and facilities will be maintained for administrative purposes in a less-intensive management regime that permits native grasses, forbs, and some shrubs to establish and provide food and cover throughout the year. Maintain 22 acres (9 ha) of grassland/old field habitat in the powerline right-of-way near duck pens (units CT-20 and CT-21).

Refuge Resource or Program	Alternative A Current Management	Alternative B Preferred Alternative	Alternative C Maximize Forest Interior
		(156 ha) of grassland or grassy cover for alternative.	
Goal 5: Provide high-quality recreation, environmental education, and interpretive programs to enhance refuge visitors' understanding and appreciation of fish and wildlife conservation.			
Wildlife Observation and Photography	**Objective 5.1:** Provide high quality opportunities for wildlife observation and photography on the refuge. Maintain observation towers and areas, trails (25 miles/40 km), wildlife drive, viewing blinds, and wildlife and nature photo gallery.	**Objective 5.1:** Provide high quality opportunities for wildlife observation and photography on the refuge by expanding facilities and hours of operation. In addition to alternative A: • Create two additional trails at North Tract (Telegraph Road 2.5 miles/4 km and Vernal Pool Trail 1.25 miles/2 km). • Create opportunities for photo exhibits with local photo clubs. • Construct new observation tower at the wildlife viewing area on the North Tract and remove existing tower. • Designate and develop an additional outdoor nature exploration area for visitors on the South Tract.	**Objective 5.1:** Provide high quality opportunities for wildlife observation and photography on the refuge by expanding facilities and hours of operation. Same as alternative B.
Interpretation	**Objective 5.2:** Promote a stewardship ethic and instill a sense of wonder and appreciation of natural resources, wildlife,	**Objective 5.2:** Promote a stewardship ethic and instill a sense of wonder and appreciation of natural resources,	**Objective 5.2:** Promote a stewardship ethic and instill a sense of wonder and appreciation of natural resources,

Refuge Resource or Program	Alternative A Current Management	Alternative B Preferred Alternative	Alternative C Maximize Forest Interior
	and research in visitors by providing engaging interpretive programs and activities for visitors of all abilities, ages, and community groups. • Continue to offer a cadre of seasonally related monthly interpretive programs year-round by reservation. These programs are offered free of charge with the exception of tram tours or when otherwise stated. • Continue to offer interpreter-led tram tours from mid-March through mid-November, with increased hours of operation during the summer months. • Continue to use outreach tools to enhance visitation and participation at interpretive programs and special events. • Continue to offer current opportunities for interpretive programs, updating them as demand dictates. • Continue to maintain and utilize outdoor exploration areas, such as schoolyard habitat. • Continue to offer	wildlife, and research in visitors by providing engaging interpretive programs and activities for visitors of all abilities, ages, and community groups. In addition to alternative A: • Increase the quality and diversity of interpretive monthly program opportunities by developing four to six new or revised interpretive programs annually. • Create and offer limited historical/interpretive guided tours on the Central and North Tracts. • Promote more hands-on, physically active outdoor activities.	wildlife, and research in visitors by providing engaging interpretive programs and activities for visitors of all abilities, ages, and community groups. In addition to alternative A: • Explore fee options for refuge entry, programs, and activities. • Reduce the number of interpretive public programs and special events offered at the refuge.

Refuge Resource or Program	Alternative A Current Management	Alternative B Preferred Alternative	Alternative C Maximize Forest Interior
	major special events (seven offered in fiscal year 2010). • Continue to offer summer series of five to six multi-day youth camps, including one week day camp for underserved youth. • Offer periodic, guided tours to the Central Tract and the Whooping Crane Observatory.		
Environmental Education	**Objective 5.3:** Promote a stewardship ethic through environmental education with students, teachers, scout leaders, and organized community groups to understand and appreciate ecological relationships and the role of refuges nationwide and the role of Patuxent Research Refuge. Continue to: • Offer naturalist-led and self-guided programs for school and scout groups year round. • Offer teacher workshops year-round, designed to meet Maryland State outcomes and with opportunities for Maryland State Department of Education credits. • Accommodate	**Objective 5.3:** Promote a stewardship ethic through environmental education with students, teachers, scout leaders, and organized community groups to understand and appreciate ecological relationships, the role of refuges nationwide, and the role of Patuxent Research Refuge. • Offer a schoolyard habitat-related teacher workshop series in accordance with local and State education standards. • Refuge staff/volunteers would increase involvement by 10 percent over 15 years by providing offsite conservation-related programs to local schools with emphasis on Junior	**Objective 5.3:** Promote a stewardship ethic through environmental education with students, teachers, and organized community groups to understand and appreciate ecological relationships, the role of refuges nationwide, and understand the role of Patuxent Research Refuge. Offer schoolyard habitat-related teacher workshop series in accordance with local and State education standards. Increase involvement in offsite conservation-related programs to local schools and number of visiting schools by ten percent over fifteen years. Explore grant and

Refuge Resource or Program	Alternative A Current Management	Alternative B Preferred Alternative	Alternative C Maximize Forest Interior
	requests from neighboring school communities and other organizations to participate in onsite environmental education program. • Offer current environmental education opportunities both onsite and offsite (approximately 10 per year offsite). • Provide workshop opportunities for scouts and scout leaders to meet advancement requirements. • Provide scout program links to scout leaders. • Support Maryland Federal Jr. Duck Stamp Program.	Duck Stamp curricula. • Increase refuge staff/volunteer led scout workshop opportunities by 10 percent over 15 years. • Incorporate additional climate change and research related information into workshops/programs. • Increase number of teacher workshops offered by 20 percent over 15 years.	sponsorship opportunities for student transportation to public programs. Increase number of teacher workshops.
Non-wildlife-dependent Public Uses	**Objective 5.4:** Allow non-wildlife-dependent uses when they are appropriate and compatible. • Continue to allow horseback riding and bicycling on North Tract. • Continue to allow hiking, cross-country skiing, and jogging on North and South Tracts. • Continue to allow dog walking with current	**Objective 5.4:** Support non-wildlife-dependent uses when deemed to be an appropriate use and compatible with the refuge purpose and mission of the Refuge System. • Allow horseback riding with cleanup or horse-diaper at the North Tract. • Allow limited virtual and no-impact geocaching along designated trails, if	**Objective 5.4:** Reduce or eliminate non-wildlife-dependent public uses of the refuge. • Prohibit horseback riding. • Prohibit dogs. • Prohibit search and rescue training. • Implement a fee program for primitive camping opportunities.

Refuge Resource or Program	Alternative A Current Management	Alternative B Preferred Alternative	Alternative C Maximize Forest Interior
	stipulations on North and South Tracts. • Continue to allow search and rescue training via special use permit on the North and South Tracts. • Continue to provide primitive camping opportunities for scout and 4H groups on the North Tract. • Allow limited dog training in designated areas on the North Tract.	found compatible at North and South Tracts. • Allow waterfowl related dog training with hunting permit in designated areas at North Tract (Cattail Pond and New Marsh), while prohibiting all dog training that is not hunting related.	
Goal 6: Provide high-quality hunting and fishing experiences for hunters and anglers.			
Hunting	**Objective 6.1:** Provide safe, high-quality hunting opportunities on the refuge. • Continue to provide hunting opportunities for upland game, migratory game birds, and white-tailed deer from September through January, and select days in April and May for wild turkey hunt. • Assess effectiveness of quality deer management for hunting and maintaining healthy deer populations and revise regulations as needed. • Area X on the North Tract is currently open	**Objective 6.1:** Provide robust and diverse high quality hunting opportunities to hunters of all ages while promoting hunter and visitor safety, wildlife health, and increasing other public use opportunities. Increase specialty hunts and organized hunts for youth and persons with disabilities. • Assess effectiveness of quality deer management for hunting and maintaining healthy deer populations and revise regulations as needed.	**Objective 6.1:** Provide robust and diverse high quality hunting opportunities to hunters of all ages while promoting hunter and visitor safety, and wildlife health and increasing other public use opportunities. • Keep Little Patuxent River trail open during waterfowl hunting with 50-yard (150-feet) buffer. • Evaluate the need to close some hunt areas seasonally to allow for other permitted uses (e.g., Area N for fishing access at Rieve's Pond). • Eliminate January hunt season

Refuge Resource or Program	Alternative A Current Management	Alternative B Preferred Alternative	Alternative C Maximize Forest Interior
	with a 50-yard (150-foot) buffer and the wildlife viewing area is currently open except during firearms season. Close Area W on the North Tract every other week to allow hiking on Forest Trail.		refugewide with the exception of January deer firearms season.
Fishing	**Objective 6.3:** Provide high quality fishing opportunities at established sites and according to State regulations. • Continue to provide year-round fishing opportunities at North Tract, which includes Lake Allen, New Marsh, Cattail Pond, Rieve's Pond, Bailey Bridge Marsh, and the Little Patuxent River areas. • Continue to provide fishing opportunities seasonally on the South Tract at Cash Lake (June to October). • Continue to improve quality of fishing through vegetation management, which may include temporary impoundment draw-downs and herbicide treatments.	**Objective 6.3:** Provide additional fishing opportunities to anglers of all ages while promoting angler and visitor safety, and wildlife health. • Open Blue Heron Pond to fishing access via hiking and biking. Allow vehicular access to Blue Heron Pond for visitors with impaired mobility. • Expand calendar days for fishing on the South Tract at Cash Lake to start in mid-March (contingent on harvest population surveys). • Expand fishing hours at North Tract (contingent on operating hours changing). • Evaluate potential new fishing areas at North Tract (upstream of Bailey Bridge and Wood Duck Pond).	**Objective 6.3:** Provide additional fishing opportunities to anglers of all ages while promoting angler and visitor safety and wildlife health. Same as alternative B.

Refuge Resource or Program	Alternative A Current Management	Alternative B Preferred Alternative	Alternative C Maximize Forest Interior
		• Assess fish populations refugewide to ensure biological integrity and health in accordance with providing a quality fishing experience. • Expand North Tract events to include youth fishing activities.	
Goal 7: Enhance partnerships with local communities and various organizations to garner support and promote refuge programs and resources.			
Volunteer Opportunities	**Objective 7.1:** Provide a wide variety of volunteer opportunities to support the refuge and to encourage community involvement and support of refuges and natural resources. • Continue current volunteer program to assist the refuge in all aspects of day-to-day operations. • Continue to maintain quality internship program. • Continue to promote organized group participation (ex. Scout groups) for one-time volunteer projects. • Continue coordination between PWRC, MNHA, and the refuge. • Continue to provide	**Objective 7.1:** Provide a wide variety of high-quality volunteer opportunities to support Patuxent Research Refuge and to encourage community involvement and support of refuges and natural resources. • Increase participation with youth volunteers and youth community service organizations by 10 percent over 15 years. • Accommodate two to four service related organizations per year for work projects. • Organize/implement a refugewide project database outlining possible volunteer projects (identify seasonality of work, age appropriateness, etc.).	**Objective 7.1:** Provide a wide variety of high-quality volunteer opportunities to support the refuge and to encourage community involvement and support of refuges and natural resources. Same as alternative B.

Refuge Resource or Program	Alternative A Current Management	Alternative B Preferred Alternative	Alternative C Maximize Forest Interior
	volunteer award and recognition programs/events.	• Better integrate volunteer opportunities with PWRC, MNHA, and Friends of Patuxent. • Encourage/recruit diverse volunteer workforce. • Increase volunteer recognition, award, social, and interactive opportunities.	
Outreach	**Objective 7.2:** Foster community relations and recruit visitors through outreach and community involvement. Send notices and press releases to local media and partners about upcoming events and programs. • Participate with an information table and/or activities at community events such as Bowiefest, Montpelier festivals, and others. • Participate in events/programs of neighboring county conference and visitors' bureaus. • Participate in tourism and educational events of the MD Tourism Council. • Allow partners to use meeting space for events/meetings.	**Objective 7.2:** Continue to foster community relations and recruit visitors through outreach and community involvement. • Increase outreach referenced above by at least ten percent per category. • Reactivate speakers' bureau. • Investigate highway radio announcement opportunities (on special frequency). • Reorganize refuge Web site to make site more user-friendly and be in accordance with Service guidelines. • Increase media partner mailings and communications for events and develop target mailing lists for events. • Actively participate	**Objective 7.2:** Continue to foster community relations and recruit visitors through outreach and community involvement. Same as alternative B.

Refuge Resource or Program	Alternative A Current Management	Alternative B Preferred Alternative	Alternative C Maximize Forest Interior
	• Continue to fund attraction signs on nearby highways (through the State Highway Administration). • Continue to maintain and update Web site. • Encourage Friends and staff to utilize social media to publicize refuge events and programs. • Continue to maintain email listserv.	in social media.	
Refuge Staffing, Facilities, and Grounds	• Maintain current staff. • Continue to work with youth and student employment programs. • Maintain existing buildings and facilities. • Central Tract facility usage and maintenance will be guided by the facilities management program. • Continue NWVC hours of operation from 9 a.m. to 4:30 p.m. daily (except Federal holidays) for building and sunrise to 4:30 p.m. daily (except Federal holidays) for trails and grounds. • Continue VCS hours of operation from 8 a.m. to 4 p.m. daily (except Federal holidays). • Continue to provide	• In addition to 2010 staffing org chart, the following positions were identified in 2009 Refuge System staffing model as a need for the refuge: ○ WG-09 Maintenance Worker – Grounds (FEM) ○ WG-09 Maintenance Worker – Buildings (FEM) ○ GS-12 Contracting Officer (BMA) ○ LE-11 Law Enforcement Officer (RLE) ○ GS-11 Visitor Services (VCS) • Continue NWVC hours of operation from 9 a.m. to 4:30 p.m. daily, including	• In addition to 2010 staffing org chart, the following positions were identified in 2009 Refuge System staffing model as a need for the refuge: ○ WG-09 Maintenance Worker – Grounds (FEM) ○ WG-09 Maintenance Worker – Buildings (FEM) ○ GS-12 Contracting Officer (BMA) ○ LE-11 Law Enforcement Officer (RLE) ○ GS-11 Visitor Services (VCS) • In addition to the positions listed above, a Forester position (GS-09) would be

Refuge Resource or Program	Alternative A Current Management	Alternative B Preferred Alternative	Alternative C Maximize Forest Interior
	conference facilities for scientific, educational, agency, and partner-related information exchange. • Collaborate with Fort Meade and other stakeholders on the design of an alternative firing range design.	most Federal holidays (except Thanksgiving, Christmas, and New Year's Day). • Expand hours of operation for South Tract trails and grounds from dawn to dusk. • Utilize green technology to update NWVC and modify building structure and grounds to be more wildlife friendly. • Update and modify the Wisdom of Wildness exhibits. • Construct additional space for environmental education and interpretation classes and storage. • Collaborate with Fort Meade and other stakeholders on the design of an alternative firing range design. • Obtain funding from the DOD for all needed remediation (such as soil sifting, phyto-remediation, phosphate immobilization) excavation of hot spots, and disposal of accumulated lead-based ammunition in soils and streams in	needed to address the increased role of forest management. • Increase weekend seasonal hours of operation for NWVC and North Tract VCS, including most Federal holidays (except Thanksgiving, Christmas, and New Year's Day).

Refuge Resource or Program	Alternative A Current Management	Alternative B Preferred Alternative	Alternative C Maximize Forest Interior
		areas D, E, F, G, H, I, and J. • Assess the cause of poor revegetation in former firing range Area NT-7 (e.g., result of soil type/soil contamination). • Continue to provide conference facilities for scientific, educational, agency, and partner-related information exchange.	
Conference Facilities	Continue to provide conference facilities for scientific, educational, agency and partner related information exchange.	Same as alternative A.	Allow use of conference facilities to non-wildlife and scientific opportunities.

Chapter 4.

USFWS

Nest Box at Mabbot Pond

Environmental Consequences

4.1 Introduction
4.2 Impacts on Air Quality
4.3 Impacts on Soils
4.4 Impacts on Hydrology and Water Quality
4.5 Impacts on Vegetation
4.6 Impacts on Federally Listed and Recently Delisted Species
4.7 Impacts on Landbirds
4.8 Impacts on Open Water and Wetland Bird Species
4.9 Impacts on Fisheries
4.10 Impacts on Mammals
4.11 Impacts on Amphibians and Reptiles
4.12 Impacts on Invertebrates
4.13 Impacts on Public Use and Access
4.14 Impacts on Cultural and Historic Resources
4.15 Impacts to the Socioeconomic Environment
4.16 Cumulative Impacts
4.17 Summary of Environmental Consequences by Alternative

4.1 Introduction

This chapter describes the environmental consequences we predict from implementing the refuge management alternatives presented in chapter 3. Where detailed information is available, we present a scientific and analytic comparison between alternatives and their anticipated consequences, which we describe as “impacts” or “effects.” In the absence of detailed information, we make comparisons based on our professional judgment and experience.

We focus our discussion on the impacts associated with the goals and key issues identified in Chapter 1, “Purpose of, and Need for, Action.” Direct, indirect, short-term, beneficial, and adverse effects likely to occur over the 15-year life span of the plan are discussed. Beyond the 15-year planning horizon, we give a more speculative description of the direct, indirect, and cumulative effects. The chapter identifies cumulative impacts, any irreversible and irretrievable commitment of resources and the relationship between short-term uses of the environment and its long-term productivity. At the end of this chapter, table 4-2 summarizes the effects predicted for each alternative and allows for a side-by-side comparison.

Regional, Historical, and Watershed Context
As required by the Council on Environmental Quality and Service regulations implementing NEPA, we assessed the importance of the effects of the alternatives presented in the draft EA based on their context and intensity. The context of the impacts ranges from site-specific to broader regional and eco-regional scales (table 4-1). Although refuge lands comprise a small percentage of these larger regional area contexts, all alternatives were developed to contribute towards conservation goals in these larger contexts.

Patuxent Research Refuge is located primarily within the Patuxent River watershed, which encompasses 957 square miles and stretches approximately 115 miles from headwaters near the intersection of Howard, Montgomery, Carroll, and Frederick Counties to its confluence with Chesapeake Bay. The Patuxent River watershed includes portions of Montgomery, Prince George’s, Charles, St. Mary’s, Howard, Anne Arundel, and Calvert Counties. The refuge includes portions of the mainstem Patuxent, the Little Patuxent, and a small portion of the Anacostia River watershed.

Table 4-1. Regional Context for Impacts Analyses at Patuxent Research Refuge

Resource	Context
Air Quality	The greater Baltimore, Annapolis, and Washington, DC area
Water Quality	Waters that pass through or are contained by the Patuxent Research Refuge and the river reaches immediately downstream
Soils	Area within the refuge boundary
Vegetation	Area within the refuge boundary

Resource	Context
Species	Immediate impacts to species while on refuge and consideration of greater populations that refuge specific individuals are a part of
Socioeconomics	Prince George's and Anne Arundel Counties
Recreation	Prince George's and Anne Arundel Counties

Across a more localized landscape scale, the refuge protects a variety of resources and provides a unique opportunity for education and outreach near the urban centers of Baltimore and Washington, DC. Connecting children and families with nature is a high-priority national program of the Service. The urban interface of the refuge provides excellent opportunities for such environmental education and conservation outreach.

Approximately 256,000 visitors from around the Baltimore-Washington Corridor and beyond visit the refuge each year. Patuxent Research Refuge is in a position where it can foster greater community understanding of natural systems, species of conservation concern, the value of the Refuge System, and the Service's mission in conserving and protecting those resources. Each of the management alternatives is consistent with State, regional, ecosystem, and watershed conservation plans identified in chapter 1. At varying levels, each of the alternatives would make positive contributions to these larger landscape-scale conservation endeavors.

Significant land use changes since European colonization brought major impacts to the refuge site and surrounding landscape, including clearing for farmland, highway construction, a major army training site, and expanded residential and industrial construction. As expressed in the refuge vision statement, Patuxent Research Refuge is a biological island in a highly urbanized landscape.

The urban environment and high levels of historical disturbance of mainly upland portions of the refuge and surrounding area also present many challenges ranging from minimizing visitor impacts, to minimizing or mitigating wildlife impacts due to degraded regional water and air quality, noise levels, and other conditions associated with urban environments.

The refuge's ability to directly and beneficially impact the regional environment is somewhat limited given the extent of surrounding land uses and the large human population, but the refuge participates to the degree possible in regional efforts for land conservation, protection of wildlife corridors, air and water quality improvements, and early detection and management of regional invasive species. Given this urban context, the analysis of impacts mainly focuses on how the Service's actions at the refuge might affect the physical and biological environment, socioeconomics, historical, and cultural resources, as well as wildlife-dependent public uses. Where possible, and information is available, we also provide discussions of how management actions would impact regional resources.

Evaluation of Environmental Impacts and Time Frames

Per Council on Environmental Quality and Service regulations on implementing NEPA, we assess the importance of the effects of the alternatives based on their context and intensity. The scale of their context ranges from site-specific to local, landscape, or regional. Although the area of the refuge is only a small percent of the context in its ecosystem or region, we developed all of our management alternatives to contribute to the many conservation goals in those larger contexts. For each alternative, we based our evaluation of the intensity of the effects on the following factors:

- Expected degree or percent of change in the resource from current conditions.
- Frequency and duration of the effect during the 15-year planning horizon.
- Sensitivity of the resource to such an effect or its natural resiliency to recover from such an effect.
- Potential for implementing effective preventive or mitigating measures to lessen the effect.

Scope, scale, and intensity can be defined on a range from negligible to major.

- Negligible: Resources would not be affected, or the effects would be at, or near, the lowest level of detection. Resource conditions would not change or would be so slight that there would not be any measurable or perceptible consequence to a population, wildlife or plant community, public use and access opportunity, visitor experience, or cultural resource.
- Minor: Effects would be detectable but localized, small, and of little consequence to a population, wildlife or plant community, public use and access opportunity, visitor experience, or cultural resource. Mitigation, if needed to offset negative effects, would be easily implemented and likely be successful.
- Intermediate: Effects would be readily detectable and localized with consequences to a population, wildlife or plant community, public use and access opportunity, visitor experience, or cultural resource. Mitigation measures would be needed to offset negative effects and would be extensive, moderately complicated to implement, and probably successful.
- Major: Effects would be obvious and would result in substantial consequences to a local area or regional population, wildlife or plant community, public use and access opportunity, visitor experience, or cultural resource. Extensive mitigating measures may be needed to offset negative effects and would be large-scale, very complicated to implement, and may not have any guarantee of success. In some instances, major effects would include the irretrievable loss of the resource.

Time scales are defined as either short-term or long-term:

- Short-term or temporary: An effect that generally would last less than a year or season.

- Long-term: A change in a resource or its condition that would last longer than a single year or season.

Management Actions Not Analyzed in Detail

The following list of management activities are not analyzed in detail in this document because they are both trivial in effect and common to all alternatives. These would qualify for categorical exclusion from further NEPA review under applicable regulations if independently proposed:

- Operations and maintenance of existing infrastructure and facilities (unless major renovation is involved).
- Issuance of new or revised management plans when only minor changes are planned.
- Law enforcement activities.
- Environmental education and interpretative programs (unless major construction is involved, or a significant increase in visitation is expected).
- Research, resource inventories, and other resource information collection activities.
- Routine, recurring management activities and improvements, including managing invasive plants.
- Small construction projects (for example, fences, berms, small stream and wetland restoration projects, trail maintenance, interpretative kiosks, and development of access for routine management purposes).
- Minor vegetation plantings.
- Reintroducing native plants and animals.
- Minor changes in amounts or types of public use.

"Extraordinary circumstances" in 43 CFR 46.215 are exceptions to our categorical exclusions. In addition, some of the management actions described in chapter 3 are not categorically excluded from NEPA, such as emergency responses to a major disease outbreak. Where either of these conditions applies, we have conducted further NEPA analysis and included it in the following section. Where possible and information is available, we provide discussions of how the below management actions could beneficially or adversely impact refuge resources:

- Restoring of open water and emergent wetland to floodplain forest under alternatives B and C.
- Restoring grassland, open water, and emergent wetland to upland forest under alternative C.
- Managing dry savannah under all alternatives.

- Restoring some areas of grassland to shrub under alternative B and additional grassland and impoundments to shrub under alternative C.
- Opportunities to use prescribed burning to manage grasslands and shrub habitats under all alternatives.
- Creating additional trails and a wildlife observation viewing tower at the North Tract under alternatives B and C.
- Reconstruction of the wildlife viewing area under alternatives B and C.
- Designation and development of an outdoor nature exploration area under alternatives B and C.
- Adjusting allowable public uses of the refuge as described in chapter 2.
- Adjusting the hunt program to increase youth and disabled persons hunting opportunities and open the trails at the wildlife viewing area during hunting season.
- Keeping the Little Patuxent River Trail open during the hunting season and eliminate hunting during January except for the firearms deer season under alternative C.
- Open Blue Heron Pond to fishing and expand fishing season at Cash Lake under alternatives B and C.
- Conducting stream assessments and corrective measures or restoration for water quality and stream function in alternatives B and C.

Adaptive Management Actions Common to All Resources

Adaptive management strategies are proposed for all management actions to mitigate uncertainties in information upon which the proposed activities are based. We propose continued and expanded monitoring, surveying, and inventorying of resources to ensure that we have sufficient scientific data, or have consulted with sufficient subject matter experts, to support our proposed activities affecting refuge resources. Where baseline data is lacking, we have proposed additional inventories. We propose continuing ongoing research and monitoring, such as deer population and impact studies, that would help inform proposed management actions. We propose strengthening and expanding partnerships with agencies, universities, and other designated parties to help conduct these activities to address uncertainties and improve management practices (see chapter 3).

All of the alternatives include a renewed focus on gathering baseline information on refuge resources and monitoring resources to evaluate the potential impacts of climate change. The potential impacts of specific monitoring, surveying, and inventorying resources to the physical and biological environment are controlled and mitigated by special use permits that specify the research activities, locations, frequency of activities and limitations, such as seasonal or temporal restrictions to mitigate potential impacts. Generally, these activities are considered to have short-term and localized adverse

impacts to physical and biological resources. However, the amount and variety of these activities could have potentially adverse cumulative impacts as discussed in section 4.19.

Organization of this Chapter
We have organized this chapter by major resource headings so that each section describes the impacts of all management activities proposed under each of the three alternatives that would likely have an effect on a given resource, such as an impact on air quality or on waterfowl. We begin with the physical environmental (air, water, soils, etc.), then the biological resources (habitats and wildlife), and finally the socioeconomic and cultural and historical environment. Under each heading, we discuss the resource context and the types of benefits and adverse impacts of management actions that we evaluated. We then discuss the benefits and adverse effects that would occur regardless of which alternative is selected and the benefits and adverse effects of each of the CCP alternatives.

4.2 Impacts on Air Quality

Chapter 2, "Affected Environment," discusses the status of air quality around the refuge. Given the urban context of the refuge, the analysis of air quality impacts considered only how the Service's actions at the refuge might affect air pollutants, visibility, and climate change to a minimal degree, focusing on the potential for localized air quality impacts or improvement.

We evaluated the following actions for their potential to protect or improve air quality:

- Managing and restoring forests and wetlands to enhance carbon sequestration and reduce greenhouse gases.
- Continuing and expanding energy efficiency practices to reduce the refuge contribution to emissions.
- Supporting regional trails and public transit to improve and encourage pedestrian and bicycle access to the refuge, and reduce total vehicle emissions.

We evaluated the following actions for their potential to cause increased emissions and adverse effects on air quality:

- Managing and restoring forests to enhance carbon sequestration and reduce greenhouse gases.
- Emissions from increases in visitors from vehicles and facilities and trespassing by off-road vehicles.
- Maintaining the existing impoundments and potential impacts from emissions of methane from the impounded area.
- Increasing use of prescribed burns.

Impacts on Air Quality That Would Not Vary by Alternative

Due to the highly urban context of the refuge, we believe that the impacts of refuge management on regional air quality would be negligible, but slightly positive overall, and would not vary significantly under any of the alternatives. Refuge land management, regardless of alternative, would be expected to have a net positive effect on air quality.

Beneficial

Our management activities should not adversely affect regional air quality. None of the alternatives would violate EPA standards; all would comply with the Clean Air Act. There would be no major stationary or mobile sources of air pollutants at the refuge created under any of the refuge management alternatives. On the contrary, Service limits public uses of the refuge to compatible wildlife-oriented activities, and land ownership and protection curtails human sources of emissions from vehicles and infrastructure by preventing development and consequent impacts to air quality.

Maintaining natural vegetation on over 97 percent of the refuge would continue to provide benefits to air quality with respect to the six air pollutants for which 1990 National Ambient Air Quality Standards (40 CFR part 50) have been established by the EPA. Trees have been shown to reduce the concentration of ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide, and particulate matter less than 10 and 2.5 microns in diameter, primarily through direct uptake and adhesion to stems and leaves (Escobedo et al. 2007). With respect to greenhouse gases, plants absorb carbon dioxide and as a result, vegetated areas can act as an important carbon sink (Heath and Smith 2004). This carbon sequestration is essentially the process by which plants take up carbon dioxide through photosynthesis, after which it is stored in plant biomass (wood) and in the soil. Generally, succession to forest stores the most carbon, and the rate of sequestration declines as trees mature (Heath and Smith 2004).

Managing and restoring forests and natural hydrology would benefit air quality in a number of ways. Long-term benefits of restoration are healthier native plant communities that would perform more ecological services, support a greater number and diversity of wildlife year round, and sustain or improve carbon sequestration capacity. Wetlands and forests both act as carbon sinks by incorporating decaying vegetation into sediment and trees, respectively. Wetlands can also produce methane, a greenhouse gas, but overall there is a net long-term benefit to air quality. Management activities in these habitats such as removing invasive plants that suppress regeneration, and planting and protecting trees from deer browse all contribute to improvements in habitat quality and carbon sequestration capacity. These activities would occur no matter which alternative is selected, but the degree to which we practice them would vary, and thus, so would their impacts. Because of the urbanized nature of the region and the close proximity of heavily travelled roadways, we do not expect our management actions to result in measurably improved regional air quality, but they would contribute to improving local air quality.

NWVC was designed as a “green building” with energy efficient lighting, heat, and cooling; using recycled materials; and using native landscaping and tertiary treatment ponds for waste water. In compliance with Federal mandates, these and other energy

efficient practices to reduce air emissions would be continued and expanded under all alternatives.

Adverse

The most likely sources of adverse impacts to air quality from the refuge would come from exhaust fumes produced by heavy equipment, herbicide spraying, or prescribed fire. Under each alternative, the refuge would continue to use Service-approved herbicides to control invasive plants. Generally, the refuge only applies herbicides on the Field Station Approval List; as other pesticides require either Regional or Service Headquarters approval. We must request approval, through a pesticide use proposal, for all uses of chemicals on the refuge. The refuge manager, regional pest management coordinator, and national pest management coordinator have the authority to approve herbicides and their application procedures. We observe best management practices and application methods that do not result in drift into the atmosphere, such as basal bark, cut-stump, or low-volume foliar with back-packs. Occasionally, we employ low-volume broadcast sprayers with small boom sprayers for larger acres of monoculture infestations of nonnative invasive species, such as lespedeza. Again, best management practices are observed to prevent drift, such as only conducting the treatment in low or no-wind conditions, low height and direct target settings on the boom. We have no plans for aerial spraying; however, should there be a disease outbreak that threatens the forest, State forestry officials might be given authority to treat the situation, but these are tightly controlled protocols.

Prescribed burns would occur no matter which alternative is selected; however, the degree to which we practice them would vary, and thus, so would their impacts. For example, we may implement more prescribed burns under alternative B as an alternative to mowing to maintain grasslands. The major pollutants from prescribed burning are particulates (small particles of ash, partly consumed fuel, and liquid droplets), and gases (carbon monoxide, carbon dioxide, hydrocarbons, and small quantities of nitrogen oxides). Those would increase or decrease based on the alternative we select.

USFWS

Grassland Two Weeks after a Prescribed Burn On-refuge

Prescribed burning releases inconsequential amounts of gases (USDA 1989). The pollutant of primary concern is particulate matter. Particulates can reduce visibility or cause negative effects on the health of people with respiratory illnesses. Appropriate smoke management can minimize or nearly eliminate both of those negative effects. The consideration of the wind speed, direction, and mixing heights is all-important in managing smoke. In planning our prescribed burns, we consider all those factors, and other environmental and geographical factors. Based on our experience, we expect prescribed burning to produce no significant impacts.

Because air quality in the region is generally good, we do not expect our management to result in measurably improved air quality, but it will contribute to the existing good conditions.

Impacts on Air Quality under Alternative A (Current Management)

Beneficial
Benefits to air quality are the same as those discussed in *Impacts on Air Quality That Would Not Vary by Alternative*.

Adverse
In 2011, we estimated 256,000 visits to the refuge, and we expect a 3 percent average increase per year over the life of the plan. Given the urban area surrounding the refuge, this increase in visitation and the associated emissions from travel to and from the refuge is expected to have negligible impacts on air quality.

Impacts on Air Quality under Alternative B (Service-preferred Alternative)

Beneficial
Under alternative B, there would be continuing benefits to air quality from maintaining the natural vegetation on the majority of refuge lands. Natural vegetation serves to filter air pollutants, and maintaining the refuge lands precludes development and the introduction of attendant sources of pollutant emissions.

Alternative B would provide some additional long-term benefits to the air quality as a result of the restoration of 300 acres of floodplain forests. This alternative also includes emphasis on improving riparian forests and coastal plain forests. Management activities in these habitats, such as removing invasive plants that suppress regeneration, restoring grasslands and impoundments to forest, and planting and protecting trees from deer browse, all contribute to improvements in habitat quality and carbon sequestration capacity.

This alternative would result in a decrease in approximately 110 acres of open water habitat associated with a conversion to forest. Current information regarding carbon storage and methane production potential of wetlands is highly uncertain and varies based on wetland location and type (Bridgham et al. 2007). We are uncertain if the refuge

impoundments act as a net source, or sink, for greenhouse gasses in the atmosphere. If these impoundments do act as a source, restoration of forests could reduce emissions of methane, a powerful greenhouse gas. Regardless, given the relatively small size of the impoundment regionally and globally, it is not expected to be a significant source of methane.

In this alternative, we would reduce the amount of grassland management and consolidate grassland habitats into fewer, but larger, contiguous tracts and reduce the amount of grassy cover that is subjected to semi-annual or annual mowing. These measures help reduce the amount of exhaust emissions from equipment.

Adverse
The adverse impacts of alternative B are similar to alternative A, except, under alternative B, there would be more short-term impacts to air quality from equipment exhaust and particulates from soil disturbance and construction associated with the additional habitat restoration efforts. These would be offset, however, by reduced grassland acreage maintained by bushhogging.

Under alternative B, we propose to use prescribed burning for habitat management when possible. The use of prescribed burning would be smaller scale, about 135 acres of savannah and about 205 acres of priority grasslands. There may be an increase in the use of prescribed fire to maintain these areas, which could lead to an increase in particulate matter from burning associated with this maintenance. The primary gases released during prescribed fire include carbon dioxide, carbon monoxide, and water vapor, with other gases present in trace amounts (EPA 1998). With fire, the pollutant of primary concern is particulate matter. Particulates can reduce visibility or cause negative effects on the health of people with respiratory illnesses. Appropriate smoke management can minimize or nearly eliminate both of those negative effects. The consideration of the wind speed, direction, and mixing heights is all-important in managing smoke. In planning our prescribed burns, we consider all these factors, and other environmental and geographical factors, and only burn within narrow, site-specific prescriptions. Based on our experience, we expect prescribed burning to produce no significant impacts.

Impacts on Air Quality under Alternative C

The benefits and adverse impacts of alternative C are similar to those discussed in *Impacts on Air Quality under Alternative B.* There would be some additional carbon sequestration and oxygen production from the additional 250 acres of forest restoration. Given the relatively small number of acres in comparison to the total number of acres of forest, we do not anticipate additional improvements to air quality in the region to be significant.

4.3 Impacts on Soils

Chapter 2, “Affected Environment,” discusses the geologic history of the coastal plain and the soils of the refuge. Soils are the structural matrix and nutrient source for plant

productivity and must be protected to sustain the variety of upland and wetland habitats that would meet refuge habitat and species management goals.

We evaluated the following actions for their potential to conserve, restore, and improve soils:

- Limiting sources of sediment by maintaining forest and other vegetation cover, preventing erosion.
- Expanding public use facilities and signage to minimize soil loss and compaction.

We evaluated the following actions for their potential to cause adverse effects on soils:

- Disturbing soils during non-regular refuge maintenance activities.
- Improving riparian and coastal plain forests.
- Impacting soils by herbicide application and invasive plant management.
- Continuation of firing range use by outside law enforcement agencies.
- Disturbing soils during public use infrastructure construction projects.

Impacts on Soils That Would Not Vary by Alternative

Due to the highly disturbed soils in the refuge, we believe that the impacts of refuge management on soil structure and productivity would be negligible and would not vary significantly under any of the alternatives, except that in alternatives B and C, there is an emphasis on stream assessment and restoration to reduce soil erosion into the streams. We predict that refuge land management, regardless of alternative, would have a net positive effect on soil quality. The following management actions would benefit or impact soils under all alternatives depending on the scale, frequency, and duration of these activities, and the sensitivity of the soils to erosion and compaction.

Beneficial

Promoting intact forest cover and restoring forests and natural hydrology would benefit soil quality and help restore soil structure and improve the biological productivity of soil. By restoring the natural vegetation and hydrology, we encourage the natural physical, chemical, biological, weathering, and other soil-formation processes. Overall, the protection, maintenance, and restoration of habitats on the refuge are expected to benefit soils. Restoration projects would consider natural landform and transitional zones with project designs in order to replicate transitional soil characteristics, soil stability, and hydrology.

Increasing public awareness of soil erosion and the ways people can reduce soil erosion would continue to be part of environmental education and interpretation programs, including the benefits of conservation landscaping and schoolyard habitats.

Adverse

Currently, the refuge has about 4 miles of crushed gravel access roads and 14 miles of paved roads to facilitate refuge management activities and recreational access for visitors (by foot, bicycle, or special access for visitors with disabilities). Although the gravel roads are pervious to precipitation, they do cause the compaction of soils and the loss of vegetation. Gravel access roads are generally located in areas previously disturbed by the original access roads used for filling wetlands with dredge material in the 1950s. Maintenance of access roads, grading to minimize storm water erosion, and repairing soil erosion is done on an as-needed basis, and regular maintenance does not typically exceed one acre per year. No new roads are proposed under any alternative.

USFWS

Road on the Refuge

There are 8.5 miles of overhead transmission lines that cross the refuge. Maintenance of the transmission lines requires the use of machinery that causes minor soil compaction. Also, the presence of the towers that support the lines compact the soil beneath them.

We also maintain approximately 20 miles of foot paths and trails consisting of mowed paths across fields or paths cut through the woods. Soil compaction occurs on those trails as well, although not to the same extent as on gravel access roads. We would continue to prohibit certain recreational activities, such as ATVs or mountain biking on these trails that would damage soils on the refuge.

Public use impacts to soil have not been observed on the refuge. We regularly monitor trails and roads and have not observed any major impact areas resulting from wildlife observation, photography, environmental education, horseback riding, or interpretive uses. Public use trails, wildlife observation areas, parking areas, and other high use areas are designed and maintained to minimize impacts on soils. We monitor parking and other concentration areas and have not observed any significant soil impacts. Maintenance of access roads, trails, and other facilities could cause negligible, short-term, localized soil compaction and erosion. These activities would occur to some degree no matter which alternative is selected. We would continue to use best management practices to minimize any potential adverse impacts. Since use by hunters is dispersed across the landscape, this use would not likely cause soil compaction or erosion.

The use of trails and gravel roads could lead to soil compaction, exposure of tree roots, and the modification of plant species 3 to 6 feet on either side of the trail which is a

function of soil compaction, invasive species, and direct trampling of plants (Kuss 1986). The refuge will continue its management practices of the use of boardwalks, woodchips, erosion control, and user education to protect plant species and habitats along trails and roadways. Visitors are restricted to the public use trails, which are located on the North and South Tracts. Restricting visitors to these trails concentrates use to areas that can be routinely maintained to ensure a quality visitor use experience while also minimizing impacts to vegetation. The implementation of boardwalks and use of woodchips along trails has reduced impacts to vegetation and reduced soil erosion along trails.

As discussed above under *Impacts to Air Quality*, herbicidal applications would be a potential source of impacts to soil; however, we use the best management practices described above in the air quality section and use herbicides that have low mobility or persistence in soils, and generally use only direct herbicide-to-plant applications.

Impacts on Soils under Alternative A (Current Management)

Beneficial impacts on soils under alternative A would be similar to those described under *Impacts on Soils That Would Not Vary By Alternative.*

Adverse

Trampled campsites can become dead zones of compacted soil and may lack understory vegetation (Boyle and Samson 1985; Kuss 1986). The refuge would continue to rotate the location of tents within the campsite to reduce impacts of compaction and to allow for the regrowth of understory vegetation, which further maintains soil health.

Horses can cause physical impacts to soil surfaces. Horses may cause trail erosion by loosening the soil and increasing soil particle detachment under both wet and dry trail conditions (Deluca et al. 1998). Horses can also increase soil compaction (Weaver and Dale 1978). All of the trails open for horseback riding are former military roads made up of gravel and sand, or asphalt (Wildlife Loop), were extensively used by military vehicles, and are currently used by refuge and public vehicles. Therefore, soils are generally compacted and less susceptible to additional physical impact and mechanical erosion. The refuge will continue to take all reasonable measures to prevent or minimize any potential negative effects, and will evaluate the roads and trails periodically to assess whether they meet established suitability criteria and to prevent degradation. If evidence of unacceptable adverse impacts appears, the refuge will continue to re-route, curtail, or close trails to this use as deemed appropriate. The refuge will also post and enforce refuge regulations, and establish, post, and enforce closed areas. Based on the information provided above and the current and projected levels of use, the refuge anticipates that there will be minimal adverse impacts to soils associated with horse use.

Impacts on Soils under Alternative B

Beneficial

The added restoration emphasis under alternative B would potentially improve soils by improving biological function (as a result of restoring vegetation and hydrology and other

components of ecosystem structure). Restoration of additional forest would potentially restore historical soil profiles that were previously buried, removed, or known to contain contaminated sediments. As the area of the softball fields reverts to natural vegetation, soil chemistry would likely return to natural conditions.

Adverse
Alternative B proposes construction of additional facilities, including an observation tower, kiosks, fishing access, and other small improvements. These facilities will be constructed on previously disturbed sites. During the construction of these structures some upper layers of soils would be disturbed and compacted. We would use appropriate erosion and sediment controls to avoid impacts to adjacent areas. As discussed earlier, two wildlife observation trails would be located on previously disturbed road and trail access areas; there would be no impacts to soils from opening the trails. There would be no construction activities associated with opening the two additional trails. Minor compaction from foot traffic over the long term is possible.

Impacts on Soils under Alternative C

Beneficial
The benefits of alternative C would be similar to alternative B. Additional impoundments would be converted to forest which would increase the amount of the localized benefits that would be realized under alternative B.

Adverse
The adverse impacts of alternative C would be the same as those described in *Impacts on Soils under Alternative B.*

4.4 Impacts on Hydrology and Water Quality

As discussed in chapter 2, the hydrology on much of the refuge has been altered and there are a number of impoundments scattered throughout the refuge. The water quality at the refuge is variable and affected by point source pollution upstream and non-point sources both upstream and across refuge lands, and related upstream and greater watershed impacts.

We evaluated the following actions for their potential to benefit hydrology and water quality:

- Protecting, conserving, and monitoring vernal pools that are important habitat for amphibians of special concern.
- Improving water quality by managing and restoring riparian forests and upland forests, creating and maintaining buffers between habitats and high use areas, and restoring hydrologic function to these habitats.
- Maintaining a diversity of aquatic wildlife habitat and supporting wildlife in some impoundments by actively controlling water levels.

- Controlling invasive species.
- Increasing public awareness through environmental interpretation and wildlife-dependent recreation.
- Supporting regional restoration and riparian buffer projects, increasing visitor and public awareness through environmental education and interpretation, and continuing existing partnerships to benefit water quality and hydrology.

We evaluated the following actions for their potential to cause adverse effects on hydrology and water quality:

- Increasing floodplain and upland forests and restoring hydrologic function to these habitats.
- Invasive plant control, including the use of herbicides.
- Larger scale routine management activities, such as mowing fields, maintaining or controlling water levels in impoundments, and less regular activities, such as repairing flood damage.
- Updating, expanding, and managing public use facilities and administrative offices.
- Increasing visitation and expanding the six priority public uses.

USFWS

Impacts on Hydrology and Water Quality That Would Not Vary by Alternative

Water quality in the refuge is a variable and complex phenomenon resulting from inputs of two major waterways: the Patuxent and Little Patuxent Rivers. The contribution from each of these sources at any given time varies depending upon hydrological, climatological, and anthropogenic conditions.

Beneficial

The forested landscape that occurs on the refuge provides a buffer along the streams that pass through the refuge. Forest litter and vegetation reduce sheet flow and allow water to absorb into the ground. In addition, the natural meandering nature and braided streambed reduces the velocity of the water allowing sediments to drop out of suspension. Aquatic vegetation in the stream can increase dissolved oxygen and overhanging trees keep stream temperatures low, which can also benefit oxygen levels and reduce bacteria levels.

Adverse

Under each alternative, adverse impacts on hydrology would be associated with the continued use of at least some of the impoundments. Although these areas benefit waterbird populations and other wildlife, their existence alters the natural flow of water. Dikes can block floodwaters, which help build soils and replenish nutrients. They can also restrict the flow of water off the land, causing extended periods of inundation which can result in the loss of plant species that require periods of drying. Although there are negative consequences associated with impoundments, through the careful use of these management units, the refuge has increased the availability of wetlands, a rare and declining habitat nationwide. Additionally, the hydrology of the refuge area was drastically and permanently altered by agricultural and other development pressures long before the refuge was established, therefore, a return to "natural" hydrologic conditions would be nearly impossible. Furthermore, careful water level management within impoundments can mimic natural hydroperiods as closely as possible, benefitting species associated with these managed wetlands.

The history of the North Tract may impact water quality as the Army altered the landscape substantially through heavy equipment operation and military training exercises, creation of multiple bunkers and storage areas, and leaving behind significant amounts of unexploded ordnance. The Army has conducted extensive surface clearance and continues to respond in the event that additional ordnance is found. In addition, the firing ranges are used for training by military and law enforcement officials with thousands of pounds of lead and "green ammo" alternatives being deposited annually. Impacts to water quality from the deposition of lead and other "green ammo" components in these areas are unknown. There are no reports of lead contamination in the vicinity of the refuge or downstream on the Patuxent River.

Depending on slope, bank and trail erosion from human activity (fishing piers, foot traffic) may increase aquatic sediment loads in ponds and lakes, or alter riparian or lakeshore habitat and vegetation in ways harmful to fish or other wildlife. Many of the areas that anglers access are flat, with a sandy or graveled substrate, with no significant topography change that would result in erosion. Boat access will be restricted to designated areas only. The boat launch area at Cash Lake is constructed of concrete pavers that support vehicle use and accommodate vegetation growth. This area is adjacent to a gravel parking lot that provides ample maneuvering space for vehicles to launch a boat without hampering vegetation or aquatic resources. Trails will be monitored and may be modified, restored, or closed, if conditions warrant. Because much of refuge fishing occurs from the shoreline, the refuge will monitor boardwalks and trails adjacent to ponds, lakes, and rivers in order to reduce trail erosion due to fishing-related foot traffic.

Since hunting activities are dispersed through the refuge, we have not seen any impacts to water quality associated with hunters. Although waterfowl hunting occurs adjacent to waterbodies and the Little Patuxent River, we do not anticipate impacts to water quality because the hunters are spread out along the shorelines of these areas.

Impacts to water quality from public fishing are a concern under any alternative. For this reason, the refuge forbids the use of lead sinkers in fishing tackle and polices adherence to State regulations mandating non-lead ammunition in waterfowl hunting. We also promote non-lead ammunition for upland game hunting, which takes place near many waterways on the refuge.

We do not anticipate any impacts to water quality from the existence or maintenance of the transmission lines on the refuge, because the lines are not located directly adjacent to waterbodies. Also, we do not anticipate impacts to hydrology associated with transmission lines, because the corridors are naturally vegetated with shrub habitat and the lines have not altered local hydrology.

Impacts on Hydrology and Water Quality under Alternative A (Current Management)

Beneficial

A portion of the refuge is bordered by high-density urban residential and industrial-commercial development (such as sand and gravel operations, commuter rail system, and a State college). By maintaining and protecting the natural forest buffers and wetlands along the Patuxent, and Little Patuxent Rivers, refuge lands help protect neighboring communities from additional impacts from flooding and stormwater pollutants. Forest cover best provides and conserves such water-related ecosystem services as groundwater recharge, water quality, flood control, nutrient and pollutant uptake, and stabilizing of soils to prevent erosion and associated sedimentation in creeks. Riparian vegetation helps shade waterways, decreasing water temperatures and increasing the water's capacity to retain dissolved oxygen. The refuge would continue to manage potential impacts of refuge activities on inputs to the two waterways in order to reduce contaminants and stormwater impacts from the refuge.

The refuge impoundments would continue to be managed to provide a variety of habitats suitable for feeding, nesting, brood rearing, and resting habitats for migratory birds and resident wildlife to the degree possible using the existing infrastructure on some of the impoundments. Water levels for Lake Redington and many of the Central Tract (370 acres) impoundments continue to be adjusted seasonally to mimic natural hydroperiods. These seasonal adjustments are similar to those associated with unaltered riverine wetlands to provide the best possible habitat for priority migratory birds and wildlife species.

Adverse

Other restoration and management activities on the refuge would be limited, thus minimizing short-term impacts to hydrology and water quality. The hydrology and water quality would continue to be locally impacted by dikes and other drainage features which are not planned for restoration under current management of the refuge. Dikes block flood waters and surface drainage, which helps build soils and encourages the establishment of phragmites, and may prevent upstream fish passage or migration.

Under alternative A, the risk of herbicide contamination, used in invasive plant control, to open water and wetland habitats would be minimal. Managing invasive species at current levels has not included widespread application of herbicides adjacent to hydrologic resources. Currently glyphosate-based or triclopyr-based herbicides are the primary chemicals used for refuge management operations. Glyphosate quickly degrades making it biologically unavailable. Both are systemic agents that operate only on enzymes located on certain plant tissues within roots or vascular system structures. We would minimize potential adverse effects to aquatic organisms by applying all herbicides according to EPA label instructions and only using herbicides approved for aquatic use in and around waters and wetlands. Refuge staff that work with herbicides are licensed applicators.

There would be little change to public and administrative facilities that would affect water quality.

Horseback riding has limited potential to have effects on hydrology and/or water quality. The trails where this use is allowed do cross riparian drainages and the Little Patuxent River. However, the roads are gravel/sand or asphalt (Wildlife Loop) and are fairly resistant to erosion that might be expected on trails made out of dirt or more organic parent materials. Horse use has been linked to increased coliform bacteria from fecal contamination in at least one study in wilderness areas (Derlet et al. 2008). However, this research was conducted in areas used heavily by pack horses and in some areas by cattle. The trails themselves do alter hydrological regimes and interrupt streamflow. A significant emphasis in this CCP is to identify those drainages most impaired by man-made structures and work to restore them to a more natural hydrology where possible. Refuge staff routinely monitors roads and trails for damage and then remediates problem areas as needed. Trail maintenance is conducted to help minimize any negative effects associated with trail use. Refuge staff ensures any potential negative effects are avoided or minimized. Based on the current and projected levels of use, condition of designated routes, and minimization measures employed, adverse effects on water resources because of this use are expected to be minimal.

Impacts on Hydrology and Water Quality under Alternative B (Service-preferred Alternative)

Beneficial

Benefits to water quality are the same as benefits of proposed actions in alternative A plus:

Conversion of 210 acres of impoundments to a floodplain forest would have the additional benefits associated with reduced runoff. By doing so, the refuge would restore some of the natural floodway capacity historically present along this portion of the Patuxent River. While we do not anticipate this single action to reduce the frequency of flooding, the restoration of historic hydrological regimes and flood capacity in this location adds to the cumulative effects of other flood management efforts.

As the refuge staff work with the NSA and the Secret Service, we anticipate the opportunity to convert at least a portion of the range area to use of "green" ammunition. The use of green ammunition would reduce the amount of lead in the area that could impact water quality. In revising the compatibility determinations for the shooting ranges, we would work with the DOD agencies to ensure that they install bullet traps so that all rounds fired can be captured and recycled.

This alternative also offers a greater emphasis on stream assessment and restoration.

Adverse

Adverse impacts to water quality are the same as adverse impacts of proposed actions in alternative A plus:

Conversion of 210 acres of impoundments to floodplain forest could have short-term impacts on water quality including potential erosion of disturbed soils and potential spills and leaks from equipment associated with the restoration process. These impacts would be minimized by using best management practices. Disturbance to vegetation and soils during replacement of culverts, opening of water control structures or installation of culverts or agri-drains, would potentially cause short-term erosion and sedimentation to nearby water ways. Any restoration would include an analysis of sediments and potential transportation of contaminants before being undertaken.

USFWS

Under alternative B, the refuge would construct public use infrastructure to support the expected increase in visitors for wildlife-oriented recreation and other refuge programs. The small construction projects include additional, observation tower, blinds, and kiosks. Any disturbed soils and suspended sediment would be managed using construction best management practices, such as erosion control barriers. However, each of the planned projects would occur on previously disturbed sites, so impacts are expected to be minimal. After construction, the long-term effects to hydrology and water quality would be minimal and use of these facilities for interpretive and environmental programs would raise appreciation and awareness of the refuge's resources, including hydrology and water quality issues. Clearing vegetation and mowing previously disturbed areas to open two additional trails would have no impact to hydrology and water quality on the refuge.

Horseback riding, repeated vehicle traffic by hunters, and other trail use on the refuge have potential to have minimal impacts on hydrology and/or water quality. The trails cross riparian drainages and the Little Patuxent River and do alter hydrological regimes and interrupt stream flow. However, the roads are gravel/sand or asphalt (Wildlife Loop) and are fairly resistant to erosion that might be expected on trails constructed of dirt or more organic parent materials. A significant emphasis in this CCP is to identify those drainages most impaired by man-made structures and work to restore them to a more natural hydrology. Refuge staff would continue to routinely monitor roads and trails for damage and remediate problem areas as needed. Trail maintenance would be conducted to help minimize any negative effects associated with trail use. Based on the current and projected levels of use, condition of designated routes, and minimization measures employed, adverse effects on water resources because of horseback riding and trail use are expected to be minimal.

Human activity on the refuge, particularly fishing and foot traffic, may increase aquatic sediment loads in ponds and lakes, or alter riparian or lakeshore habitat/vegetation. Human waste and litter may also impact water quality. Public outreach and education on littering, proper waste disposal, and the prohibition of gasoline motors would lessen potential negative water quality impacts. Boat access would be restricted to designated areas and trails would be monitored and may be modified, restored, or closed, if conditions warrant.

Impacts on Hydrology and Water Quality under Alternative C

Beneficial
Benefits to water quality are the same as benefits of proposed actions in alternative B plus:

The conversion of 239 acres of impoundments to floodplain forest would also increase water quality benefits in comparison to alternative B in terms of increased filtering and uptake of pollutants by vegetation and restoring the natural hydrology. By doing so, the refuge would restore the natural floodway capacity historically present along this area of the refuge. While we do not anticipate this single action would reduce frequency of flooding, the restoration of historical hydrologic regimes and flood capacity in this location adds to the cumulative effects of other flood management efforts.

Adverse
The adverse impacts of alternative C are similar to those described in *Impacts to Hydrology and Water Quality under Alternative B*. Effects from horseback riding would not be realized under this alternative.

4.5 Impacts on Vegetation

As discussed in chapter 2, refuge lands include a variety of habitat types, including open water, forests, shrub, grasslands, and emergent or shrub wetlands (see map 2-1). Many of the habitats had been degraded or damaged as a result of the numerous impacts

previously discussed. Some habitats are the result of alteration, such as impoundments, or secondary succession forests. Despite these alterations, many of these impacted habitats have the potential to be restored through various management actions, natural succession, and specific projects. Some habitats support rare plant communities or species of concern.

We evaluated the following actions for their potential to benefit vegetation:

- Conserving and protecting refuge lands to limit the growth of development on these lands, thereby limiting impacts on vegetation and losses of ecosystem integrity.
- Protecting, conserving, and monitoring habitats that contain rare or endangered plants, unique habitats and habitats which are important for species of special concern.
- Conversion or restoration of certain impoundments and grassland areas of the refuge to forest.
- Maintaining wildlife habitat and supporting wildlife in some impoundments by actively controlling water levels, restoring certain impoundments to native forest, or maintaining static water levels in other impoundments.
- Controlling invasive species and pests that impact vegetation on the refuge, and monitoring for these pests, particularly pests known to be present in the region.
- Supporting regional restoration projects and biological and scientific studies which improve habitat management, knowledge of species of concern, or provide learning opportunities for students.
- Increasing public awareness of the importance of vegetation to habitat quality through environmental interpretation and wildlife-dependent recreation.
- Emphasis on “native” species wherever plantings or vegetation restoration is conducted, striving for species and structural diversity and consideration for overwinter survival or future native plant recruitment objectives.

We evaluated the following actions for their potential to cause adverse effects on vegetation and losses of ecosystem integrity:

- Direct or indirect actions that cause soil, hydrology, and water quality impacts that could adversely impact vegetation, and habitat productivity and integrity.
- Managing and restoring riparian forests and upland forest communities.
- Managing invasive species.
- Larger scale routine management activities such as mowing fields and maintaining or controlling water levels in the impoundment, and less regular activities such as repairing flood damage, or prescribed burns.
- Constructing, updating, expanding, and managing public use facilities and

administrative offices.

- Increasing visitation and expanding the six priority uses.

Impacts on Vegetation That Would Not Vary by Alternative

We predict that refuge land management, regardless of which alternative, would be expected to have a net positive effect on vegetation abundance and quality.

Beneficial
Overall, the protection, maintenance, and restoration of habitats are expected to benefit vegetation.

USFWS
Jack-in-the-Pulpit

Under all alternatives, we would continue to employ early detection and rapid response monitoring in conjunction with other conservation partners, to prevent establishment of any known invasive plants. We would continue to reduce the footprint of habitats degraded by stand-replacing, near-monocultures of nonnative plant species, such as Chinese lespedeza, Japanese stiltgrass or honeysuckle. Invasive species control efforts would continue under all alternatives. These efforts are expected to result in a net benefit to native vegetation across the refuge.

Under all alternatives, the refuge would continue to protect areas of upland and floodplain forests. Management efforts across all alternatives would include invasive species controls expected to result in a net benefit to native vegetation across all forested habitats.

Managing deer populations has shown a positive response by vegetation in experimental exclosures (Augustine and Frelich 1998, McCullough 1982). Deer browse lines are visible along some forest edges on certain tracts of the refuge. Signs of deer such as browse, rubbings, trails, droppings, rooting through leaf litter, and tracks are visible throughout the refuge and very few locations contain the woodland wildflowers that one would expect in the area including columbine, trillium, bloodroot, and spring beauty. In this situation, no hunting or no-culling of deer would have lasting effect on sensitive vegetation and may set back resiliency for many years depending on the ‘shelf life’ of seeds in the seed bank and in the long run would have potential negative impacts on the songbird community (Allombert et al 2005).

Under all alternatives, the refuge would continue to protect areas of wetland, river and stream habitats, and associated vegetation. The refuge would continue to protect existing lands adjacent to these rivers and stream segments within refuge boundaries that influence aquatic vegetation in and along them.

Public use can benefit vegetation through our education and interpretive actions proposed under all alternatives. By educating visitors on the importance and identification of native vegetation and intact plant communities, we help individuals to recognize the prevalence of invasive species and the benefits of native species. Under all alternatives, we would continue to encourage volunteer-based efforts to help control invasive species and restore native plant communities.

The refuge would also continue to support deer hunting under all alternatives. Deer hunting benefits a variety of vegetative communities, and native species dependent upon those communities, by keeping deer populations within the carrying capacity of the habitat, thus reducing excessive damage to vegetation caused by over-browsing, and maintaining understory habitat for other species (Rawinsky 2008).

The area under the transmission lines is managed as shrub habitat, which provides habitat for State species of concern such as the whip-poor-will.

Adverse

Managing and restoring forest communities are consistent themes within the refuge goals and are common to all of the alternatives in different degrees. Vegetation clearing or removal during construction activities (and prior to the establishment of cover vegetation) would result in a temporary loss of vegetative cover. However, the refuge would promote revegetation of areas with native species typical of the target plant communities identified for each project.

Public use can affect vegetation in a variety of ways including directly by trampling and indirectly through soil compaction which can affect root systems, or introduction of nonnative weed seeds on footwear, tires, horses and dogs. We regularly monitor trails and roads and have not observed any major impact areas resulting from wildlife observation, photography, environmental education, fishing, interpretive uses, research, or horseback riding. Public use trails, wildlife observation areas, parking areas, and other high use areas are designed and maintained to minimize impacts on vegetation. The most intense concentration of public use is from maintenance of access roads, ongoing trail, and other maintenance activities would cause negligible short-term, localized disturbance (e.g., mowing, herbicide application) to vegetation. These activities would occur to some degree no matter which alternative is selected. These impacts would be minimized by using best management practices.

Horse travel can impact plants on roads and trails by crushing them. Indirectly, horses can impact plants by compacting soils, thereby diminishing soil porosity, aeration and nutrient availability (Kuss 1986). Hammitt and Cole (1998) note compaction limits the ability of plants to re-vegetate affected areas. Plants growing in wet or moist soils are the most sensitive to disturbance from trampling effects (Kuss 1986). Weaver and Dale (1978) found horse use caused a greater loss of vegetation cover, wider and deeper roads and trails, and greater soil compaction when compared to hiker use on meadow and forest trail conditions. Some incidental grazing along roads and trails may occur as well. Therefore, it is anticipated that horses would have some impacts on refuge plant

communities growing on the designated travel routes. Designated routes for horseback riding consist of former military roads with hardened surfaces, and are located predominately on upland soils to prevent impacts to fragile wetland soils and associated plant communities. Designated routes do not have any known occurrences of rare plant species on their surface that would be affected by this use. The refuge does not allow tethering horses to trees or other vegetation, which will help prevent further damage to vegetation.

Invasive plant species that alter native vegetation may be transported onto the refuge through the presence of exotic plant seeds in feed hay, horse trailers, and horse manure. This concern has initiated strict requirements for weed-free hay in some national parks and forests. Currently, there are no programs to provide for certified weed-free hay in Maryland or surrounding states (Rayburn 2001, 2009). Due to the relatively short time-frame for horseback riding excursions on the refuge, most users do not even bring in supplemental feed. It has not been identified as a problem to this point by refuge staff. We anticipate that horse use would cause minimal increases in invasive plants relative to the current presence of invasive plants on the refuge.

We also anticipate that there would be minimal adverse impacts to plant communities on designated routes. Most routes designated for horse use have hardened surfaces where plant communities are sparse or already have a heavy mix of invasive species such as Japanese stiltgrass. Users leaving designated trails could have impacts to adjacent vegetation. Where impacts to vegetation are observed, we would take necessary measures, such as remediation and trail closures, to restore plant communities on or adjacent to the affected trail.

Hunter trampling of vegetation is undetectable due to the high acreage to hunter ratio, limited number of hunt days, sparse understory vegetation, and time of year (dormant season). Plant species vary in their resistance to trampling, leading to changes in plant communities where there is tramping. In general, plant diversity has been shown to increase with slight use and to decrease as use intensifies (Liddle 1997). Plant recovery in the Mid-Atlantic Coastal Plain is relatively rapid compared to wilderness areas located in alpine, arctic, and desert ecosystems where abiotic factors limit plant growth. Plant recovery from trampling damage in these areas can take many years and may never occur (Newsome and others 2002).

Some direct adverse impacts on vegetation may occur as a result of hunting activities. However, those impacts should be minimal, because the refuge prohibits the use of ATVs, off-road vehicle travel, permanent stands and blinds, camping, and fires, which are most likely to damage vegetation. Hunter trampling of vegetation is likely to be further minimized as a result of the high acreage to hunter ratio and the time of year most hunting occurs (dormant season).

People and vehicles can be vectors for invasive plants when seeds or other propagules are moved from one area to another. Once established, invasive species can out-compete native plants, thereby altering habitats and indirectly impacting wildlife. The threat of

invasive plant establishment will always be an issue requiring annual monitoring and, when necessary, treatment. Staff will work to eradicate invasives and educate the visiting public.

Adverse impacts to vegetation may also be realized from lead deposition in the environment from the shooting ranges.

The transmission lines that cross the refuge displace interior forest habitat. In some areas, the edge of the forest intersects with grassland habitat, which not a natural transition and provides limited habitat benefit. However, in most areas the transition is from forest to shrub habitat, which is not as stark of a contrast between habitat types.

Impacts on Vegetation under Alternative A (Current Management)

Beneficial
Beneficial impacts from refuge management under alternative A would be similar to those described under *Impacts on Vegetation That Would Not Vary by Alternative*.

Monarch on Blazingstar at Refuge Butterfly Garden - USFWS

Adverse
Vegetation disturbance, compaction and erosion could occur on trails that are frequently used by campers to access the campground and fishing areas. In order to manage for this impact, campers are restricted to designated areas where trails have been previously established and maintained (Kuss 1986). Invasive plants gain their first footholds in sunny disturbed areas, along trails or around shelters (Scherer 2001). Campers are required to camp only in designated areas in order to alleviate the creation of newly disturbed areas which may foster invasive plants. As the refuge develops its invasive weed management plan, new control measure may be implemented to lessen the possibility of establishing invasive weed communities.

Vegetation changes in and near campgrounds appear to be responsible for the increase of alpha diversity in bird species (Guth 1978). These increases of alpha diversity birds appear to have an effect on forest dwelling species of birds. This effect would be countered by allowing the campgrounds to only be used approximately 45 days a year as well as allowing the campsites to regenerate forest undergrowth through cyclical closures if necessary.

We anticipate that there would be minimal adverse impacts to plant communities on designated trails. Most trails designated for hiking, biking, jogging, and skiing use have hardened surfaces where plant communities are sparse or already have a heavy mix of invasive species such as Japanese stiltgrass, garlic mustard, lespedeza, Chinese

silvergrass, and others. Users leaving designated trails could have impacts to adjacent vegetation. Where impacts to vegetation are observed, we would take necessary measures, such as remediation and trail closures, to restore plant communities on or adjacent to the affected trail.

Impacts on Vegetation under Alternative B (Service-preferred Alternative)

Beneficial

In addition to the benefits to vegetation described under *Impacts on Vegetation That Would Not Vary by Alternative,* alternative B would create a focus on restoring and expanding forest habitats, through converting some impoundments and grassland habitat into forested habitat over the life of the plan. This would shift the plant community structure and species composition over this time.

Remaining grasslands would be enhanced to improve vegetative structure and species composition in order to more closely resemble the grassland patches historically present in the area and to minimize interior-to-edge ratio.

In this alternative, powerline right-of-way vegetation would be primarily shrubland, except for patches of natural wetlands, which could be bogs, shrub, or emergent wetlands. This would provide additional 260 or so acres of shrub habitat.

Another benefit to this alternative is the reduced mowing and burning associated with grassland habitat maintenance. The area of the softball fields would likely regenerate to natural conditions as the land is not mowed or fertilized. Seeds and plant species would colonize from the adjacent forested areas.

Adverse

The adverse impacts of alternative B are similar to alternative A, except:

There would be minor, temporary, negative effects on vegetation associated with impoundment restoration resulting from equipment needed for restoration work and would likely be localized to the berms or dikes that form the impoundment. These effects are expected to be temporary and the restoration plan would include strategies for minimizing negative effects (e.g., damage to soils and vegetation) and revegetating disturbed areas. The vegetation communities would change with a loss of emergent wetland plants and increase in floodplain forest community associated species.

People, vehicles, boats, dogs, and horses can be vectors for invasive plants when seeds or other propagules are accidentally, or deliberately, introduced into the refuge. Once established, invasive species can out-compete native plants, thereby altering habitats and indirectly impacting wildlife. The threat of invasive plant establishment will always be an issue requiring annual monitoring and, when necessary, treatment. Staff would work to eradicate invasive species and educate the visiting public.

Alternative B proposes construction of additional facilities that include an observation tower, kiosks, and improved fishing access points. During the construction of these structures some areas of vegetation would be disturbed. Most, if not all, small project construction would be located where vegetation is already degraded, so a minor permanent loss of vegetated cover would result in a negligible impact. To open new trails, we would clear minor amounts of vegetation (branches and parts of shrubs) from the trail corridor and mow grasses and forbs in the trail footprint.

Impacts on Vegetation under Alternative C

Benefits
The benefits of alternative C are similar to alternative B, except:

A benefit under this alternative would be the increase in floodplain and upland forest acreage. The increased acreage would aid in forest resiliency and redundancy, factors important in weathering the effects of future climate change anticipated for this area, such as increased storm events, increased temperatures, more or less rainfall, new diseases and pests, and new invasive plant species. Conversion of additional impoundments and grasslands to forest cover and shrub communities would also increase the amount of forest cover on the refuge.

Another benefit to this alternative is the reduced mowing and burning associated with grassland habitat maintenance.

Adverse Impacts
The adverse impacts of alternative C are similar to alternative B, except:

There will be less available habitat to support native plants and pollinators associated with long-term grasslands and other species in the food web that use open habitats.

As in alternative B, alternative C also anticipates an increase in refuge participation and visitation. Effects of increased visitation under alternative C are expected to be similar to those described under alternative B.

4.6 Impacts on Federally Listed and Recently Delisted Species

There are no known federally listed species on the refuge at this time. As part of the Refuge System, one of our highest priorities is the conservation and management of federally listed or recently delisted species. We evaluated each of the alternatives for its potential to beneficially or adversely affect the riparian habitat or other habitats where breeding, wintering, or foraging bald eagles concentrate. State-endangered species or species of greatest conservation need (including amphibians, reptiles, birds, and plants) also occur on the refuge and are addressed under their individual taxonomic sections.

Bald eagle
Although the bald eagle was removed from the Federal list of endangered and threatened species on August 12, 2007, it is still a federally protected species under the Bald and Golden Eagle Protection Act and the State continues to list it as a threatened species. Bald eagles remain a priority for conservation on the refuge. We would continue to adhere to the Federal management guidelines for bald eagles in Maryland.

Impacts on Federally Listed and Recently Delisted Species That Would Not Vary by Alternative

We evaluated the benefits of our actions that would conserve, restore, improve, or increase habitats of federally listed and recently delisted species (e.g., bald eagle). We do not anticipate any impacts to any endangered or threatened species under any of the alternatives.

4.7 Impacts on Landbirds

The conservation and management of forested habitats are a priority of the refuge and consistent with its establishment purposes, and one of our CCP goals. We evaluated each of the alternatives for its potential to benefit or adversely affect early successional and forested habitats and associated landbirds.

We evaluated the benefits of our actions that would conserve, restore, improve, or increase habitats of landbirds and identified focal species in chapter 2 and in our biological objectives:

- Improving and restoring floodplain and upland forests.
- Controlling invasive species.
- Increasing public awareness through environmental interpretation and wildlife-dependent recreation.
- Improving and restoring stream health.
- Improving the structural and species diversity, and native composition of other habitat types, especially shrublands.

We evaluated the potential for the proposed actions to cause adverse effects on habitats of landbird focal species:

- Disturbance from public use.
- Potential impacts from spraying of invasive species, forest restoration, and impoundment water level manipulation.
- Construction of additional wildlife observation infrastructure such as an observation tower and viewing blinds.

- Mechanical management actions such as bushhogging.
- Construction of new facilities or de-construction activities.
- Operation and maintenance of facilities, buildings and associated infrastructure.

Impacts on Landbirds That Would Not Vary by Alternative

Beneficial

Several State-listed endangered or threatened landbirds use the refuge including blackburnian warbler, Henslow's sparrow, mourning warbler (*Oporornis Philadelphia*), northern goshawk (*Accipiter gentilis*), olive-sided flycatcher, least bittern (*Ixobrychus exilis*), and short-eared owl (*Asio flammeus*). These species primarily use upland and floodplain forests for breeding, foraging, and resting habitats. These species primarily use upland and floodplain forests foraging and stopover wintering habitats, but Henslow's sparrow used to breed here and least bitterns still breed here.

Bill Thomspon/USFWS

Short-eared Owl

Several other landbirds that are not State-listed, but are identified as regional conservation priorities, are included in this group as well. Species such as American woodcock, blue-winged warbler, prairie warbler, wood thrush, and worm-eating warbler are all noted as high management priorities in plans such as BCR 30, the Service's Birds of Conservation Concern list, and Maryland's Wildlife Action Plan.

Forest birds would also benefit by the expansion of the widths of forested riparian zones that will create more habitat for roosting, foraging, or seeking cover and, depending on the width, breeding. The acreage depends on the alternative selected, as grassland management may occupy some acreage that otherwise would be forested.

Across all alternatives, valuable shrubland habitat would be provided within the powerline right-of-ways.

Under all alternatives, the refuge would continue to restrict access and management activities when and where appropriate near known nesting sites and continue breeding success monitoring as described in chapter 3. Long-term benefits to landbirds are anticipated through the ongoing management of upland and floodplain forests and other terrestrial habitats around the refuge. Invasive species management and supplemental plantings help enhance and restore the habitats that landbirds use for nesting, foraging,

and migratory stopover. Ongoing management activities, such as invasive species management and inventory and monitoring programs, would continue to be completed in a manner that would prevent potential impacts to individual species.

The refuge would continue to coordinate with MD DNR, along with our conservation partners, to ensure that we use the best available science in our management decisions related to State-listed species.

Adverse

Regardless of the alternative, we would continue to employ a range of invasive species management tools, such as mechanical and chemical options, to achieve our objectives in managing for the improved health and integrity of landbird habitats. We would use these tools only when and where appropriate, and only with the proper training and focused application to avoid adverse impacts. Invasive species control can be detrimental to landbirds if proper timing and application are not considered, but we tailor our treatments to protect birds during the nesting and fledgling periods and to avoid harm to amphibians. A less noticeable but long-term impact would result from no action with respect to invasive species control or failing to curtail the deer population, as these have the potentially to significantly alter vegetation communities upon which birds and their prey base depend.

Disturbances vary with the wildlife species involved and the type, level, frequency, duration, and the time of year such activities occur. The responses of wildlife to human activities include avoidance or departure from the site (Owen 1973, Burger 1981, Kaiser and Fritzell 1984, Korschen et al. 1985, Kahl 1991, Klein 1993, Whittaker and Knight 1998), the use of sub-optimal habitat (Erwin 1980, Williams and Forbes 1980), altered behavior or habituation (Burger 1981, Korschen et al. 1985, Morton et al. 1989, Ward and Stehn 1989, Havera et al. 1992, Klein 1993, Whittaker and Knight 1998), attraction (Whittaker and Knight1998), and an increase in energy expenditure (Morton et al. 1989, Belanger and Bedard 1990).The presence of people hiking, jogging, biking, and skiing on refuge trails and roads can lead to displacement of animals from trails, although disturbance usually is a negligible influence on large mammal distributions and movements (Purdy et al. 1987; Boyle and Samson 1985). The effects of roads and trails on plants and animals are complex. Trail use can disturb areas outside the immediate trail corridor (Trails and Wildlife Task Force 1998, Miller et al. 2001). Studies have found that bird communities are affected by the presence of recreational roads and trails, where common species (e.g., American robins) are found near trails and rare species (e.g., grasshopper sparrows) are found farther from trails. Songbird nest failure was also greater near trails. The effects on other forms of wildlife appear to be short-term with the exception of breeding bird communities.

A study by Miller, Knight, and Miller (1998) indicates that species composition and nest predation was altered adjacent to trails in both forested and grassland habitats. It appears that species composition changes are due to the presence of humans and not the trail or roadway itself. On the other hand, nest predation does appear to be a function of the trail which allows access to mammalian nest predators. Several studies have examined the

effects of recreationists on birds using shallow-water habitats adjacent to trails and roads through wildlife refuges and coastal habitats in the eastern U.S. (Burger 1981, Burger 1986, Klein 1993, Klein et al. 1995, Rodgers and Smith 1995, Rodgers and Smith 1997, Burger and Gochfeld 1998).Overall, the existing research clearly demonstrates that disturbances from recreation activities have at least temporary effects on the behavior and movement of birds within a habitat or localized area.

Anticipated impacts of hiking, jogging, biking, and skiing on wildlife include temporary disturbances to species using habitat on the trail or directly adjacent to the trail. These disturbances are likely to be short term. Use of some roads and trails may cause direct mortality to amphibians crossing trails during migration or foraging. There may also be nest abandonment of bird species nesting on, or next to, trails should these uses become too frequent during breeding season. Long-term impacts may include certain wildlife species avoiding trail corridors as a result of this use over time. However, trails open to hiking, biking, jogging, and skiing are located primarily in continuous tracts of hardwood or mixed hardwood/pine forests, with some open meadow areas mixed in. More sensitive or underrepresented wildlife habitats such as riparian and wetland areas were avoided, reducing the potential for wildlife disturbance. Locating these trails in upland forested habitat spreads the disturbance over the largest habitat type on the refuge, minimizing the overall impact on refuge wildlife associated with this habitat.

Wildlife disturbance may be compounded by seasonal needs. For example, some species, like warblers, could be negatively affected by disturbance associated with bird watching particularly during the breeding season. When visitors approach nests too closely, they often cause the adult bird to flush exposing the eggs to weather conditions or predators (Banks and Bryant 2007, Miller et al. 2001).

As discussed throughout this document, the refuge is located in a highly urban environment, with substantial baseline disturbance associated with the international airport, Baltimore-Washington Parkway, several State routes, and numerous houses, business, community buildings, and associated human activity. By limiting the presence of humans to refuge trails and infrastructure, refuge visitors are not expected to add significantly to existing disturbance levels. Overall, the direct disturbance from public use is expected to have minimal or no adverse effects on landbirds because human presence would be limited to refuge trails and infrastructure.

Domestic or house cats, both free-ranging domestic and feral, also have negative effects on wildlife. Cats prey on wildlife, compete with native wildlife, and can transmit diseases to wildlife, pets, and people. Cat predation is an added stress to wildlife populations already struggling to survive habitat loss, pollution, pesticides, and other human impacts (ABC 2011). The cumulative negative effects of cats on wildlife are impossible to quantify; however, there is a growing body of literature that strongly indicates that domestic cats are a significant factor in the mortality of native small mammals, birds, reptiles, and amphibians (CDFG 2009). At this time, we have limited ability to control feral cat populations on the refuge, because the amount of effort that would be required to effectively reduce the feral cat population to a level that would not quickly rebound to the current level would be cost prohibitive. We would continue to monitor the impacts of

feral cats on landbirds and make changes in management or access as needed to continue our protection of these species. Other primary predators on bird populations include snakes, fox, raccoon, possum, and skunk. Minimizing edge or fragmentation helps to reduce bird predation from these animals as they prefer to work within 300 feet of forest edges. For this reason, we also seek to maximize the interior to edge ratio of our grasslands to minimize predation on ground nesting birds from snakes, raccoons, and fox.

The shooting ranges may have direct and indirect, short and long-term impacts to landbirds in the nearly 3,000-acre impact zone. Long-range fire that reaches beyond the limits of the range has the potential to disturb, flush, injure, or even cause mortality of birds in the area. While we have not directly measured the impacts of these ranges which operate daily, year-round, indirect effects can be seen. Trees are shorn of small branches and trimmed of vegetation in the area and bullets have been seen lodged in bark. Spent lead-based ammunition also accumulates beyond the berm and can contaminate the soil, or gets washed into nearby streams; it can also be taken up by plants and invertebrates, which are consumed by birds. Direct ingestion of lead by birds can occur by raptors feeding on decaying game, or by other birds which mistake fragments of shot for grit. The impact zone is unsafe for researchers or monitors to study the immediate area without shutting down the range. In revising the compatibility determinations for the shooting ranges, we will work with the DOD to ensure that it find solutions to mitigate these effects.

In the transmission line corridors, there is an overall loss of interior forest habitat. This area still provides habitat for landbirds of concern, such as the American woodcock. The edge effect along most of this area is minimized by managing for shrub habitat.

Impacts on Landbirds under Alternative A (Current Management)

Beneficial and adverse impacts to landbirds under alternative A are the same as those discussed in *Impacts on Landbirds That Would Not Vary by Alternative*.

Impacts on Landbirds under Alternative B (Service-preferred Alternative)

Beneficial

Compared to alternative A, alternative B would provide additional long-term benefits to landbirds through the protection and restoration of upland and floodplain forests, and grassland enhancements. The conversion of the 210 acres of impoundments to a mix of hardwood floodplain forest species would provide improved habitat structure and species composition needed for various warblers, such as prothonotary warbler. Phased removal and reforestation of this area would help minimize short-term impacts or habitat loss.

We would also maintain and improve larger patches of grassland in locations where this habitat has less impact on the habitat value of interior forest blocks. By expanding warm-season grass coverage in conjunction with seed-producing native flowering species, we would improve habitat quality for bird species that use these areas for foraging, nesting

and wintering. This alternative also benefits the insects and other invertebrates on which these birds depend.

Controlling the deer population under alternative B would improve plant regeneration in forested and grasslands areas of the refuge. An increased diversity and abundance of vegetation across these habitats would help improve nesting site availability and success.

Adverse

Habitat management and restoration of forests and grasslands under alternative B would likely result in short-term and infrequent disturbances to landbirds during necessary work and maintenance of these areas. We would continue to monitor known nest locations and adjust our management and timing of our actions to minimize impacts on landbirds. We would minimize activities such as prescribed burns, bushhogging, forest thinning, and broadcast spraying from April 15 through August 1 or later, and would scout areas for nesting birds prior to commencing work.

Alternative B anticipates an increase in refuge participation and visitation over the next 15 years. Much of this increase is expected in the form of school groups or recreational uses. As noted in the *Impacts on Landbirds That Would Not Vary by Alternative* discussion, increased use of existing trails poses minimal potential impact to nesting landbirds because human presence would be limited to refuge trails and infrastructure.

Researchers could cause disturbance to ground-nesting birds, or winter roosting species that have limited energy reserves. The presence of people on refuge trails and roads can lead to displacement of animals from trails, although disturbance usually is a negligible influence on large mammal distributions and movements (Purdy et al. 1987; Boyle and Samson 1985). A study by Miller, Knight, and Miller (1998) indicates that species composition and nest predation was altered adjacent to trails in both forested and grassland habitats. It appears that species composition changes are due to the presence of humans and not the trail or roadway itself. On the other hand, nest predation does appear to be a function of the trail which allows access to mammalian nest predators (Miller, Knight, Miller, 1998).

USFWS

Kestral Banding

Disturbance to wildlife and vegetation by researchers could occur through observation, a variety of wildlife capture techniques, banding, collecting blood samples, flushing wildlife, and vegetation trampling from accessing the study area by foot or vehicle. It is possible that direct or indirect mortality could result as a by-product of research activities. Mist-netting or other wildlife capture techniques, for example, can cause mortality directly through the capture method or in-trap predation, and indirectly through capture injury or stress caused to the organism. Multiple, concurrent research projects could exacerbate impacts. Additional impacts could result from abandoned research apparatus left in the field. Overall, however, allowing well-designed and properly reviewed research to be conducted by non-Service personnel is likely to have very little impact on refuge wildlife populations. If the research project is conducted with professionalism and integrity, potential adverse impacts are likely to be outweighed by the knowledge gained through allowing the research. Similarly, the refuge maintains a database and GIS maps of current research to prevent conflicts and imposes guidelines to prevent negative impacts, such as keeping vehicles on refuge roads, prohibiting intrusive marking of vegetation, or staggering the timing of research at same sites.

Disturbance to breeding birds attempting to establish and settle into nest territories, nest-building and incubating is more likely to result from off-trail visitor use, such as would occur for turkey hunting during the spring gobbler season, particularly for low-elevation or ground nesting birds and particularly if the same spots experience repeated disturbance from gunshot, vehicles, lights, and communications. Overall, direct effects from consumptive use during the spring should be greatly reduced if such use is fairly dispersed, confined to limited areas on tracts opened to public use, large areas remain undisturbed, and sensitivity to breeding season is observed. Direct effects to breeding landbirds from consumptive visitor activities may also be mitigated by observing time of year restrictions, limiting the frequency, duration, and number of locations of consumptive activity.

We would pursue opening additional trails and visitor facilities like the observation tower on the North Tract. We would evaluate the sites and programs periodically to assess whether they are meeting the objectives, and to prevent site degradation. If the use causes evident and unacceptable adverse impacts, the refuge would rotate the activities to secondary sites, curtail, or discontinue them.

Added public use infrastructure proposed under alternative B such as kiosks and trails would not occur near known nesting areas. Construction timing would be scheduled to avoid potential disturbance to nesting species in areas adjacent to the proposed trails and observation tower, as well as to minimize impacts on foraging and resting habitat during important seasonal periods such as nesting or migration. As a result, minimal adverse impacts are anticipated from proposed construction projects. Overall, we do not anticipate that visitor use numbers will change as a result of providing these new opportunities. The total number of visitors would be dispersed among these new opportunities. The level of disturbance on the refuge as a whole is anticipated to be the same under all alternatives.

Disturbance to breeding birds attempting to establish and settle into nest territories, nest-building and incubating is more likely to result from off-trail visitor use, such as would occur for turkey hunting during the spring gobbler season, particularly for low-elevation or ground nesting birds and particularly if the same spots experience repeated disturbance from gunshot, vehicles, lights, and communications. Overall, direct effects from consumptive use during the spring should be greatly reduced if such use is fairly dispersed, confined to limited areas on tracts opened to public use, large areas remain undisturbed, and sensitivity to breeding season is observed. Direct effects to breeding landbirds from consumptive visitor activities may also be mitigated by observing time of year restrictions and limiting the frequency, duration, and number of locations of consumptive activity.

Under alternative B, the use of dogs on the refuge for search and rescue training and waterfowl hunting is allowed. Dogs on the refuge could have negative impacts on refuge landbirds. The dogs could cause birds to expend energy moving to other areas of the refuge. Waterfowl hunting occurs along waterways and is not anticipated to impact landbirds. Search and rescue training occurs at low numbers and is timed to avoid nesting season and located to avoid sensitive locations.

Studies on impacts of recreational dog walking in woodlands demonstrated a 35 percent reduction in bird diversity and 41 percent reduction in abundance, regardless of whether dog walking was allowed or prohibited (Banks and Bryant 2007). Free-ranging and uncontrolled dogs can chase and flush ground-nesting or foraging birds. Potential impacts of domestic dogs could be broadly classified as harassment, injury, or death of wildlife. Harassment to ground-nesting for foraging birds is the disruption of normal maintenance activities, such as feeding, bedding, or grooming. It can take the form of disrupting, alarming, or even chasing. If dogs chase or pursue wildlife, injuries could be sustained directly or indirectly as a result of accidents that occur during the chase itself rather than direct contact with the dog. Impacts of domestic dogs can also include modification of wildlife behavior; however, the requirement that dogs be kept on a 6-foot leash would keep dogs on trails and not in habitat areas. Therefore, this use is not expected to add significantly to existing disturbances. Suitable habitat for escape is near areas where training is allowed to occur so disturbances to wildlife are expected to be temporary and minimal.

Large game hunting takes place outside of the breeding season, so negative impacts to breeding forest and grassland or shrubland birds are not anticipated.

Turkey hunting has the most potential to cause disturbance to landbirds, particularly ground nesting forest birds of conservation concern, such as worm-eating warbler, Kentucky warbler, and ovenbird. Woodthrush is another species of conservation concern that nests in lower branches and forages and sings from the ground. It is an area-sensitive forest interior species that could also be disturbed by turkey hunting. The spring hunting season currently takes place on select days between mid-April and late May, when birds are likely to be laying or incubating. Since the number of days of turkey hunting each

year is low, we have not seen significant impacts to breeding landbirds, nor do we anticipate additional impacts.

Impacts on Landbirds under Alternative C

Beneficial
Alternative C differs slightly from alternative B in benefits to landbirds. This alternative would provide additional upland forest and floodplain forest communities. Shrub and early successional habitats are currently under-represented across the refuge and region. These habitat types benefit various warbler species and other songbirds that use dense shrub cover.

Similar to alternative B, providing additional opportunities for environmental education and interpretation would raise public awareness and support for wildlife protection and habitat conservation.

Adverse
Adverse impacts to landbirds are similar to those discussed in alternative B, except, that it would result in the loss of grassland habitat of sizes and configurations that would benefit grassland generalist birds.

Alternative C anticipates slightly lower numbers of public use visitation when compared to alternative B. Potential adverse impacts under this alternative would be intermediate between alternatives A and B.

4.8 Impacts on Open Water and Wetland Bird Species

We evaluated the following actions for their potential to conserve, restore, improve, or increase habitats of waterbird focal species (e.g., American bittern, great egret, king rail (*Rallus elegans*), and least bittern):

- Managing and restoring freshwater impoundments and emergent wetlands.
- Controlling invasive species.
- Increasing public awareness through environmental interpretation and wildlife-dependent recreation.
- Improving riparian buffer vegetation.

We evaluated the following actions for their potential to cause adverse effects on habitats of waterbird focal species:

- Disturbance of species from public use.
- Restoration of some impoundments to forest.

- Potential impacts from spraying of invasive species, forest restoration, or impoundment water level manipulation.
- Construction of additional wildlife observation infrastructure such as boardwalks and viewing blinds.

Impacts on Open Water and Wetland Birds That Would Not Vary by Alternative

Beneficial

Under all alternatives, the refuge would continue to restrict access and management activities when and where appropriate near known nesting sites and continue breeding success monitoring.

Waterfowl and shorebirds of regional conservation priority, such as American and least bittern, sora, king rail, and American black duck, would continue to use available impoundments and naturally occurring wetlands.

Sally Gentry/USFWS

American Bittern

Adverse

Bennett and Zuelke (1999) summarize several studies indicating recreation activities that would have at least temporary effects on the behavior and movement of birds using shallow water habitats adjacent to trails and roads through wildlife refuges (Burger 1981, 1986; Klein 1993; Burger et al. 1995; Klein et al. 1995; Rodgers and Smith 1997; Burger and Gochfeld 1998). Winter hunt seasons (deer and waterfowl) have the potential to disturb winter waterbirds where hunt zones are in proximity to their forage and loafing areas. Deer hunting does not generally occur adjacent to waterbird areas. Waterfowl hunting would likely have impacts to waterbirds, especially the waterfowl that are hunted at the refuge. Each year, bag limits are set according to population goals for the species to ensure that there are no population impacts. The refuge will continue to adhere to these limits.

As discussed under the section on landbirds above, we would take all necessary measures to mitigate those effects, particularly where group educational activities are involved. We would evaluate the sites and programs periodically to assess whether they are meeting objectives, and to prevent site degradation. If the use causes evident and unacceptable adverse impacts, the refuge would rotate the activities to secondary sites, curtail, or discontinue them. Since dogs are allowed only on trails and the majority of trails are not in close proximity to areas of waterfowl nesting, loafing, or foraging, we do not anticipate significant impacts from dog walking.

Public users of the areas along the Patuxent and Little Patuxent Rivers and various impoundments could damage marsh grasses or disturb nesting or foraging marsh birds or

otherwise degrade these areas, for example through deposit of used fishing line, tackle, or other trash, or by disturbance to bank areas and creation of turbidity. Refuge signage, flyers, and other public information materials would continue to be used to ensure that the public is aware of these issues and does not engage in harmful activities.

Negative impacts to waterfowl and other wildlife from lost fishing gear may include ingestion of lead sinkers, hooks, lures, or litter; or entanglement in fishing line or hooks. Lost fishing tackle may harm waterfowl, eagles, and other birds externally by catching on, and tearing skin. Fishing line may also become wrapped around body parts and hinder movement (legs, wings), impair feeding (bill), or cause a constriction with subsequent reduction of blood flow and tissue damage. Entangled animals may become snagged by an object above or below the water surface, from which they are unable to escape. Fishing line entanglement has also caused mortality of bald eagles. Birds may also ingest sinkers, hooks, floats, lures, and fishing line. Ingested tackle may be toxic or cause damage or penetration of the mouth or other parts of the digestive tract that may result in impaired functioning or death. There have not been any documented cases of this occurring on the refuge. However, Patuxent Research Refuge would continue to provide education and outreach on the hazards of fishing tackle. The refuge has also placed monofilament recycle bins at Cash Lake, New Marsh, the Visitor Contact Station, the NWVC, and Lake Allen to reduce the probability of wildlife coming in contact with lost fishing gear. Refuge officers assist with this public outreach effort. Fishing seasons in Maryland coincide, in part, with spring to early summer nesting and brood-rearing periods for many species of aquatic-dependent birds. Anglers may disturb resting and foraging birds by approaching too closely. Flushing may expose eggs to predation or cooling, resulting in egg mortality. The refuge would continue to seasonally close areas around sensitive sites to fishing. Public outreach and placement of warning signs would also be continued.

It is important to note that the refuge exists within a highly altered area with substantial baseline levels of disturbance associated with interstate traffic, airport activities, adjacent neighborhoods, roads, and past military use. Overall, the effects from public use are expected to have minimal adverse effects on waterbirds utilizing open water and wetland habitats, except for the minor disturbance levels noted above. There are few visitor facilities (e.g., trails) in these habitats due to the presence of open water, saturated soils, and their location in a closed area of the refuge; therefore, they are relatively inaccessible to the public. The size and dense vegetation supported by freshwater emergent vegetation and portions of open water should provide adequate buffers to protect wetland bird species against human disturbance (Gibbs and Melvin 1992). Boaters that access the Cash Lake could disturb species using these habitats.

Impacts on Open Water and Wetland Birds under Alternative A (Current Management)

Benefits and adverse impacts to open water and wetland birds are the same as those discussed in *Impacts That Would Not Vary by Alternative.*

Impacts on Open water and Wetland Birds under Alternative B (Service-preferred Alternative)

Beneficial

Benefits to open water and wetland birds are the same as those discussed in *Impacts on Open Water and Wetland Birds That Would Not Vary by Alternative*.

Adverse

Alternative B would result in a decrease in open water habitats through the restoration of floodplain and upland forest. This change in focus away from some impoundment management would likely reduce the number of open water dependent waterfowl that use the refuge. The reduction in available habitat would impact the refuge waterfowl population, but given the size of the impoundments and their location on the landscape, displaced waterfowl would use other open water areas on the refuge or adjacent. As such, we do not anticipate any impacts to overall waterfowl populations.

When not properly monitored, providing increased fishing opportunities may lead to unnecessary wildlife hazards. Such negative impacts to birds could occur from lost fishing gear, including ingestion of lead sinkers, hooks, lures, or litter; or entanglement in fishing line or hooks. Lost fishing tackle may harm waterfowl, eagles, kingfishers, and other birds by catching on, and tearing skin. Fishing line may also become wrapped around body parts and hinder movement (legs, wings), impair feeding (bill), or cause a constriction with subsequent reduction of blood flow and tissue damage. Birds may also ingest sinkers, hooks, floats, lures, and fishing line. Ingested tackle may be toxic or cause damage or penetration of the mouth or other parts of the digestive tract that may result in impaired functioning or death. There have not been any documented cases of this occurring on the refuge. However, the refuge will continue to provide education and outreach on the hazards of fishing tackle. The refuge has also placed monofilament recycle bins at Cash Lake, New Marsh, Lake Allen, the Visitor Contact Station, and NWVC to reduce the probability of wildlife coming in contact with lost fishing gear.

USFWS

Sign about Proper Disposal of Fishing Line

Alternative B anticipates an increase in refuge participation and visitation. Much of this increase is expected in the form of school groups or recreational uses. As noted in the "adverse impacts common to all alternatives" discussion, use of existing trails poses minimal potential impact to birds nesting in open water or wetland habitats. The overall trend regarding the location of visitation is likely to remain the same.

There may be disturbance to wintering waterfowl during deer season and, of course, waterfowl hunting, causing wintering birds to expend more energy as they are flushed. Bag limits for waterfowl hunting are set at a flyway scale to ensure that there are no population level impacts. The majority of deer and upland game hunting on the refuge occurs in areas that are far enough away from waterfowl wintering areas that levels of disturbance are expected to be low.

Added public use infrastructure proposed under alternative B, such as kiosks, would not be constructed near known nesting areas. Construction timing for kiosks would also be considered where necessary to avoid potential disturbance to sensitive species. As a result, only minimal, short-term impacts are anticipated from proposed construction projects.

Impacts on Open Water and Wetland Birds under Alternative C

Beneficial
The increase in floodplain forest under alternative C would increase benefits associated with wetland and open water species that use adjacent floodplain forest for some of their lifecycle needs. For example, nesting wood ducks could benefit from increased nesting cavities associated with floodplain forest.

Adverse
Compared to alternative B, alternative C further decreases the number of acres of open water and impoundments by an additional 210 acres. This reduction in habitat would likely reduce the number of open water-dependent species, such as ring-neck ducks and buffleheads that use the refuge regularly or occasionally, respectively, during the non-breeding season. However, the refuge lies at the periphery of the core range for Atlantic Flyway waterbirds, especially waterfowl and shorebirds. Its largely forested and urbanized landscape does not make the refuge a key contributor to this species suite.

Alternative C anticipates a decrease in refuge visitation when compared to alternative B. Potential adverse impacts to open water and wetland birds from public use under this alternative would be intermediate between alternatives A and B.

4.9 Impacts on Fisheries

The refuge supports a relatively diverse fish community with at least 28 documented species. Water quality is generally within the tolerable range for most species. Estimates of species richness suggest the total number of species in refuge waters may be as high as 36 species. The refuge also serves as habitat for some species that are of Federal or State conservation concern, which is notable in such an urban environment (Sweka and Mohler 2010).

The refuge supports several Federal trust fish species, such as blueback herring, hickory shad (also considered State-endangered), alewife, American eel, and striped bass. These

species are considered species of conservation and management concern by the Region 5 fisheries program (Sweka and Mohler 2010).

Fishing is a regular public use at Cash Lake, Lake Allen, Rieve's Pond, New Marsh, Cattail Pond, Bailey Bridge Marsh, and the lower Little Patuxent River.

Wetland management to protect the river's fisheries and nurseries for native anadromous and catadromous fish is a priority at the refuge, one that is consistent with its original establishing purposes, and our CCP goals. We evaluated the management actions and public uses each of the alternatives proposes for its potential to benefit or adversely affect wetlands and riparian habitats used by fish.

We evaluated the following actions for their potential to conserve, restore, improve, or increase habitats of fish species on the refuge:

- Managing and restoring upland and floodplain forests, grasslands, and open waters, and freshwater emergent marsh.
- Controlling invasive species.
- Increasing public awareness through environmental interpretation and wildlife-dependent recreation.

We evaluated the following actions for their potential to cause adverse effects on habitats of fish species on the refuge:

- Disturbance of species from public use.
- Impacts on habitat quality from the construction of facilities.
- Potential impacts from spraying of invasive species, forest restoration, and impoundment water level manipulation.
- Expanding office facilities.
- Construction of additional wildlife observation infrastructure such as boardwalks, observation tower, and viewing blinds.

Impacts on Fisheries That Would Not Vary by Alternative

Beneficial

Many of the same management actions for protecting wetlands and other species, such as controlling nonnative invasive plants and providing or improving vegetated buffers around wetland-upland interfaces and riparian edges, are actions that would take place regardless of which alternative we select, and would not only benefit wetlands but the fish species that depend on good water quality and a well-functioning wetland ecosystem.

Where floodplain forests are found adjacent to open water, trees and other vegetation falling into the water provides cover and food, as well as shade that helps to lower water

temperatures. Many related benefits of floodplain forests are also described under the section on hydrology and water quality. Benefits regarding open water and wetlands relate to fisheries as well.

Adverse
Overall, the effects from public use (both current and anticipated) would not likely have an impact on fisheries utilizing open water and wetland habitats on the refuge. By providing fishing opportunities, there would be impacts to individual fish. Anglers on the refuge are required to comply with State fishing regulations which are intended to protect fish populations. While we encourage catch and release because of the potential contaminants present in game fish, this also helps maintain local fish populations. We feel that the long-term protection benefits gained by connecting people to nature through this public use do not affect the health of fish populations as a whole and outweigh the adverse impacts on individual fish. Regardless of the alternative, we would continue to employ a range of management tools to achieve our objectives in managing for the improved health and integrity of open water and wetland habitats.

Other sources of environmental contamination can be created by stormwater runoff from surrounding lands and the watershed. Use of herbicides in invasive species control could potentially cause small, localized, and temporary contamination in the event of an unintentional spill or misapplication. We would continue to employ best management practices in terms of herbicide use and spill prevention and response to minimize impacts from these other sources of contamination. Generally, the refuge only applies herbicides on the Field Station Approval List, as other pesticides require either Regional or Service Headquarters approval. We must request approval, through a pesticide use proposal, for all uses of chemicals on the refuge. The refuge manager, regional pest management coordinator, and national pest management coordinator have the authority to approve herbicides and their application procedures.

Impacts on Fisheries under Alternative A (Current Management)

Benefits and adverse impacts to fisheries are the same as those discussed in *Impacts That Would Not Vary by Alternative*.

Impacts on Fisheries under Alternative B (Service-preferred Alternative)

Beneficial
Alternative B would allow visitors improved fishing opportunities as well as access to Blue Heron Pond. As discussed under *Impacts That Would Not Vary by Alternative*, this would create isolated negative impacts for some individual fish and would increase the potential for adverse impacts associated with increased public use to occur (e.g., littering); however, we feel that connecting people to nature through this activity would help encourage habitat conservation over time.

This alternative includes an increased emphasis on stream assessment and corrective measures to restore impaired segments that have degraded physical and biological

parameters in order to improve water quality and streambed substrate. This would improve fish nursery and foraging habitat.

Adverse

Alternative B also anticipates an increase in refuge visitation, from the 233,000 estimated in 2011. Much of this increase is expected in the form of school groups or recreational uses such as wildlife observation and photography. Recreational fishing is likely to increase along with this trend. We anticipate an increase in angling based upon the increased opportunities that would be provided and associated with an increase in general visitation, which would result in an increase in the scale of impacts. At this time, we do not anticipate impacts on local fish populations as a result of this increase. As noted, this would create isolated negative impacts for some individual fish; however, we believe adhering to State fishing regulations protects fish populations and that connecting people to nature through this activity would help encourage habitat conservation over time.

USFWS

Fishing at Wounded Military Visitation Day

Accidental or deliberate introductions of nonnative fish through public fishing may negatively impact native fish populations. The refuge would continue to provide educational outreach and signage on this subject, and minimize impacts associated with nonnative species introductions, if they occur.

Deconstruction of impoundments may have minor, temporary impacts due to flushing of sediment from the impoundments. We would conduct measured releases to avoid severe sedimentation downstream. The refuge would continue to utilize best management practices, including soil erosion and sedimentation controls, as part of all construction projects to minimize the impacts to fisheries.

Impacts on Fisheries under Alternative C

Beneficial
Benefits to fisheries are similar to those discussed in *Impacts on Fisheries under Alternative B.*

Adverse
Adverse impacts to fisheries are similar to those discussed in *Impacts on Fisheries under Alternative B.*

Similar to alternative B, alternative C anticipates an increase in refuge participation and visitation although alternative C would also result slightly lower numbers of public use visitation when compared to alternative B. As discussed under *Impacts That Would Not Vary by Alternative*, this would create isolated negative impacts for some individual fish; however, we feel that connecting people to nature through this activity would help encourage habitat conservation over time.

Effects of construction and restoration projects would be similar to those described under alternative B.

4.10 Impacts on Mammals

Mammals in the vicinity of Patuxent Research Refuge occupy a diverse array of habitat types and food webs, and play an important role in habitats found within the refuge boundary. As a taxonomic group, mammals benefit from refuge land protection and management of upland and floodplain forests, grasslands, shrub, open water, and wetlands. Likewise, refuge habitats would benefit from careful attention to the impacts on mammals resulting from refuge activities.

Mammals on the refuge consist largely of relatively common species found across the Mid-Atlantic. Most of these species are able to use a variety of wetland or terrestrial woodland habitats, and their populations on the refuge would not be expected to change under each alternative.

It is possible that the endangered Indiana bat (*Myotis sodalist*) and little brown bat may use the refuge. We are concerned about the status of our forest bats given the forest fragmentation occurring on the landscape and the important role they play in the foodweb and ecosystems. River otters (*Lutra canadensis*) and mink (*Mustela vison*) have been found in the rivers on and adjacent to the refuge (PNHP 2008). The open waters of the Patuxent and Little Patuxent Rivers throughout the refuge provide suitable habitat for these two species. The refuge has the potential for the State-listed eastern harvest mouse, once documented on the refuge but which may now be locally extirpated.

We evaluated the following actions for their potential to conserve, restore, improve, or increase habitats of mammal species likely to utilize refuge habitats:

- Managing and restoring floodplain and upland forests, grasslands and shrublands.
- Management of existing hunting program.
- Controlling invasive species.
- Increasing public awareness through environmental interpretation and wildlife-dependent recreation.

We evaluated the following actions for their potential to cause adverse effects on habitats of mammals:

- Disturbance of species from public use.
- Potential impacts from spraying of invasive species, forest restoration, or impoundment water level manipulation.
- Construction of additional wildlife observation infrastructure such as boardwalks, observation decks, and viewing blinds.

Impacts on Mammals That Would Not Vary by Alternative

Beneficial
Our strategies for habitat improvement measures and controlling invasive or nuisance species hold potential for impacts on mammals, and would continue regardless of the alternative we select. Each management action indirectly benefits mammals over the long term by ensuring the continuation of quality natural habitats on the refuge. Ongoing management activities, such as invasive species management and inventory and monitoring programs, would continue in a manner that would minimize potential impacts to individual species.

We would continue to monitor and control overabundant species such as beaver or deer where we notice habitat degradation. These activities would benefit and improve the health of remaining individuals. Other furbearers and rodent mammals would benefit from the habitat diversity and quality, and promotion of native plants species emphasized across all alternatives. Expanded and improved forest corridors on the refuge (and locally via refuge land protection partnerships) would benefit bats and aquatic or wetland mammals such as otter and mink.

Adverse
Regardless of the alternative, we would continue to employ a range of management tools to achieve our objectives in managing for the improved health and integrity of terrestrial and wetland habitats. We would use these tools only when and where appropriate, and only with the proper training and focused application to avoid adverse impacts.

One such example is control of invasive plant species or bushhogging and mowing activities associated with roadsides, facilities, or habitats. Areas where invasive species control or habitat diversity objectives warrant clearing an entire monoculture stand occur on a very small scale. The timing of herbicide applications to be most effective varies

depending on target species and treatment method. Occasionally, eliminating an entire field of a single nonnative species is necessary, but in most cases, the treatments are spot-specific. The treated sites soon regrow, and mammals still have margins of habitat or other areas nearby for alternate use. Therefore, this activity is expected to have minimal negative impacts on some individuals that are localized and short term.

Hunting of mammals would occur at some level under each of the alternatives. For the 2010 to 2011 deer seasons, hunters took 272 deer. For the 2009 to 2010 deer seasons, hunters took 242 deer. This level of harvest is expected to keep deer population level within the refuge to a density that reduces impacts to the forest understory and allows for forest regeneration (Obrecht 1992). However, it is unlikely that this level of deer harvest would negatively impact the overall deer population of eastern Maryland.

Overall, the effects from public use are not likely to have a negative impact on mammals. There is the potential for some negative impacts from increased vehicle use associated with greater visitation. Low refuge speed limits would likely keep the number of mammals hit by vehicles very low. Limiting visitors to existing trails prevents unintended disturbance to terrestrial mammals. An expected increase in visitation may create isolated negative impacts for some individual mammals; however, we feel that connecting people to nature through appropriate wildlife-dependent recreation, such as wildlife observation and photography would minimize potential impacts and help encourage habitat conservation over time.

The presence of transmission lines on the refuge will have negligible impacts to mammals, because the shrub and grassland habitat in the corridor is used by these species.

USFWS

Trash Bag Dispenser at the Refuge

<u>Impacts on Mammals under Alternative A (Current Management)</u>

Beneficial

Beneficial impacts to mammals are similar to those discussed in *Impacts on Mammals That Would Not Vary by Alternative*.

Adverse

Food and other debris may influence small mammal populations by attracting them to the campsite areas (Boyle and Samson 1985). The refuge requires all trash to be packed out when the campers leave the refuge. The sites are inspected after each visit to ensure trash has been removed from the premise.

Impacts on Mammals under Alternative B (Service-preferred Alternative)

Beneficial
Under this alternative, we would refine and improve our deer population estimations in order to evaluate the success of our hunt programs and gain insight on where improvements could be made.

Adverse
Alternative B anticipates the continued presence of dogs on the refuge for search and rescue training and waterfowl hunting. Dogs could potentially have negative impacts on refuge mammals. Free-ranging and uncontrolled dogs can chase and flush wildlife. Wintering red bats (*Lasiurus borealis*) could be flushed from their hibernacula in the leaf litter, causing them to expend energy at a time when food resources to replenish their fat reserves is low. Potential impacts of domestic dogs could be broadly classified as harassment, injury, or death of wildlife. Harassment is the disruption of normal maintenance activities, such as feeding, bedding, or grooming. It can take the form of disrupting, alarming, or even chasing. If dogs chase or pursue wildlife, injuries could be sustained directly or indirectly as a result of accidents that occur during the chase itself rather than direct contact with the dog. Impacts of domestic dogs can also include modification of wildlife behavior. However, the low frequency of dog use on the refuge is not expected to add significantly to existing disturbances. Suitable habitat for escape is near areas where training is allowed to occur so disturbances to wildlife are expected to be temporary and minimal.

Impacts from dogs on leash associated with dog walking on trails would be similar to the impacts described above; however the impacts would occur to a smaller degree. The trails that the dog walkers use are not considered ideal habitat and the impacts are limited to the trail corridors. Dogs also have endo- and ectoparasites and can transmit diseases to wild animals. Canine distemper, for example, can be transmitted freely in wild carnivore populations such as wolves, foxes, badgers, and raccoons. The best way to prevent this contact is for dog owners to prevent contact with wildlife. We do not anticipate significant impacts because dogs are required to be on a six foot leash and contact with wildlife at that distance is very unlikely.

Impacts on Mammals under Alternative C

Beneficial and adverse impacts to mammals are the same as those discussed in *Impacts on Mammals That Would Not Vary by Alternative,*except that there could be less forage habitat for bats, which forage over fields adjacent to woodlands, and less food and nest-cover for open-habitat small mammals..

4.11 Impacts on Amphibians and Reptiles

As a group, amphibians and reptiles would benefit from the refuge land protection and management of upland and floodplain forests, grasslands, shrub, open water, and wetlands. This is especially important in the context of some massive die-offs occurring

to wood frogs and spotted salamanders due to disease such as ranavirus and chytrid fungus. In other parks and refuges that have been particularly hard hit, the species persists because there were other vernal pools available that were free of the diseases (Grant 2011).

We evaluated the following actions for their potential to conserve, restore, improve, or increase the habitats of amphibians and reptiles likely to utilize refuge habitats:

- Managing and restoring floodplain and upland forests, grasslands, open waters, and emergent wetlands.
- Controlling invasive species.
- Increasing public awareness through environmental interpretation and wildlife-dependent recreation.

We evaluated the following actions for their potential to cause adverse effects on habitats of amphibians and reptiles:

- Disturbance of species from public use.
- Potential impacts from the aerial spraying of invasive species, forest restoration, or impoundment water level manipulation.
- Construction of additional wildlife observation infrastructure such as boardwalks, observation tower, and viewing blinds.
- Light pollution from security lights.
- Vehicle traffic during breeding season.

Impacts on Amphibians and Reptiles That Would Not Vary by Alternative

Beneficial

Long-term improvements in water quality would create benefits to environmental health and to amphibian and reptile populations. Amphibians and reptiles would likely continue to be impacted by environmental contaminants, unrelated to refuge activities, known to occur in waters around the refuge.

Long-term benefits to amphibians and reptiles are anticipated through the ongoing management of existing freshwater emergent wetlands and impoundments.

Protection of floodplain forests and associated vernal pools would continue to benefit amphibians and reptiles that rely on these sites for breeding habitat. Any protection of large, intact forests on the refuge or on the local landscape through partnerships would benefit amphibians requiring vernal pools.

Adverse

Regardless of the alternative, we would continue to employ a range of management tools to achieve our objectives in managing for the improved health and integrity of open water and wetland habitats. We would use these tools only when and where appropriate, and only with the proper training and focused application to minimize or avoid adverse impacts. We would continue to avoid mowing in early successional habitats and wet grasslands when amphibians or reptiles may be breeding or seasonally moving through transitional zones. Some amphibians and reptiles may be present during aerial applications of herbicides and may experience direct contact with herbicides if they are present during applications, or if spray misses the targeted application patch. We do not expect this as a frequent occurrence. Ongoing management activities, such as invasive species management and inventory and monitoring programs, would continue to be completed in a manner that would minimize potential impacts.

Overall, the effects from public use are likely to minimally impact amphibians and reptiles utilizing forested, grassland, open water, and wetland habitats on the refuge. Impacts associated with disturbance include displacement, stress, and potential mortality. Given the size of the refuge and location of trails and roads for visitor use, we expect these impacts to be negligible.

Another source of negative impact and mortality is that of vehicular traffic after dark during warm rainy nights in the spring and summer when frogs, toads, and other amphibians are moving to or from breeding grounds. This can be a problem during the day for basking snakes and turtles as well. Some of this traffic is unavoidable (employees that live onsite, occasional evening research, law enforcement activities). Some nighttime vehicle traffic is due to users of the shooting range.

De-icing compounds used on roads in the winter may affect surrounding water quality. Wood frogs emerge for breeding in early spring at a time when there is the potential for a late winter snow or ice storm requiring de-icing for staff, residents, and other visitors to the refuge. However, we estimate that with vegetation buffers between roads and impoundments this risk is not significant. Traffic on roads and brushhogging have the potential to injure turtles during the breeding or migration seasons. These are potential areas for future monitoring.

USFWS

Leopard Frog

We have a number of buildings and residences throughout the refuge, some of which have security lights or other lighting. Artificial lighting at night, if bright and not diffused in the way moonlight and starlight may have long-term negative effects on frogs' ability to respond and move appropriately to forage or evade predators (Rich and Longcore

2006). Given the location of the refuge in the Baltimore - Washington corridor and the number of acres of natural habitat compared with the small number of lighted areas, we expect impacts to be minimal.

Impacts on Amphibians and Reptiles under Alternative A (Current Management)

Beneficial and adverse impacts to amphibians and reptiles would be the same as those discussed in *Impacts on Amphibians and Reptiles That Would Not Vary by Alternative*.

Impacts on Amphibians and Reptiles under Alternative B (Service-preferred Alternative)

Beneficial
Amphibian species (Ambystoma salamanders, wood frogs, chorus frogs, and spring peepers) that utilize forested wetlands would increase as more vernal pools, forested floodplain habitat, and green-tree reservoirs become available. Large blocks of grasslands adjacent to woodlands and forest are beneficial to box turtles that emerge to bask in the sun and feed on forbs and insects. Snake species benefit from the increased supply of rodents.

This alternative would also continue the deer management program across the refuge. Improving natural regeneration of ground cover and shrub vegetation, through reduction of the deer population, would improve available cover and non-breeding habitat for the coastal plain leopard frog and other reptiles and amphibians.

Adverse
Added public use infrastructure proposed under alternative B such as kiosks are not expected to have long-term negative effects on known amphibian and reptile breeding sites as these would be avoided. Added infrastructure could cause additional disturbance or lead to isolated stormwater runoff or sedimentation during construction. However, we would use best management practices to ensure that these disturbances, if present, would be infrequent and of negligible impact.

In early spring, particularly during rains, breeding amphibians are on the move from wintering ranges to breeding areas and may cross roads or trails. This increases the risk of injury or death from vehicles or trampling. However, amphibian movement usually occurs at night when visitor use is minimal to none. Direct impacts on wildlife in the form of disturbance can be expected wherever humans have access to an area, and the degree may vary depending on the habitat type. In general, human presence disturbs most wildlife, which typically results in a temporary displacement without long-term effects on individuals or populations. Some species, such as wood thrush, will avoid areas frequented by people, such as developed trails and buildings, while other species, particularly highly social species such as eastern tufted titmouse, Carolina chickadee, or Carolina wren, seem unaffected or even drawn to a human presence. When visitors approach too closely to nests, they may cause the adult bird to flush exposing the eggs to weather events or predators. Provided that visitor use is confined to trails, disturbance

during the breeding season will be limited to the trail area. The extent of this disturbance on either side of the trail also depends on visibility, the density of vegetation through which the trail is laid. Overall, direct impacts from non-consumptive uses should be greatly reduced if trails and other high-use facilities avoid area-sensitive habitats (interiors of grasslands and forests) and are confined to a 300-foot edge zone.

The continued presence of dogs on the refuge for search and rescue trainings and waterfowl hunting could have negative impacts on refuge amphibians and reptiles. Free-ranging and uncontrolled dogs can chase and flush wildlife and occasionally prey on reptiles. Potential impacts of domestic dogs could be broadly classified as harassment, injury, or death of wildlife. Harassment is the disruption of normal maintenance activities, such as feeding, bedding, or grooming. It can take the form of disrupting, alarming, or even chasing. If dogs chase or pursue wildlife, injuries could be sustained directly or indirectly as a result of accidents that occur during the chase itself rather than direct contact with the dog. Impacts of domestic dogs can also include modification of wildlife behavior.

Impacts from traffic, roads, infrastructure and facilities maintenance are expected to be somewhat less in this alternative once the footprint of the refuge's built environment is reduced.

Impacts on Amphibians and Reptiles under Alternative C

Benefits and adverse impacts to amphibians and reptiles would be similar to those discussed in *Impacts on Amphibians and Reptiles under Alternative B*.

4.12 Impacts on Invertebrates

This broad group is the least understood within the ecosystems around the refuge. Yet, they are likely the most important contributor and modifier in the functioning of those ecosystems and related food webs. Invertebrates play key roles in those ecosystems as:

- Detritivores, returning nutrients and basic elements back to the soil and the system.
- Pollinators, without which many sexually reproducing plants would not be able to propagate.
- Prey for other species in the food web, such as the millions of mosquitoes upon which fish, frogs, birds and bats feed.
- Predators, such as spiders, that help keep rapidly producing insects in check.
- Filters of sediment, nutrients, and other contaminants, making conditions better for fish and aquatic life.

We evaluated the following actions for their potential to conserve, restore, improve, or increase habitats of invertebrates likely to utilize refuge habitats:

- Managing and restoring floodplain and upland forests, impoundments, grasslands, open waters, and emergent wetlands.
- Controlling invasive species.
- Increasing public awareness through environmental interpretation and wildlife-dependent recreation.

We evaluated the potential for the proposed actions to cause adverse effects on habitats of invertebrates:

- Disturbance from public use.
- Potential impacts from the aerial spraying of invasive species, forest restoration, or impoundment water level manipulation.
- Construction of additional wildlife observation infrastructure such as boardwalks and viewing blinds.
- Impacts of light pollution from artificial lighting.

Impacts on Invertebrates That Would Not Vary by Alternative

Invasive species control and grounds maintenance, security lighting, and forest health measures are actions common to all alternatives that may impact refuge invertebrates. Invasive species control, grounds maintenance, and prescribed burn are recurring activities throughout the year.

Beneficial
The refuge's land management provides a wide array of general habitat types and microhabitats that serve as foraging, breeding, and overwintering habitat for many groups of invertebrates. Improving stream water quality would benefit aquatic insects and other invertebrates.

Removing invasive species permits native plants to reestablish and expand. This particularly benefits insects that coevolved with the native plants, particularly those that are host-specific, such as the monarch butterfly, which mostly uses milkweed as the host plant for its eggs. Many species of invasive, nonnative plants are not optimal hosts for native insects, and do not contribute to the health or diversity of the pollinator community. Therefore, we project that removing these nonnative plants and planting or allowing native species to regenerate would be beneficial to native invertebrates. The number of native insects that use nonnative plant species as host plants is minimal and, therefore, removing them would not result in unacceptable losses in the insect populations.

Mowing and brushhogging is reduced in all alternatives where maintenance of grassy areas is needed, and generally some standing cover will be left for the overwintering stage of insects.

Adverse

Maintaining refuge grounds currently involves mowing of roadsides, parking areas, walking paths, and small lawn areas. Generally, regularly mowed areas are kept short in vegetation height (less than 6 inches). Thus, they provide very limited sources of nectar, usually clovers. Where grasses and forbs have grown tall, such as along seldom-used roads or paths where they begin to flower and set seed, pollinators and herbivorous insects would be found. Mowing in the warm months, when insects are breeding, may destroy the eggs or pupae attached to leaves, consume adults, remove food sources, or unfavorably alter microhabitat. However, the area we maintain is a very small fraction of the amount of land serving as habitat. Although we have yet to conduct a formal forest health inspection for disease and pests, staff conducting other research or surveys have not noticed an infestation to the level that would warrant intervention, as yet. We foresee, however, that there may come a time when spraying for forest pests, such as gyspy moth, (which affects oaks, a highly desired canopy tree type) could be necessary. Emerald ash borer has been detected in Prince George's County. Since we have substantial percentage of green ash in the floodplain forest composition, we are concerned. We would consult with forestry experts and the Service pesticide use authority for recommendations on the least harmful products and methods to avert impacts to non-target species. For example, there currently is a species-specific, albeit expensive, pesticide for gypsy moth, Gypcheck, a biological pesticide derived from a virus that commonly exists in the soil (USDA 2009).

USFWS

Buckeye

Although the Service approves the herbicides we use in controlling invasive species because of their neutrality on animal life, should soft-bodied insects, eggs, pupae, or organisms with permeable skin come in direct contact with an herbicide or its surfactant, mortality, reduced fitness, or abnormal development may result. Since we treat limited portions of the refuge each year, overall negative effects on invertebrates are expected to be minimal. We use only herbicides that are systemic operants on plants and approved by EPA for having little or no impact on terrestrial insects. Very few native invertebrates may use nonnative plants for feeding, breeding, or pupating. We presume that any dependence on those plants is incidental and, therefore, removing them would not result in unacceptable losses in the insect populations.

Artificial lighting for the security of existing facilities and administrative buildings such as the visitor center, and maintenance building is another potential source of adverse impacts on invertebrates, particularly nocturnal moths. Decreases in populations of moths

have been attributed to artificial lighting. However, extinctions due exclusively to lighting have not been recorded. When compounded with other disturbances, such has habitat fragmentation, unnatural lighting may weaken or eliminate local populations (Frank 2002).

The direct impacts of lighting on moths and other arthropods are increased rates of predation, entrapment, desiccation and burning of moths and other insects that fly into lamp housings, disruption in migration, and interference with mating, vision, dispersal, migration, feeding, depositing eggs, and possibly circadian rhythm. An indirect impact may result in densely illuminated urban environments where the lighting may have favored species that either fly during the day, do not fly to lamps, or do not fly at all (Frank 1988).

To the extent practical, given needs for facility security, maintenance, and access, the refuge has minimized its use of artificial lighting. No new projects proposed under any alternative would pose a substantial increase in artificial lighting.

Impacts on Invertebrates under Alternative A (Current Management)

Beneficial and adverse impacts to invertebrates are the same as those discussed in *Impacts on Invertebrates That Would Not Vary by Alternative*.

Impacts on Invertebrates under Alternative B (Service-preferred Alternative)

Beneficial

Although there would be fewer total acres of grasslands under alternative B, the remaining grasslands would be less fragmented and higher quality. The provision of large tracts of diverse grasslands in multiple locations would provide numerous benefits for pollinating, herbivorous, or predatory insects. Well-established grasslands possess a diverse array of nectaries and plant structures that would provide food and cover year round for the annual life cycles of many species. This also benefits small mammals, reptiles, amphibians, and grassland dependent birds. Prescribed fire, a grassland maintenance action, increases the production of seed in legumes, grasses and spurges in frequently burned areas. Grassland fires cause early green up of warm season grasses, improved seed-germination, and greater production of grasses and forbs. It also increases the production of berries, drupes, and pomes for two to four years after fire (Lyon et al. 2000). Fire modifies the invertebrate communities, which may continue to change a few years post burn. Different orders of invertebrates respond differently to fire depending on season and year, but prairies where fires occur in different years and seasons tend to have greater species diversity (Lyon et al. 2000.) Thus, indirect benefits may be derived to invertebrates from variable applications of the refuge fire regime. An indirect benefit is derived through increased habitat quality.

Maintenance of grasslands also requires dramatic and periodic disturbance. It is impossible to do this without cost to some species, particularly above ground insects using plant structures for roosting, egg laying, and development. Monarch butterflies are

completely migratory and are among the many species of pollinating Lepidoptera (butterflies, moths, and skippers) that use refuge habitats. Monarchs lay their eggs exclusively on milkweed. In some instances, it is necessary to conduct late growing season burns in order to more effectively set back woody encroachment. This poses a direct conflict for the latest generation of monarch should patches of milkweed be destroyed by fire or mowing. This generation, which may still be as eggs by late September to mid-October (Monarch Larvae Monitoring Project) would be the generation to migrate to the monarch wintering grounds in the Oyamel forests of Mexico (Solensky 2004). However, we do not burn or mow all the fields at once, some are left in reserve, and thus some patches of milkweed would remain. Milkweed is also stimulated or returns more vigorously after fire and mowing. We expect that these two factors bestow benefits at the population and habitat level and offset the negative impacts sustained at the individual level.

The greater diversity of habitats considered under this alternative would allow a greater diversity of host plants and their associated insects.

Adverse
No additional adverse impacts to invertebrates are foreseeable under this alternative.

Impacts on Invertebrates under Alternative C

Benefits and adverse impacts to invertebrates would be similar to those discussed in *Impacts on Invertebrates under Alternative B,* except that there would be substantially less grassland or grassy cover available to support the insects associated with native forbs and grasses..

4.13 Impacts on Public Use and Access

Annual refuge visitation is estimated to be 256,000 visits to the refuge in 2011. Most visitors to the refuge engage in some form of wildlife-dependent recreation. Environmental interpretation programs and environmental education programs are the two activities with the most participants.

Impacts on Public Use and Access That Would Not Vary by Alternative

Beneficial
The main goals of the visitor services program would be to continue working with partners to promote the benefits of wildlife and habitat conservation and management, to foster an awareness and appreciation for the refuge and its role along the Atlantic Flyway and within the Refuge System, and to provide quality wildlife-dependent recreational experiences to visitors. We would continue to evaluate environmental education programs already available across the region to identify potential needs in the environmental education community. For many residents of the Baltimore-Washington area, refuge staff may be their one and only interaction with the Service. Under all

alternatives, refuge staff would continue to be active in outreach and partnership development.

NWVC would continue to be free to the public. The facility would continue to be an important example of sustainable design and construction, and we would continue to use it as an interpretive tool for the benefits of sustainable building and relate this to effects on climate change.

USFWS

NWVC

Adverse

We would continue to limit access to ecologically sensitive areas such as nesting sites during breeding seasons and high-quality wetlands. While these would result in short-term restrictions on public access and use, we would minimize these restrictions to the extent possible while ensuring proper protection of wildlife and their habitats. We do not anticipate any long-term negative impacts on public use and access.

The presence of dogs can lead to short-term and long-term adverse impacts to wildlife populations. Some wildlife species are particularly sensitive to the presence of dogs and their response to disturbance is amplified above and beyond disturbance effects from recreationists traveling without dogs. Declines in bird diversity and abundance on trails where leashed dogs were permitted were in excess of declines observed from human disturbance alone (Banks and Bryant 2007). In addition, native carnivores, bobcats and coyotes, also appear to shift their periods and areas of activity to avoid peak times of recreational use (George and Crooks 2006). Disturbance of bats hibernating in leaf litter was discussed in the mammals section of this chapter. In all alternatives, the refuge permits dogs on leash as long as the activity is restricted to designated access road corridors.

Impacts on Public Use and Access under Alternative A (Current Management)

Beneficial
Under alternative A, we would continue to allow currently approved public uses on refuge lands. These are noted in chapter 3, alternative A. Appendix C documents the refuge manager's justification for why they are deemed appropriate and compatible. Other ownerships nearby or elsewhere sufficiently provide opportunities for other activities not determined to be compatible with the purposes of refuge management.

No major additions or changes in facilities would occur. The refuge would continue to allow already approved public uses. These include wildlife observation and photography, environmental education and interpretation, hunting and fishing.

Adverse
These impacts would be the same as those outlined in *Impacts on Public Use and Access that would not Vary by Alternative.*

Impacts on Public Use and Access under Alternative B (Service-preferred Alternative)

Beneficial
Other wildlife-dependent, priority public uses are restricted during the 5-month public hunting season. In order to minimize conflict between hunters and other user groups, the refuge has subdivided Area Y on North Tract to clearly show hunted areas versus a publicly-accessible trail. The refuge also has two trails in the Wildlife Viewing Area, which is closed to hunting, for other priority, wildlife-dependent public uses to be administered in conjunction with hunting. With the exception of shotgun season, all other trails will remain open to other users during the hunting season.

Adverse Impacts
Adverse impacts on public use and access would be the same as *Impacts on Public Use and Access That Would Not Vary by Alternative.* No additional adverse impacts would occur under this alternative.

Impacts on Public Use and Access under Alternative C

Beneficial
Under alternative C, wildlife-dependent public uses such as wildlife observation, viewing, and photography will be emphasized and expanded. If fees were implemented, we would be able to use money collected to provide improved trail maintenance and additional interpretive programs.

Adverse
Under alternative C, non-wildlife dependent uses would be reduced or eliminated. Special events and interpretive programming both on and off-site would also be reduced. We would explore implementation of a fee program for refuge entry, as well as for

programs and activities. Reducing or eliminating programs or charging fees could have a long-term negative impact on public use and access by limiting the ability of some people to access the refuge and potentially reducing the number of visitors overall.

4.14 Impacts on Cultural and Historic Resources

Impacts on Cultural and Historic Resources That Would Not Vary by Alternative

Beneficial
Under all alternatives, the refuge would expand its interpretation of cultural and historic resources related to the refuge and conservation. The extent and emphasis of cultural and historic resource interpretation varies between alternatives. Under alternative B we would increase efforts to include information about cultural and historic resources compared to alternatives A. However, under all scenarios the refuge communicates the importance of understanding and appreciating the area's rich cultural history and how it relates to our natural history. In doing so, we would potentially provide long-term benefits to regional cultural and historic resources.

The refuge would also continue its adaptive reuse of several historic-eligible buildings, such as Nelson and Merriam Labs for office space. This potentially would include other Service programs currently offsite, such as the Chesapeake Bay Field Office. Such collocation would save the Service significant General Services Administration rental expenses, and also allow for easier communication and collaboration between Service programs and other partners.

Adverse
While no adverse impacts to cultural or historic resources are anticipated, we will send this draft CCP/EA to the State Historic Preservation Office for review in compliance with section 106 of the National Historic Preservation Act. In all of the alternatives, we will consult with our regional archeologist and the State Historic Preservation Office as needed to ensure compliance with the act and other applicable laws and regulations.

4.15 Impacts to the Socioeconomic Environment

Chapter 2, "Affected Environment," discusses the socioeconomic environment of the refuge and its context with the greater Baltimore-Washington area. The refuge management activities of economic concern in the analysis are:

- Purchasing of goods and services within the local community for refuge operations;
- Spending of salaries by refuge personnel;
- Spending in the local area by refuge visitors;
- Purchasing additional refuge land and resulting changes in local tax revenues; and
- Effects of refuge management on local townships.

Although the refuge economic contribution is relatively minor, tourism and recreation contribute significantly to the local economy. The majority of the visits to the refuge were by nearby residents, although non-residents make the greatest economic contribution to the economy. This economic environment increases the potential of the refuge to increase visitation through management actions such as increased coordination with local cultural attractions and transportation hubs, and support of regional trail connections with the refuge.

Another important aspect of the socioeconomic setting is the number of educational institutions and environmental education centers in the Baltimore-Washington area. This allows the refuge partnership and recruitment opportunities from a wide range of social and cultural backgrounds.

Impacts on Socioeconomic Environment That Would Not Vary by Alternative

Beneficial

Ongoing public uses related to wildlife-dependent recreation would continue to have a small but positive effect on the local economies surrounding the refuge. Refuge visitors, researchers, and volunteers would continue to utilize businesses around the refuge for food, fuel, supplies, and lodging. The refuge would continue to provide environmental education and interpretation programming free-of-charge to local schools in order to allow all students access to quality environmental educational programming. We would also strive to provide monetary assistance to help pay for busing of students to and from the refuge for field trips.

USFWS

Environmental Eduation Activity

We would continue to provide meeting space for conservation-environmental related meetings and symposiums.

The economic value of the ecosystem services provided by the extensive forest cover and other vegetation cover types provided by the refuge and any future land protection efforts achieved by refuge partnerships has not been quantified. The services provided by refuge forests include groundwater recharge, flood control, nutrient filtration and uptake, improved air quality, and temperature moderation.

Adverse
The impact of protecting land is considered negligible on the economy of the region. Although some loss of tax revenue and commercial income results from protecting lands, the ecosystem services provided by natural landscapes – flood control, carbon sequestration, sediment and erosion control, for example – offset much of the lost tax revenue.

Impacts on Socioeconomic Environment in Alternative A

Beneficial
In summary, implementing alternative A would continue to provide socioeconomic benefits to the community. The refuge helps to maintain the quality of life not only for local residents, but also for all refuge visitors. Alternative A would continue to provide opportunities for public use, and current refuge regulations would remain in effect (see chapters 2 and 3).

The refuge provides economic benefits mainly through spending in the local area by refuge visitors and refuge staff income and taxes. It also provides benefits from public use, as in the increasingly important ecotourism industry.

Adverse
Adverse impacts under this alternative are the same as those discussed under *Impacts on Socioeconomic Environment That Would Not Vary by Alternative*.

Impacts on Socioeconomic Environment under Alternative B (Service-preferred Alternative)

Beneficial
The refuge would expand environmental education programming for local schools and teachers. This would help improve the quality of and access to quality environmental education in the region.

Under this alternative, the refuge would improve programs for under-represented audiences including providing interpretive materials in other languages, providing programs and materials designed to meet the needs of people with special needs, as well as continuing to reach out to urban youth. The refuge also tends to draw students from nearby schools that might not otherwise be exposed to environmental education programs. Under alternative B, we would create more opportunities for blind and bilingual visitors to appreciate wildlife-dependent recreation and the refuge's role in conservation. In doing so, we would reach out to new audiences to experience the refuge first-hand, and ultimately foster environmental stewardship and support for conservation in their own lives.

In our visitor services step-down plan, we would identify themed messages that support refuge purposes, the Refuge System mission, and the Service mission and that address

specific issues and challenges facing wildlife, people, and habitats on the refuge, region, and world.

Adverse
Adverse impacts under this alternative are the same as those discussed under *Impacts on Socioeconomic Environment That Would Not Vary by Alternative*.

Impacts on Socioeconomic Environment under Alternative C

Beneficial
Benefits under alternative C are similar to those discussed in *Impacts of Alternative B,* with the addition of:

We would expand wildlife-dependent public uses which could bring new and increased numbers of visitors to the refuge which may also lead to increases in visitor spending in the surrounding areas. Collection of fees would allow refuge staff to provide enhanced interpretive programs and increased trail maintenance which could lead to improved visitor experiences, which could then lead to additional visitation from word of mouth publicity.

Adverse
Under alternative C, non-wildlife dependent public uses would be eliminated or reduced in refuge habitats. We would also explore fee options for refuge entry, programs, and activities. This reduction in public uses and the creation of fees could potentially have a negative impact on the socioeconomic environment. These changes may reduce the number of visitors to the refuge and potentially cause reductions in spending by visitors in the surrounding area.

4.16 Cumulative Impacts

According to the Council on Environmental Quality regulations on implementing NEPA (40 CFR 1508.7), a cumulative impact is the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-federal) or person undertakes the other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over time.

This cumulative impacts assessment includes the actions of other agencies or organizations, if they are interrelated and influence the same environment. Thus, this analysis considers the interaction of activities at the refuge with other actions occurring over a larger spatial and temporal frame of reference. Specific to this analysis we considered the facilities modernization plan, the potential expansion of Highway 198, the continued residential and commercial development of the surrounding area, previous military activities on and off refuge, and the potential land expansion project for the Refuge System.

Cumulative Impacts on the Physical and Biological Environment

The area around the refuge is highly developed and influenced by urban and suburban development, activities at the adjacent Fort Meade, and other local, State, and Federal agencies. Based on the environmental analysis that is presented in this document, the actions of the refuge, when added to the continuation of residential and commercial development, will not cumulatively effect the natural or socioeconomic environment at or adjacent to the refuge.

Overall, habitat management and maintenance of the open space on the refuge provides a net positive impact on species, vegetation, water quality, and air quality of the region. Given the relative size of the refuge in the surrounding landscape, the benefits that are provided are noticeable, but do not rise to a level of significance.

We expect that refuge management activities have a net benefit to water quality as detailed in the previous sections. We do not anticipate that these improvements will provide a net overall improvement of water quality outside the refuge, given the level of development that is occurring in the region.

Cumulative Impacts Related to Climate Change

Climate Change Impacts on Vegetation

The Patuxent Research Refuge is predominately forest. Refuge management goals have been guided by conditions of pre-settlement times. Advocates of climate change argue that past conditions are inadequate models for future targets. We may need to remain flexible, manage in increments that allow some reversibility, and avoid single solution approaches in the face of so much uncertainty (Millar et al. 2007). Plant communities and species adapted to warmer subtropical latitudes are expected to expand and establish beyond their northern boundaries. Increasing dominance of mixed pines and southern oak species would be a likely scenario. This may be a favorable outcome for some of the focal refuge forest bird species, bats, and other associated wildlife.

Some positive effects on forests include increased forest productivity through longer growing seasons, increased precipitation, and increased carbon dioxide fertilization which will increase primary production and yield greater biomass and soil inputs (Swanston 2010).

Some negative effects include extreme weather events causing damage and erosion, altered timing of aquifer recharge leading to potential declines in summer seasonal streamflow, species range shifts which would mean a decline of some species, increased severity in stress factors and increased susceptibility to disturbance. We may also expect expanded pest and disease ranges due to decreased probability of lower lethal temperatures, migrations to the north and accelerated life cycles. Also expected is an increase in the frequency or intensity of fire where there is less summer moisture. Mature trees, however, should fare better because of developed root systems and higher carbon reserves (Swanston 2010).

Changing conditions surrounding a healthy forest can cause stress and enhance vulnerability to climate change-related stressors. If an adequate buffer is not maintained, refuge forests could face ground level ozone and acid deposition (caused by nitrogen oxide and sulfur dioxide emissions from cars and power plants) which stress trees (Rogers and McCarty).

The U.S. Forest Service assessed the current and predicted range of 134 tree species following climate change. This interactive program, the Climate Change Tree Atlas, allows the end user to generate future scenarios for the distribution based on suitable habitat and importance values for each of the 134 tree species by the year 2100. Distribution and importance predictions are based on three global climate or general circulation models and two emissions scenarios, high or low, which can also be combined to produce an average. The model produces a range of importance values per species analyzed, which is a measure of the relative dominance of a species in a forest community based on three criteria: how commonly it occurs across an entire forest, the total amount of area it occupies, and the total number of individuals.

We ran this model for some mast-producing upland hardwood species--white oak, southern red oak, scarlet oak and American beech, and the most common coniferous species, Virginia pine. We also ran the model for some of the most dominant floodplain species: green ash, red maple, and sweetgum. White oak will shift its entire range northward. In the vicinity of the refuge, its importance value will decline from about 7 to 10 to about 4 to 6. Southern red oak will expand its range northward and increase in importance in the deep south, but may lose importance values in Maryland from current 7 to 10 to 4 to 6 or even lower. Scarlet oak will maintain its footprint but will decline in importance from its current 7 to 10 or 11 to 20, down to 1 to 3 depending on emissions scenario. Beech will decline in importance value overall throughout the eastern U.S., but importance values 1 to 3 will cover more of the landscape than it does currently. Around the refuge, the importance values will decline from 11 to 20 to 1 to 6. Virginia pine will retract its range in the Mid-Atlantic to higher elevations and shift toward the north, but will decline in importance value, 1 to 3. Green ash will shift its range to the northwest and dwindle in importance value from 1 to 3. Red maple will maintain its current footprint in the eastern U.S. but its higher importance values will shift to the Northeast or higher elevations. Around the refuge its importance will decline from the current 11 to 20 to 4 to 6. Sweetgum will benefit from warmer climates and higher emissions by gaining importance throughout its range. On the refuge this may mean an increase from 1 to 3 to as much as 11 to 20.

Loblolly pine, a species that currently is not dominant in Maryland, will expand its range to the north and its importance value will increase from current 1 to 3 to 7 to 10 or even 11 to 20, depending upon the emission scenario. We can expect the surrounding landscape to become increasingly fragmented by development and infrastructure, and non-forest land uses, which will have an impact on species range expansion, and recruitment rates.

For the 15-year planning horizon of this document, these trends will barely register.

Climate Change Impacts on Biological Resources
Climate change will have a range of effects on vegetation and ecological systems. It is expected that species ranges will shift northward or toward higher elevations as temperatures rise, but responses will likely be highly variable and either species or family-specific. Under these rapidly changing conditions, migration, not evolution, will determine which species are able to survive. Species that cannot migrate will suffer the most. For example, plants, mussels, and amphibians are more vulnerable to temperature shifts that may affect their ability to survive, grow, and reproduce (USFWS 2009).

Four types of responses by animal and plant species are possible. First, the density of species may change locally and their ranges may shift in response to the need to find areas within their range of tolerance. Second, there will likely be changes in phenology, or the timing of such important life history events as flowering, egg-laying, or migration. Third, changes in body sizes and behaviors may occur. And fourth, genetic frequencies may shift. In a study that investigated 61 studies on phenology changes of 694 species over the past 50 years, a statistically significant shift toward earlier timing of spring events was evident.

Species with short generation times, such as insects and annual plants, might be helped in adapting to change because of their more rapid evolution. Longer lived species such as trees, would experience longer evolution time frames and thus be less adaptable (Rogers and McCarty n.d.) Since so many animal species time important events in their life cycles, particularly reproduction, so that young are produced when food sources are available, changes in other phonological events such as flowering or insect hatching, could be disastrous for species that fail to adapt in time. We cannot, at this writing, predict how this will play out at Patuxent Research Refuge, but we can seek to provide biologically diverse habitats and connected corridors diversity to increase their options and ensure resilience.

Climate Change Impacts on Birds
According to a recent analysis of Christmas Bird Count data over the past 40 years, a significant northward shift of the winter center of abundance is occurring among at least 305 bird species in North America (Niven et al. 2009). Of these, 208 species shifted north with 123 species shifting more than 50 miles. Landbirds as a group shifted more than waterfowl or coastal species. Seventy-five percent of land birds shifted north an average of 48 miles. Landbirds were further analyzed according to four habitat guilds: woodland, grassland, shrub, and generalist. Woodland birds shifted the most, followed by shrub species, while grassland birds and generalist shifted the least. This study confirmed northward shift of species already suspected, such as red-bellied woodpecker (*Melanerpes carolinus*), tufted titmouse (*Baeolophus bicolor*), Carolina wren (*Thryothorus ludovicianus*), and northern cardinal (*Cardinalis cardinalis*). These are all common species at the refuge throughout the year.

Thomas Tetzner/USFWS

Northern Cardinal

Waterfowl range contraction is anticipated as milder, warmer winters shift northward, reducing the need to migrate as far south. Fewer waterfowl now winter in the Chesapeake Bay area, attributed to climatic changes occurring in the breeding grounds of the Prairie Pothole region, milder winters further north, and decline of eelgrass in the bay (from warmer water temperatures, turbidity, and sea-level rise).

Department of the Interior Secretarial Order 3226 states that "there is a consensus in the international community that global climate change is occurring and that it should be addressed in governmental decision making. This order ensures that climate change impacts are taken into account in connection with Departmental planning and decision making." Additionally, it calls for the incorporation of climate change considerations into long-term planning documents, such as a CCP.

The Wildlife Society published an informative technical review report in 2004 titled "Global Climate Change and Wildlife in North America" (Inkley et al. 2004). It interprets results and details from such publications as the Intergovernmental Panel on Climate Change reports (1996 to 2002) and describes the potential impacts and implications on wildlife and habitats. It mentions that projecting the impacts of climate change is hugely complex because not only is it important to predict changing precipitation and temperature patterns, but more importantly their rate of change, as well as the exacerbated effects of other stressors on the ecosystems. Those stressors include loss of wildlife habitat to urban sprawl and other developed land uses, pollution, ozone depletion, nonnative species, disease, and other factors. Projections over the next 100 years indicate major impacts such as extensive warming in most areas, changing patterns of precipitation, and significant acceleration of sea level rise. According to the Wildlife Society report, "…other likely components of on-going climate change include changes in season lengths, decreasing range of nighttime versus daytime temperatures, declining snowpack, and increasing frequency and intensity of severe weather events" (Inkley et al. 2004). The report details known and possible influences on habitat and wildlife, including: changes in primary productivity, changes in plant chemical and nutrient composition, changes in seasonality, sea level rise, snow, permafrost, sea ice decline, increased invasive species, pests and pathogens, and impacts on major vertebrate groups.

The effects of climate change on populations and range distributions of wildlife are expected to be species specific and highly variable, with some effects considered negative and others considered positive. Generally, the prediction in North America is that the ranges of habitats and wildlife would generally move upwards in elevation and northward as temperature rises. Species with small or isolated populations and low

genetic variability would be least likely to withstand impacts of climate change. Species with broader habitat ranges, wider niches, and greater genetic diversity should fare better or may even benefit. This would vary depending on specific local conditions, changing precipitation patterns, and the particular response of individual species to the different components of climate change (Inkley et al 2004). The report notes that developing precise predictions for local areas is not possible due to the scale and accuracy of current climate models, which is further confounded by the lack of information concerning species-level responses and to ecosystem changes, their interactions with other species, and the impacts from other stressors in the environment. In other words, only generalizations can be made about the implications of our refuge management on regional climate change.

Our evaluation of the proposed actions concludes that only one area of activities may contribute negligibly, but incrementally, to stressors regionally affecting climate change: our use of vehicles and equipment to administer the refuge. We discuss the direct and indirect impacts of those activities elsewhere in chapter 4. We also discuss measures to minimize the impacts of both. With regards to our equipment and facilities, we are trying to reduce our carbon footprint wherever possible by using alternative energy sources and energy saving appliances, and using recycled or recyclable materials (as exemplified by the green construction incorporated in NWVC), along with reduced travel, more energy efficient vehicles, and other conservation measures.

In our professional judgment, most management actions we propose would not exacerbate climate change in the region or project area, and in fact, some might incrementally prevent or slow down local impacts. We discuss our actions relative to the 18 recommendations the Wildlife Society report gives to assist land and resource managers in meeting the challenges of climate change when working to conserve wildlife resources (Inkley et al. 2004).

- Recommendation #1: Recognize global climate change as a factor in wildlife conservation: This recommendation relates to land managers and planners becoming better informed about the consequences of climate change and the variability in the resources they work with.

Throughout our alternatives we have highlighted the need to address climate change, specifically in regard to habitat changes and new species introductions on the refuge. We have proposed a series of strategies involving monitoring habitat changes, new species introductions, and other potential impacts of climate change as it relates to the long-term protection and management of habitats.

The Service is taking a major role among Federal agencies in distributing and interpreting information on climate change. There is a dedicated webpage to this issue at: *http://www.fws.gov/home/climatechange/* (accessed March 2012). The Service's Northeast Region also co-hosted a workshop in June 2008 titled "Climate Change in the Northeast: Preparing for the Future," and a similar workshop for all Federal, state, and nongovernmental organization land managers and conservationists of the Mid-Atlantic

was held in March 2009. Both workshops provided valuable scientific information and resources to aid managers in land management planning in the context of climate change. All of the Northeast Region refuge supervisors and planners attended, as did over 20 refuge field staff.

- Recommendation #2: Manage for diverse conditions: This recommendation relates to developing sound wildlife management strategies under current conditions, anticipating unusual and variable weather conditions, such as warming, droughts and flooding.

Our proposed habitat management actions described in chapter 3 promote healthy, functioning upland and floodplain forests, open waters, and grasslands. We have identified monitoring elements, which will be fully developed in the inventory and monitoring step-down plan, to evaluate whether we are meeting our objectives and to assess changing conditions. We will implement an adaptive management approach as new information becomes available.

- Recommendation #3: Do not rely solely on historical weather and species data for future projections without taking into account climate change: This recommendation relates to the point that historical climate, habitat and wildlife conditions are less reliable predictors as climate changes. For example, there may be a need to adjust breeding bird survey dates if migratory birds are returning earlier to breed than occurred historically.

We are aware of these implications and plan to build these considerations into our inventory and monitoring plan so that we can make adjustments accordingly. The Service is working to establish long-term monitoring protocols and sites to document future trends in the Northeast.

- Recommendation #4: Expect surprises, including extreme events: This recommendation relates to remaining flexible in management capability and administrative processes to deal with ecological “surprises” such as floods or pest outbreaks.

Refuge managers have flexibility within their operations funds to deal with emergencies. The refuge has already experienced a series of large flood events over the past 10 years. Due to the frequency experienced, these types of events are being considered as a “new normal” when planning annual needs. Other regional operations funds would also be redirected as needed to deal with an emergency.

- Recommendation #5: Reduce non-climate stressors on the ecosystem: This recommendation relates to reducing human factors that adversely affect resilience of habitats and species.

Similar to our response to #2 above, the objectives of our habitat management program are to protect the biological integrity, diversity, and environmental health of refuge lands.

Objectives to enhance riparian habitat for watershed protection, and establish healthy, diverse, native, and resilient forests, would help offset the local impacts of climate change.

- Recommendation #6: Maintain healthy, connected, genetically diverse populations: This recommendation relates to the fact that small isolated populations are more prone to extirpations than larger, healthy, more widespread populations. Large tracts of protected land facilitate more robust species populations and can offer better habitat quality in core areas.

As noted in chapter 2, the refuge is in many ways a biological island surrounded by dense urbanization. Where we can restore or preserve connections, we pursue these opportunities. We would also continue to work with our many conservation partners at the State and regional level to support and complement restoration and protection efforts, build upon existing conserved tracts and target others to create corridors.

- Recommendation #9: Reduce the risk of catastrophic fire: This recommendation acknowledges that fire can be a natural part of the ecosystem, but that climate change could lead to more frequent fires and/or a greater likelihood of a catastrophic fire.

Our plans to maintain forests and grasslands, control invasive plants, provide for structural diversity, reduce dense monocultural stands of early succession pine in combination with the natural and man-made firebreaks (roads, utility corridors, etc.) found across the refuge would reduce the overall risk of a catastrophic fire.

- Recommendation #10: Reduce likelihood of catastrophic events affecting populations: This recommendation states that increased intensity of severe weather can put wildlife at risk. While the severe weather cannot be controlled, it may be possible to minimize the effects by supporting multiple, widely spaced populations to offset losses.

Our response to recommendations #2, #3, and #6 above describes the actions we are taking to minimize this risk. Unfortunately, the limited footprint of the refuge and lack of nearby undeveloped lands limits opportunities for the refuge itself to support multiple, widely spaced populations. A proposed land protection plan would help address this issue. In the meantime, we will work with other regional conservation land managers to support this effort.

- Recommendation #11: Prevent and control invasive species: This recommendation emphasizes the increased opportunities for invasive species to spread because of their adaptability to disturbance. Invasive species control will be essential, including extensive monitoring and control to preclude larger impacts.

Invasive species control is a major initiative within the Service and on the refuge. The Northeast Region, in particular, has taken a very active stand. In chapter 3, we provide detailed descriptions of our current and future plans on the refuge to control existing invasive plant infestations. We also describe monitoring and inventorying strategies to protect against any new infestations.

- Recommendation #13: Account for known climatic conditions: This recommendation states we should monitor key resources through predictable, short-term, periodic weather phenomena, such as El Nino, to aid us in future management efforts.

We plan to develop a monitoring program that would help us evaluate our assumptions and success in achieving objectives, assess the health and contribution of our forests and other habitats toward our objectives, as well as help us make future management decisions. Any restoration activities or management actions would be carefully planned and their effectiveness monitored and documented so we can use this information in future management decisions.

- Recommendation #14: Conduct medium- and long-range planning: This recommendation states that plans longer than 10 years should take into account potential climate change and variability as part of the planning process.

This 15-year CCP addresses climate change with its emphasis on restoring and maintaining healthy, contiguous, native habitat areas, reducing human stressors on refuge lands, working with private landowners to improve the health and integrity of their lands, and pursuing larger conservation connections and corridors with partners to enhance protected core areas. Our monitoring program and adaptive management strategies would also facilitate our ability to respond to climate change.

- Recommendation #15: Select and manage conservation areas appropriately: This recommendation states that establishing refuges, parks and reserves is used as a conservation strategy to try to minimize the decline of wildlife and habitats in North America. Decisions on locating future conservation areas should take into account potential climate change and variability. For example, it is suggested that decisions on new acquisition consider the anticipated northward migrations of many species, or the northern portion of species ranges. Managers of existing conservation lands should consider climate change in future planning.

The Service as a whole is working with partners on making decisions on where and how to provide conservation areas in light climate change. In particular, the Service is developing landscape conservation cooperatives throughout the country. The refuge would continue to support these nationwide initiatives, as well as more local efforts.

- Recommendation #16: Ensure ecosystem processes: This recommendation suggests that managers may need to enhance or replace diminished or lost

ecosystem processes. Manually dispersing seed, reintroducing pollinators, treating invasive plants and pests, are examples used.

While we plan to take an aggressive approach to treating invasive plants species, we also are planning actions to enhance or replace ecosystem processes. None of our proposed management actions would diminish natural ecosystems processes underway. Should our monitoring results reveal that we should take a more active role in enhancing or replacing those processes, we will reevaluate and/or refine our management objectives and strategies.

- Recommendation #17: Look for new opportunities: This recommendation states that managers must be continually alert to anticipate and take advantage of new opportunities that arise. Creating wildlife conservation areas out of abandoned or unusable agricultural land, and taking advantage of industry interest in investing in carbon sequestration or restoration programs, are two examples cited.

Refuge staff has maintained many conservation partners in the area which, in turn, are networked throughout the larger region. We are apprised of many opportunities for land protection or habitat restoration through this broad-based network. Our Northeast Region has field offices and a regional office that integrates the other Service program areas, including those that work with private entities. We have developed outreach materials, and make ourselves available to interested organizations and groups, to provide more detailed information on the Service and Refuge System missions, refuge goals and objectives, and partnership opportunities.

- Recommendation #18: Employ monitoring and adaptive management: This recommendation states that we should monitor climate and its effects on wildlife and their habitats and use this information to adjust management techniques and strategies. Given the uncertainty with climate change and its impacts on the environment, relying on traditional methods of management may become less effective.

We agree that an effective and well-planned monitoring program, coupled with an adaptive management approach, will be essential to dealing with the future uncertainty of climate change. We have built both aspects into alternatives B and C of our draft CCP/EA and in the draft habitat management plan. We will develop a detailed step-down inventory and monitoring plan designed to test our assumptions and management effectiveness in light of on-going changes. With that information in hand, we would either adapt our management techniques, or reevaluate or refine our objectives as needed.

Unavoidable Adverse Effects

Unavoidable adverse effects are the effects of those actions that could cause harm to the environment and that cannot be avoided, even with mitigation measures. All of the alternatives would result in some minor, localized, unavoidable adverse effects. For example, forest restoration projects would produce minor, short-term, localized, adverse effects on waterfowl populations. Increased visitation could have minor unavoidable

effects. However, we do not believe that any of these effects would rise to a significant level.

Many of the habitat management and facility construction projects in the alternatives have a certain level of unavoidable adverse effects, especially during the actual construction. Those effects are mitigated to some degree by the use of practices and precautions that safeguard water quality, avoid sensitive habitats, or time the actions (or include safeguards) to avoid or minimize impacts on fish and wildlife. The adverse effects generally are short-term and more than offset by the long-term gains in habitat quality and fish, wildlife, and plant productivity.

Forest habitat is also likely to undergo changes in species composition and structure as we create a more natural forest composition resembling native coastal plain or floodplain forests. The transition from one habitat type to another is not drastic in measure and occurs over an extended period of time. Restoration of habitats may cause an initial adverse effect on some plant or wildlife species, but in the long-term, populations are not expected to be harmed.

Some aspects of wildlife-dependent recreation, such as hunting or fishing, would result in the unavoidable adverse impacts on individual fish and wildlife as a result of providing that activity. However, we would protect populations from adverse effects by requiring all participants to follow applicable State and refuge regulations. In addition, we anticipate long-term benefits to species and habitats from connecting people with nature through these activities. Fishing, under all alternatives, would continue in designated areas on the refuge. This activity results in the unavoidable adverse loss of individual fish. However, this activity constitutes a relatively minor impact on species populations. In addition, alternatives B and C propose management actions that would result in improved and increased habitat for fisheries. The deer management programs under all alternatives would also result in the unavoidable loss of individuals. However, overall health of the refuge's deer population would likely improve by reducing competition for limited resources. In addition, there would be long-term benefits to refuge habitats, particularly upland habitats, and the other species that depend on them.

USFWS

Kids' Fishing Day at the Refuge

All of these unavoidable adverse effects on the physical and biological environment would be relatively local and more than offset by the long-term benefits for the diversity and ecological health of the broader landscape.

Some impacts on certain individuals or refuge neighbors may be unavoidable, but our responsibility is to provide equal opportunities to the American public, not a select few. We believe we have sought a fair balance in minimizing and mitigating adverse impacts while providing quality recreational opportunities to the public. All of what we propose in the arena of public use results from public involvement and input during the planning process.

Potential Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be undone, except perhaps in the extreme long term. One example is an action that contributes to a species' extinction. Once extinct, it can never be replaced and is an irreversible loss. By comparison, irretrievable commitments of resources are those that are lost for an extended period of time, but could be undone given sufficient time and resources, although there may be a loss in productivity or use for a time. An example of an irretrievable commitment is converting what was once a mature forest and actively managing and maintaining it in an early successional forest habitat condition. If, for some reason, that early successional habitat was no longer an objective, those acres could progress gradually to mature forest again over a period of 70 or more years, or we could determine it best to expedite that reversion by planting shrubs and trees and controlling invasive plants.

Environmental Justice

President Clinton signed Executive Order No. 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" on February 11, 1994, to focus Federal attention on the environmental and human health conditions of minority and low-income populations, with the goal of achieving environmental protection for all communities. The order directs Federal agencies to develop environmental justice strategies to aid in identifying and addressing disproportionately high, adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. The order is also intended to promote nondiscrimination in Federal programs substantially affecting human health and the environment, and to provide minority and low-income communities with access to public information and participation in matters relating to human health or the environment.

We expect none of the three proposed alternatives to have significant adverse cumulative impacts on the economy of the towns or counties in which refuge lies. We would expect none of the alternatives to alter the demographic or economic characteristics of the local community. The actions we propose would neither disproportionately affect any communities nor damage or undermine any businesses or community organizations. Consequently, no adverse impacts would be expected including changes in the community character or demographic composition.

Overall, we expect none of the alternatives would place a disproportionately high, adverse environmental, economic, social, or health effects on minority or low-income persons. Our programs and facilities are open to all who are willing to adhere to the established refuge rules and regulations, we acquire land only from willing sellers, and

we do not discriminate in our responses for technical assistance in managing private lands. In addition, proposed refuge construction projects under alternatives B and C would occur within the refuge boundary and are not expected to have disproportionate adverse effects on any group or area.

4.17 Summary of Environmental Consequences by Alternative

Table 4-2. Summary of the Foreseeable Consequences of Each Alternative.

Alternative A: Current Management	Alternative B: Balance of Interior Forest, Grasslands, and Public Uses (Service-preferred)	Alternative C: Increased Interior Forest Management and Reduced Non-wildlife Dependent Public Uses
Effects on Air Quality		
Current management activities neither substantially benefit nor adversely affect local and regional air quality. Minor long-term benefits in air filtration and carbon sequestration from protection of vegetated upland, riparian, and wetlands habitats. We would continue energy efficient practices and adopt additional practices as feasible, such as hybrid vehicles. Negligible adverse effects from prescribed burning on small patches to maintain grassland and control invasive species. Anticipated increase in annual refuge visits by motor vehicles would cause a negligible increase in air emissions in the long term.	Long-term benefits for air filtering and carbon sequestration from land protection would increase under alternative B as a result of restoring forest habitat. Same energy efficient practices as in alternative A. Negligible adverse effects from increased use of prescribed burning on small patches to maintain grassland and control invasive species. Other impacts similar to alternative A.	Long-term benefits to improved air quality would be similar to alternative B, with a small increase as a result of allowing additional acres to succeed to forest. Same energy efficient practices as in alternative A. Reduced adverse effects from particulate emissions, compared to alternative B, due to less prescribed burning, on approximately a smaller number of acres/year. Slight increase over alternative A. Other impacts similar to alternative A.
Effects on Soils		
<u>Impacts Common to All Alternatives:</u> We would continue to maintain native vegetation cover on the refuge that stabilizes and minimizes soils losses through erosion. Intact forest cover would help restore soil structure and biological productivity. Within each of the alternatives, construction and/or maintenance of some dikes would continue in		

Alternative A: Current Management	Alternative B: Balance of Interior Forest, Grasslands, and Public Uses (Service-preferred)	Alternative C: Increased Interior Forest Management and Reduced Non-wildlife Dependent Public Uses
order to manage impounded wetlands, causing some soil disturbance. Regardless of which alternative is selected, we would continue to use best management practices; conduct all prescribed burns under a strict prescription and in optimal weather conditions; permit mowing and brush hogging only in dry grassland areas and only on a rotational basis; use approved herbicides to control invasive plants; and limit public use to designated areas.		
Same as common to all alternatives.	Alternative B would increase long-term benefits to soils through reconnecting the hydrology in some areas.	Impacts to soils would be similar to alternative B; however, more acres would benefit from un-impounded wetlands.
Effects on Hydrology and Water Quality		
Impacts Common to All Alternatives: Under each alternative, the forest landscape provides a buffer along streams that pass through the refuge. Forest litter and vegetation reduce sheetflow and reduce erosion from water coming from off-refuge. In managing the refuge, we would closely monitor and mitigate all of our routine activities that may result in chemical contamination of water directly through leakage or spills or indirectly through soil runoff.		
Same as common to all alternatives.	Under alternative B, additional acres of riparian forest habitat would be restored. Benefits would be similar to those described under alternative A, but would be greater because more area would be restored. Also, removing or breaching dikes at select impoundments would further restore the area's natural hydrology. There are slight risks of short-term adverse effects on water quality associated with new construction of trails and kiosks, when compared to alternative A.	Under alternative C, additional hydrologic processes would be restored by restoring additional impoundments to forest, thereby reducing the acreage of emergent marsh and increasing the acreage of forested wetlands. Compared to alternatives A and B, alternative C offers additional flood plain forest and would restore connectivity to existing hydrology. This could offer additional flood protection and could potentially improve water quality by increasing natural filtration, and reducing sediment loads in flood waters.

Alternative A: Current Management	Alternative B: Balance of Interior Forest, Grasslands, and Public Uses (Service-preferred)	Alternative C: Increased Interior Forest Management and Reduced Non-wildlife Dependent Public Uses
Effects on Vegetation		
Impacts Common to All Alternatives: Regardless of which alternative we select, we would use standard and effective habitat management techniques to conduct forest, shrubland, and grassland management activities in the refuge uplands. Whenever feasible, we would replace nonnative plant species with native species to restore the ecological integrity of the refuge. Management actions would cause no major mortality or loss in local populations, because actions occur on a rotational basis, meaning no major habitat components would change completely in any one year. We would continue a hunt program under all alternatives that includes the harvesting of white-tailed deer, to control the deer population on the refuge and minimize the negative impacts of overbrowsing. We anticipate an increase in visitation that may lead to direct and indirect impacts on these habitats. Indirect impacts could result from the activity of visitors trampling vegetation, as well as potential impacts associated with habitat restoration or general service activities, including chemical leaks or spills.		
Forests, Shrublands, and Grasslands Same as those effects listed as common to all.	Forests, Shrublands, and Grasslands Beneficial impacts to forests would be greater under alternative B through increased restoration and invasive plant control. Additional biological staff under this alternative would allow for more control of invasive species. Our reforestation activities would be strategically focused to decrease edge and increase connectivity of forested tracts on the refuge. Adverse effects would increase slightly under this alternative as a result of constructing new trails and kiosks.	Forests, Shrublands, and Grasslands Benefits to forest habitat under alternative C would be greatest because acreage would be increased as a result of allowing impoundments, shrublands, and grasslands to convert to forest. This approach would benefit floodplain forest, but adversely impact early successional habitats. An indirect benefit would come from the reduced use of heavy equipment and increased opportunities over several forested tracts to increase the recruitment of forest species and improve stand health.

Alternative A: Current Management	Alternative B: Balance of Interior Forest, Grasslands, and Public Uses (Service-preferred)	Alternative C: Increased Interior Forest Management and Reduced Non-wildlife Dependent Public Uses
	Shrublands Under this alternative, units that would be maintained as shrublands are more suited to this habitat and would therefore provide high-quality scrub/shrub species. This alternative would result in a loss of acres of shrubland compared with alternative A. Localized adverse effects from mowing include soil compaction, damage and loss of vegetation. Grasslands The refuge would maintain about 255 acres of grassland habitat on the refuge. Although this alternative provides less acreage than alternative A, the quality of existing grasslands would improve from our efforts to remove hedgerows, decrease fragmentation, and increase species diversity within grassland units.	Shrublands Under this alternative, the refuge would maintain about 240 acres of managed shrubland. This acreage would be maintained along forest edges to provide a gradual transition from forested areas to roads. The loss of potential rare plant communities and plant species would likely be an adverse effect under this alternative. Grasslands Alternative C would provide the least benefits to grasslands on the refuge. Only 78 acres would be maintained as grassland habitat; however these areas would provide high quality habitat in locations ideally suited for obligate grassland breeding birds. The loss of grassland habitat would adversely impact grassland dependent wildlife, and the refuge would reduce its part in sustaining this habitat type in the region.
Effects on Federally Listed and Recently Delisted Species		
Impacts Common to All Alternatives: We do not anticipate any impacts to any endangered or threatened species under any of the alternatives.		
Effects on Landbirds		
Impacts Common to All Alternatives:		

Alternative A: Current Management	Alternative B: Balance of Interior Forest, Grasslands, and Public Uses (Service-preferred)	Alternative C: Increased Interior Forest Management and Reduced Non-wildlife Dependent Public Uses
Regardless of the alternative we select, we would continue implementing our habitat management objectives, including improving forest stands affected by off refuge and past land management activities and controlling and managing invasive species. All of these management actions directly benefit landbird species by improving the quality of habitat, areas in which they nest and forage, and further protecting them from loss of habitat to development. The addition of new trails and visitor infrastructure would be strategically located to minimize any adverse effects on landbirds. The expected increase in visitation could have additional adverse impacts on landbirds; however, we would take all measures necessary to mitigate potential negative impacts by evaluating which sites to use for environmental education and interpretation programs, and time of year to conduct certain events.		
The effects would be similar to those described under common to all alternatives.	Raptor species that require large tracts of intact forest would benefit under this alternative as forested areas would increase. Alternative B would provide additional long-term benefits to landbirds through the protection and restoration of upland and floodplain forests, and grassland enhancements. The conversion of the 210 acres of impoundments to a mix of hardwood floodplain forest species would provide improved habitat structure and species composition needed for various warblers, such as prothonotary warbler. Phased removal and reforestation of this area would help minimize short-term impacts or habitat loss. Although overall shrubland acreage would decrease under this alternative, improved management would have a beneficial impact on species that depend on this habitat type. Some grassland species, such as	Alternative C differs slightly from alternative B in benefits to landbirds. This alternative would provide additional upland forest and floodplain forest communities. It would reduce shrub and early successional habitats which are currently under-represented across the refuge and region. These habitat types benefit various warbler species and other songbirds that prefer dense shrub cover.

Alternative A: Current Management	Alternative B: Balance of Interior Forest, Grasslands, and Public Uses (Service-preferred)	Alternative C: Increased Interior Forest Management and Reduced Non-wildlife Dependent Public Uses
	sedge wren, bobolink, and savannah sparrow would decline on the refuge (but not regionally) as less acreage of grassland would be available.	
Effects on Open Water and Wetland Birds		
Impacts Common to All Alternatives: Under all alternatives, the refuge would continue to restrict access and management activities when and where appropriate near known nesting sites and continue breeding success monitoring. Waterfowl and shorebirds of regional conservation priority, such as American and least bittern, sora, king rail, and American black duck would continue to use available impoundments and naturally occurring wetlands. Across all alternatives, waterbirds would benefit from our control of nonnative invasive species and maintenance of native plant communities. The refuge would continue to offer a hunt program that includes the harvesting of waterfowl. The waterfowl hunt program follows Federal and State regulations for annual harvest levels and seasons by species, and does result in individual losses, but the projected cumulative harvest would not negatively impact any species' population on the refuge. An increase in visitation is likely to occur under any alternative; we would continue to work with the State in implementing a public education and outreach program. The impacts of recreation on waterbirds are well-documented and disturbance on these species include displacement, higher occurrences of flushing, and general avoidance.		
Effects would be the same as those described as common to all alternatives.	Under alternative B, benefits would be similar to those described as common to all alternatives. Alternative B would result in a decrease in open water habitats through the restoration of floodplain and upland forest. This change in focus away from some impoundment management would likely reduce the number of open water dependent waterfowl that use the refuge. The reduction in available habitat would impact the refuge waterfowl	Under alternative C, benefits would be similar to those described as common to all alternatives. The increase in floodplain forest under alternative C would increase benefits associated with wetland and open water species that use adjacent floodplain forest for some of their lifecycle needs. For example, nesting wood ducks could benefit from increased nesting cavities associated with floodplain

Alternative A: Current Management	Alternative B: Balance of Interior Forest, Grasslands, and Public Uses (Service-preferred)	Alternative C: Increased Interior Forest Management and Reduced Non-wildlife Dependent Public Uses
	population, but given the size of the impoundments and their location on the landscape, displaced waterfowl would use other open water areas on the refuge or adjacent. As such, we do not anticipate any impacts to overall waterfowl populations. Alternative B anticipates an increase in refuge participation and visitation. Much of this increase is expected in the form of school groups or recreational uses. As noted in the "adverse impacts common to all alternatives" discussion, use of existing trails poses minimal potential impact to birds nesting in open water or wetland habitats. The overall trend regarding the location of visitation is likely to remain the same.	forest. Compared to alternative B, alternative C further decreases the number of acres of open water and impoundments by an additional 210 acres. This reduction in habitat would likely reduce the number of open water dependent species that use the refuge, such as ringneck ducks and buffleheads. However, the refuge lies at the periphery of the core range for Atlantic Flyway waterbirds, especially waterfowl and shorebirds. Its largely forested and urbanized landscape does not make the refuge a key contributor to this species suite. Similar to alternative B, alternative C anticipates an increase in refuge visitation. As noted in the discussion of Impacts on Open Water and Wetland Birds under Alternative B, precautionary measures already in place on the refuge would result in infrequent, localized impacts on open water or wetland birds with the anticipated increase in visitation. We would continue to monitor refuge visitation and potential impacts on open water and wetland birds and adjust our management to continue our protection of these species as needed.

Alternative A: Current Management	Alternative B: Balance of Interior Forest, Grasslands, and Public Uses (Service-preferred)	Alternative C: Increased Interior Forest Management and Reduced Non-wildlife Dependent Public Uses
Effects on Fisheries		
Impacts Common to All Alternatives: Under all of the alternatives, we would take management actions to protect wetlands, refuge impoundments, and open water, such as controlling nonnative invasive plants and providing and improving riparian buffers around wetland-upland interfaces. Where floodplain forests are found adjacent to open water, the debris from trees and other vegetation falling into the water provides cover and food, as well as helping to lower water temperatures. Many related benefits of floodplain forests are also described under the section on hydrology and water quality. Components regarding open water and wetlands relate to fisheries as well. Overall, the effects from public use (both current and anticipated) are not likely to have an impact on fisheries utilizing open water and wetland habitats on the refuge. By providing fishing opportunities, we do have impacts to individual fish. While we encourage catch and release because of the potential contaminants present in game fish, this also helps maintain local fish populations. Regardless of the alternative, we would continue to employ a range of management tools to achieve our objectives in managing for the improved health and integrity of open water and wetland habitats. Other sources of environmental contamination can be created by stormwater runoff from surrounding lands and the watershed. Use of herbicides in invasive species control could potentially cause small localized and temporary contamination in the event of an unintentional spill or misapplication. We would continue to employ best management practices in terms of herbicide use and spill prevention and response to minimize impacts from these other sources of contamination.		
Effects would be similar to those described as common to all alternatives.	Impacts to fish would be similar as described under alternative A. Our additional restoration efforts along the riparian zone would offer greater benefits to the fish population. Alternative B would allow visitors improved fishing opportunities as well as access to Blue Heron Pond. As discussed under Impacts That Would Not Vary by Alternative, this would create isolated negative impacts for some	Effects would be similar to alternative B.

Alternative A: Current Management	Alternative B: Balance of Interior Forest, Grasslands, and Public Uses (Service-preferred)	Alternative C: Increased Interior Forest Management and Reduced Non-wildlife Dependent Public Uses
	individual fish and would increase potential for adverse impacts associated with increased public use (e.g., littering).	
Effects on Mammals		
Impacts Common to All Alternatives: We would continue to use habitat management techniques, such as maintaining impoundments, prescribed burning, mowing, and controlling invasive species, all of which provide benefits to the habitats wildlife reside in, as well as adverse effects previously described under Wetlands and Uplands. Hunting of mammals would occur at some level under each of the alternatives. For the 2010 to 2011 deer season, hunters took 272 deer. For the 2009 to 2010 deer seasons, hunters took 242 deer. This level of harvest is expected to keep deer populations level within the refuge to a density that reduces impacts to the forest understory and allows for forest regeneration. However, it is unlikely that this level of deer harvest would negatively impact the overall deer population of eastern Maryland. Overall, the effects from public use are not likely to have a negative impact on mammal populations.		
Effects on Amphibians and Reptiles		
Impacts Common to All Alternatives: Long-term improvements in water quality would create benefits to environmental health and to amphibian and reptile populations. Amphibians and reptiles would likely continue to be impacted by environmental contaminants, unrelated to refuge activities, known to occur in waters around the refuge. Long-term benefits to amphibians and reptiles are anticipated through the ongoing management of existing freshwater emergent wetlands and impoundments. Protection of floodplain forests and associated vernal pools would continue to benefit amphibians and reptiles that rely on these sites for breeding habitat. Any protection of large, intact forests on the refuge on the local landscape through partnerships would benefit amphibians requiring vernal pools. We would continue to avoid mowing in early successional habitats and wet grasslands when amphibians or reptiles may be breeding or seasonally moving through transitional zones. Some amphibians and reptiles may be present during aerial applications of herbicides and may experience direct contact with herbicides if they are present during applications, or if spray misses the targeted application patch. We do not expect this as a frequent occurrence. Ongoing		

Alternative A: Current Management	Alternative B: Balance of Interior Forest, Grasslands, and Public Uses (Service-preferred)	Alternative C: Increased Interior Forest Management and Reduced Non-wildlife Dependent Public Uses
management activities, such as invasive species management and inventory and monitoring programs would continue to be completed in a manner that would minimize potential impacts. Overall, the effects from public use are likely to minimally impact amphibians and reptiles utilizing forested, grassland, open water, and wetland habitats on the refuge. Impacts associated with disturbance include displacement, stress, and potential mortality. Given the size of the refuge and location of trails and roads for visitor use, we expect these impacts to be negligible.		
Effects would be similar to those described as common to all alternatives.	Amphibian species (Ambystoma salamanders, wood frogs, chorus frogs, spring peepers) that utilize forested wetlands would increase as more vernal pools, forested floodplain habitat and green-tree reservoirs become available. Large blocks of grasslands adjacent to woodlands and forest are beneficial to box turtles, which emerge to bask in the sun and feed on forbs and insects. The continued presence of dogs on the refuge for search and rescue trainings and waterfowl hunting could have negative impacts on refuge amphibians and reptiles. Free-ranging and uncontrolled dogs can chase and flush wildlife and occasionally prey on reptiles.	Effects would be similar to alternative B.
Effects on Invertebrates		
<u>Impacts Common to All Alternatives:</u> Patuxent Research Refuge's land management provides a wide array of general habitat types and microhabitats that serve as foraging, breeding, and overwintering habitat for many groups of invertebrates. Improving stream water quality would benefit aquatic insects and other invertebrates. Removing invasive species permits native plants to reestablish and expand. This particularly benefits insects that coevolved with the native plants, particularly those that are host-specific,		

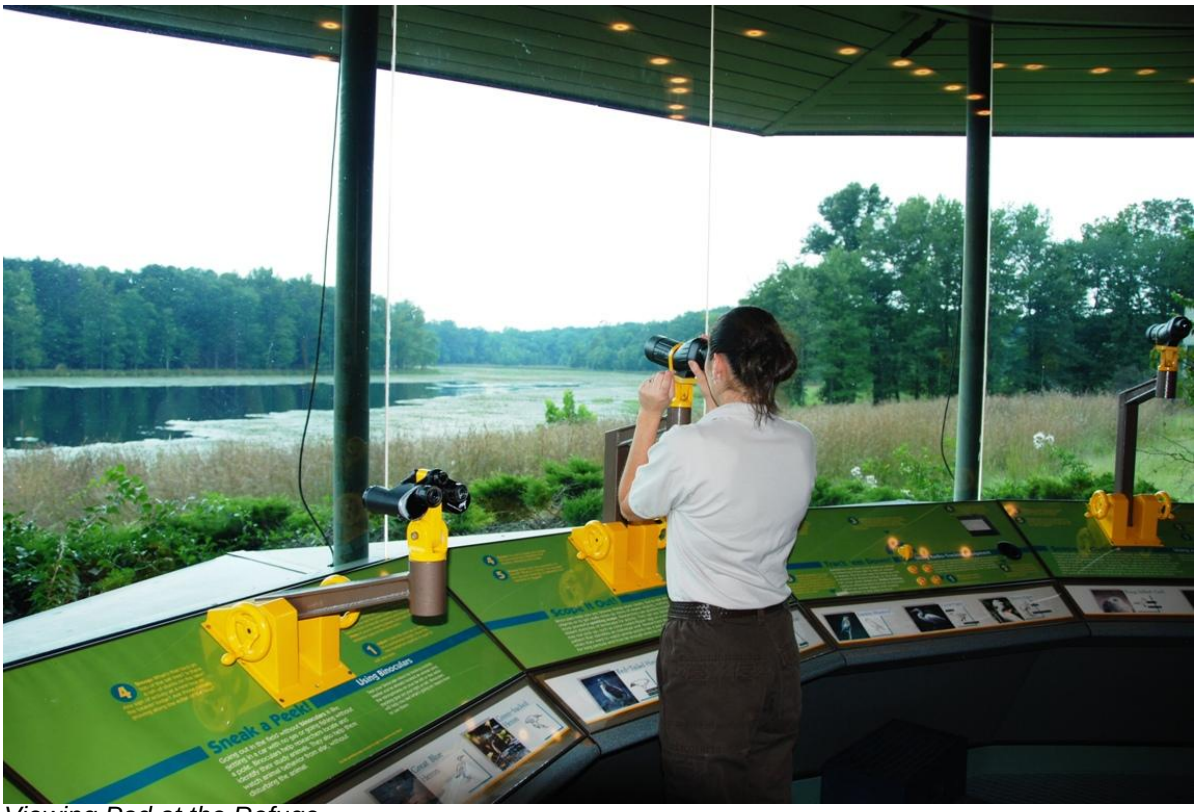
Alternative A: Current Management	Alternative B: Balance of Interior Forest, Grasslands, and Public Uses (Service-preferred)	Alternative C: Increased Interior Forest Management and Reduced Non-wildlife Dependent Public Uses
such as the monarch butterfly, which mostly uses milkweed as the host plant for its eggs. Many species of invasive, nonnative plants are not optimal hosts for native insects, and do not contribute to the health or diversity of the pollinator community. Maintaining refuge grounds currently involves mowing of roadsides, parking areas, walking paths, and small lawn areas. Generally, regularly mowed areas are kept short in vegetation height (less than 6 inches). Thus, they provide very limited sources of nectar, usually clovers. Where grasses and forbs have grown tall, such as along seldom-used roads or paths where they begin to flower and set seed, pollinators and herbivorous insects would be found. Mowing in the warm months, when insects are breeding, may destroy the eggs or pupae attached to leaves, consume adults, remove food sources, or unfavorably alter microhabitat. However, the area we maintain is a very small fraction of the amount of land serving as habitat. Artificial lighting for the security of existing facilities and administrative buildings such as the visitor center, and maintenance building is another potential source of adverse impacts on invertebrates, particularly nocturnal moths. Decreases in populations of moths have been attributed to artificial lighting. To the extent practical, given needs for facility security, maintenance, and access, the refuge has minimized its use of artificial lighting. No new projects proposed under any alternative would pose a substantial increase in artificial lighting.		
Effects would be similar to those described as common to all alternatives.	An important, direct benefit is the provision of large tracts of diverse grasslands in multiple locations for pollinating, herbivorous, or predatory insects. Well-established grasslands possess a diverse array of nectaries and plant structures that would provide food and cover year round for the annual life cycles of many species. The greater diversity of habitats considered under this alternative will allow a greater diversity of host plants and their associated insects.	Effects would be similar to alternative B.
Effects on Public Use and Access		
<u>Impacts Common to All Alternatives:</u> The main goals of the visitor services program would be to continue working with partners to		

Alternative A: Current Management	Alternative B: Balance of Interior Forest, Grasslands, and Public Uses (Service-preferred)	Alternative C: Increased Interior Forest Management and Reduced Non-wildlife Dependent Public Uses
promote the benefits of wildlife and habitat conservation and management; to foster an awareness and appreciation for the refuge and its role along the Atlantic Flyway and within the Refuge System; and to provide quality wildlife-dependent recreational experiences to visitors. We would continue to evaluate environmental education programs already available across the region to identify potential needs in the environmental education community. For many residents of the Baltimore-Washington area, refuge staff may be their one and only interaction with the Service. Under all alternatives, refuge staff would continue to be active in outreach and partnership development. NWVC would continue to be free to the public. The facility would continue to be an important example of sustainable design and construction, and we would continue to use it as an interpretive tool for the benefits of sustainable building and relate this to effects on climate change.		
Effects would be similar to those described as common to all alternatives.	Under alternative B, the refuge would expand public uses and strive to maintain a better balance among the wildlife-dependent public uses on the refuge. For example, allow hiking trails to be open during some hunting seasons.	Under alternative C, wildlife-dependent public uses such as wildlife observation, viewing, and photography would be emphasized and expanded. Under alternative C, non-wildlife dependent uses would be reduced or eliminated. Special events and interpretive programming both on and offsite would also be reduced. We would explore implementation of a fee program for refuge entry, as well as for programs and activities. This would allow refuge staff to implement enhanced interpretive programs and increase trail maintenance. Reducing or eliminating programs or charging fees could have a long-term negative impact on public use and access by limiting the ability of some people to access the refuge and potentially reducing the number of visitors overall.

Alternative A: Current Management	Alternative B: Balance of Interior Forest, Grasslands, and Public Uses (Service-preferred)	Alternative C: Increased Interior Forest Management and Reduced Non-wildlife Dependent Public Uses
Effects on Cultural and Historical Resources		
Impacts Common to All Alternatives: Under all alternatives, the refuge would expand its interpretation of cultural and historical resources related to the refuge and conservation. The extent and emphasis of cultural and historical resource interpretation varies between alternatives. Under all scenarios the refuge communicates the importance of understanding and appreciating the area's rich cultural history and how it relates to our natural history. In doing so, we would potentially provide long-term benefits to regional cultural and historical resources. The refuge would also continue its adaptive reuse of several historic register-eligible buildings, such as Nelson and Merriam Labs for office space. This potentially would include other Service programs currently offsite, such as the Chesapeake Bay Field Office. Such collocation would save the Service significant General Services Administration rental expenses, and also allow for easier communication and collaboration between Service programs and other partners. While no adverse impacts to cultural or historic resources are anticipated, we will send this draft CCP/EA to the State Historic Preservation Office for review in compliance with section 106 of the National Historic Preservation Act. In all of the alternatives, we will consult with our regional archeologist and the State Historic Preservation Office as needed to ensure compliance with the act and other applicable laws and regulations.		
Effects on the Socioeconomic Environment		
Impacts Common to All Alternatives: Ongoing public uses related to wildlife-dependent recreation would continue to have a small but positive effect on the local economies surrounding the refuge. Refuge visitors, researchers, and volunteers would continue to visit businesses around the refuge for food, fuel, supplies, and lodging. The refuge would continue to provide environmental education and interpretation programming free-of-charge to local schools in order to allow all students access to quality environmental educational programming. We would also strive to provide monetary assistance to help pay for busing of students to and from the refuge for field trips. We would continue to provide meeting space for conservation and environmentally related meetings and symposiums. The economic value of the ecosystem services provided by the extensive forest cover and other vegetation cover types provided by the refuge and any future land protection efforts achieved by refuge partnerships has not been quantified. The services provided by refuge forests include groundwater recharge, flood control, nutrient filtration and uptake, improved air quality, and temperature moderation. Although some loss of tax revenue and commercial income results from protecting lands, the		

Alternative A: Current Management	Alternative B: Balance of Interior Forest, Grasslands, and Public Uses (Service-preferred)	Alternative C: Increased Interior Forest Management and Reduced Non-wildlife Dependent Public Uses
impact of protecting land is considered negligible on the economy of the region. Under all alternatives, providing opportunities for wildlife research would remain a priority for the refuge. It is difficult to predict the amount of future research that will occur. Funding sources and research priorities change over time and refuge staff will work with potential partners to ensure that opportunities are available for compatible research activities.		
Impacts would be similar to those described as common to all alternatives.	The addition of full-time staff would minimally increase benefits for the local economy in jobs, income, and expenditures. Under this alternative, the refuge would improve programs for under-represented audiences including providing interpretive materials in other languages, providing programs and materials designed to meet the needs of people with special needs, as well as continuing to reach out to urban youth. The refuge also tends to draw students from nearby schools that might not otherwise be exposed to environmental education programs. Adverse impacts under this alternative are the same as those discussed as common to all alternatives.	Impacts would be similar to those described as common to all alternatives.

Chapter 5.



USFWS

Viewing Pod at the Refuge

Consultation and Coordination with Others

5.1 Introduction

5.2 Planning to Protect Land and Resources

5.3 Contact Information

5.4 Members of the Core Planning Team

5.1 Introduction

This chapter describes how we included others in developing this draft CCP/EA and how we plan to continue consulting and coordinating with others in the future. It details how we first invited, and will continue to encourage, the partnership of other Federal and State agencies, civic, public, and private conservation and education organizations, and the affected public in our decisions about managing the refuge.

As we mentioned in chapters 1, 2, 3, and 4, we must comply with the NEPA in seeking public input on proposed Federal actions. A 45-day period for public review is included with the release of this draft CCP/EA. We encourage you to give us your responses and ideas about the plan. During that period, we will host an open house at a location near the refuge to gather your opinions and answer your questions about its future management. We will weigh carefully the responses we receive before we write the final CCP.

5.2 Planning to Protect Land and Resources

We began the CCP process for Patuxent Research Refuge in December 2009 with a kick-off meeting at the refuge. We discussed the current status of the refuge, important issues to be addressed in the CCP, and the status and sources of data for the analysis. We defined a core planning team to include managers and staff from the refuge, a representative from the USGS PWRC, a representative from the Service Division of Migratory Bird Management, the Service Chesapeake Bay Field Office, Service regional planners, and an MD DNR representative.

We published and distributed our first newsletter in February 2010. On March 23 and 24, 2010, we held public scoping meetings at NWVC and MD DNR's headquarters in Annapolis, Maryland to solicit comments from the community and other interested parties on the scope of the CCP and the issues and impacts that should be evaluated in the CCP/EA.

We held a number of core planning team and partner meetings throughout the planning process to review habitat management, visitor services and research. Table 5-1 outlines the planning meetings that we held during the process.

Table 5-1. List of Planning Meetings

Date	Topic	Audience
January 14, 2010	CCP issues and opportunities	Refuge and PWRC staff
May 18, 2010	Refuge vision	Refuge staff
May 19, 2010	Habitat management	Core planning team
August 4, 2010	Public Use alternatives	Core planning team
August 5, 2010	Habitat alternatives	Core planning team
February 22, 2010	Research goal	Refuge and PWRC staff
November 30 - December 2, 2010	Impoundment management	Core planning team and additional experts
January 25, 2011	Habitat management	Core planning team

Date	Topic	Audience
January 26, 2011	Land protection opportunities	County, State, and NGO representatives
April 11 - 12, 2011	Impoundment management	Core planning team and additional experts
May 24, 2011	Grassland management	Core planning team and additional experts
June 29, 2011	Alternatives	Core planning team
October 4, 2011	Alternatives	PWRC research managers

We have published our Notice of Availability in the *Federal Register* announcing the release of this draft CCP/EA. During the 45-day period of public review, we will hold a public meeting to obtain comments. We also expect to receive comments by regular mail or electronic mail. After the comment period expires, we will review and summarize all of the comments we have received and develop our responses. We will present them in an appendix to the final CCP.

Once we have prepared the final CCP, we will submit it to our Regional Director for her review and approval. She will determine whether a FONSI is appropriate and certify whether the final CCP meets agency compliance requirements, achieves refuge purposes, and helps fulfill the mission of the Refuge System. With an affirmative FONSI and other positive findings, the Regional Director can approve the final CCP. If that happens, we will publish another *Federal Register* NOA to announce the availability of the final plan. That will complete the planning and compliance requirements for implementation of a final CCP.

5.3 Contact Information

Bill Perry, Refuge Planner
U.S. Fish and Wildlife Service
300 Westgate Center Drive
Hadley, MA 01035-9589
Phone: (413) 253-8688
Fax: (413) 253-8468
E-mail: bill_perry@fws.gov

Brad Knudsen, Refuge Manager
Patuxent Research Refuge
10901 Scarlet Tanager Loop
Laurel, MD 20708
Phone: (301) 437-5580

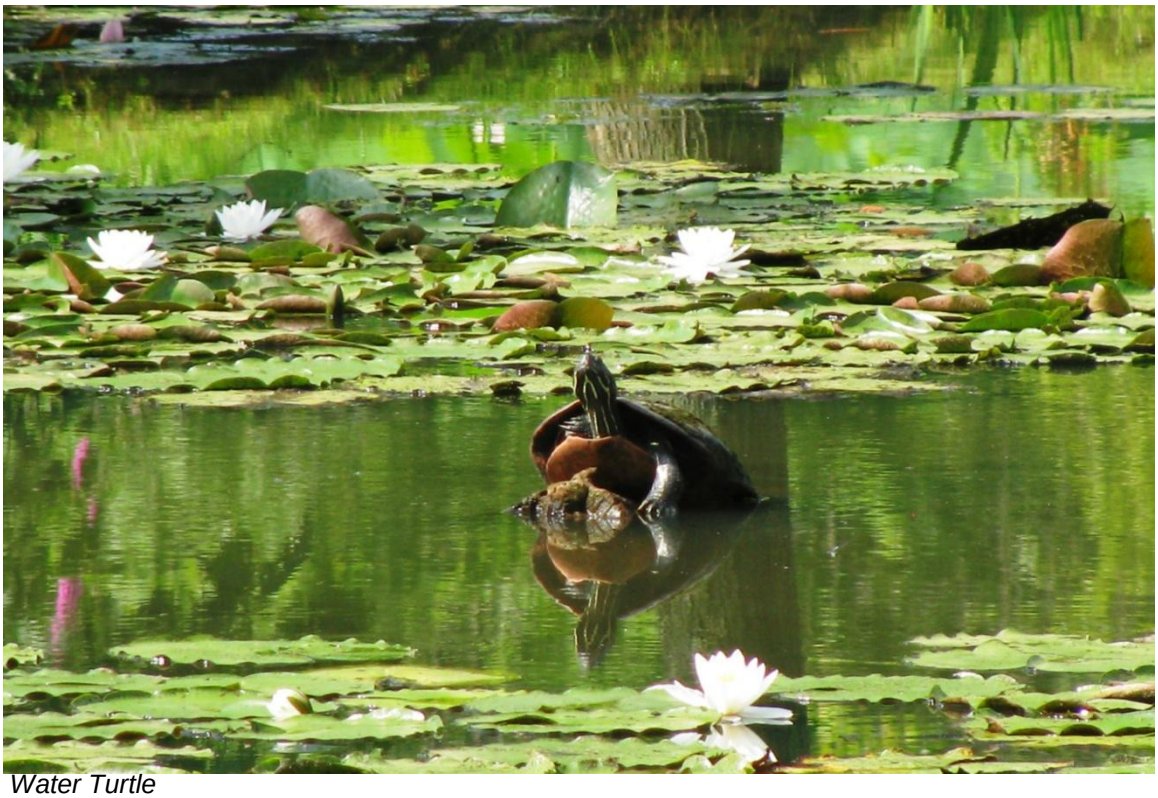
5.4 Members of the Core Planning Team

Service Personnel
Brad Knudsen, Refuge Manager, Patuxent Research Refuge
Jennifer Hill, Planner, Patuxent Research Refuge
Nell Baldacchino, Visitor Services Manager, Patuxent Research Refuge
Tarik Adams, Assistant Facilities Manager, Patuxent Research Refuge
Sandy Spencer, Wildlife Biologist, Patuxent Research Refuge
Holliday Obrecht, (retired) Wildlife Biologist, Patuxent Research Refuge
Bill Perry, Natural Resource Planner, Planning Team Leader, Regional Office
Les Vilchek, Cartographer, USFWS
Melanie Steinkamp, Migratory Bird Biologist, Region 5 Migratory Birds Program
Dan Murphy, Chesapeake Bay Field Office
Susan McMahon, Deputy Refuge Chief, Region 5
Ken Richkus, Division of Migratory Bird Management
Tom Bonetti, Natural Resource Planner (former Planning Team Leader), Regional Office
Nancy McGarigal, Natural Resource Planner (former Planning Team Leader), Regional Office
Meredith Bixby, Assistant Planner, USFWS Regional Office
Katie Fox, Assistant Planner, USFWS Regional Office

Other Core Team Members
John French, Research Manager, Patuxent Wildlife Research Center
Christine Conn, Director, MD DNR Strategic Land Planning

Other Contributors
Glenn Therres, MD DNR
Tony Proschaka, MD DNR
Jan Taylor, Regional Refuge Biologist, Great Bay NWR
Harold Laskowski, (retired) Regional Biologist, Region 5, Prime Hook NWR
John Wilson, Regional Historic Preservation Officer, Region 5 Regional Office
Shelley Small, Regional Archaeologist, Region 5 Regional Office
Jim Lyons, Division of Migratory Bird Management, USFWS
Christopher Wicker, Assistant Biologist, Patuxent Research Refuge, USFWS
Nancy Morrissey, Deputy Refuge Manager, Patuxent Research Refuge, USFWS
Teresa Wright, Engineer, Patuxent Research Refuge, USFWS
Jennifer Casey, Biologist, USFWS

Bibliography



USFWS

Water Turtle

Bibliography

Abrams, M.D. 1996. Distribution, historical development and ecophysiological attributes of oak species in the eastern United States. Annales des Sciences Forestieres (Paris) 53: 487-512.

American Bird Conservancy (ABC). 2009. Cats indoor! The campaign for safer birds and cats. Accessed August 2012 at: *http://www.abcbirds.org/abcprograms/policy/cats/index.html*.

Andreasen, D.C. 2007. Optimization of ground-water withdrawals in Anne Arundel County Maryland, from the Upper Patapsco, Lower Patapsco, and Patuxent Aquifers projected through 2044. Report of Investigation No.77, Maryland Geological Survey, Baltimore, MD.

Anne Arundel County. 2009. Assessment of the biological health of streams on the Patuxent Research Refuge within Anne Arundel County, Maryland. Department of Public Works, Bureau of Engineering, Watershed, Ecosystem, and Restoration Services Division, Annapolis, MD.

Askins, R.A. 1997. History of grasslands in the Northeastern United States: implications for bird conservation. In: Grasslands of Northeastern North America, Ecology and Conservation of Native and Agricultural Landscapes (Vickery, P. D. and P. W. Dunwiddie, eds.), pp. 119-136. Massachusetts Audubon Society, Lincoln, MA.

Banks, P.B. and J.V. Bryant. 2007. Four-legged friend or foe? Dog walking displaces native birds from natural areas. Biological Letter 3: 611-613. doi:10.1098/rsbl.2007.0374.

Bélanger, L. and J. Bédard. 1990. Energetic cost of man-induced disturbance to staging snow geese. Journal of Wildlife Management 54(1): 36-41.

Bennett, K.A. and E. Zuelke. 1999. The effects of recreation on birds: a literature review. Delaware Natural Heritage Program, Smyrna, DE 1977.

Best, L.B. and D.F. Stauffer. 1986. Factors confounding evaluation of bird-habitat relationships. In Wildlife 2000: Modeling Habitat Relationships of Terrestrial Vertebrates (J. Verner, M.L. Morrison, and C.J. Ralph, eds.), pp. 209-216. University of Wisconsin Press, Madison, WI.

Blake, J.G. and J.R. Karr. 1987. Breeding birds of isolated woodlots: area and habitat relationships. Ecology 86:1724-1734.

Bond, R.R. 1957. Ecological distribution of breeding birds in the upland forests of southern Wisconsin. Ecological Monograph 27: 351-384.

Boyle, S.A. and F.B. Samson. 1985. Effects of nonconsumptive recreation on wildlife: a review. Wildlife Society Bulletin 13(2): 110–116.

Bridgham, S.D., J.P. Megonigal**,** J.K. Keller**,** N.B. Bliss, and C. Trettin. 2007. Wetlands. In: The First State of the Carbon Cycle Report (SOCCR): The North American Carbon Budget and Implications for the Global Carbon Cycle. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research (King, A.W., L. Dilling, G.P. Zimmerman, D.M. Fairman, R.A. Houghton, G. Marland, A.Z. Rose, and T.J. Wilbanks, eds.), pp. 139-148. National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville, NC.

Burger, J. 1981. Effect of human activity on birds at a coastal bay. Biological Conservation 21:231-241.

Burger, J. 1986. The effect of human activity on shorebirds in two coastal bays in northeastern United States. Environmental Conservation 13(2):123-130.

Burger, J. and M. Gochfeld. 1998. Effects of ecotourists on bird behaviour at Loxahatchee National Wildlife Refuge, Florida. Environmental Conservation 25(1): 13-21.

California Department of Fish and Game (CDFG). 2009. Cats and wildlife. Accessed August 2012 at: *http://www.dfg.ca.gov/wildlife/nongame/nuis_exo/dom_cat/index.html*.

Christman, S.P. 1984. Breeding bird response to greentree reservoir management. Journal of Wildlife Management 48: 1164-1172.

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teague. 2003. Ecological systems of the United States: a working classification of U.S. terrestrial Systems. NatureServe, Arlington, Virginia.

Council on Environmental Quality (CEQ). 1997. Federal Register, Final DOT 5610.2, Order to Address Environmental Justice in Minority Populations and Low Income Populations, Volume 62, No. 72.15 U.S. Department of Transportation, April 1997.

Crawford, H.S., R.G. Hooper, and R.W. Titterington. 1981. Songbird population response to silvicultural practices in central Appalachian hardwoods. Journal of Wildlife Management 45: 680-692.

Crouch, W.B.I., and P.W. Paton. 2000. Using egg-mass counts to monitor wood frog populations. Wildlife Society Bulletin 28: 895-901.

Curry, D.C. 1978. Archeological Reconnaissance of the Baltimore-Washington Parkway from the Washington, D.C. Line to the Baltimore City Line, Prince George's, Anne Arundel, and Baltimore Counties, Maryland. File Report No. 113, Maryland Geological Survey, Division of Archeology. On file at the Maryland Historical Trust, Crownsville, MD.

DeGraaf, R.M., G.M. Whitman, J.W. Lanier, B.J. Hill, and J.M. Keriston. 1980. Forest habitat for birds of the Northeast. U.S. Department of Agriculture, U.S. Forest Service, Northeast Forest Experiment Station, 598 pp.

DeLuca, T.H., W.A.I Patterson, W.A. Freimund, and D. Cole. 1998. Influence of llamas, horse, and hikers on soil erosion from established recreation trails in Western Montana, USA. Environmental Management 22: 255-262

Derlet, R.W. MD, K. Ali Ger, J.R. Richards MD, and J.R. Carlson PhD. 2008. Risk factors for coliform bacteria in backcountry lakes and streams in the Sierra Nevada mountains: a 5-year study. Wilderness and Environmental Medicine 19: 2, 82-90.

Droege, S. 1996. USGS. Unpublished memo.

Droege, S. 2011. USGS. Personal communication.

Droege, S., C. A. Davis, W.E. Steiner Jr., and J. Mawdsley. 2009. The lost micro-deserts of the Patuxent River: Using landscape history, insect and plant specimens and field work to detect and define a unique community. Proceedings of the Entomoloigcal Society of Washington 111(1): 132-144.

Dulaney, C.A. 1948. The Andersons from the Great Fork of the Patuxent. Self-published, Odenton, MD.

Dyrland, R., B. Knudsen, J. Sauer, and J. Weant. 2009. Environmental assessment for the facilities modernization program at Patuxent Research Refuge and Patuxent Wildlife Research Center. U.S. Department of the Interior, U.S. Fish and Wildlife Service, Laurel, MD.

Ecological Society of America. 2004. Guidelines for describing associations and alliances of the U.S. national vegetation classification. Version 4.

Environmental Protection Agency (EPA). 1998. Fact sheet: the Environmental Protection Agency's (EPA's) interim air quality policy on wildland and prescribed fires. Accessed August 2012 at: *http://www.epa.gov/ttn/oarpg/t1/fact_sheets/firefl.pdf*.

Erwin, R.M. 1980. Breeding habitat use by colonially nesting waterbirds in two Mid-Atlantic U. S. regions under different regimes of human disturbance. Biological Conservation 18: 39-51.

Escobedo, F., R. Northrop, and W. Zipperer. 2007. Developing an urban forest management plan for hurricane-prone communities. University of Florida.

Faanes, C.H. 1983. Breeding birds of wooded draws in western North Dakota. Prairie Nat. 15(4): 173-187.

Ferguson. D. 1994. Species of moths collected on the Patuxent Wildlife Research Center, season 1992. Systematic Entomology Laboratory, ARS, USDA. [Ibid, 1994], [Ibid 1996].

Fischer, S.A., L.W. Hall Jr., and W.D. Killen Jr. 1992. Distribution of the endangered glassy darter in Maryland coastal plain streams. Virginia Journal of Science 43(1A).

Fort George G. Meade. 1997. Coastal Hazardous Waste Site Review. Anne Arundel County, Maryland. CERCLIS #MD9210020567.

Frank, K.D. 1988. Impact of outdoor lighting on moths: an assessment. Journal of the Lepidopterists' Society 42(2): 63-93.

Frank, K.D. 2002. Impact of artificial lighting on moths. In: Abstracts of Ecological Consequences of Artificial Lighting. Los Angeles, CA.

Freeman, M. 1997. Results of a preliminary survey of fishes of the Patuxent River on the Patuxent Wildlife Research Center. Accessed December 2011 at: *http://www.pwrc.usgs.gov/history/fishsurv.htm*.

Frieswyk, T.S. 2001. Forest statistics for Maryland: 1986 and 1999. Resources Bulletin NE-154. U.S. Department of Agriculture, U.S. Forest Service, Northeastern Research Station, Newtown Square, PA.

Frost, C.C. 1998. Pre-settlement fire frequency regimes of the United States: a first approximation. In: Fire in Ecosystem Management: Shifting the Paradigm from Suppression to Prescription (Teresa, L.P. and L.A. Brennen, eds.), pp.70-81. Tall Timbers Fire Ecology Conference Proceedings, No. 20. Tall Timbers Research Station, Tallahassee, FL.

George, S. and K. Crooks. 2006. The effects of recreation on large mammals in an urban nature reserve. Biological Conservation.

Gibbs, J.P. and S.M. Melvin. 1992. American bittern, *Botaurus lentiginosus*. In: Migratory nongame birds of management concern in the Northeast (K.J. Schneider and D.M. Pence, eds), pp.51-69. U.S. Department of the Interior, U.S. Fish and Wildlife Service, Newton Corner, MA.

Graber, R.R., J.W. Graber, and E.L. Kirk. 1970. Illinois birds: *Mimidae*. Illinois Natural History Survey. Biological Notes 68: 24-35.

Grant, E.H.C., R.E. Jung, J.D. Nichols, and J.E. Hines. 2005. Double-observer approach to estimating egg mass abundance of pool-breeding amphibians. Wetlands Ecology and Management 13: 305-320.

Grant, E. 2011. USGS. Personal communication.

Greenberg, R. 1987. Seasonal foraging specialization in the worm-eating warbler. Condor 89: 158-168. Accessed August 2012 at: *http://elibrary.unm.edu/sora/Condor/files/issues/v089n01/p0158-p0168.pdf*.

Guth, R.W. 1978. Forest and campground bird communities of Peninsula State Park, Wisconsin. Passenger Pigeon 40: 489-493.

Haglen, B. 2010. Habitat management plan. U.S. Department of the Interior, U.S. Fish and Wildlife Service.

Hall, G.A. 1983. West Virginia birds: distribution and ecology. Carnegie Museum of Natural History Special Publication No. 7.

Hamel, P.B.1992. Land manager's guide to the birds of the south. The Nature Conservancy, Southeastern Region, Chapel Hill, NC.

Hammit, W.E. and D.N. Cole. 1998. Management alternatives. In: Wildland Recreation: Ecology and Management, Second Edition, pp. 205-347. John Wiley and Sons, Inc.

Havera, S. P., L.R. Boens, M.M. Georgi, and R.T. Shealy. 1992. Human disturbance of waterfowl on Keokuk Pool, Mississippi River. Wildlife Society Bulletin 20: 290-298.

Heath, L.S. and J.E. Smith. 2004. Criterion 5, indicator 27: contribution of forest ecosystems to the total global carbon budget, including absorption and release of carbon (standing biomass, coarse woody debris, peat and soil carbon). In: A supplement to the national report on sustainable forests 2003 (Darr, D.R., ed.), pp.1-7. FS-766A. U.S. Department of Agriculture, Washington, DC. Accessed August 2012 at: *http://www.fs.fed.us/ne/durham/4104/papers/Heath_Smith_Indicator27_2004.pdf*.

Hileman, C. 1988. Census of cemetaries located on Fort George G. Meade Military Reservation July 1, 1988. On file at the Fort Meade Historical Museum.

Hotchkiss, N. and R.E. Stewart . 1979. Vegetation and vertebrates of the Patuxent Wildlife Research Center: outline of ecology and annotated lists (reprint with new supplements of vegetation of the Patuxent Research Refuge, Maryland). U.S. Department of the Interior, U.S. Fish and Wildlife Service, Laurel, MD.

Howard County. 2002. Little Patuxent River watershed restoration action strategy. Prepared for the Maryland Department of Natural Resources, Watershed Restoration Division. Howard County Department of Public Works, Stormwater Management Division, Columbia, MD.

Huston, M. and S. Krest. 2004. Ecological Risk Assessment for Range 17 (Trap and Skeet Range), Patuxent Research Refuge, Laurel, MD. U.S. Fish and Wildlife Service and U.S. Environmental Protection Agency. Accessed August 2012 online at: *http://www.fws.gov/chesapeakebay/pdf/CBFO-C0405.pdf.*

Inkley, D.B., M.G. Anderson, A.R. Blaustein, V.R. Burkett, B. Felzer, B. Griffith, J. Price, and T.L. Root. 2004. Global climate change and wildlife in North America. Wildlife Society Technical Review 04-2. The Wildlife Society, Bethesda, MD. 26 pp.

James, F.C. 1971. Ordination of habitat relationships among breeding birds. Wilson Bulletin 83(3): 215-236.

Jones, C., J. McCann, and S. McConville. 2000. A guide to conservation of forest interior dwelling birds in the Chesapeake Bay critical area. Critical Area Commission for the Chesapeake and Atlantic Coastal Bays.

Joseph, J.W., M.B. Reed, and L.E. Abbott. 1991 Cultural resources overview of Fort George G. Meade, Arundel County, Maryland. Dated April 1991. On file at the Maryland Historical Trust, Crownsville, MD.

Kahl, R. 1991. Boating disturbance of canvasbacks during migration at Lake Poygan, Wisconsin. Wildlife Society Bulletin 19: 242-248.

Kaiser, M.S. and E.K. Fritzell. 1984. Effects of river recreationists on green-backed heron behavior. Journal of Wildlife Management 48(2): 561–567.

Klein, M.L. 1993. Waterbird behavioral responses to turbances. Wildlife Society Bulletin 21: 31-39.

Klein, M. L., S. R. Humphrey, and H. F. Percival. 1995. Effects of ecotourism on distribution of waterbirds in a wildlife refuge. Conservation Biology 9: 1454-1465.

Knight, R. L., and D. N. Cole. 1991. Effects of recreational activity on wildlife in wildlands. Transactions of the 56th North American Wildlife and Natural Resources Conference, pp. 238-247.

Komarek, E. V. 1968. Lightning and lightning fires as ecological forces. In: Proceedings of the Tall Timbers Fire Ecology Conference, no. 8, pp. 169-197. Tall Timbers Research Station, Tallahassee, FL.

Korschen, C.E., L.S. George, and W.L. Green. 1985. Disturbance of diving ducks by boaters on a migrational staging area. Wildlife Society Bulletin 13: 290-296.

Kuss. F. 1986. A review of major factors influencing plant responses to recreation impacts. Environmental Management 10: 638-65.

Ladd, D. 1997. Statement of Doug Ladd, Director of Science and Stewardship, Missouri Chapter of The Nature Conservancy, before the House Committee on Agriculture, July 15, 1997.

Latham, R.E., J.E. Thompson, S.A. Riley, and A.W. Wibiralske. 1996. The Pocono till barrens: shrub savanna persisting on soils favoring forest. Bulletin of the Torrey Botannical Club 123(4): 330-349.

Lee, D.S., R.E. Jenkins, and C.R. Gilbert. 1980. *Etheostoma citreum* (Cope), glassy darter. In: Atlas of North American Fereshwater Fishes (Lee, D.S.., Gilbert, C.H. Hocutte, R.E. Jenkins, D.E. McAllister and J.R. Stauffer, Jr., eds), pp. 708. North Carolina State Museum of Natural History, Raleigh, NC.

Liddle, M. 1997. Recreation ecology: the ecological impact of outdoor recreation and ecotourism. Chapman and Hall, London, United Kingdom. pp. 639.

LimnoTech. 2008. Upper Patuxent River watershed overall summary recommendation report. Prepared for Anne Arundel County Department of Public Works, Annapolis, MD.

Lynch, J.M. 1981. Status of the cerulean warbler in the Roanoke River Basin of North Carolina. Chat 45: 29-35.

Lyon, L.J., M.H. Huff, R.G. Hooper, E.S. Telfer, D.S. Schreiner, and J.K. Smith. 2000. Wildland fire in ecosystems. U.S. Department of Agriculture, U.S. Forest Service Gen. Tech. Rep. RMRS-GTR-42. 83 pp.

Martin, W. 1996 and 2001. Checklist of butterflies at Patuxent Wildlife Research Center 2001. Accessed December 2011 at: *http://www.pwrc.usgs.gov/history/nathist/butterflies/butterfly_wmartin.PDF*.

Mattsson, B. J., T.L. Master, R.S. Mulvihill and W.D. Robinson. 2009. Louisiana waterthrush (*Parkesia motacilla*). In: The Birds of North America Online (A. Poole, ed.). Cornell Lab of Ornithology, Ithaca, NY. Accessed August 2012 at: *http://bna.birds.cornell.edu/bna/species/151*.

Maryland Department of the Environment (MDE). 2006. Summer 2006 air quality summary. Maryland Department of the Environment, Baltimore, MD.

Maryland Department of the Environment (MDE). 2007. Water quality analysis of eutrophication for the Patuxent River Upper Watershed, Anne Arundel, Prince George's, and Howard Counties, Maryland. Maryland Department of the Environment, Baltimore, MD.

Maryland Department of Environment (MDE). 2009. Water quality analysis of eutrophication for the Little Patuxent River basin in Anne Arundel and Howard Counties, Maryland. Maryland Department of the Environment, Baltimore, MD.

Maryland Department of the Environment (MDE). 2010.

Maryland Department of Natural Heritage. 2010. Current and historical rare, threatened, and endangered species of Prince Georges County, Maryland. Accessed August 2012 at: *http://www.dnr.state.md.us/wildlife/Plants_Wildlife/rte/pdfs/rteprin.pdf*.

Maryland Department of Natural Resources (MD DNR). 1995. Changes in the fish population of Cash Lake during the five years after opening to public fishing.

Maryland Department of Natural Resources (MD DNR). 2001. Little Patuxent River watershed characterization. Chesapeake and Coastal Watershed Service, Watershed Management and Analysis Division.

Maryland Department of Natural Resources (MD DNR). 2005a. Maryland wildlife diversity conservation plan. Maryland Department of Natural Resources, Annapolis, MD.

Maryland Department of Natural Resources (MD DNR). 2005b. Maryland biological stream survey 2000-2004 Volumes 4, 7-12, and 14. Maryland Department of Natural Resources, Monitoring and Non-Tidal Assessment Division, Annapolis, MD.

Maryland Department of Natural Resources (MD DNR). 2005c. New biological indicators to better assess the condition off Maryland streams. Monitoring and Non-Tidal Assessment Division, Annapolis, MD.

Maryland Department of Natural Resources (MD DNR). 2007. Restoration of American Shad in Maryland's Chesapeake Bay, 2007 final progress report. Fisheries Service, Annapolis, MD.

Maryland Department of Natural Resources (MD DNR). 2010. Current and Historical Rare, Threatened and Endangered Species of Prince George's County, Maryland. Maryland Department of Natural Resources, Wildlife and Heritage Divsion.

Maryland Geological Survey (MGS). 2007. Physiographic provinces of Maryland. Department of Natural Resources, Resource Assessment Service, Annapolis, MD.

Mayre, W.B. 1920. The old Indian road. Maryland Historical Magazine 15: 107-395.

Mayre, W.B. 1955. The great Maryland barrens (Parts I, II, and III). Maryland Historical Magazine 50: 11-23, 120-142, 234-252.

McGilvery, F. 1997. Characterization of wetland areas included in census.

Millar, C.I., N.L. Stephenson, and S.L. Stephens. 2007. Climate change and forests of the future: managing in the face of uncertainty. Ecological Applications 17(8): 2145-2151.

Miller, S.G., Knight R.L., and Miller C.K. 1998. Influence of recreational trails on breeding bird communities. Ecological Applications 8(1): 162-169.

Miller, S.G., Knight R.L., and Miller C.K. 2001. Wildlife responses to pedestrians and dogs. Wildlife Society Bulletin 29(1): 124-132.

Mitch, W.J. and J.G. Gosselink. 1993. Wetlands 2nd edition. Van Nostrand Reinhold, New York, NY.

Monarch Larvae Monitoring Project (MLMP). 2012. Accessed August 2012 at: *http://www.mlmp.org/*.

Morley, L.B. 1948. Early history of Patuxent Wildlife Research Center: a report on the history and development of the Patuxent Research Refuge. Laurel, MD.

Morton, J.M., A.C. Fowler, and R.L. Kirkpatrick. 1989. Time and energy budgets of American black ducks in winter. Journal of Wildlife Management 53(2): 401–410.

Murray, N. and D. Stauffer. 1995. Nongame bird use of habitat in central Appalachian riparian forests. Journal of Wildlife Management 59: 78-88.

National Oceanic and Atmospheric Adminstration (NOAA). 2004. Climatology of the United States No. 20 1971-2000, Station: Baltimore – Washington AP, MD. Accessed August 2012 at: *http://cdo.ncdc.noaa.gov/climatenormals/clim20//md/180465.pdf*.

Natural Resources Conservation Service (NRCS). 2010. Climate reports (narratives and tables) for soil survey regions of the U.S. (for Prince George's and Anne Arundel Counties). Accessed August 2012 at: *http://www.wcc.nrcs.usda.gov/cgibin/soil-nar-state.pl?state=md*.

Nature Conservancy. 2002. Chesapeake Bay Lowland ecoregional plan (draft). Nature Conservancy, Arlington, VA.

Nedeau, E. 2007. Triangle floater fact sheet. Massachussetts Division of Fisheries and Wildlife, Natural Heritage and Endangered Species Program.

Newsome, D., S.A. Moore, and R.K. Dowling. 2002. Environmental impacts. In: Natural Area Tourism: Ecology, Impacts and Management (Newsome, D., S.A. Moore, R.K. Dowling, eds.), pp.79-145. Channel View Publications, Clevedon, United Kingdom.

Niven, D.K., G.S. Butcher, and G.T. Bancroft. 2009. Christmas bird counts and climate change: northward shifts in early winter abundance. American Birds: 10-15. *http://web4.audubon.org/bird/cbc/pdf/AB_109_CBC_and_Climate_Change.pdf.*

Obrecht, H. 2005 USFWS. Unpublished memo.

Orr, R. 1996. The dragonflies and damselflies of Patuxent Wildlife Research Center and vicinity. U.S. Department of Agriculture, Animal Plant Health Inspection Service.

Owen, M. 1973. The management of grassland areas for wintering geese. Wildfowl 24: 123-130.

Perry, M.C. 2004. The evolution of Patuxent. Friends of Patuxent, Laurel, MD.

Perry, M.C. and C.S. Bond 2011. Herbaceous and woody plants of Patuxent Research Refuge. Laurel, MD. 47 pp.

Patterson, W.A. III and K.E. Sassman. 1988. Indian fires in the prehistory of New England. In: Holocene human ecology in northeastern North America (G.P. Nichols, ed.), pp.107-135. Plenum, NY.

Pennsylvania Natural Heritage Program (PNHP). 2008.

Pousson, J.F. 1987. Archaeological overview and assessment Patuxent Wildlife Research Center, Laurel, Maryland. U.S. Department of Interior, National Park Service, Denver Service Center, Applied Archaeology Center.

Purdy, K.G., G.R. Goff, D.J. Decker, G.A. Pomerantz, N.A. Connelly. 1987. A guide to managing human activity on national wildlife refuges. U.S. Department of the Interior, U.S. Fish and Wildlife Service, Office of Information Transfer, Fort Collins, CO. 57 pp.

Rawinsky, T.J. 2008. Impacts of white-tailed deer overabundance in forest ecosystems: an overview. U.S. Department of Agriculture, U.S. Forest Service, Northeastern Area State and Private Forestry. Newton Square, PA. 8 pp.

Rayburn, E. 2001. Personal communication with Ed Rayburn, West Virginia University, Agricultural Extension Office. December 10, 2001.

Rayburn, E. 2009. Personal communication with Ed Rayburn, West Virginia University, Agricultural Extension Office. December 7, 2009.

Reed, P. 2002. Historic architectural identification and evaluation, Patuxent Wildlife Research Refuge, Laurel, MD. On file at the U.S. Fish and Wildlife Service Region 5 Office, Hadley, MA.

Rich, C. and T. Longcore (editors). 2006. Ecological consequences of artificial night lighting. Island Press, Washington, DC. 458 pp.

Richard Grubb and Associates, Inc. 2011. Archeological overview and assessment of the Patuxent Research Refuge Prince George's and Anne Arundel Counties, Maryland. Cultural Resources Review.

Richards, K. May 10, 1994. Blueback herring return. Baltimore Sun, Baltimore, MD. Accessed August 2012 at: *http://articles.baltimoresun.com/1994-05-10/news/1994130039_1_blueback-herring-herring-runs-patuxent-river*.

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

Robbins, C.S. and E. Blom. 1996. Atlas of the breeding birds of Maryland and the District of Columbia. University of Pittsburgh Press, Pittsburgh, PA.

Robbins, C.S., J. Fitzpatrick, and P.B. Hamel. 1992. A warbler in trouble: Dendroica cerulea. In: Ecology and Conservation of Neotropical Migrant Landbirds (Hagan, J.M., III and D.W. Johnston, eds.), pp.549-562. Smithsonian Institution Press, Washington, DC.

Rodgers, J.A., Jr. and H.T. Smith. 1995. Set-back distances to protect nesting bird colonies from human disturbance in Florida. Conservation Biology 9(1): 89–99.

Rodgers, J.A., Jr. and H.T. Smith. 1997. Buffer zone distances to protect foraging and loafing waterbirds from human disturbance in Florida. Wildlife Society Bulletin 25(1): 139–145.

Rogers, C.E. and J.P. McCarty. No date. Climate change and ecosystems of the Mid-Atlantic region. National Center for Environmental Assessment, US Environmental Protection Agency, Washington, DC, and University of Maryland, College Park, MD.

Rosenberg, K.V., R.W. Rohrbaugh, Jr., S.E. Barker, J.D. Lowe, R.S. Hames, and A.A. Dhondt. 1999. A land managers guide to Improving habitat for scarlet tanagers and other forest interior birds. The Cornell Lab of Ornithology, Ithaca, NY.

Russo, J., T. Bonetti, S. Perchetti, and A. VanBeuchisem. January 2009. Patuxent Research Refuge visitor services review. U.S. Department of the Interior, U.S. Fish and Wildlife Service, Laurel, MD.

Scherer, G. 2001. Backcountry visitor impacts: we have met the enemy, and he is us. American Hiker.

Shugart, H.H., Jr. and D. James. 1973. Ecological succession of breeding bird populations in northwestern Arkansas. Auk 90: 62-77.

Simmons, R. and M. Strong. 2001. Araby bog flora surveys. Maryland Native Plant Society, SAMMS.

Solensky, M.J. 2004. The effect of behavior and ecology on male mating success in overwintering monarch butterflies (*Danaus plexippus*). Journal of Insect Behavior 17: 723–743.

Stauffer, D.F. and L.B. Best. 1980. Habitat selection by birds of riparian communities: evaluating effects of habitat alterations. Journal of Wildlife Management 44(1): 1-15.

Steponaitis, L.C. 1980. A survey of artifact collections from the Patuxent River drainage. Maryland Historical Trust Monograph Series No. 1, Annapolis. Maryland Historical Trust, Crownsville, MD.

Swanston, C. 2010. Interactions between forests, carbon, and climate change. Presentation at "Adapting to Climate Change in the Mid-Atlantic" conference, March 23-25, 2010, Cambridge, MD. USDA Forest Service Northern Research Station.

Sweka, J. and J. Mohler. 2010. Fish species richness on the John Heinz National Wildlife Refuge at Tinicum. U.S. Department of the Interior, U.S. Fish and Wildlife Service, Northeast Fishery Center.

Temple, S.A., M.J. Mossman, and B. Ambuel. 1979. The ecology and management of avian communities in mixed hardwood-coniferous forests. Pages 132-153 In: Management of North Central and Northeastern Forests for Nongame Birds (DeGraaf, R.M. and K. E. Evans, compilers). U.S. Department of Agriculture, For. Servo Gen. Tech. Rep. NC-51.

Trails and Wildlife Task Force, Colorado State Parks, and Hellmund Associates. 1998. Planning trails with wildlife in mind: a handbook for trail planners. Colorado State Parks, Denver, CO. 51 pp.

Trapp, H. and M.A. Horn. 1997. Groundwater atlas of the United States: Delaware, Maryland, New Jersey, North Carolina, Pennsylvania, Virginia, West Virginia. HA 730-L. U.S. Geological Survey. Accessed August 2012 at: *http://pubs.usgs.gov/ha/ha730/ch_l/index.html*.

Tyndall, R.W. 1992. Historical considerations of conifer expansion in Maryland serpentine barrens. Castanea 57(2): 123-131.

University of Maryland, Baltimore County (UMBC). 2003. Maryland growing season. Accessed August 2012 at: *http://www.umbc.edu/ges/student_projects/Ag_Atlas/pages/09.htm*.

URS Group, Inc. 2010. Amended site management plan, Fort George G. Meade, MD. Project no. 15301086. Contract Number W912DR-09-D-0017. (Fort George G. Meade Site Mgmt Plan 2010, 1-3).

United States Census Bureau (USCB). 2000. 2000 United States Census data.

United States Census Bureau (USCB). 2010. 2010 United States Census data.

United States Department of Agriculture (USDA) Forest Service. 1989. A guide for prescribed fire in southern forests. Technical publication R8-TP11. U.S. Department of Agriculture, U.S. Forest Service.

United States Department of Agriculture (USDA) Forest Service. 2009. Gypcheck – bioinsecticide for the gypsy moth. U.S. Department of Agriculture, U.S. Forest Service, Forest Health Technology Enterprise Team. Accessed August 2012 at: *http://www.fs.fed.us/foresthealth/technology/pdfs/gypchek.pdf*.

United States Fish and Wildlife Service (USFWS). 1989. Fishery survey report Patuxent Wildlife Research Center Laurel, Maryland. U.S. Department of the Interior, U.S. Fish and Wildlife Service, Office of Fishery Assistance.

United States Fish and Wildlife Service (USFWS). 2003. National strategy for invasive species management. U.S. Department of the Interior, U.S. Fish and Wildlife Service, National Wildlife Refuge System. Accessed August 2012 at: *http://www.fws.gov/invasives/pdfs/NationalStrategyFinalRevised05-04.pdf.*

United States Fish and Wildlife Service (USFWS). 2004. Writing refuge management goals and objectives: a handbook. U.S. Department of the Interior, U.S. Fish and Wildlife Service, National Wildlife Refuge System. Accessed August 2012 at: *http://library.fws.gov/Refuges/WritingRefugeGoals_022504.pdf*.

United States Fish and Wildlife Service (USFWS). 2007. Banking on nature 2006: the economic benefit to local communities of National Wildlife Refuge visitation. U.S. Department of the Interior, U.S. Fish and Wildlife, Division of Economics, Washington, DC.

United States Fish and Wildlife Service (USFWS). 2008. Birds of conservation concern. U.S. Department of the Interior, U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, VA.

United States Fish and Wildlife Service (USFWS). 2009. Rising to the urgent challenge: strategic plan for responding to accelerating climate change. U.S. Department of the Interior, U.S. Fish and Wildlife Service.

United States Fish and Wildlife Service (USFWS). 2010. Service manual. U.S. Department of the Interior, U.S. Fish and Wildlife Service. Accessed August 2012 at: *http://www.fws.gov/policy/direct.html.*

United States Fish and Wildlife Service (USFWS). 2011. Strategic Decision Making Plan (draft). U.S. Department of the Interior, U.S. Fish and Wildlife Service.

Vanasse Hangen Brustlin, Inc., March 2010. Patuxent Research Refuge transportation plan. Laurel, MD.

Victoria, C.J. 2009. Assessment of the biological health of streams on the Patuxent Research Refuge within Anne Arundel County, Maryland. Department of Public Works, Bureau of Engineering, Watershed, Ecosystem, and Restoration Services, Anne Arundel County, MD.

Victoria, C. and J. Markusic. 2009. Assessment of the biological health of streams on the Patuxent Research Refuge within Anne Arundel County, Maryland. Anne Arundel County Department of Public Works, Bureau of Engineering, Watershed, Ecosystem and Restoration Services, Annapolis, MD. 31 pp. Accessed August 2012 at: *http://www.aacounty.org/DPW/Watershed/PRR%20Biological%20Condtions%20Summary_final.pdf*.

Vilchek, L. 2011, 2012. USFWS. Personal communication.

Vogl, R.J. 1974. Effects of fire on grasslands. In: Fire and Ecosystems (T. T. Kozlowski and C. E. Ahlgren, eds.), pp. 139-193. Academic Press, New York, NY.

Ward, D. H., and R. A. Stehn. 1989. Response of brant and other geese to aircraft disturbance at Izembek Lagoon, Alaska. Final report to the Minerals Management Service. U.S. Department of the Interior, U.S. Fish and Wildlife Service, Alaska Fish and Wildlife Research Center, Anchorage, Alaska. 193 pp.

Watts. 1999. Partners in Flight (PIF). Bird conservation plan for the Mid-Atlantic Coastal Plain (Physiographic Area 44), Version 1.0. American Bird Conservancy, Williamsburg, VA.

Weaver, T. and D. Dale. 1978. Trampling effects of hikers, motorcycles and horses in meadows and forests. Journal of Applied Ecology 15: 451-457.

Whittaker, D. and Knight, R. L. 1998. Understanding wildlife responses to humans. Wildlife Society Bulletin 26(2): 312–317.

Wildland Fire Associates LLC. 2008. Patuxent Research Refuge fire management plan.

Williams, G.J. and E. Forbes. 1980. The habitat and dietary preferences of dark-bellied brant geese and widgeon in relation to agricultural management. Wildfowl 31:151-157.

Williams, B.K., R.C. Szaro, and C.D. Shapiro. 2007. Adaptive management: the U.S. Department of Interior technical guide. U.S. Department of Interior, Adaptive Management Working Group, Washington, DC.

Wilson, M.D. and B.D. Watts. 2008. Landscape configuration effects on distribution and abundance of whip-poor-wills. The Wilson Journal of Ornithology 120: 778-783.

Wurster, F. November 2010. Patuxent Research Refuge water resources inventory and assessment. Laurel, MD.

Glossary and Acronyms and Abbreviations

USFWS

Bayscape Garden

Glossary

adaptive management	a process in which projects are implemented within a framework of scientifically driven experiments to test predictions and assumptions outlined within the comprehensive conservation plan. The analysis of the outcome of project implementation helps managers determine whether current management should continue as is or whether it should be modified to achieve desired conditions.
abiotic	nonliving; a physical feature of the environment such as climate, temperature, geology, soils.
avullium	an unconsolidated accumulation of stream-deposited sediments, often including sands, silts, clays, or gravels.
alternative	a set of objectives and strategies needed to achieve refuge goals and the desired future condition.
ambient	of the surrounding area or outside environment.
anadromous fish	fish that spend a large portion of their life cycle in the ocean and return to freshwater to breed.
appropriate use	a proposed or existing use on a refuge that meets at least one of the following three conditions: 1. the use is a wildlife-dependent one; 2. the use contributes to fulfilling the refuge purpose(s), the System mission, or goals or objectives described in a refuge management plan approved after October 9, 1997, the date the National Wildlife Refuge System Improvement Act was signed into law; or 3. the use has been determined appropriate as specified in section 1.11 of that act.
approved acquisition boundary	a project boundary that the Director of the U.S. Fish and Wildlife Service approves upon completion of the planning and environmental compliance process. An approved acquisition boundary only designates those lands that the Service has authority to acquire or manage through various agreements. The approval of an acquisition boundary does not grant the Service jurisdiction or control over lands within the boundary, and it does not make lands within the refuge boundary part of the National Wildlife Refuge System. Lands do not become part of the System until the Service buys them or they are placed under an agreement that provides for their management as part of the System.
avian	of or having to do with birds.

basin	the surrounding land that drains into a water body.
best management practice	land management practices that produce desired results (usually describing forestry or agricultural practices effective in reducing non-point source pollution.
biological diversity	the variety of life forms and its processes, including the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur.
biological integrity	biotic composition, structure, and functioning at genetic, organism, and community levels comparable with historic conditions, including natural biological processes that shape genomes, organisms, and communities.
bird conservation region	ecologically distinct regions in North America with similar bird communities, habitats, and resource management issues.
brackish	brackish water is water that is more salty than freshwater, but less salty that seawater. It is generally defined as water with a salinity of 0.5 to 30 dissolved salts parts per thousand.
buffer	lands bordering water bodies that reduce runoff and nonpoint source pollution.
canopy	the layer of foliage formed by the crowns of trees in a stand. For stands with trees of different heights, foresters often distinguish among the upper, middle and lower canopy layers. These represent foliage on tall, medium, and short trees. The uppermost layers are called the overstory.
categorical exclusion	a category of Federal agency actions that do not individually or cumulatively have a significant effect on the human environment.
compatible use	a wildlife-dependent recreational use, or any other use on a refuge that will not materially interfere with or detract from the fulfillment of the mission of the Service or the purposes of the refuge.
compatibility determinations	a required determination for wildlife-dependent recreational uses or any public uses of a refuge.
Comprehensive Conservation Plan	a document that describes the desired future conditions of the refuge, and specifies management direction to achieve refuge goals and the mission of the National Wildlife Refuge System.
community	a distinct assemblage of plants that develops on sites characterized by particular climates and soils, and the species

	and populations of wild animals that depend on the plants for food, cover and/or nesting.
cover type	the current vegetation of an area.
cultural resource	those parts of the physical environment – natural and built – that have cultural values to some sociocultural group or institution. Cultural resources include historic sites, archaeological sites and associated artifacts, sacred sites, buildings, and structures.
diameter at breast height	(dbh) – the diameter of the stem of tree measure at breast height (usually 4.5 feet above the ground). The term is commonly used by foresters to describe tree size.
disturbance	a disruption in the natural plant succession of a community or ecosystem resulting in a new community.
early successional habitat	Succession is the gradual replacement of one plant community by another. In a forested ecosystem, tree cover can be temporarily displaced by natural or human disturbance (e.g., flooding by beaver, or logging). The open environments created by removal of tree cover are referred to as 'early-successional' habitats because as time passes, trees will return. The open conditions occur 'early' in the sequence of plant communities that follow disturbance. We define *early successional forest* in this CCP as: the shrub-sapling stage; 0-20 years old.
ecological integrity	native species populations in their historic variety and numbers naturally interacting in naturally structured biotic communities. For communities, integrity is governed by demographics of component species, intactness of landscape-level ecological processes (e.g., natural fire regime), and intactness of internal community processes (e.g., pollination).
ecological succession	the orderly progression of an area through time in the absence of disturbance from one vegetative community to another.
ecoregion	a territory defined by a combination of biological, social, and geographic criteria, rather than geopolitical considerations; generally, a system of related, interconnected ecosystems.
ecosystem	a dynamic and interrelated complex of plant and animal communities and their associated non-living environment.
emergent marsh	wetlands dominated by erect, rooted, herbaceous plants.
endangered species	any species of plant or animal defined through the Endangered Species Act as being in danger of extinction throughout all or a significant portion of its range, and published in the *Federal Register.*

Environmental Assessment	a systematic analysis to determine if proposed actions would result in a significant effect on the quality of the environment.
environmental health	the composition, structure, and functioning of soil, water, air, and other abiotic features comparable with historic conditions, including the natural abiotic processes that shape the environment.
exotic species	a species that is not native to an area and has been introduced intentionally or unintentionally by humans.
extinction	the termination of existence of a lineage of organisms (e.g., a subspecies or species.
federally listed species	a species listed either as endangered, threatened, or species at risk (formerly a "candidate" species) under the Endangered Species Act of 1973, as amended.
fragmentation	the process of reducing the size and connectivity of habitat patches; the disruption of extensive habitats into isolated and small patches.
geographic information system	a computer system capable of storing and manipulating spatial mapping data; more commonly referred to by the acronym GIS
goals	descriptive statements of desired future conditions.
habitat	the sum of environmental factors – food, water, cover, and space – that each species needs to survive and reproduce in an area.
hectare	equal to 2.47 acres.
historic conditions	the composition, structure, and functioning of ecosystems resulting from natural processes that we believe, based on sound professional judgment, were present prior to substantial human-related changes to the landscape.
impoundment	a body of water, such as a pond, confined by a dam, dike, floodgate, or other barrier, that is used to collect and hold water.
interjurisdictional fish	populations of fish that are managed by two or more State or national or tribal governments because of the scope of their geographic distributions or migrations.
invasive species	a non-native species whose introduction causes or is likely to cause economic or environmental harm or harm to human health.
issue	any unsettled matter that requires a management decision. For example, a resource management problem, concern, a threat to

	natural resources, a conflict in uses, or in the presence of an undesirable resource condition.
marl	An unconsolidated sedimentary rock or soil consisting of clay and lime.
migratory bird	a bird species that migrates between wintering and breeding grounds.
National Wildlife Refuge System	all lands, waters, and interests therein administered by the U.S. Fish and Wildlife Service as wildlife refuges, wildlife ranges, wildlife management areas, waterfowl production areas, and other areas for the protection and conservation of fish, wildlife and plant resources.
nonpoint source pollution	a diffuse form of water quality degradation in which wastes are not released at one specific, identifiable point but from a number of points that are spread out and difficult to identify and control.
objectives	actions to be accomplished to achieve a desired outcome or goal. Objectives are more specific, and generally more measurable, than goals.
physiographic area	a bird conservation planning unit with relatively uniform vegetative communities, bird populations, and species assemblages, as well as land use and conservation issues, developed by Partners in Flight.
point source pollution	a source of pollution that involves discharge of waste from an identifiable point, such as a smokestack or sewage-treatment plant.
preferred alternative	the Service's selected alternative identified in the draft Comprehensive Conservation Plan.
prescribed burning/fire	the application of fire to wildland fuels, either by natural or intentional ignition, to achieve identified land use objectives.
priority public use	a compatible wildlife-dependent recreational use of a refuge involving hunting, fishing, wildlife observation and photography, or environmental education and interpretation.
range	the geographic area within which a particular species is found.
restoration	management of a disturbed or degraded habitat that results in the recovery of its original state (e.g., restoration may involve planting native species, removing invasive shrubs, prescribed burning).
riparian	relating the floodplains, banks, and terraces that line rivers.

riparian area	habitat along the banks of a stream, river, or wetland.
scoping	a process for determining the scope of issues to be addressed by a comprehensive conservation plan and for identifying the significant issues. Involved in the scoping process are federal, state and local agencies; private organizations; and individuals.
shifting mosaic	an interconnected patchwork of distinct vegetation types that may shift across the land surface as a result of dynamic ecosystem processes, such as periodic wildfire or flooding.
spawn	the act of reproduction of fishes--the mixing of the sperm from the male fish and the eggs of a female fish.
special use permit	a permit authorized by the refuge manager for an activity that is not usually available to the general public.
species	a distinctive kind of plant or animal having distinguishable characteristics, and that can interbreed and produce young. In taxonomy, a category of biological classification that refers to one or more populations of similar organisms that can reproduce with each other but is reproductively isolated from – that is, incapable of interbreeding with – all other kinds of organisms.
species richness	a simple measure of species diversity calculated as the total number of species in a habitat or community.
stand	an easily defined area of the forest that is relatively uniform in species composition or age and can be managed as a single unit.
stopover habitat	habitat where birds rest and feed during migration. Also called staging area.
strategies	a general approach or specific actions to achieve objectives.
structure	the horizontal and vertical arrangement of trees and other vegetation having different sizes, resulting in different degrees of canopy layering, tree heights, and diameters within a stand.
succession	the natural, sequential change of species composition of a community in a given area.
terrestrial	living on land.
threatened species	those plant or animal species likely to become endangered species throughout all of or a significant portion of their range within the foreseeable future. A plant or animal identified and defined in accordance with the 1973 Endangered Species Act and published in the *Federal Register*.

torpor	a state of decreased activity in an animal, usually short-term, often characterized by a reduced body temperature and rate of metabolism.
trust resources	national resources entrusted by Congress to the U.S. Fish and Wildlife Service for conservation and protection. These "trust resources" include migratory birds, federal-listed endangered and threatened species, inter-jurisdictional fishes, wetlands, and certain marine mammals.
understory	the lower layer of vegetation in a stand, which may include short trees, shrubs, and herbaceous plants.
vernal pool	depressions holding water for a temporary period in spring and other high water periods, and in which several species of amphibians lay eggs.
water rights	the right of a user to use water from a source such as a river, stream, pond, or groundwater source.
watershed	the geographic area within which water drains into a particular river, stream, or body of water. A watershed includes both the land and the body of water into which the land drains.
Wilderness Area	An area designated by Congress as part of the National Wilderness Preservation System.
wilderness study area	Lands and waters identified by inventory as meeting the definition of wilderness and being evaluated for a recommendation that they be included in the Wilderness System.
wildfire	an unplanned, unwanted wildland fires including unauthorized human-caused fires, escaped wildland fires, escaped prescribed fires, and all other wildland fires where the objective is to put the fire out.
wildland fire	any non-structure fire that occurs in the wildland. Three distinct types of wildlife fire have been defined and include wildfire, wildland fire use, and prescribed fire.
wildlife-dependent recreation	A use of a refuge involving hunting, fishing, wildlife observation, wildlife photography, environmental education, or interpretation. The National Wildlife Refuge System Improvement Act of 1997 specifies that these are the six priority general public uses of the National Wildlife Refuge System.

Acronyms and Abbreviations

ADA	Americans with Disabilities Act
ATV	All Terrain Vehicle
BCR	Bird Conservation Region
BG&E	Baltimore Gas and Electric
CCP	Comprehensive Conservation Plan
CFR	Code of Federal Regulations
DOD	Department of Defense
DOI	Department of the Interior
EA	Environmental Assessment
EIS	Environmental Impact Assessment
EO	Executive Order
EPA	Environmental Protection Agency
FONSI	Finding of No Significant Impact
GIS	Geographic Information System
IBA	Important Bird Area
LCC	Land Conservation Cooperative
MD DNR	Maryland Department of Natural Resources
MDE	Maryland Department of the Environment
MOA	Memorandum of Agreement
MNHA	Meade Natural Heritage Association
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NVCS	National Vegetation Classification Standard
NWVC	National Wildlife Visitor Center
Pepco	Potomac Electric Power Company
PIF	Partners in Flight
Refuge	Patuxent Research Refuge
Refuge System	National Wildlife Refuge System
RONS	Refuge Operations Needs System
SAMMS	Service Asset Maintenance Management System
SDM	Structured Decision-making
Service	United States Fish and Wildlife Service

U.S.	United States
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

Appendix A.

USFWS

Tree Swallow

Suspected or Known Species on Patuxent Research Refuge

Table A-1. Suspected or Known Bird Species on Patuxent Research Refuge

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	Federal T & E Status[3]	State T & E Status[4]	Seasons on Refuge[5]	Breeding on Refuge[6]	BCR 30[7]
WATERBIRDS								
American Bittern	*Botaurus lentiginosus*	G4	S1 S2B S1N		I	Yr		M
Anhinga	*Anhinga anhinga*					Sp		
Belted Kingfisher	*Megaceryle alcyon*					Yr	B	
Black-crowned Night Heron	*Nycticorax nycticorax*	G5	S3B S2N			SpSF		M
Cattle Egret	*Bubulcus ibis*					SpF		
Common Loon	*Gavia immer*	G5	S4N			SpF		
Double-crested Cormorant	*Phalacrocorax auritus*					Yr		
Glossy Ibis	*Plegadis falcinellus*	G5	S4B			SpSF		H
Great Blue Heron	*Ardea herodias*	G5	S4B S3 S4N			Yr	B	
Great Egret	*Ardea alba*	G5	S4B			SpSF		
Green Heron	*Butorides virescens*					Yr	B	
Horned Grebe	*Podiceps auritus*	G5	S4N			SpF		H
Least Bittern	*Ixobrychus exilis*	G5	S2 S3B		I	SpS	B	M
Little Blue Heron	*Egretta caerulea*	G5	S3B			SpSF		M
Pied-billed Grebe	*Podilymbus podiceps*	G5	S2B S3N			Yr	B	
Red-necked Grebe	*Podiceps grisegena*					Sp		
Snowy Egret	*Egretta thula*	G5	S3 S4B			SpSF		M
White Ibis	*Eudocimus albus*					SF		
Yellow-crowned Night Heron	*Nyctanassa violacea*	G5	S2B			SpF		M
WATERFOWL								
American Black Duck	*Anas rubripes*	G5	S4B S5N			Yr	B	HH
American Coot	*Fulica americana*					SpFW		
American Wigeon	*Anas americana*					SpFW		M
Blue-winged Teal	*Anas discors*					SpSF		
Bufflehead	*Bucephala albeola*					SpFW		H
Canada Goose	*Branta canadensis*					Yr		?
Canvasback	*Aythya valisineria*	G5	S3 S4N			SpF		H
Common Gallinule	*Gallinula galeata*					SpF		

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	Federal T & E Status[3]	State T & E Status[4]	Seasons on Refuge[5]	Breeding on Refuge[6]	BCR 30[7]
Common Goldeneye	*Bucephala clangula*					SpFW		M
Common Merganser	*Mergus merganser*					SpFW		
Gadwall	*Anas strepera*					SpFW		M
Green-winged Teal	*Anas crecca*					SpFW		M
Hooded Merganser	*Lophodytes cucullatus*					SpSFW	B	M
King Rail	*Rallus elegans*							
Lesser Scaup	*Aythya affinis*					SpFW		H
Long-tailed Duck	*Clangula hyemalis*					Sp		H
Mallard	*Anas platyrhynchos*					SpSFW	B	H
Mute Swan	*Cygnus olor*					SpFW		
Northern Pintail	*Anas acuta*					SpFW		M
Northern Shoveler	*Anas clypeata*					SpFW		
Red-breasted Merganser	*Mergus serrator*					SpFW		M
Redhead	*Aythya americana*					SpFW		
Ring-necked Duck	*Aythya collaris*					Yr	B	
Ruddy Duck	*Oxyura jamaicensis*	G5	S3N			SpFW		M
Sandhill Crane	*Grus canadensis*					FW		
Snow Goose	*Chen caerulescens*					SpFW		
Sora	*Porzana carolina*					SpF		M
Tundra Swan	*Cygnus columbianus*					SpFW		H
Virginia Rail	*Rallus limicola*					Sp F		
Wood Duck	*Aix sponsa*					Yr	B	M
SHOREBIRDS								
American Woodcock	*Scolopax minor*	G5	S4B S4N			Yr	B	HH
Black Tern	*Chlidonias niger*					S		
Bonaparte's Gull	*Chroicocephalus philadelphia*					Yr		
California Gull	*Larus californicus*					W		
Caspian Tern	*Hydroprogne caspia*					SpSF		
Common Snipe	*Gallinago gallinago*					SpFW		M
Common Tern	*Sterna hirundo*	G5	S4B			SpF		M
Forster's Tern	*Sterna forsteri*	G5	S5			SpF		H
Glaucous Gull	*Larus hyperboreus*					W		

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	Federal T & E Status[3]	State T & E Status[4]	Seasons on Refuge[5]	Breeding on Refuge[6]	BCR 30[7]
Great Black-backed Gull	*Larus marinus*					SpFW		
Greater Yellowlegs	*Tringa melanoleuca*	G5	S1N			Yr		M
Herring Gull	*Larus argentatus*					Yr		
Iceland Gull	*Larus glaucoides*					W		
Killdeer	*Charadrius vociferus*					Yr	B	M
Laughing Gull	*Leucophaeus atricilla*	G5	S1B S4N			Yr		
Least Sandpiper	*Calidris minutilla*					SpSF		M
Least Tern	*Sternula antillarum*	G4	S2B		T	SpSF		H
Lesser Black-backed Gull	*Larus fuscus*					W		
Lesser Yellowlegs	*Tringa flavipes*					Yr		M
Pectoral Sandpiper	*Calidris melanotos*					SpSF		
Ring-billed Gull	*Larus delawarensis*					Yr		
Semipalmated Plover	*Charadrius semipalmatus*					SpSF		M
Semipalmated Sandpiper	*Calidris pusilla*	G5	SZN			SF		H
Solitary Sandpiper	*Tringa solitaria*	G5	SZN			SpSF		H
Spotted Sandpiper	*Actitis macularius*					SpSF		M
Thayer's Gull	*Larus thayeri*					W		
Upland Sandpiper	*Bartramia longicauda*	G5	S1B		E	SpSF		M
Western Sandpiper	*Calidris mauri*					F		M
Wilson's Snipe	*Gallinago delicata*							
LANDBIRDS								
Acadian Flycatcher	*Empidonax virescens*	G5	S5B			SpSF	B	
Alder Flycatcher	*Empidonax alnorum*	G5	S2B		I	SpSF		
American Crow	*Corvus brachyrhynchos*					Yr	B	
American Goldfinch	*Carduelis tristis*					Yr	B	
American Kestrel	*Falco sparverius*					Yr	B	
American Pipit	*Anthus rubescens*					SpFW		
American Redstart	*Setophaga ruticilla*	G5	S4B			SpSF	B	
American Robin	*Turdus migratorius*					Yr	B	
American Tree Sparrow	*Spizella arborea*					SpFW		
Bald Eagle	*Haliaeetus leucocephalus*	G4	S2 S3B S3N		T	Yr	B	M

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	Federal T & E Status[3]	State T & E Status[4]	Seasons on Refuge[5]	Breeding on Refuge[6]	BCR 30[7]
Baltimore Oriole	*Icterus galbula*					SpSF	B	H
Bank Swallow	*Riparia riparia*	G5	S3 S4B			SpSF	B	
Barn Owl	*Tyto alba*	G5	S3			SpS		
Barn Swallow	*Hirundo rustica*					SpSF	B	
Barred Owl	*Strix varia*	G5	S5			Yr	B	
Bay-breasted Warbler	*Setophaga castanea*					SpSF		H
Bicknell's Thrush	*Catharus bicknelli*	G4	SZN			SpF		H
Black Vulture	*Coragyps atratus*					Yr	B	
Black-and-white Warbler	*Mniotilta varia*	G5	S4B			SpSF	B	H
Black-billed Cuckoo	*Coccyzus erythropthalmus*	G5	S4B			SpSF		
Blackburnian Warbler	*Setophaga fusca*	G5	S1 S2B		T	SpSF		M
Black-capped Chickadee	*Poecile atricapillus*					SpFW		
Blackpoll Warbler	*Setophaga striata*					SpSF		
Black-throated Blue Warbler	*Setophaga caerulescens*	G5	S3 S4B			SpSF		
Black-throated Green Warbler	*Setophaga virens*	G5	S4B			SpSF		
Blue Grosbeak	*Passerina caerulea*							
Blue Jay	*Cyanocitta cristata*					Yr	B	
Blue-gray Gnatcatcher	*Polioptila caerulea*					SpSF	B	
Blue-headed Vireo	*Vireo solitarius*	G5	S3 S4B			SpSF		
Blue-winged Warbler	*Vermivora cyanoptera*	G5	S4B			SpSF		HH
Bobolink	*Dolichonyx oryzivorus*	G5	S3 S4			SpSF		
Broad-winged hawk	*Buteo platypterus*	G5	S4B			SpSF	B	H
Brown Creeper	*Certhia americana*	G5	S4			Yr	B	
Brown Thrasher	*Toxostoma rufum*	G5	S5B S2N			SpSF	B	H
Brown-headed Cowbird	*Molothrus ater*					Yr	B	
Canada Warbler	*Cardellina canadensis*	G5	S3B			SpSF		M
Cape May Warbler	*Setophaga tigrina*					SpSF		
Carolina Chickadee	*Poecile carolinensis*					Yr	B	
Carolina Wren	*Thryothorus ludovicianus*					Yr	B	
Cedar Waxwing	*Bombycilla cedrorum*					Yr	B	
Cerulean Warbler	*Setophaga cerulea*	G4	S3 S4B			SpSF	B	M

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	Federal T & E Status[3]	State T & E Status[4]	Seasons on Refuge[5]	Breeding on Refuge[6]	BCR 30[7]
Chestnut-sided Warbler	*Setophaga pensylvanica*	G5	S4B			SpSF		
Chimney Swift	*Chaetura pelagica*					SpSF	B	H
Chipping Sparrow	*Spizella passerina*					Yr	B	
Chuck-will's-widow	*Caprimulgus carolinensis*	G5	S4B			SpS	B	
Cliff Swallow	*Petrochelidon pyrrhonota*					SpS		
Common Grackle	*Quiscalus quiscula*					Yr	B	
Common Nighthawk	*Chordeiles minor*	G5	S3 S4B			SpFS		
Common Raven	*Corvus corax*							
Common Redpoll	*Carduelis flammea*					W		
Common Yellowthroat	*Geothlypis trichas*					Yr	B	
Connecticut Warbler	*Oporornis agilis*					F		
Cooper's Hawk	*Accipiter cooperii*					Yr	B	
Dark-eyed Junco	*Junco hyemalis*	G5	S2B S5N			SpFW		
Dickcissel	*Spiza americana*	G5	S2B			SpFW		
Downy Woodpecker	*Picoides pubescens*					Yr	B	
Eastern Bluebird	*Sialia sialis*					Yr	B	
Eastern Kingbird	*Tyrannus tyrannus*					SpSF		H
Eastern Meadowlark	*Sturnella magna*	G5	S5B S3N			Yr	B	
Eastern Phoebe	*Sayornis phoebe*					Yr	B	
Eastern Screech Owl	*Megascops asio*					Yr	B	
Eastern Towhee	*Pipilo erythrophthalmus*	G5	S5B S4N			Yr	B	H
Eastern Wood-Pewee	*Contopus virens*					SpSF	B	
European Starling	*Sturnus vulgaris*							
Evening Grosbeak	*Coccothraustes vespertinus*					SpFW		
Field Sparrow	*Spizella pusilla*	G5	S5			Yr	B	H
Fish Crow	*Corvus ossifragus*					Yr	B	
Fox Sparrow	*Passerella iliaca*					SpFW		
Golden Eagle	*Aquila chrysaetos*	G5	S1N			SpFW		
Golden-crowned Kinglet	*Regulus satrapa*	G5	S2B S4N			SpFW		
Golden-winged Warbler	*Vermivora chrysoptera*	G4	S2B			SpSF		M
Grasshopper Sparrow	*Ammodramus savannarum*	G5	S4B			SpSF	B	M

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	Federal T & E Status[3]	State T & E Status[4]	Seasons on Refuge[5]	Breeding on Refuge[6]	BCR 30[7]
Gray Catbird	*Dumetella carolinensis*					Yr	B	M
Gray-cheeked Thrush	*Catharus minimus*					SpF		
Great Crested Flycatcher	*Myiarchus crinitus*					SpFS	B	H
Great Horned Owl	*Bubo virginianus*					Yr	B	
Hairy Woodpecker	*Picoides villosus*	G5	S5			Yr	B	
Henslow's Sparrow	*Ammodramus henslowii*	G4	S1 S2B		T	SP		H
Hermit Thrush	*Catharus guttatus*	G5	S3 S4B S4N			SpF		
Hooded Warbler	*Setophaga citrina*	G5	S4 S5B			SpSF	B	
Horned Lark	*Eremophila alpestris*					SpSF	B	
House Finch	*Carpodacus mexicanus*					Yr	B	
House Sparrow	*Passer domesticus*					Yr	B	
House Wren	*Troglodytes aedon*					Yr	B	
Indigo Bunting	*Passerina cyanea*					SpSF	B	
Kentucky Warbler	*Geothlypis formosa*	G5	S4B			SpSF	B	H
Least Flycatcher	*Empidonax minimus*	G5	S3 S4B			SpSF		
Lincoln's Sparrow	*Melospiza lincolnii*					SpF		
Louisiana Waterthrush	*Parkesia motacilla*	G5	S5B			SpSF	B	H
Magnolia Warbler	*Setophaga magnolia*	G5	S3 S4B			SpSF		
Marsh Wren	*Cistothorus palustris*	G5	S4B S2N			SpF		H
Merlin	*Falco columbarius*					SpFW		
Mourning Dove	*Zenaida macroura*					Yr	B	
Mourning Warbler	*Geothlypis philadelphia*	G5	S1B		E	SpSF		
Nashville Warbler	*Oreothlypis ruficapilla*	G5	S1 S2B		I	SpF		
Northern Bobwhite	*Colinus virginianus*	G5	S5			Yr	B	H
Northern Cardinal	*Cardinalis cardinalis*					Yr	B	
Northern Flicker	*Colaptes auratus*					Yr	B	H
Northern Goshawk	*Accipiter gentilis*	G5	S1B SZN		E*	SpFW		
Northern Harrier	*Circus cyaneus*	G5	S2B S4N			SpFW		
Northern Mockingbird	*Mimus polyglottos*					Yr	B	
Northern Parula	*Setophaga americana*	G5	S1B S1N			SpSF	B	
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*					SpSF	B	

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	Federal T & E Status[3]	State T & E Status[4]	Seasons on Refuge[5]	Breeding on Refuge[6]	BCR 30[7]
Northern Saw-whet Owl	*Aegolius acadicus*	G5	S1B S1N			SpFW		
Northern Shrike	*Lanius excubitor*					W		
Northern Waterthrush	*Parkesia noveboracensis*	G5	S2 S3B			SpSF		
Olive-sided Flycatcher	*Contopus cooperi*	G4	SHB SZN		E	SpF		
Orange-crowned Warbler	*Oreothlypis celata*					F		
Orchard Oriole	*Icterus spurius*					SpSF	B	
Osprey	*Pandion haliaetus*					SpSF		
Ovenbird	*Seiurus aurocapilla*	G5	S5B			SpSF	B	
Palm Warbler	*Setophaga palmarum*					SpF		
Peregrine Falcon	*Falco peregrinus*	G4 T3	S2		I	Yr		
Philadelphia Vireo	*Vireo philadelphicus*					SoF		
Pileated Woodpecker	*Dryocopus pileatus*	G5	S5			Yr	B	
Pine Siskin	*Spinus pinus*					SpFW		
Pine Warbler	*Setophaga pinus*					SpSF	B	
Prairie Warbler	*Setophaga discolor*	G3	S4B			SpSF	B	HH
Prothontary Warbler	*Protonotaria citrea*	G5	S4B			SpSF	B	H
Purple Finch	*Carpodacus purpureus*					SpFW		
Purple Martin	*Progne subis*					SpSF	B	
Red Crossbill	*Loxia curvirostra*							
Red-bellied Woodpecker	*Melanerpes carolinus*					Yr	B	
Red-breasted Nuthatch	*Sitta canadensis*	G5	S1B S3N			Yr		
Red-eyed Vireo	*Vireo olivaceus*	G5	S5B			SpSF	B	
Red-headed Woodpecker	*Melanerpes erythrocephalus*	G5	S4			Yr		M
Red-shouldered Hawk	*Buteo lineatus*	G5	S4 S5B SAN			Yr	B	
Red-tailed Hawk	*Buteo jamaicensis*					Yr	B	
Red-winged Blackbird	*Agelaius phoeniceus*					Yr	B	
Rock Dove (or Rock Pigeon)	*Columbia livia*					Yr		
Rose-breasted Grosbeak	*Pheucticus ludovicianus*					SpFW		
Rough-legged Hawk	*Buteo lagopus*					F		
Ruby-crowned Kinglet	*Regulus calendula*					SpFW		

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	Federal T & E Status[3]	State T & E Status[4]	Seasons on Refuge[5]	Breeding on Refuge[6]	BCR 30[7]
Ruby-throated Hummingbird	*Archilochus colubris*					SpSF	B	
Rusty Blackbird	*Euphagus carolinus*					SpFW		H
Savannah Sparrow	*Passerculus sandwichensis*	G5	S3 S4B S4N			SpFW		
Scarlet Tanager	*Piranga olivacea*	G5	S5B			SpSF	B	H
Sharp-shinned Hawk	*Accipiter striatus*	G5	S2B S4N			SpFW		
Short-eared Owl	*Asio flammeus*	G5	S1B S2N		E	SpFW		M
Song Sparrow	*Melospiza melodia*					Yr	B	
Summer Tanager	*Piranga rubra*	G5	S4B			SpSF	B	
Swainson's Thrush	*Catharus ustulatus*	G5	SXB			SpF		
Swamp Sparrow	*Melospiza georgiana*					SpFW		
Tennessee Warbler	*Oreothlypis peregrina*					SpSF		
Tree Swallow	*Tachycineta bicolor*					SpSF	B	
Tufted Timouse	*Baeolophus bicolor*					Yr	B	
Turkey Vulture	*Cathartes aura*					Yr	B	
Veery	*Catharus fuscescens*	G5	S4B			SpSF		
Vesper Sparrow	*Pooecetes gramineus*	G5	S3 S4B S2N			SpF		
Warbling Vireo	*Vireo gilvus*					SpSF		
Whip-poor-will	*Caprimulgus vociferus*	G5	S3 S4B			SpFS	B	H
White-breasted Nuhatch	*Sitta carolinesis*					Yr	B	
White-crowned Sparrow	*Zonotrichia leucophrys*					SpFW		
White-eyed Vireo	*Vireo griseus*					SpSF	B	
White-throated Sparrow	*Zonotrichia albicollis*					Yr		
White-winged Crossbill	*Loxia leucoptera*							
Wild Turkey	*Meleagris gallopavo*					Yr	B	
Willow Flycatcher	*Empidonax traillii*	G5	S4B			SpSF		H
Wilson's Warbler	*Cardellina pusilla*					SpSF		
Winter Wren	*Troglodytes hiemalis*	G5	S2B S3N			SpFW		
Wood Thrush	*Hylocichla mustelina*	G5	S5B			SpSF	B	HH
Worm-eating Warbler	*Helmitheros vermivorum*	G5	S4B			SpSF	B	HH
Yellow Warbler	*Setophaga petechia*					SpSF	B	

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	Federal T & E Status[3]	State T & E Status[4]	Seasons on Refuge[5]	Breeding on Refuge[6]	BCR 30[7]
Yellow-bellied Flycatcher	*Empidonax flaviventris*					SpSF		
Yellow-bellied Sapsucker	*Sphyrapicus varius*	G5	SHB S3N			SpFW		
Yellow-billed Cuckoo	*Coccyzus americanus*					SpSF	B	
Yellow-breasted Chat	*Icteria virens*					SpSF	B	
Yellow-rumped Warbler	*Setophaga coronata*					SpFW		
Yellow-throated Vireo	*Vireo flavifrons*	G5	S4 S5B			SpSF	B	H
Yellow-throated Warbler	*Setophaga dominica*					SpS	B	

[1] **Global Natural Heritage Rank**: G1=Highly globally rare; G2=Globally rare; G3=Either very rare and local throughout its range or distributed locally in a restricted range; G4=Apparently secure globally; G5=Demonstrably secure globally; GH=No known extant occurrences; GU=Possibly in peril range-wide, but status is uncertain; GX=Believed to be extinct throughout its range with virtually no likelihood that it will be rediscovered; G?=The species has not yet been ranked; Q=Questionable or uncertain taxonomic standing; T=The infraspecific taxon is being ranked differently than the full species.

[2] **State Natural Heritage Rank**: S1=Highly state rare; S2=State rare; S3=Watch list; S3.1=A "watch list" species that is actively tracked; S4=Apparently secure; S5=Demonstrably secure; SA=Accidental or a vagrant in MD; SE=Established, but not native to MD; SH=Historically known from MD, but not verified for an extended period; SNA=Species is not a suitable conservation target; SP=Potentially occurring or likely to have occurred in MD; SR=Reported from MD, but without persuasive documentation; SRF=Reported falsely in MD; SU=Possibly rare in MD but of uncertain status; SX=Believed to be extirpated in MD with virtually no chance of rediscovery; S?=The species has not yet been ranked; B=A qualifier at the end of a rank - species is a migrant and the subrank refers only to the breeding status of the species in MD; N=A qualifier at the end of a rank - species is a migrant and the subrank refers only to the non-breeding status of the species in MD.

[3] **Federal List of Threatened and Endangered Species:** LE=Endangered, LT=Threatened, PE=Proposed to be listed as endangered, PT=Proposed to be listed as threatened, C=Candidate for listing.

[4] **State List of Threatened and Endangered Species**: E=Endangered, T=Threatened, I=In need of conservation, X=Endangered extirpated, *=A qualifier denoting the species is listed in a limited geographic area only.

[5] **Seasons on Refuge**: Yr=Year-round, W=Winter, Sp=Spring, S=Summer, F=Fall.

[6] **Breeding on Refuge**: B=Breeding.

[7] **New England/Mid-Atlantic Coast Bird Conservation Region 30Implementation Plan**: HH=Highest, H=High Priority, M=Moderate Priority.

Table A-2. Other Suspected or Known Species on Patuxent Research Refuge

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
MAMMALS					
American Beaver	*Castor canadensis*				
American Mink	*Neovison vison*				
Big Brown Bat	*Eptesicus fustus*				
Common Gray Fox	*Urocyon c. cinereoargenteus*				
Common Opposum	*Didelphis marsupialis marsupialis*				
Common Raccoon	*Procyon lotor lotor*				
Deer Mouse	*Peromyscus maniculatus bairdii*				
Eastern Chipmunk	*Tamias striatus*				
Eastern Cottontail	*Sylvilagus floridanus mallurus*				
Eastern Gray Squirrel	*Sciurus carolinensis*				
Eastern Harvest Mouse	*Reithrodontomys humulis*	G5	SH	X	
Eastern Mole	*Scalopus a. aquaticus*				
Eastern Red Bat	*Lasiurus borealis*				
Evening Bat	*Nycticeius humeralis*				
House Mouse	*Mus musculus*				
Least Shrew	*Cryptotis parva*				
Little Brown Bat	*Myotis lucifugus*				
Long-tailed Weasel	*Mustela frenata noveboracensis*				
Masked Shrew	*Sorex cinereus fontinalis*				
Meadow Jumping Mouse	*Zapus hudsonius*				
Meadow Vole	*Microtus p. pennsylvanicus*				
Muskrat	*Ondatra z. zibethicus*				
Northern Long-eared Bat	*Myotis septentrionalis*				
Norway Rat	*Rattus norvegicus*				
Pine Vole	*Microtus pinetorum*				
Red Fox	*Vulpes vulpes fulvus*				
Red Squirrel	*Tamiasciurus h. hudsonicus*				
River Otter	*Lontra canadensis lataxina*				
Short-tailed Shrew	*Blarina brevicauda kirtlandi*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Silver-haired Bat	*Lasionycteris noctivagans*				
Southern Flying Squirrel	*Glaucomys v. volans*				
Star-nosed Mole	*Condylura cristata nigra*				
Striped Skunk	*Mephitis mephitis nigra*				
Tri-coloered bat	*Perimyotis subflavus*				
Unknown myotis	*Myotis sp.*				
White-footed Mouse	*Peromyscus leucopus*				
White-tailed Deer	*Odocoileus v. virginianus*				
Woodchuck	*Marmota monax*				
AMPHIBIANS					
Salamanders					
Eastern Mud Salamander	*Pseudotriton montanus montanus*	G5	S2?		
Eastern Red-backed Salamander	*Plethodon cinereus*				
Four-toed Salamander	*Hemidactylium scutatum*				
Long-tailed Salamander	*Eurycea longicauda*				
Marbled salamander	*Ambystoma opacum*				
Northern Dusky Salamander	*Desmognathus fuscus*				
Northern Red Salamander	*Pseudotriton ruber ruber*				
Northern Two-lined Salamander	*Eurycea bislineata*				
Red-spotted Newt	*Notophthalmus viridescens viridescens*				
Spotted salamander	*Ambystoma maculatum*				
Frogs and Toads					
American Bullfrog	*Lithobates catesbeianus*				
American toad	*Anaxyrus americanus*				
Eastern Spadefoot Toad	*Scaphiopus holbrookii*				
Fowler's toad	*Anaxyrus fowleri*				
Gray Treefrog	*Hyla versicolor*				
Green frog	*Lithobates clamitans*				
Green Treefrog	*Hyla cinerea*				
Northern Cricket Frog	*Acris crepitans*				
Pickerel frog	*Lithobates palustris*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Southern leopard frog	*Lithobates sphenocephalus*				
Spring Peeper	*Pseudacris crucifer*				
Upland Chorus Frog	*Pseudacris feriarum*				
Wood frog	*Lithobates sylvaticus*				
REPTILES					
Turtles					
Eastern Box Turtle	*Terrapene carolina*				
Eastern Mud Turtle	*Kinosternon subrubrum*				
Eastern Musk Turtle	*Sternotherus odoratus*				
Eastern Painted Turtle	*Chrysemys picta picta*				
Eastern Snapping Turtle	*Chelydra serpentina serpentina*				
Northern Red-bellied Cooter	*Pseudemys rubriventris*				
Red-eared Slider	*Trachemys scripta elegans*				
Spotted Turtle	*Clemmys guttata*				
Lizards and Snakes					
Broad-headed Skink	*Plestiodon laticeps*	G5	S4		
Common Five-lined Skink	*Plestiodon fasciatus*				
Common Gartersnake	*Thamnophis sirtalis*				
Common Kingsnake	*Lampropeltis getula*				
Eastern Fence Lizard	*Sceloporus undulatus*				
Eastern Hog-Nosed Snake	*Heterodon platirhinos*				
Eastern Ratsnake	*Pantherophis alleghaniensis*				
Eastern Ribbonsnake	*Thamnophis sauritus*	G5	S5		
Eastern Wormsnake	*Carphophis amoenus*				
Little Brown Skink	*Scincella lateralis*				
Milk Snake	*Lampropeltis triangulum*				
Mole Kingsnake	*Lampropeltis calligaster rhombomaculata*				
Northern Bed-bellied Snake	*Storeria occipitomaculata occipitomaculata*				
Northern Bingneck Snake	*Diadophis punctatus edwardsii*				
Northern Black Racer	*Coluber constrictor constrictor*				
Northern Brownsnake	*Storeria dekayi dekayi*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Northern Copperhead	*Agkistrodon contortrix mokasen*				
Northern Watersnake	*Nerodia sipedon*				
Queensnake	*Regina septemvittata*	G5	S5		
Rough Greensnake	*Opheodrys aestivus*				
Six-lined Racerunner	*Aspidoscelis sexlineatus*				
Smooth Earthsnake	*Virginia valeriae*				
FISH					
Lampreys					
Least Brook Lamprey	*Lampetra aepyptera*				
Sea Lamprey	*Petromyzon marinus*				
Eels					
American Eel	*Anguilla rostrata*				
Herrings					
Alewife	*Alosa pseudoharengus*				
American Shad	*Alosa sapidissima*				
Gizzard Shad	*Dorosoma cepedianum*				
Mudminnows and Pikes					
Eastern Mudminnow	*Umbra pygmaea*				
Chain Pickerel	*Esox niger*				
Redfin Pickerel	*Esox americanus*				
Suckers and Minnows					
Blacknose Dace	*Rhinichthys atratulus*				
Comely Shiner	*Notropis amoenus*	G5	S2	T	
Common Carp	*Cyprinus carpio*				
Common Shiner	*Luxilus cornutus*				
Creek Chubsucker	*Erimyzon oblongus*				
Cutlips Minnow	*Exoglossum maxillingua*				
Fallfish	*Semotilus corporalis*				
Golden Shiner	*Notemigonus crysoleucas*				
Lake Chubsucker	*Erimyzon sucetta*				
Longnose Dace	*Rhinichthys cataractae*				
Northern Hogsucker	*Hypentelium nigricans*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
River Chub	*Nocomis micropogon*				
Rosyside Dace	*Clinostomus funduloides*				
Satinfin Shiner	*Cyprinella analostana*				
Short-head Redhorse	*Moxostoma macrolepidotum*				
Silvery Minnow	*Hybognathus reguis*				
Spotfin Shiner	*Cyprinella spiloptera*				
Spottail Shiner	*Notropis hudsonius*				
Swallowtail Shiner	*Notropis procne*				
White Sucker	*Catostomus commersonii*				
Catfishes					
Brown Bullhead	*Ameiurus nebulosus*				
Channel Catfish	*Ictalurus punctatus*				
Margined Madtom	*Noturus insignis*				
Tadpole Madtom	*Notorus gyrinus*				
White Catfish	*Ameiurus catus*	G5	SU		
Yellow Bullhead	*Ameiurus natalis*				
Killifishes					
Eastern Mosquitofish	*Gambusia affinis*				
Trout-perches					
Pirate Perch	*Aphredoderus sayanus*				
Perch-line Fishes					
Banded Sunfish	*Enneacanthus obesus*				
Black Crappie	*Pomoxis nigromaculatus*				
Bluegill	*Lepomis macrochirus*				
Bluespotted Sunfish	*Enneacanthus gloriosus*	G5	S3 S4		
Glassy Darter	*Etheostoma vitreum*	G4 G5	S1 S2	T	
Green Sunfish	*Lepomis cyanellus*				
Johnny Darter	*Etheostoma nigrum*	G5	S3		
Largemouth Bass	*Micropterus salmoides*				
Pumpkinseed	*Lepomis gibbosus*				
Redbreast Sunfish	*Lepomis auritus*				
Shield Darter	*Percina peltata*	G5	S3		

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Stripeback Darter	*Percina notogramma*	G4	S1	E	
Tessellated Darter	*Etheostoma olmstedi*				
Warmouth	*Chaenobryttus gulosus*	G5	S3?		
Yellow Perch	*Perca flavescens*				
BUTTERFLIES					
Swallowtails, parnassians					
Black Swallowtail	*Papilio polyxenes*				
Eastern Tiger Swallowtail	*Papilio glaucus*				
Pipevine Swallowtail	*Battus philenor*				
Spicebush Swallowtail	*Papilio troilus*				
Zebra Swallowtail	*Eurytides marcellus*				
White, sulphurs, yellows					
Cabbage White	*Pieris rapae*				
Checkered White	*Pontia protodice*				
Clouded Sulphur	*Colias philodice*[3]				
Cloudless Sulphur	*Phoebis sennae*				
Falcate Orangetip	*Anthocharis midea*				
Little Yellow	*Pyrisitia lisa lisa*				
Orange Sulphur	*Colias eurytheme*				
Sleepy Orange	*Abaeis nicippe*				
Butterflies, excluding skippers					
'Spring' Spring Azure	*Celastrina ladon ladon*				
'Summer' Spring Azure	*Celastrina ladon neglecta*				
American Copper	*Lycaena phlaeas*				
Banded Hairstreak	*Satyrium calanus*[3]				
Brown Elfin	*Callophrys augustinus*				
Coral Hairstreak	*Satyrium titus*[3]				
Eastern Pine Elfin	*Callophrys niphon*				
Eastern Tailed-Blue	*Cupido comyntas comyntas*				
Gray Hairstreak	*Strymon melinus*				
Harvester	*Feniseca tarquinius*				
Henry's Elfin	*Callophrys henrici*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Olive Hairstreak	*Mitoura gryneus*[1,3]				
Red-banded Hairstreak	*Calycopis cecrops*				
Striped Hairstreak	*Satyrium liparops*[3]				
White M Hairstreak	*Parrhasius m-album*[3]				
Brushfooted butterflies					
Hackberry Emperor	*Asterocanmpa celtis*				
Meadow Fritillary	*Boloria bellona toddi*				
Common Wood-Nymph	*Cercyonis pegala*				
Monarch	*Danaus plexippus*				
Baltimore Checkerspot	*Euphydryas phaeton*	G4	S2		
Variegated Fritillary	*Euptoieta claudia*				
Common Buckeye	*Junonia coenia*				
Northern Pearly-Eye	*Lethe anthedon anthedon*				
Appalachian Brown	*Lethe appalachia*				
American Snout	*Libytheana carinenta bachmanii*				
Viceroy	*Limenitis archippus*				
Red-spotted Purple	*Limenitis arthemis astyanax*				
Little Wood-Satyr	*Megisto cymela*				
Mourning Cloak	*Nymphalis antiopa*				
Compton tortoiseshell	*Nymphalis vau-album*				
Pearl Crescent	*Phyciodes tharos*				
Eastern Comma	*Polygonia comma*				
Question Mark	*Polygonia interrogationis*				
Great Spangled Fritillary	*Speyeria cybele*				
Red Admiral	*Vanessa atalanta*				
Painted Lady	*Vanessa cardui*				
American Lady	*Vanessa virginiensis*				
Skippers					
Clouded Skipper	*Lerema accius*				
Columbine Duskywing	*Erynnis lucilius*[3]				
Common Checkered-Skipper	*Pyrgus communis*				
Common Roadside-Skipper	*Amblyscirtes vialis*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Common Sootywing	*Pholisora catullus*				
Confused Cloudywing	*Thorybes confusis*				
Crossline Skipper	*Polites origenes*				
Delaware Skipper	*Anatrytone logan*				
Dreamy Duskywing	*Erynnis icelus*[3]				
Juvenal's/ Sleepy Duskywing	*Erynnis juvenalis/ brizo*				
Dun Skipper	*Euphyes vestris ruricola*				
European Skipper	*Thymelicus lineola*				
Fiery Skipper	*Hylephila phyleus*				
Hoary Edge	*Achalarus lyciades*[3]				
Hobomok Skipper	*Poanes hobomok*				
Horace's Duskywing	*Erynnis horatius*				
Juvenal's Duskywing	*Erynnis juvenalis*				
Least Skipper	*Ancyloxypha numitor*				
Leonard's Skipper	*Hesperia leonardus*[3]				
Little Glassywing	*Pompeius verna*				
Long Dash	*Polites mystic*				
Mulberry Wing	*Poanes massasoit*[3]				
Northern Broken-Dash	*Wallengrenia egeremet*				
Northern Cloudywing	*Thorybes pylades*				
Ocola Skipper	*Panoquina ocola*[3]				
Pecks Skipper	*Polites peckius*				
Sachem	*Atalopedes campestris*				
Silver-Spotted Skipper	*Epargyreus clarus*				
Sleepy Duskywing	*Erynnis brizo*[3]				
Southern Cloudywing	*Thorybes bathyllus*				
Swarthy Skipper	*Nastra lherminier*				
Tawny-edged Skipper	*Polites themistocles*[3]				
Whirlabout	*Polites vibex*				
Wild Indigo Duskywing	*Erynnis baptisiae*				
Zabulon Skipper	*Poanes zabulon*				
DAMSELFLIES					

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Broad-winged					
American rubyspot	*Hetaerina americana*		S4		
Ebony jewelwing	*Calopteryx maculata*				
Narrow-winged					
Attenuated bluet	*Enallagma daeckii*	G4	S3		
Aurora damsel	*Chromagrion conditum*	G5	S3 S4		
Azure bluet	*Enallagma aspersum*				
Blue-fronted dancer	*Argia apicalis*				
Blue-ringed dancer	*Argia sedula*	G5	S3		
Blue-tipped dancer	*Argia tibialis*				
Citrine forktail	*Ischnura hastata*				
Double-stipped bluet	*Enallagma basidens*				
Dusky dancer	*Argia translata*				
Eastern forktail	*Ischnura verticalis*				
Eastern red damsel	*Amphiagrion saucium*	G5	S3 S4		
Familiar bluet	*Enallagma civile*				
Fragile forktail	*Ischnura posita*				
Lilypad forktail	*Ischnura kellicotti*	G5	S3 S4		
Orange bluet	*Enallagma signatum*				
Powdered dancer	*Argia moesta*				
Rambur's forktail	*Ischnura ramburii*				
Sedge sprite	*Nehalennia irene*	G5	S3		
Seepage dancer	*Argia bipunctulata*	G4	S3		
Skimming bluet	*Enallagma geminatum*				
Slender bluet	*Enallagma traviatum*	G5	S3		
Southern sprite	*Nehalennia integricollis*	G5	S1S2		
Sphagnum sprite	*Nehalennia gracilis*	G5	S2		
Stream bluet	*Enallagma exsulans*				
Turquoise bluet	*Enallagma divagans*	G5	S3 S4		
Vesper bluet	*Enallagma vesperum*	G5	S3		
Violet dancer	*Argia fumipennis violacea*				
Spreadwings					

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Amber-winged Spreadwing	*Lestes eurinus*	G4	S3		
Elegant Spreadwing	*Lestes inaequalis*				
Great Spreadwing	*Archilestes grandis*	G5	S3		
Northern Spreadwing	*Lestes disjunctus australis*				
Slender Spreadwing	*Lestes rectangularis*				
Southern Spreadwing	*Lestes australis*				
Spotted Spreadwing	*Lestes congener*	G5	S3		
Swamo Spreadwing	*Lestes vigilax*				
Sweetflag Spreadwing	*Lestes forcipatus*	G5	S3		
Petaltails					
Gray Petaltail	*Tachopteryx thoreyi*	G4	S3		
Darners					
Comet Darner	*Anax longipes*	G5	S3		
Common Green Darner	*Anax junius*				
Cyrano Darner	*Nasiaeschna pentacantha*	G5	S3 S4		
Fawn Darner	*Boyeria vinosa*				
Green-striped Darner	*Aeshna verticalis*	G5	S2		
Harlequin Darner	*Gomphaeschna furcillata*		S3 S4		
Shandow Darner	*Aeshna umbrosa*				
Spatterdock Darner	*Rhionaeschna mutata*	G4	S1	E	
Springtime Darner	*Basiaeschna janata*				
Swamp Darner	*Epiaeschna heros*				
Taper-tailed Darner	*Gomphaeschna antilope*	G4	S2		
Clubtails					
Appalachian Snaketail	*Ophiogomphus incurvatus incurvatus*	G3 T2 T3	S1	E	
Arrow Clubtail	*Stylurus spiniceps*	G5	S3		
Ashy Clubtail	*Gomphus lividus*				
Black-shouldered Spinyleg	*Dromogomphus spinosus*				
Common Sanddragon	*Progomphus obscurus*	G5	S3		
Dragonhunter	*Hagenius brevistylus*				
Eastern Least Clubtail	*Stylogomphus albistylus*				

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Lancet Clubtail	*Gomphus exilis*				
Laura's Clubtail	*Stylurus laurae*	G4	S2 S3		
Rapids Clubtail	*Gomphus quadricolor*				
Russet-tipped Clubtail	*Stylurus plagiatus*	G5	S3		
Sable Clubtail	*Gomphus rogersi*	G4	S2	I	
Unicorn Clubtail	*Arigomphus villosipes*				
Spiketails					
Arrowhead Spiketail	*Cordulegaster obliqua*	G4	S2		
Brown Spiketail	*Cordulegaster bilineata*	G5	S3		
Pacific Spiketail	*Cordulegaster dorsalis*$_3$				
Tiger Spiketail	*Cordulegaster erronea*	G4	S3		
Twin-spotted Spiketail	*Cordulegaster maculata*				
Cruisers					
Georgia river cruiser	*Macromia illinoiensis georgina*	G5 T5	S3 S4		
Stream Cruiser	*Didymops transversa*				
Swift River Cruser	*Macromia illinoiensis*				
River Cruiser	*Macromia illinoiensis illinoiensis*				
Emeralds					
Clamp-tipped Emerald	*Somatochlora tenebrosa*		S4		
Common Baskettail	*Epitheca cynosura*				
Five-lined Emerald	*Somatochlora filosa*	G5	S2		
Mocha Emerald	*Somatochlora linearis*	G5	S3 S4		
Prince Baskettail	*Epitheca princeps*				
Robust Baskettail	*Epitheca spinosa*	G4	S1 S2		
Salys Sundragon	*Helocordulia selysii*	G4	S2	T	
Slender Baskettail	*Epitheca costalis*	G5	S1		
Treetop Emerald	*Somatochlora provocans*	G4	S1	E	
Common skimmers					
Autumn Meadowhawk	*Sympetrum vicinum*				
Banded Pennant	*Celithemis fasciata*	G5	S3		
Band-winged Meadowhawk	*Sympetrum semicinctum*	G5	S3		
Bar-winged Skimmer	*Libellula axilena*	G5	S3		

Common Name	Scientific Name	Global Natural Heritage Rank[1]	State Natural Heritage Rank[2]	State T & E Status[3]	Federal T & E Status[4]
Black Saddlebags	*Tramea lacerata*				
Blue Corporal	*Ladona deplanata*				
Blue Dasher	*Pachydiplax longipennis*				
Blue-faced Meadowhawk	*Sympetrum ambiguum*	G5	S3 S4		
Calico Pennant	*Celithemis elisa*				
Carolinia Saddlebags	*Tramea carolina*				
Common Whitetail	*Planthemis lydia*				
Double-ringed Pennant	*Celithemis verna*	G5	S2		
Eastern-amber Wing	*Perithemis tenera*				
Elfin Skimmer	*Nannothemis bella*	G4	S1	E	
Golden-winged Skimmer	*Libellula auripennis*	G5	S3		
Great Blue Skimmer	*Libellula vibrans*				
Green Clearwing	*Erythemis simplicicollis*				
Halloween Pennant	*Celithemis eponina*				
Little Blue Dragonlet	*Erythrodiplax minuscula*	G5	S1		
Martha's Pennant	*Celithemis martha*	G4	S1		
Needham's Skimmer	*Libellula needhami*				
Ornate Pennant	*Celithemis ornata*	G5	SH		
Painted Skimmer	*Libellula semifasciata*				
Red-mantled Saddlebags	*Tramea onusta*	SA			
Ruby Meadowhawk	*Sympetrum rubicundulum*				
Slaty Skimmer	*Libellula incesta*				
Spangled Skimmer	*Libellula cyanea*				
Spot-winged Glider	*Pantala hymenaea*				
Twelve-spotted Skimmer	*Libellula pulchella*				
Wandering Glider	*Pantala flavescens*				
White-faced Meadowhawk	*Sympetrum obtrusum*	G5	S3		
Widow Skimmer	*Libellula luctuosa*				
Yellow-sided Skimmer	*Libellula flavida*	G5	S2 S3		
	Dythemis sp.				

[1] **Global Natural Heritage Rank**: G1=Highly globally rare; G2=Globally rare; G3=Either very rare and local throughout its range or distributed locally in a restricted range; G4=Apparently secure globally; G5=Demonstrably secure globally; GH=No known extant occurrences; GU=Possibly in peril range-wide, but status is uncertain; GX=Believed to be extinct throughout its range with virtually no likelihood that it will be rediscovered; G?=The species has not yet been ranked; Q=Questionable or uncertain taxonomic standing; T=The infraspecific taxon is being ranked differently than the full species.

[2] **State Natural Heritage Rank**: S1=Highly state rare; S2=State rare; S3=Watch list; S3.1=A "watch list" species that is actively tracked; S4=Apparently secure; S5=Demonstrably secure; SA=Accidental or a vagrant in MD; SE=Established, but not native to MD; SH=Historically known from MD, but not verified for an extended period; SNA=Species is not a suitable conservation target; SP=Potentially occurring or likely to have occurred in MD; SR=Reported from MD, but without persuasive documentation; SRF=Reported falsely in MD; SU=Possibly rare in MD but of uncertain status; SX=Believed to be extirpated in MD with virtually no chance of rediscovery; S?=The species has not yet been ranked; B=A qualifier at the end of a rank - species is a migrant and the subrank refers only to the breeding status of the species in MD; N=A qualifier at the end of a rank - species is a migrant and the subrank refers only to the non-breeding status of the species in MD.

[3] **State List of Threatened and Endangered Species**: E=Endangered, T=Threatened, I=In need of conservation, X=Endangered extirpated, *=A qualifier denoting the species is listed in a limited geographic area only.

[4] **Federal List of Threatened and Endangered Species**: LE=Endangered, LT=Threatened, PE=Proposed to be listed as endangered, PT=Proposed to be listed as threatened, C=Candidate for listing.

Appendix B.

USFWS

Tram Route

Wilderness Review

Introduction

The purpose of a wilderness review is to identify and recommend to Congress lands and waters of the National Wildlife Refuge System (Refuge System) that merit inclusion in the National Wilderness Preservation System (NWPS). Wilderness reviews are a required element of comprehensive conservation plans, are conducted in accordance with the refuge planning process outlined in the U.S. Fish and Wildlife Service Manual (602 FW 1 and 3), and include compliance with the National Environmental Policy Act and public involvement.

The wilderness review process has three phases: inventory; study; and, recommendation. Lands and waters that meet the minimum criteria for wilderness are identified in the inventory phase. These areas are called wilderness study areas (WSAs). In the study phase, a range of management alternatives are evaluated to determine if a WSA is suitable for wilderness designation or management under an alternate set of goals and objectives that do not involve wilderness designation.

The recommendation phase consists of forwarding or reporting the suitable recommendations from the Regional Director through the Secretary and the President to Congress in a wilderness study report. The wilderness study report is prepared after the record of decision for the final comprehensive conservation plan (CCP) has been signed. Areas recommended for designation are managed to maintain wilderness character in accordance with management goals, objectives, and strategies outlined in the final CCP until Congress makes a decision or the CCP is amended to modify or remove the wilderness proposal.

Wilderness Inventory

Introduction
The wilderness inventory takes a broad look at each planning area, also known as Wilderness Inventory Areas (WIAs), to identify WSAs. A WSA is an area of undeveloped Federal land that retains its primeval character and influence, without permanent improvements or human habitation, and further, meets the minimum criteria for wilderness as identified in Section 2(c) of the Wilderness Act.

Minimum Wilderness Criteria
A WSA is required to appear natural, provide for solitude or primitive recreation, and be either a roadless area that meets the size criteria, or an island of any size. Only Federal lands are eligible to be considered for wilderness designation and inclusion within the NWPS.

<u>Roadless</u>
Roadless refers to the absence of improved roads suitable and maintained for public travel by means of motorized vehicles primarily intended for highway use. A route maintained solely by the passage of vehicles does not constitute a road.

The following factors were the primary considerations in evaluating the roadless criteria:

A. The area does not contain improved roads suitable and maintained for public travel by means of motorized vehicles primarily intended for highway use.

B. The area is an island, or contains an island that does not have improved roads suitable and maintained for public travel by means of motorized vehicles primarily intended for highway use. A roadless island is defined as an area surrounded by permanent waters or that is markedly distinguished from the surrounding lands by topographical or ecological features.

C. The area is in Federal fee title ownership.

Size

The size criteria can be satisfied if an area has at least 5,000 acres of contiguous roadless public land, or is sufficiently large that its preservation and use in an unimpaired condition is practicable.

The following factors were the primary considerations in evaluating the size criteria:

A. An area of more than 5,000 contiguous acres. Adjacent state and private lands are not included in making this acreage determination.

B. A roadless island of any size.

C. An area of less than 5,000 contiguous Federal acres that is of sufficient size as to make practicable its preservation and use in an unimpaired condition, and of a size suitable for wilderness management.

D. An area of less than 5,000 contiguous acres that is contiguous with a designated wilderness, recommended wilderness, or area under wilderness review by another Federal wilderness managing agency such as the Forest Service, National Park Service, or Bureau of Land Management.

Naturalness

The Wilderness Act, Section 2(c), defines wilderness as an area that "generally appears to have been affected primarily by the forces of nature with the imprint of human work substantially unnoticeable." The area must appear natural to the average visitor, rather than "pristine." The presence of historic landscape conditions is not required.

An area may include some human impacts provided they are substantially unnoticeable in the unit as a whole. Significant hazards caused by humans, such as the presence of unexploded ordnance from military activity and the physical impacts of refuge management facilities and activities are also considered in evaluating the naturalness criteria.

An area may not be considered unnatural in appearance solely on the basis of the sights and sounds of human impacts and activities outside the boundary of the unit. The cumulative effects of these factors in conjunction with land base size, physiographic and vegetative characteristics were considered in the evaluation of naturalness.

The following factors were the primary considerations in evaluating naturalness:

A. The area appears to have been affected primarily by the forces of nature with the imprint of human work substantially unnoticeable.

B. The area may include some human impacts provided they are substantially unnoticeable in the unit as a whole.

C. Does the area contain significant hazards caused by humans, such as the presence of unexploded ordnance from military activity?

D. The presence of physical impacts of refuge management facilities and activities.

Solitude or Primitive and Unconfined Recreation

A WSA must provide outstanding opportunities for solitude or primitive and unconfined recreation. The area does not have to possess outstanding opportunities for both solitude and primitive and unconfined recreation, and does not need to have outstanding opportunities on every acre. Further, an area does not have to be open to public use and access to qualify under this criteria; Congress has designated a number of wilderness areas in the Refuge System that are closed to public access to protect resource values.

Opportunities for solitude refer to the ability of a visitor to be alone and secluded from other visitors in the area. Primitive and unconfined recreation means non-motorized, dispersed outdoor recreation activities that are compatible and do not require developed facilities or mechanical transport. These primitive recreation activities may provide opportunities to experience challenge and risk; self reliance; and adventure. These two elements—solitude and primitive recreation—are not well defined by the Wilderness Act, but can be expected to occur together in most cases. However, an outstanding opportunity for solitude may be present in an area offering only limited primitive recreation potential. Conversely, an area may be so attractive for recreation use that experiencing solitude is not an option.

The following factors were the primary considerations in evaluating outstanding opportunities for solitude or primitive unconfined recreation:

A. The area offers the opportunity to avoid the sights, sounds and evidence of other people. A visitor to the area should be able to feel alone or isolated.

B. The area offers non-motorized, dispersed outdoor recreation activities that are compatible and do not require developed facilities or mechanical transport.

Supplemental Values

The Wilderness Act states that an area of wilderness may contain ecological, geological, or other features of scientific, educational, scenic or historical value. Supplemental values of the area are optional, but the degree to which their presence enhances the area's suitability for wilderness designation should be considered. The evaluation should be based on an assessment of the estimated abundance or importance of each of the features.

Wilderness Inventory Areas at Patuxent Research Refuge

The CCP planning team identified three wilderness inventory areas (map B-1) at Patuxent Research Refuge (refuge). The CCP planning team evaluated the areas to determine if they retained their primeval character and influence, were without permanent improvements or human habitation, and met the minimum criteria for wilderness as identified in Section 2(c) of the Wilderness Act. Our findings are described below.

WIA 1: North Tract

Does the wilderness inventory area:

(1) *Have at least 5,000 roadless acres of land, or is it of sufficient size to make practicable its preservation and use in an unconfined condition, or is it a roadless island?*

The North Tract is 8,100 acres; however, the area contains about 9.5 miles of asphalt and gravel roads that are open to the public.

(2) *Generally appear to have been affected primarily by the forces of nature with the imprint of man's work substantially unnoticeable?*

No. The North Tract contains a variety of managed areas, including ballfields, impoundments, shooting ranges, and visitor facilities.

(3a) *Have outstanding opportunities for solitude?*

No. Roads and parking lots provide vehicle access to visitors; most visitors are confined to the two major interpretive trails. Hunters however, have wide access to the refuge on foot.

(3b) *Have outstanding opportunities for a primitive and unconfined type of recreation?*

No. Off-road or off-trail access is not allowed except during the white tailed deer hunting season, which is highly regulated.

(4) *Contain ecological, geological, or other features of scientific, educational, scenic, or historical value?*

The North Tract contains numerous historic resources. These include cemeteries, and the remains of homesteads, taverns and mills.

WIA 2: Central Tract

Does the wilderness inventory area:

(1) *Have at least 5,000 acres of land, or is it of sufficient size to make practicable its preservation and use in an unconfined condition, or is it a roadless island?*

No. The Central Tract is approximately 2,700 acres and contains 13 miles of road that are open to U.S. Fish and Wildlife Service staff, U.S. Geological Survey staff, and visitors.

(2) *Generally appear to have been affected primarily by the forces of nature with the imprint of man's work substantially unnoticeable?*

No. The area contains 21 major structures including administrative buildings, endangered species rearing facilities, and research laboratories.

(3a) *Have outstanding opportunities for solitude?*

No. Roads and parking lots provide vehicle access to staff. Other areas of the Central Tract are off-limits to the public.

(3b) *Have outstanding opportunities for a primitive and unconfined type of recreation?*

No. The Central Tract is closed to the public.

(4) *Contain ecological, geological, or other features of scientific, educational, scenic, or historical value?*

The Central Tract contains the Patuxent Wildlife Research Center and the associated buildings and grounds. The educational and scientific features of this area relate to the human influenced areas.

<u>WIA 3: South Tract</u>
Does the wilderness inventory area:

(1) *Have at least 5,000 acres of land, or is it of sufficient size to make practicable its preservation and use in an unconfined condition, or is it a roadless island?*

No. The South Tract is approximately 2,000 acres and is home to the National Wildlife Visitor Center. The area is served by tram tours and a public access road.

(2) *Generally appear to have been affected primarily by the forces of nature with the imprint of man's work substantially unnoticeable?*

No. The area is actively managed with numerous culverts and water control structures. There is also a tram route that is operated by the refuge Friends group. The National Wildlife Visitor Center and associated parking lot, trails, and boardwalk are located in the South Tract.

(3a) *Have outstanding opportunities for solitude?*

No. Roads and parking lots provide vehicle access to visitors; most visitors are confined to an interpretive trail and the tram.

(3b) *Have outstanding opportunities for a primitive and unconfined type of recreation?*

No. Off-road or off-trail access is not allowed.

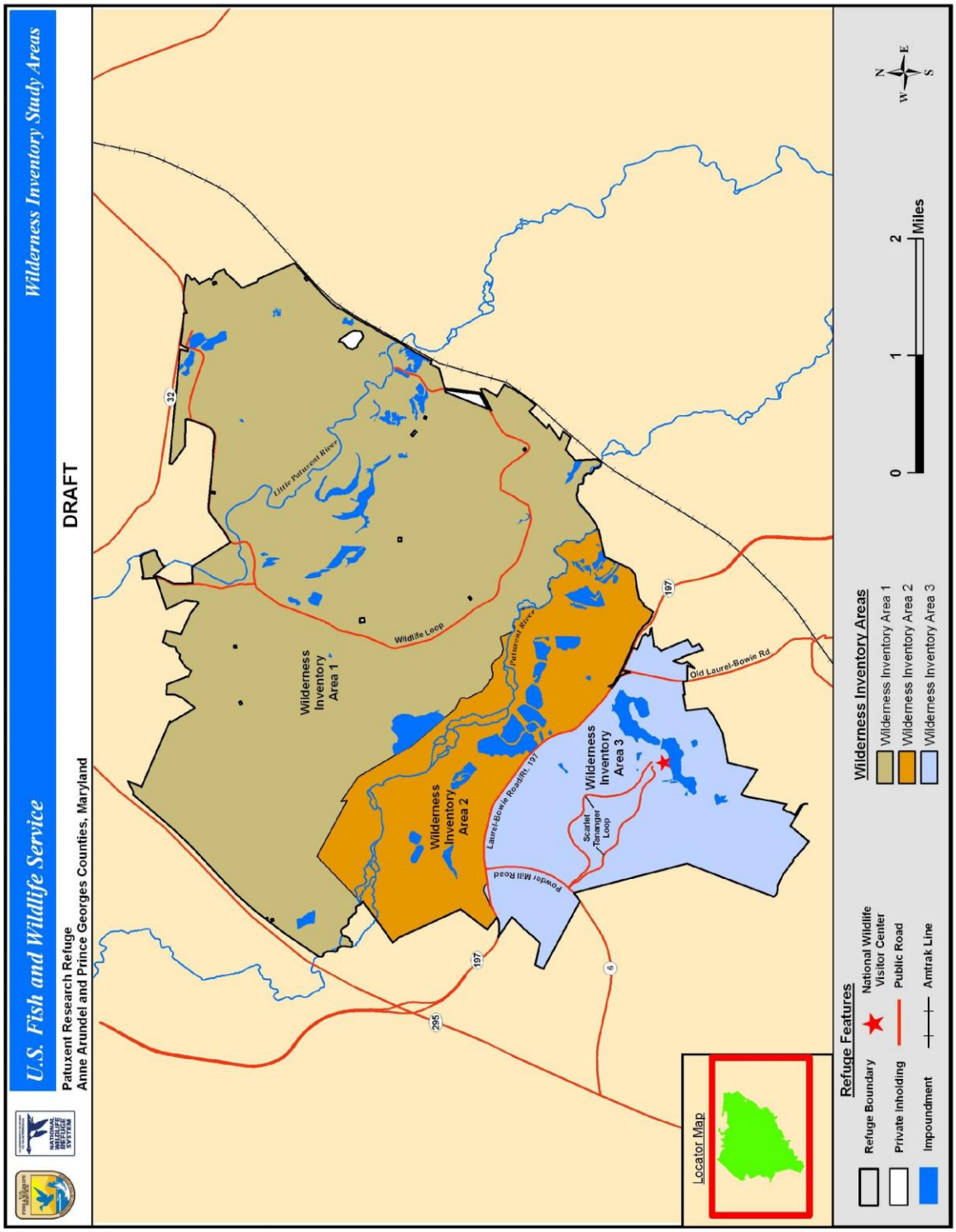
(4) *Contain ecological, geological, or other features of scientific, educational, scenic, or historical value?*

The South Tract contains the Upland Hardwoods Research Natural Area, a 1,700 forest tract designated by the Department of the Interior for scientific research that is to remain in an undeveloped and natural condition.

Summary of Wilderness Inventory Findings

The CCP planning team found that Patuxent Research Refuge does not meet the minimum criteria for wilderness as identified in Section 2(c) of the Wilderness Act. Each of the WIAs contain characteristics that make them unsuitable for further study. The largest of the WIAs is the North Tract (WIA 1), which has been heavily used as a military training area in the past and contains active firing ranges. The Central Tract (WIA 2) contains over 30 buildings and animal pens and WIA 3 contains the National Wildlife Visitor Center and the heaviest amount of public use. While there are ecological and historic values on the refuge, these do not, in and of themselves, warrant wilderness recommendation. In summary, Patuxent Research Refuge does not qualify as a WSA, and will not be considered further for wilderness designation in this CCP.

Map B-1. Wilderness Inventory Study Areas



Appendix C.

USFWS

Trail Sign

Findings of Appropriateness and Compatibility Determinations

- Wildlife Observation, Photography, Environmental Education, and Interpretation
- Public Hunting
- Public Fishing
- Hiking, Biking, Jogging, and Cross-country Skiing
- Horseback Riding
- Production of Educational Films and Conducting Photography Workshops
- Wildlife Research
- Primitive Camping for Boy and Girl Scouts and 4-H Groups
- Dog Training for Waterfowl Hunting Purposes
- Dog Walking
- Search and Rescue Training for Canine Teams
- U.S. Secret Service Training Exercises at the National Wildlife Visitor Center
- Baltimore Gas and Electric Powerline Right-of-Way
- Toro Energy Underground Gas Right-of-Way
- Potomac Electric Power Company Powerline Right-of-Way
- Use of North Tract Softball Fields

COMPATIBILITY DETERMINATION

USES:

Wildlife Observation, Photography, Environmental Education, and Interpretation

REFUGE NAME:

Patuxent Research Refuge

ESTABLISHING AND ACQUISITION AUTHORITIES:

Executive Order 7514, dated December 16, 1936; Executive Order 11724, dated June 27, 1973; 16 U.S.C. 715d, Migratory Bird Conservation Act of 1929; 16 U.S.C. 1534; 16 U.S.C. 667b, dated May 19, 1948 - An Act Authorizing the Transfer of Certain Real Property for Wildlife or other purposes; and Public Law 101-519 Sec. 126, 104 Stat. 2247, dated November 5, 1990.

REFUGE PURPOSES:

1. "...as a wildlife experiment and research refuge" – Executive Order 7514, dated December 16, 1936
2. "…recreation, conservation, wildlife preservation, and related scientific and educational activities" – Executive Order 11724, dated June 27, 1973
3. "...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" – 16 U.S.C. 715d, dated February 18, 1929 (Migratory Bird Conservation Act)
4. "...to conserve fish, wildlife and plants, including those which are listed as endangered species or threatened species – 16 U.S.C. 1534, dated December 28, 1973 (Endangered Species Act)
5. "...particular value in carrying out the national migratory bird management program." – 16 U.S.C. 667b, dated May 19, 1948 (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes)
6. "...(b) The Secretary of the Interior shall administer the property transferred pursuant to subsection (a) consistent with wildlife conservation purposes and shall provide for the continued use of the property by Federal agencies to the extent such agencies are using it on the date of the enactment of this Act." – Public Law 101-519 Sec. 216, 104 Stat. 2247, dated November 5, 1990 (Defense Appropriation Act – including transfer of the North Tract from Fort Meade).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

"To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." 16 U.S.C. 668dd(a)(2) (National Wildlife Refuge System Improvement Act of 1997)

DESCRIPTION OF USES:

What are the uses? Are they priority public uses?
The uses are wildlife observation, photography, environmental education, and interpretation. Wildlife observation, photography, environmental education, and interpretation are priority public uses of the National Wildlife Refuge System (Refuge System) under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee), and the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57).

Where would the uses be conducted?
Wildlife observation, photography, environmental education, and interpretation will be allowed to occur on designated roads, trails, viewing areas, exploration areas, and visitor contact facilities throughout the refuge. The National Wildlife Visitor Center (NWVC) and education pavilion on the South Tract; the Visitor Contact Station, environmental education building, and wildlife observation tower on the North Tract; and the immediate surroundings of these facilities on both the North and South Tracts are primary areas for interpretation and education programs. However, trail areas and education sites along trails and a tram tour route are also used for education and interpretation as well as for wildlife observation, photography, nature art, and interpretation. A schoolyard habitat and nature exploration site on the South Tract provide and facilitate opportunities for these uses, as do the scout camp sites on the North Tract. The exact locations where wildlife observation, photography, and nature art would occur; or where particular educational workshops, interpretive programs, activities, or events would be allowed to occur, are at the discretion of the refuge manager.

In addition to the above, wildlife observation, photography, environmental education, and interpretation may also occur on the following trails on the North Tract: South Road (1.7 miles), Wild Turkey Way (3.6 miles), Sweetgum Lane (1.6 miles), Whip-poor-will Way (1.8 miles), Kingfisher Road (0.5 miles), Pine Trail (.75 miles), trail around Lake Allen (1.5 miles), trail around Rieve's Pond (.5 miles), Telegraph Road Trail (2.5 miles), Little Patuxent River Trail (.75 miles), Forest Habitats Nature Trail (2.5 miles), trail around Cattail Pond (.5 miles), New Marsh Trail (.75 miles), Vernal Pool Trail (1.25 miles) and Loop Trail (.3 miles). And on the South Tract: Goose Pond Trail (.2 miles), Cash Lake Trail (1.4 miles), Laurel Trail (.4 miles), Valley Trail (.6 miles), Telegraph Road Trail (~2.5 miles), Wildlife Viewing Area Trail (2.5 miles), and Fire Road Trail (.9 miles).

The North Tract's Wildlife Loop (8 miles) and NWVC entrance and exit road (2 miles) are available for automobile-based wildlife observation.

When would the uses be conducted?
Wildlife observation, photography, environmental education, and interpretation will be allowed on the refuge daily, year-round, unless a conflict with a management activity or an extenuating circumstance necessitates deviating from these procedures. Closures for Federal holidays, snow and ice storms, or other events affecting human safety; or for nesting season and other sensitive times of the year, are examples that would require these uses to be temporarily suspended. Most educational and interpretive programs and opportunities to view and photograph wildlife occur during normal operating hours. However, early morning and evening programs and opportunities would be facilitated to support these activities. Closures related to the hunt season do occur and

are tailored to eliminate multiple user conflict.

How would the uses be conducted?
Wildlife observation, photography, and environmental education and interpretation will be facilitated by the strategies found in the Comprehensive Conservation Plan (CCP) for Patuxent Refuge.

Environmental education and interpretation will be conducted by way of personal presentations by staff and volunteers, teachers, and other youth leaders, and at special events and displays both on and off the refuge. Educational and interpretive information will also be provided via signage and printed information, exhibits, and audiovisual presentations. Wildlife observation and photography are typically self-conducted, but may be facilitated through the availability of trails, viewing areas, a self-guided auto tour route, and informational materials. Wildlife observation programs such as bird walks, night hikes, and owl prowls are frequently given. Binoculars and viewing scopes are provided in designated areas and binoculars are available for loan in educational "packs" that families or individuals may borrow. The refuge also periodically sponsors educational classes in nature photography and promotes photography and art through regular wildlife photography and art exhibits at the NWVC. Automobile-based wildlife observation would be conducted primarily on the North Tract's Wildlife Loop Trail, which is approximately 8 miles of road specifically designed to support wildlife-dependent recreation such as wildlife observation and photography. We also provide virtual or no-impact geocaching opportunities. Virtual geocaching provides coordinates to areas where impacts will not affect wildlife or habitats, such as the NWVC or Schoolyard Habitat. Visitors may be guided to a particular exhibit or area of the Schoolyard Habitat where they have the opportunity to view wildlife or learn about habitat management. Guidance on rules and regulations are provided online, in refuge literature, and through social media.

A new observation tower on the North Tract overlooking the Wildlife Viewing Area would support wildlife observation and photography. The current observation tower, an old shooting range tower, provides poor observation opportunities due to its location.

A new nature exploration area on the South Tract, just off of the Cash Lake and Goose Pond Trail heads, would provide new wildlife observation and photography opportunities, as well as support interpretive activities. The nature exploration area will seek to facilitate unstructured "free play" and instill a sense of wonder for natural resources in young and old alike.

In addition to strategies listed in the CCP, refuge staff perform the following:

- On-site evaluations to resolve public use issues
- Monitoring and evaluating impacts
- Maintaining boundaries and signs
- Meeting with interested public
- Recruiting volunteers
- Preparing and presenting interpretive and educational programs
- Maintaining trails and viewing areas
- Revising leaflets and developing new information materials
- Installing and updating kiosks

- Developing needed signage
- Organizing and conducting refuge events
- Conducting regularly scheduled public programs
- Displaying off-site exhibits at local events
- Developing relationships with media
- Providing law enforcement and responding immediately to public inquiries

Why are these uses being proposed?
Wildlife observation, wildlife photography, environmental education, and interpretation are priority public uses as defined by the National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57), and if compatible with the individual refuge purposes and the Refuge System mission, are to receive enhanced consideration over other general public uses.

These uses are conducted to provide compatible educational and recreational opportunities for visitors to enjoy the resource and to gain understanding and appreciation for fish and wildlife, ecology, and the relationships of plant and animal populations within various ecosystems, and to better understand wildlife management. These uses will provide opportunities for visitors to observe and learn about wildlife and refuge lands at their own pace in an unstructured environment and to observe wildlife habitats firsthand. These uses will also enhance the public's understanding of natural resource management and ecological concepts that will enable the public to better understand the problems facing our natural resources, to realize what effect the public has on natural resources, to learn about the Service's role in conservation, to better understand the biological facts upon which Service management programs are based, and to gain an appreciation as to why wildlife and wildlands are important. It is anticipated that participation in these uses will produce a more informed public, with an enhanced stewardship ethic and enhanced support and advocacy for the Service and for natural resources.

AVAILABILITY OF RESOURCES:
Sufficient refuge resources in terms of personnel and budget are available to administer wildlife observation, photography, environmental education, and interpretation.

Cost Breakdown
The following is the list of costs to the refuge required to administer and manage the refuge programs for wildlife observation and photography and environmental education and interpretation.

Identifier	Cost
Administration/management to facilitate activity, this includes staff/law enforcement	$220,000/yr
Maintenance of buildings, roadways, trails and parking areas	$220,000/yr
Supplies and support	$110,000/yr
Operating costs	$275,000/yr
Total Costs	**$825,000/yr**

After review of the refuge budget, there are sufficient funds to sustain this activity.

ANTICIPATED IMPACTS OF THE USES:

Wildlife observation, photography, environmental education, and interpretation can produce positive or negative impacts to the wildlife resource. A positive effect of public involvement in these priority public uses will be a better appreciation and more complete understanding of the wildlife, habitats, and issues associated with Mid-Atlantic ecosystems. This can translate into personal stewardship and more widespread and stronger support for the refuge, the Refuge System, and the U.S. Fish and Wildlife Service (Service).

The presence of people on refuge trails and roads can lead to displacement of animals from trails, although disturbance usually is a negligible influence on large mammal distributions and movements (Purdy et al. 1987, Boyle and Samson 1985). The effects on other forms of wildlife appear to be short-term with the exception of breeding bird communities. A study by Miller, Knight, and Miller (1998) indicates that species composition and nest predation was altered adjacent to trails in both forested and grassland habitats. It appears that species composition changes are due to the presence of humans and not the trail or roadway itself. On the other hand, nest predation does appear to be a function of the trail which allows access to mammalian nest predators (Miller, Knight, and Miller 1998). With respect to Patuxent Research Refuge, we anticipate that similar impacts will occur here as well, particularly in high visitor use areas. Negative influences may be amplified during breeding seasons, especially to ground nesting birds and amphibians that may be crossing trails. Disturbance to forest birds at Patuxent Research Refuge is complex and involves many factors. Important factors include the height and density of vegetation; topography; behavioral differences in species for ground nesting birds, low nesting birds, or foraging birds; and species response to human behaviors. Vegetation density and topography can obscure line of sight for birds. Some birds are more tolerant than others with respect to human proximity, while some birds are more apt to flee than others, (e.g., wood ducks).

Another example of potential harm to wildlife that is specific to Patuxent Research Refuge pertains to the box turtle. While it is difficult to interpret species response to human presence, we do know that human presence on roads and trails may lead to injury or death to turtles from vehicles, dog attacks, trampling, or being handled or removed by people.

With regard to amphibian populations at Patuxent Research Refuge, in early spring, particularly during rains, breeding amphibians are on the move from wintering ranges to breeding areas and may cross roads or trails. This increases the risk of injury or death from vehicles or trampling. However, amphibian movement usually occurs at night when visitor use is minimal to none. Direct impacts on wildlife in the form of disturbance can be expected wherever humans have access to an area, and the degree may vary depending on the habitat type. In general, human presence disturbs most wildlife, which typically results in a temporary displacement without long-term effects on individuals or populations. Some species, such as wood thrush, will avoid areas frequented by people, such as developed trails and buildings. Other species, particularly highly social species such as eastern tufted titmouse, Carolina chickadee, or Carolina wren, seem unaffected or even drawn to a human presence. When visitors approach too closely to nests, they may cause the adult bird to flush exposing the eggs to weather events or predators. Provided that

visitor use is confined to trails, disturbance during the breeding season will be limited to the trail area. The extent of this disturbance on either side of the trail also depends on visibility, determined by the density of vegetation through which the trail is laid. Various studies have shown that the edge effect related is variable and conservation design recommendations related to public use areas vary from 50 meters (164 feet) (Paton 1994) to about 90 meters (300 feet) (Robbins et al. 1989, Brittingham and Temple 1983, Jones et al. 2000). Since the trails do not occur in the highest quality habitat and visitors are confined to trails, we anticipate that impacts will be minimal.

The refuge will continue management strategies of educating trail and roadway users how of their activities affect wildlife and how to modify their use to minimize impacts on wildlife. Portions of trails and roadways are closed seasonally to reduce human disturbance to wintering and nesting waterfowl and, based on volunteer and staff observations, has proven effective.

The use of trails and gravel roads could lead to soil compaction, exposure of tree roots, and the modification of plant species 3 to 6 feet on either side of the trail which is a function of soil compaction, invasive species, and direct trampling of plants (Kuss 1986). The refuge will continue its management practices of the use of boardwalks, woodchips, erosion control, and user education to protect plant species and habitats along trails and roadways. Visitors are restricted to the public use trails, which are located on the North and South Tracts. Restricting visitors to these trails concentrates use to areas that can be routinely maintained to ensure a quality visitor use experience while also minimizing impacts to vegetation. The implementation of boardwalks and use of woodchips along trails has reduced impacts to vegetation and reduced soil erosion along trails. Potential conflict with priority public uses will be minimized by using trail head signs and other media to inform the various users about current public uses. Some trail and roadway use will be restricted during the refuge-specific hunting seasons, primarily during shotgun season.

People and vehicles can be vectors for invasive plants when seeds or other propagules are moved from one area to another. Once established, invasives can out-compete native plants, thereby altering habitats and indirectly impacting wildlife. The threat of invasive plant establishment will always be an issue requiring annual monitoring and, when necessary, treatment. Staff will work to eradicate invasives and educate the visiting public.

These uses will have no impacts to water quality, because individuals are limited to the trail system. The majority of the trails are set back from the water. In the instances where the trails are adjacent to water, pollutants and sediments are unlikely to be introduced to the waterbodies by individuals using the trails.

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning process for Patuxent Research Refuge, this compatibility determination will undergo extensive public review, including a comment period of 45 days following the release of the draft CCP/Environmental Assessment.

DETERMINATION (CHECK ONE BELOW):

____ Use is not compatible
_X_ Use is compatible with the following stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

Refuge staff and volunteers take several measures to minimize impacts to wildlife and habitats which include, but are not limited to:

- Provide seasonal closures (i.e., for safety purposes, wintering or nesting needs).
- Ensure that Central Tract, approximately 2,500 acres, is closed to public use.
- Restrict visitor use to public use trails and roadways.
- Provide information about proper etiquette and the effects of human impacts on habitat and wildlife resources in refuge publications, flyers, and routinely scheduled public programs.
- Maintain a regular law enforcement presence to ensure compliance with regulations and area closures, and discourage vandalism.
- Monitor public trails for signs of deterioration and disturbance to wildlife and habitat.

JUSTIFICATION:

Wildlife observation, photography, environmental education, and interpretation are priority wildlife-dependent uses for the Refuge System through which the public can develop an appreciation for fish and wildlife (Executive Order 12996, March 25, 1996, and the National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57)). These uses do not adversely impact the refuge's research purpose since large portions of the refuge are closed to the visiting public. The Central Tract portion of the refuge is set aside specifically to support research. At the scales and level of current visitor use, wildlife and habitats are not appreciably negatively affected by these uses, based on professional judgment and the consistently high biodiversity observed on the refuge. Therefore, no significant adverse effects from wildlife observation, photography, and environmental education or interpretation are anticipated.

The Service’s policy is to provide expanded opportunities for these uses when compatible and consistent with sound fish and wildlife management and ensure that they receive enhanced attention during planning and management. As listed in the purposes section of this compatibility determination, the refuge was established and subsequently land was acquired for a total of six purposes. Wildlife observation, photography, environmental education, and interpretation will not materially interfere with or detract from the research purpose of the refuge, because wildlife research does not generally occur in the vicinity of the locations that these uses occur and impacts will be minimal. These uses will not materially interfere with or detract from the two purposes related to wildlife conservation, because disturbance to wildlife will be short term and the trails that are used for these activities do not occur in core habitat areas. These uses will not materially interfere with or detract from the two purposes related to migratory bird conservation, because these uses are allowed in areas that are generally not in the vicinity of migratory waterfowl or land bird habitat. Finally, wildlife observation, photography, environmental education, and interpretation will not materially interfere with or detract from the

endangered species purpose, because there are no federally listed threatened or endangered species that occur on the refuge. These activities will not materially interfere with or detract from the mission of the Service, because providing these wildlife-dependent recreational opportunities is a focus of the Refuge System.

SIGNATURE:

REFUGE MANAGER: _____

(signature and date)

CONCURRENCE:

REGIONAL CHIEF: _____

(signature and date)

MANDATORY 15-YEAR REEVALUATION DATE: 2027

REFERENCES:

Brittingham, M.D. and A. Temple. 1983. Have cowbirds caused forest songbirds to decline? BioScience 33:31-35.

Jones, C., J. McCann, S. McConville. 2000. A guide to conservation of forest interior dwelling birds in the Chesapeake Bay critical area. Critical Area Commission for the Chesapeake and Atlantic Coastal Bays.

Kuss. F. 1986. A review of major factors influencing plant responses to recreation impacts. Environmental Management 10:638-665.

Miller, S.G., R.L. Knight, and C.K. Miller. 1998. Influence of recreational trails on breeding bird communities. Ecological Applications 8(1):162-169.

Paton, P.W.C. 1994. The effect of edge on avian nest success: how strong is the evidence? Conservation Biology 8(1):17-26.

Purdy, Goff, Decker, Pomerantz, Connelly. 1987. A guide to managing human activity on a national wildlife refuge. New York Cooperative Fish and Wildlife Research Unit.

Robbins, C.S., D.K. Dawson, and B.A. Dowell. 1989. Habitat area requirements of breeding forest birds of the Middle Atlantic States. Wildlife Monograph No. 103. Wildlife Society, Blacksburg, VA.

COMPATIBILITY DETERMINATION

USE:

Public Hunting

REFUGE NAME:

Patuxent Research Refuge

ESTABLISHING AND ACQUISITION AUTHORITIES:

Executive Order 7514, dated December 16, 1936; Executive Order 11724, dated June 27, 1973; 16 U.S.C. 715d, Migratory Bird Conservation Act of 1929; 16 U.S.C. 1534; 16 U.S.C. 667b, dated May 19, 1948 - An Act Authorizing the Transfer of Certain Real Property for Wildlife or other purposes; and Public Law 101-519 Sec. 126, 104 Stat. 2247, dated November 5, 1990.

REFUGE PURPOSES:

1. "...as a wildlife experiment and research refuge" – Executive Order 7514, dated December 16, 1936
2. "…recreation, conservation, wildlife preservation, and related scientific and educational activities" – Executive Order 11724, dated June 27, 1973
3. "...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" – 16 U.S.C. 715d, dated February 18, 1929 (Migratory Bird Conservation Act)
4. "...to conserve fish, wildlife and plants, including those which are listed as endangered species or threatened species – 16 U.S.C. 1534, dated December 28, 1973 (Endangered Species Act)
5. "...particular value in carrying out the national migratory bird management program." – 16 U.S.C. 667b, dated May 19, 1948 (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes)
6. "...(b) The Secretary of the Interior shall administer the property transferred pursuant to subsection (a) consistent with wildlife conservation purposes and shall provide for the continued use of the property by Federal agencies to the extent such agencies are using it on the date of the enactment of this Act." – Public Law 101-519 Sec. 216, 104 Stat. 2247, dated November 5, 1990 (Defense Appropriation Act – including transfer of the North Tract from Fort Meade).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

"To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." 16 U.S.C. 668dd(a)(2) (National Wildlife Refuge System Improvement Act of 1997)

DESCRIPTION OF USE:

Public hunting is one of the six wildlife-dependent public recreational uses identified for priority consideration under the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act). The Improvement Act defines wildlife-dependent recreational use as, "A use of a refuge involving hunting, fishing, wildlife observation and photography, and environmental education and interpretation." The Improvement Act states that, when compatible with the National Wildlife Refuge System (Refuge System) mission to protect wildlife habitat and the specific refuge purposes, the six wildlife-dependent recreational uses are appropriate and legitimate uses of the Refuge System and are the priority general public uses of the Refuge System.

What is the use? Is it a priority public use?
Public hunting is defined as the act or sport of pursuing game for harvest. Hunting is a priority public use of the Refuge System under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 6688dd-6688ee) and the Improvement Act. Hunting has occurred on a portion of the refuge since 1991.

Where would the use be conducted?
Patuxent Research Refuge has three large sub-units known as North Tract, Central Tract, and South Tract. Public hunting is allowed on all three tracts with certain restrictions. Designated hunting zones are available on all tracts (Attachment A – Hunting Control Maps).

When would the use be conducted?
Public hunting is conducted in accordance with the State of Maryland's big game, upland game, and migratory bird hunting seasons; and in accordance with Federal, State, and refuge-specific regulations (50 CFR 32.39). Hunting generally occurs from September through January. A lottery-style spring turkey hunt will be held mid-April through May. Special, out-of-season, deer shotgun and bow harvest authorization is obtained from the Maryland Department of Natural Resources annually for controlled hunts on the Central Tract to maintain deer populations at or below carrying capacity, to protect habitat, and wildlife health.

How would the use be conducted?
Public hunting is conducted in accordance with State and Federal regulations. Federal regulations contained in 50 CFR (Sub-chapter C, Parts 25-35) pertaining to the National Wildlife Refuge System Administration Act, as well as existing refuge-specific regulations, will apply. No change from the existing hunting program is proposed. The hunt program is operated through partnership with the Meade Natural Heritage Association (MNHA), a cooperating association. The refuge manager may, upon review of the hunting program, impose further restrictions on hunting activity, open or close certain seasons or areas, or amend the conduct of the hunt if hunting becomes inconsistent with other higher priority refuge programs or endangers refuge resources or public safety.

After completing the required weapon qualifications and purchasing a hunting permit from MNHA, hunters check-in at the Hunting Control Station (HCS) on the North Tract and select an open zone for hunting.

All harvested animals are checked through HCS and biological data is recorded. All hunters must check out through HCS when they are finished hunting for the day.

North Tract: Some hunting zones may be closed due to shooting range activity. Shotgun, muzzleloader, and bow seasons are allowed for deer hunting. Upland game (gray squirrel and eastern cottontail rabbit), migratory game bird (mourning dove, Canada goose, and ducks), and wild turkey seasons are only permitted on the North Tract. Open meadow, river, water impoundments, and hunting blinds are available for waterfowl hunters.

Central Tract: Deer hunting occurs in the refuge headquarters area and M-R areas. These hunts occur by lottery and are for shotgun and bow only during special, controlled harvest dates. Designated tree stand sites are mandatory for the refuge headquarters area lottery hunts. Deer hunting by bow is available on Schafer Farm during specified dates.

South Tract: Shotgun, muzzleloader, and bow deer seasons are allowed in designated zones during specified dates.

Why is the use being proposed?
Public hunting on the refuge accommodates one of the priority public uses of the Refuge System. Public hunting is used to manage wildlife populations for the protection of wildlife habitat and health and, in some instances, to protect habitat for research.

Hunting is critical to regulating and maintaining populations of deer at the carrying capacity of the habitat, thus reducing excessive damage to vegetation caused by over-browsing, maintaining understory habitat for other species, and maintaining habitat integrity for current and future wildlife related research.

Table C-1: Number of Hunter Visits Refugewide and Wildlife Harvested

	Hunter Visits	**Deer**	**Waterfowl**	**Migratory Bird**	**Small Game**
2010-2011	6,718	272	192	7	76
2011-2012	5,294	247	201	59	75

AVAILABILITY OF RESOURCES:
Public hunting occurs as a refuge-regulated hunting program full-time over a 5-month period, and requires significant staff time. Costs associated with administration of this use include:

Identifier	**Cost**
Administration/management to facilitate activity, this includes staff/law enforcement	$100,000/yr
Maintenance of buildings, roadways, trails, and parking areas; this includes operation of equipment	$93,500/yr
Supplies and support	$66,000/yr
Operating cost	$132,000/yr
Total Costs	**$391,500/yr**

Important to note: MNHA provides approximately 1,800 hours of volunteer time to manage hunting. We do not anticipate this volunteer base to stop or subside. MNHA permit fees help to fund the hiring of hunt control managers.

After review of the refuge budget, there are sufficient funds to sustain this activity.

ANTICIPATED IMPACTS OF THE USE:

Effects on Target Species Populations

The refuge hunt program will not impair local or regional populations of deer. The use of hunting for deer as a management tool prevents over-browsing of vegetation directly benefitting the health and quality of deer populations (in addition to other non-target species). In addition, the refuge check station document any indication of disease or possible signs of wildlife overpopulation (e.g., starvation).

The refuge hunt program will not impair local or regional populations of small game, migratory birds or waterfowl. For these target species, we follow Maryland State hunting seasons and bag limits that are set to allow for sustainable harvest of species.

Effects on Wildlife

Disturbance to non-hunted wildlife is minimized by controlling hunter density in each hunting zone to approximately one hunter per 20 acres of hunted habitat; thus, hunters are dispersed in low densities, which provides for hunting safety and a quality hunt program. Hunting units are rarely filled to capacity except during opening days of a new season. Disturbance to vegetation is minimized by not allowing permanent tree stands and restricting vehicle access to open roadways only. No all terrain vehicle (ATV) use is allowed, except for disabled hunters with appropriate documentation. Hunting areas are designed consistent with public safety but hunters have the potential to encounter unexploded ordnance (UXO); therefore, hunters must sign a UXO waiver before purchasing a hunting permit.

Direct impacts on wildlife in the form of disturbance can be expected wherever humans have access to an area, and the degree may vary depending on the habitat type. In general, human presence disturbs most wildlife, which typically results in a temporary displacement without long-term effects on individuals or populations. The responses of wildlife to human activities include avoidance or departure from the site (Owen 1973, Burger 1981, Kaiser and Fritzell 1984, Korschen et al. 1985, Kahl 1991, Klein 1993, Whittaker and Knight 1998), the use of sub-optimal habitat (Erwin 1980, Williams and Forbes 1980), altered behavior or habituation (Burger 1981, Korschen et al. 1985, Morton et al. 1989, Ward and Stehn 1989, Havera et al. 1992, Klein 1993, Whittaker and Knight 1998), attraction (Whittaker and Knight1998), and an increase in energy expenditure (Morton et al. 1989, Belanger and Bedard 1990). Some species, such as wood thrush, will avoid areas frequented by people, such as developed trails and buildings, while other species, particularly highly social species such as eastern tufted titmouse, Carolina chickadee, or Carolina wren, seem unaffected or even drawn to a human presence. When visitors approach too closely to nests, they may cause the adult bird to flush exposing the eggs to weather events or predators. Disturbance can have other effects including shifts in habitat use, abandonment of habitat, and increased energy demands on affected wildlife (Knight and Cole

1991). Because hunter use is not confined to trails, disturbance during the breeding season may occur to early ground-nesting birds (e.g., woodcock, ovenbird).

Disturbance to breeding birds attempting to establish and settle into nest territories, nest-building and incubating is more likely to result from off-trail visitor use, such as would occur for turkey hunting during the spring gobbler season, particularly for low-elevation or ground nesting birds. Overall, direct effects from hunting during the spring should be greatly reduced at Patuxent, because the use is fairly dispersed, confined to limited areas on tracts opened to public use, and large areas remain undisturbed. Direct effects to breeding landbirds from consumptive visitor activities are mitigated by observing time of year restrictions, limiting the frequency, duration and number of locations.

Due to its seasonal nature, public hunting may limit researchers' access to parts of the refuge during certain periods during the year (primarily during fall and winter). Generally white-tailed deer hunting has less impact in this regard than wild turkey hunting which takes place in the spring. However, a narrow window of opportunity is provided for turkey hunting to minimize any potential conflicts. The Central Tract portion of the refuge is set aside specifically to support research during throughout the year. At the scales and level of current hunting opportunities, wildlife may be temporarily disturbed but habitats and biodiversity may benefit over the long term. With the land acquisition from Fort Meade we continued public hunting for deer, migratory waterfowl, upland game birds, and small game on the North Tract (Obrecht, 1992). Before a hunting program for deer was implemented, browse-lines were clearly visible along woodland edges, and throughout the forest interior deer browse and other sign were readily noticeable from casual observations. One management concern is that ungulate populations generally overshoot the ultimate carrying capacity of the habitat before an equilibrium is reached (McCullough 1982). White-tailed deer are more prone to habitat alteration during this process than many other species due to their high reproductive potential (McCullough 1982, McCullough 1997), with substantial impact on the vegetation. Deer foraging habits and preferences can change plant composition and structure over time (Russell and Fowler 1999, Augustine and Jordan1998, Brown and Parker 1997, Van Deelen et al. 1996, Porter 1991) and such alterations have subsequent impacts on other wildlife, such as songbird species richness and abundance (DeCalesta 1994). This impact is magnified when other factors, such as mild weather, alternative food sources, and reduced annual mortality allow populations to quickly increase in numbers. This results in severe degradation of habitat which can easily be observed on many of the protected lands in the area as evidenced by the distinct browse lines and virtual lack of forest understory.

Effects on Vegetation

With respect to public deer hunts, both direct benefits impacts have been realized. On the benefits side, keeping the deer population in check has shown a positive response by vegetation in experimental exclosures (Augustine and Frelich 1998, McCullough 1982). Deer browse lines are visible along some forest edges on certain tracts of the refuge, particularly on the Central and South Tracts where hunting is more limited than on the North Tract. Signs of deer such as browse, rubbings, trails, droppings, rooting through leaf litter, and tracks are visible throughout the refuge and very few locations contain the woodland wildflowers that one would expect in the area including columbine, trillium, bloodroot, and spring beauty. In this situation, no hunting or

no-culling of deer would have lasting effect on sensitive vegetation and may set back resiliency for many years depending on the 'shelf life' of seeds in the seed bank and in the long run would have potential negative impacts on the songbird community (Allombert et al 2005).

The intensity of grazing by deer on woody browse in forest fragments is inversely proportionate to the availability of field forbs (Augustine and Jordan 1998). Pastures and old fields are vulnerable to overgrazing when deer densities are high because they contain more abundant and higher quality forage, especially in spring and summer (Johnson et al.1995). Cumulative effects of grazing over successive years may result in reduced plant reproduction and growth (Augustine and Frelich 1998) and height (Anderson 1994), which places sensitive plants at risk of extirpation (Augustine and Frelich 1998). Also, species richness and abundance of shrubs and herbaceous vegetation was shown to decline when deer densities reach between 4 to 8 deer/km^2 (deCalesta and Stout 1997). Browse damage takes years to recover and often, by the time it is noticed, it is past the time when deer population reduction should have been initiated. Regeneration may be further retarded by the invasion of exotic species and where there is mature forest with a predominantly closed canopy.

In the more mature forests of the refuge, shade tolerant species such as American holly, American beech, paw paw, spicebush, mountain laurel, witch hazel, hornbeam, box elder, rhododendron, high-bush blueberry, dogwood, and in sunnier areas, cedar, form a noticeable mid- and under-story beneath the canopy. This feature is highly desirable from a management perspective, as it provides structural and species diversity in vegetation and provides greater food and cover resources for migratory and residential birds and other wildlife. Also of concern to refuge management is the continued recruitment of large, upper story tree species, such as oak, ash, cherry, maple, beech, or pines, upon which we rely to provide nest and roost sites for migratory and resident landbirds, food sources for native insects, roost and forage for forest bats, and the recruitment of desirable forbs and grasses for grassland restoration.

Hunter trampling of vegetation is undetectable due to the high acreage to hunter ratio, limited number of hunt days, sparsity of understory vegetation, and time of year (dormant season). Plant species vary in their resistance to trampling, leading to changes in plant communities. In general, plant diversity has been shown to increase with slight use and to decrease as use intensifies (Liddle 1997). Plant recovery in the Mid-Atlantic Coastal Plain is relatively rapid compared to wilderness areas located in alpine, arctic, and desert ecosystems where abiotic factors limit plant growth. Plant recovery from trampling damage in these areas can take many years and may never occur (Newsome et al. 2002). Because deer are everywhere all the time and hunters are present on a limited number of days and only during the dormant season, deer impacts to vegetation far outweigh trampling of vegetation by deer hunters.

Spring turkey hunts are more likely to directly impact native vegetation, depending on the time of year, length of season, number of hunters, and extent of hunt locations. Spring turkey season is also when spring ephemerals are in bloom and are most vulnerable to trampling. However, given the scope of hunting locations, this has not proven to be a problem.

Waterfowl hunts may pose direct impacts on vegetation from foot traffic and use of dogs for retrieval. Portions of, or whole plants, can be torn, sometimes by the roots. Accidental

introduction of invasive plants, pathogens, or exotic invertebrates could be a direct adverse impact. Given the range and varying degrees of invasive species found on the refuge, it is hard to determine what uses most contribute to invasive species populations. Inventory and monitoring aid in controlling levels of invasive species spread. However, uncontrolled growth of resident Canada geese may potentially have a greater impact on vegetation. This may be an even greater concern where the refuge desires to manage habitat for breeding grassland birds. In this case, hunting opportunities for Canada geese aid in curbing these impacts.

Effects on Soils

Recreation impacts to soils from trampling indirectly affects vegetation by loosening the soil's surface layers and compacting the underlying layers. Coupled with a loss of plant cover, this leads to increased soil erosion (Hammitt 1986). Trampling also decreases the abundance and diversity of soil organisms such as microbes, earthworms, arthropods, snails, and slugs, which often play a major role in nutrient cycling (Liddle 1997). However, damage to soil and subsequent impacts to vegetation have been undetectable on the refuge. This is likely due to the high acreage to hunter ratio and the fact that hunters, when going off-trail, tend to follow existing deer trails. There is more trampling of vegetation in the forests and fields of the refuge by deer than by hunters, as evidenced by the many deer paths.

Effects on Water Quality

We do not anticipate negative impacts to water quality as a result of public hunting.

Effects on Other Wildlife-dependent, Recreational Uses

Other wildlife-dependent, priority public uses are restricted during the 5-month public hunting season. In order to minimize conflict between hunters and other user groups, the refuge has subdivided Area Y on North Tract to clearly show hunted areas versus a publicly-accessible trail. The refuge also has two trails in the Wildlife Viewing Area, which is closed to hunting, for other priority, wildlife-dependent public uses to be administered in conjunction with hunting. With the exception of shotgun season, all other trails will remain open to other users during the hunting season.

The following information relates to site-specific hunting and potential impacts.

North Tract

Public hunting had occurred on the 8,100-acre North Tract for over 30 years prior to its transfer to the refuge in 1991. Department of Defense firing range activity is restricted during the hunting seasons. The ranges close on Fridays and Saturdays during deer bow season, waterfowl and other small game seasons, and during the entire two-week shotgun deer season. This helps maximize the deer harvest.

Central Tract

Deer hunting has occurred on the Central Tract since 1998 in a very controlled fashion. Refuge headquarters and U.S. Geological Survey's Patuxent Wildlife Research Center (PWRC) are located on Central Tract. The PWRC's laboratories, research facilities, and captive populations of migratory birds (including the endangered whooping crane) demand that hunter disturbance from access and noise be strictly minimized.

1. Refuge headquarters and M-R Areas. These deer hunts are by lottery only. Headquarters hunts are controlled deer harvests whereby hunters are assigned a tree to hunt from; a zone of fire is marked on the ground with arrowed stakes. Numbered tree stand locations are randomly assigned to shotgun and bow hunters. In addition, shotgun deer hunters are allowed to enter a more remote area within the M-R Area, north of the Patuxent River, where hunters may pick their own tree stand locations.
2. Schafer Farm. Bow deer hunting only is allowed adjacent to the Whooping Crane Propagation facility to minimize noise disturbance to the birds. A safety zone is well marked to keep hunters away from crane pens.

Negative impacts related to hunting are minimal. On Central Tract, due to the highly controlled nature of the hunt program, no research programs have been compromised. Some trash has been found around tree stand locations. Overall, success has been high with a significant reduction in deer populations in the refuge headquarters area. The deer population has gone from over three times the carrying capacity to below carrying capacity, with a concurrent recovery of over-browsed habitat and a preservation of the research mission. Deer populations in and around the Schafer Farm continue to remain over carrying capacity due to abundant sanctuary for deer to avoid hunters near the crane pens.

South Tract

As with all hunting zones on the refuge, those at South Tract were carefully selected and marked to keep hunters at a safe distance from the office buildings and residences near Gate 4, and to separate hunters from public use activities around the National Wildlife Visitor Center (NWVC). Existing roadways are used as landmarks. One hunting unit, near the interpretive tram tour route, is opened after tram tours are closed for the season. Designated hunter parking areas are clearly identified. Safety zones are marked with either orange fiberglass posts or flagging, to alert hunters to the nearby presence of structures or roadways. Public hunting impacts on the South Tract have been minimal since deer hunting was initiated in that area in 1997, with an additional area added in 2003. There have been a few cases of lost, or out-of-bounds hunters, but public safety has never been compromised. Deer populations continue to remain above carrying capacity in some areas on the South Tract because deer have abundant sanctuary to avoid hunting pressure near the NWVC building and in the forest between the entrance and exit roads of the NWVC. The overpopulation of deer in this area has put high deer-browse pressure on native vegetation plantings (Pepco Exhibit, Bayscapes, and Schoolyard Habitat) in the vicinity of the NWVC. Implementing hunting on the South Tract was established where feasible to help address the overpopulation of deer.

Additional information about impacts from hunting programs at Patuxent Research Refuge can be found in the draft Comprehensive Conservation Plan and Environmental Assessment (CCP/EA).

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning process for Patuxent Research Refuge, this compatibility determination will undergo extensive public review, including a comment period of 45 days following the release of the draft CCP/EA.

DETERMINATION (CHECK ONE BELOW):

____ Use is not compatible
_X_ Use is compatible with the following stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

The public hunting program will be managed in accordance with Federal and State regulations. The program will be reviewed annually to ensure that wildlife and habitat management goals are achieved and that the program is providing a safe, high-quality hunting experience for participants. Stipulations are based on the refuge's hunting management plan and the refuge-specific regulations published in Title 50, Code of Federal Regulations (50 CFR 32.39).

We publish the Refuge Hunting Regulations, which include the daily and yearly bag limits and hunting dates for the North, Central, and South Tracts prior to the hunting season. We give hunters a copy of the regulations with the fee permit, and we require the hunters to know the specific hunt seasons and regulations. All hunters are encouraged to carry a flashlight, and a whistle, and compass or a GPS while hunting all areas.

A. Migratory Game Bird Hunting. We allow hunting of goose, duck, and dove on the North Tract in accordance with State regulations subject to the following conditions:

1. We require a hunting permit issued through MNHA at the refuge HCS. MNHA charges a fee for each permit. This fee supports MNHA operational needs.
2. We publish the Refuge Hunting Regulations, which includes the daily and yearly bag limits and hunting dates, in late summer. We provide hunters with a copy of the regulations with a fee permit, and we require hunters to know the specific hunt seasons and regulations. Hunters may only possess approved nontoxic shot while in the field.
3. We require hunters age 17 or younger to have a parent or guardian cosign to receive a hunting permit.
4. We require hunters age 17 or younger to be accompanied in the field by an adult possessing a refuge hunting permit, age 21 or older.
5. Hunters must check-in and out at the HCS and exchange hunting permit for a daily hunting vehicle pass at every entry/exit of the refuge. This includes breakfast, lunch, dinner, and any other breaks where the designated hunt area is left.
6. Hunters must use designated and maintained roads for vehicular traffic.
7. Hunters must park within the selected area specified and not block traffic or gates.
8. Hunters are restricted to the selected area and activity until check-out at the HCS.
9. Hunting is prohibited on or across any road (paved, gravel, dirt, opened, or closed), within 50 yards (45 meters) of a road (paved, gravel, dirt, opened or closed), within 150 yards (135 meters) of any building or shed, and within 25 yards (22.5 meters) from any designated “No Hunting” and “Safety Zone” areas. Loaded weapons are prohibited in the above, except:

i. Hunters may hunt from the road, 50 yards (135 meters) beyond the gate at Blue Heron Pond;

ii. Hunters may hunt from the road, 50 yards (135 meters) beyond the barricade at Wood Duck Pond;

iii. Hunters may hunt waterfowl (goose and duck) from any refuge-permanent photo and hunt blind;

iv. Hunters may hunt from the roadside, at designated areas, if they possess a Maryland State "Hunt from a Vehicle Permit;" and

v. Hunters may hunt from the roadside for waterfowl in the designated posted portion of Wildlife Loop at Bailey Marsh.

10. Hunters must wear fluorescent orange in accordance with State regulations subject to the additional following conditions:

    i. The hunter's solid-colored, fluorescent hunter-orange must be visible 360 degrees while carrying-in and carrying-out equipment (e.g., portable blinds).

    ii. "Jump shooters" must wear at least a solid-colored, fluorescent hunter-orange hat or cap while hunting. If hunters stop and stand, it may be removed.

11. The refuge allows the taking of only Canada goose during the Canada goose early resident season and late Canada goose migratory Atlantic population season.

12. The refuge prohibits hunting of goose, duck, and dove during the early deer muzzleloader seasons that occur in October, and all deer firearms seasons including the youth firearms deer hunts.

13. The refuge requires waterfowl hunters to use retrieving dogs while hunting duck and goose within 50 yards (45 meters) of the following impounded waters: Blue Heron Pond, Lake Allen, New Marsh, and Wood Duck Pond.

    i. The refuge requires dogs to be under the immediate control of their owner at all times.

    ii. Law enforcement officers may seize or dispatch dogs running loose or unattended.

B. Upland Game Hunting. The refuge allows hunting of gray squirrel, Eastern cottontail rabbit, and wild turkey on the North Tract. All hunting is in accordance with State and Federal regulations subject to the following conditions:

1. Conditions A1 through A10i apply.
2. Hunters may only possess approved nontoxic shot while in the field.
3. The refuge prohibits hunting of upland game during the deer muzzleloader and firearms seasons, including the youth firearms deer hunts.
4. The refuge prohibits the use of dogs to hunt upland game.
5. Spring turkey hunters are exempt from wearing the hunter orange.
6. The refuge allows the use of a bow and arrow for turkey hunting.

7. The refuge requires turkey hunters to use #4, #5, or #6 nontoxic shot or vertical bows.
8. The refuge selects turkey hunters by a computerized lottery for youth, disabled, and general public hunts. The refuge requires documentation for disabled hunters.
9. The refuge requires turkey hunters to show proof they have attended a turkey clinic sponsored by the National Wild Turkey Federation.
10. The refuge requires turkey hunters to pattern their weapons prior to hunting.

C. Big Game Hunting. The refuge requires hunters to pass a proficiency test with each weapon they desire to use prior to hunting deer. The refuge allows hunting of white-tailed deer in accordance with state and federal regulations subject to the following conditions:

1. Conditions A1 through A10i apply.
2. Hunters must pass an annual proficiency test with each weapon to be used prior to receiving a hunt permit.
3. The refuge only allows the use of a shotgun, muzzleloader, or bow and arrow according to Refuge Hunting Regulations.
    i. The refuge require muzzleloaders to be .40 caliber or larger with not less than 60 grains of black powder or a black powder equivalent.
    ii. The refuge prohibits the discharging of weapons after legal shooting hours, including the unloading of muzzleloaders.
4. The refuge requires (when transporting or storing) longbows and recurve bows to be unstrung and compound and crossbows must be locked in such a way to render them inoperable or cased, with no arrows nocked.
5. The refuge prohibits possession or use of buckshot.
6. All bucks harvested must have a 15-inch (37.5-centimeter) minimum outside antler spread.
7. All deer harvested will have a jaw extracted at the HCS before leaving the refuge.
8. Hunters must use portable tree stands that are at least 10 feet (3 meters) off the ground and equipped with a full-body safety harness while hunting at Schafer Farm, Central Tract, and South Tract. Hunters must wear the full-body safety harness while in the tree stand. The refuge will make limited accommodations for disabled hunters for Central Tract lottery hunts.
9. The refuge allows the use of ground blinds on North Tract only.
10. The refuge prohibits the use of dogs to hunt or track wounded deer.
11. Hunters must gain consent from a refuge law enforcement officer to track wounded deer beyond 1 and ½ hours after legal sunset. The refuge prohibits tracking 2 and ½ hours after legal sunset. Hunters must make a reasonable effort to retrieve wounded deer. This may include next-day tracking except Sundays and Federal holidays.

12. The refuge prohibits deer drives or anyone taking part in any deer drive. The refuge defines a "deer drive" as an organized or planned effort to pursue, drive, chase or otherwise frighten or cause deer to move in any direction.
13. The refuge allows shotgun, muzzleloader, and bow hunting on the North Tract, in accordance with the following regulations: Conditions C1 through C12 apply.
14. The refuge allows shotgun and bow hunting on the Central Tract, in accordance with the following regulations:
    i. Conditions C1 through C13 apply except C3.
    ii. The refuge selects Central Tract shotgun and bow hunters by a computerized lottery. The refuge assigns a specific hunting location.
    iii. Schafer Farm Hunt: The refuge only allows bow hunting in accordance with the following regulations: Conditions C1, C2, and C4 through C13.
15. The refuge allows shotgun, muzzleloader, and bow hunting on the South Tract, in accordance with the following regulations:
    i. Conditions C1 through C13 apply.
    ii. Hunters must access South Tract hunting areas A, B, and C off Springfield Road via the Old Beltsville Airport; and South Tract hunting area D via MD Rt. 197 through Gate 4. Hunters must park in designated parking areas.
    iii. The refuge prohibits driving or parking along the entrance or exit roads, to and from the NWVC, and parking in the visitor center parking lot when checked-in to any hunt area.

JUSTIFICATION:

Since the land transfer of the North Tract to the U.S. Fish and Wildlife Service (Service) in 1991, public hunting has become a wildlife-dependent priority public recreational use that is consistent with the purposes for which the refuge was established, the Service policy on hunting, the Improvement Act, and the broad management objectives of the Refuge System. The former 7,600-acre Fort Meade tract has had a successful history of public hunting for 30 years. At the time of transfer, hunting was continued as a public use that the military had previously allowed for the general public.

The Service's policy is to provide expanded opportunities for recreational, public hunting when it is compatible with the Refuge System mission and specific refuge purposes, and consistent with sound wildlife management and public safety. We ensure that this use receives enhanced attention during planning and management. As listed in the purposes section of this compatibility determination, the refuge was established and subsequently land was acquired for a total of six purposes. Hunting will not materially interfere with or detract from the research purpose of the refuge, because wildlife research can occur throughout the year, while hunting is limited to hunting seasons. In addition, there are certain days of the week and areas of the refuge that are not open to hunting where research can occur. These uses will not materially interfere with or detract from the two purposes related to wildlife conservation, because hunting seasons reduce deer populations to levels that reduce the intensity of grazing which provides improved wildlife

habitat, a healthier deer population, and increased plant diversity. The other target species also are hunted at levels to protect their regional populations. Also, this use will occur on only a portion of the refuge, which will afford some habitat that is not impacted at all. Hunting will not materially interfere with or detract from the two purposes related to migratory bird conservation, because bag limits and seasons for waterfowl hunting are set at a flyway scale such that these limits will not impact regional populations. In addition, deer hunting will reduce the deer herd which will improve forest interior habitat for migratory landbirds. This use will not materially interfere with or detract from the endangered species purpose, because there are no federally listed threatened or endangered species that occur on the refuge. Hunting will not materially interfere with or detract from the mission of the Service, because providing hunting opportunities is a focus of the Refuge System.

SIGNATURE:

REFUGE MANAGER: _____

(signature and date)

CONCURRENCE:

REGIONAL CHIEF: _____

(signature and date)

MANDATORY 15-YEAR REEVALUATION DATE: 2027

REFERENCES:

Allombert, S., A.J. Gaston, and J.L. Martin. 2005. A natural experiment on the impact of overabundant deer on songbird populations. Biological Conservation 126(1):1-13.

Augustine, D.J. and L.E. Frelich. 1998. Effects of white-tailed deer on populations of understory forb in fragmented deciduous forests. Conservation Biology 12(5): 995-1004.

Belanger, L., and J. Bedard. 1990. Energetic cost of man-induced disturbance to staging snow geese. Journal of Wildlife Management 54:36.

Burger, J. 1981. Effect of human activity on birds at a coastal bay. Biological Conservation 21:231-241.

Erwin, R.M. 1980. Breeding habitat use by colonially nesting waterbirds in two Mid-Atlantic U.S. regions under different regimes of human disturbance. Biological Conservation 18:39-51.

Hammitt, W.E. 1986. Resource impacts of recreation on wilderness. In: Wilderness and Natural Areas in the Eastern United States: A Management Challenge (Kulhavy, D.L., R.N. Conner, eds.), pp. 253-258. Stephen F. Austin State University, School of Forestry, Center for Applied Studies, Nacogdoches, TX.

Havera et al. 1992. Hunting Control Maps—North Tract, Central Tract Headquarters, Area M-R, Schafer Farm, and South Tract.

Kahl, R. 1991. Boating disturbance of canvasbacks during migration at Lake Poygan, Wisconsin. Wildlife Society Bulletin 19:242-248.

Kaiser, M.S., and E.K. Fritzell. 1984. Effects of river recreationists on green-backed heron behavior. Journal of Wildlife Management 48:561-567.

Klein, M.L. 1993. Waterbird behavioral responses to human disturbance. Wildlife Society Bulletin 21:31-39.

Knight, R.L. and D.N. Cole. 1991. Effects of recreational activity on wildlife in wildlands. Transactions of the 56th North American Wildlife and Natural Resources Conference pp. 238-247.

Korschen, C.E., L.S. George, and W.L. Green. 1985. Disturbance of diving ducks by boaters on a migrational staging area. Wildlife Society Bulletin 13:290-296.

Liddle, Michael. 1997. Recreation ecology: the ecological impact of outdoor recreation and ecotourism. London, United Kingdom: Chapman and Hall. 639 pp.

Morton, J.M., A.C. Fowler, and R.L. Kirkpatrick. 1989. Time and energy budgets of American black ducks in winter. Journal of Wildlife Management 53:401-410 (See also corrigendum in Journal of Wildlife Management 54:683).

National Wildlife Refuge Improvement Act 1997. Public Law 105-57-Oct. 9, 1997.

Newsome, D., S.A. Moore, R.K. Dowling. 2002. Environmental impacts. In: Natural area tourism: ecology, impacts and management (Newsome, D., S.A. Moore, R.K. Dowling, eds.), pp. 79-145. Channel View Publications, Clevedon, United Kingdom.

Owen, M. 1973. The management of grassland areas for wintering geese. Wildfowl. 24:123-130.

Obrecht, H.H. 1992. Hunting Management Plan/EA for Patuxent Wildlife Research Center.

Public Law 101-519, Section 126, 104 Stat. 2247

U.S. Fish and Wildlife Service. Hunting Regulations, Patuxent Research Refuge, North, Central, and South Tracts, 2011-2012 Season, 50 C.F.R. § 32.39.

Ward, D.H. and R.A. Stehn. 1989. Response of Brant and other geese to aircraft disturbance at Izembek Lagoon, Alaska. U.S. Fish and Wildlife Service, Alaska Fish and Wildlife Research Center. Final report to the Minerals Management Service. Anchorage, Alaska. 193 pp.

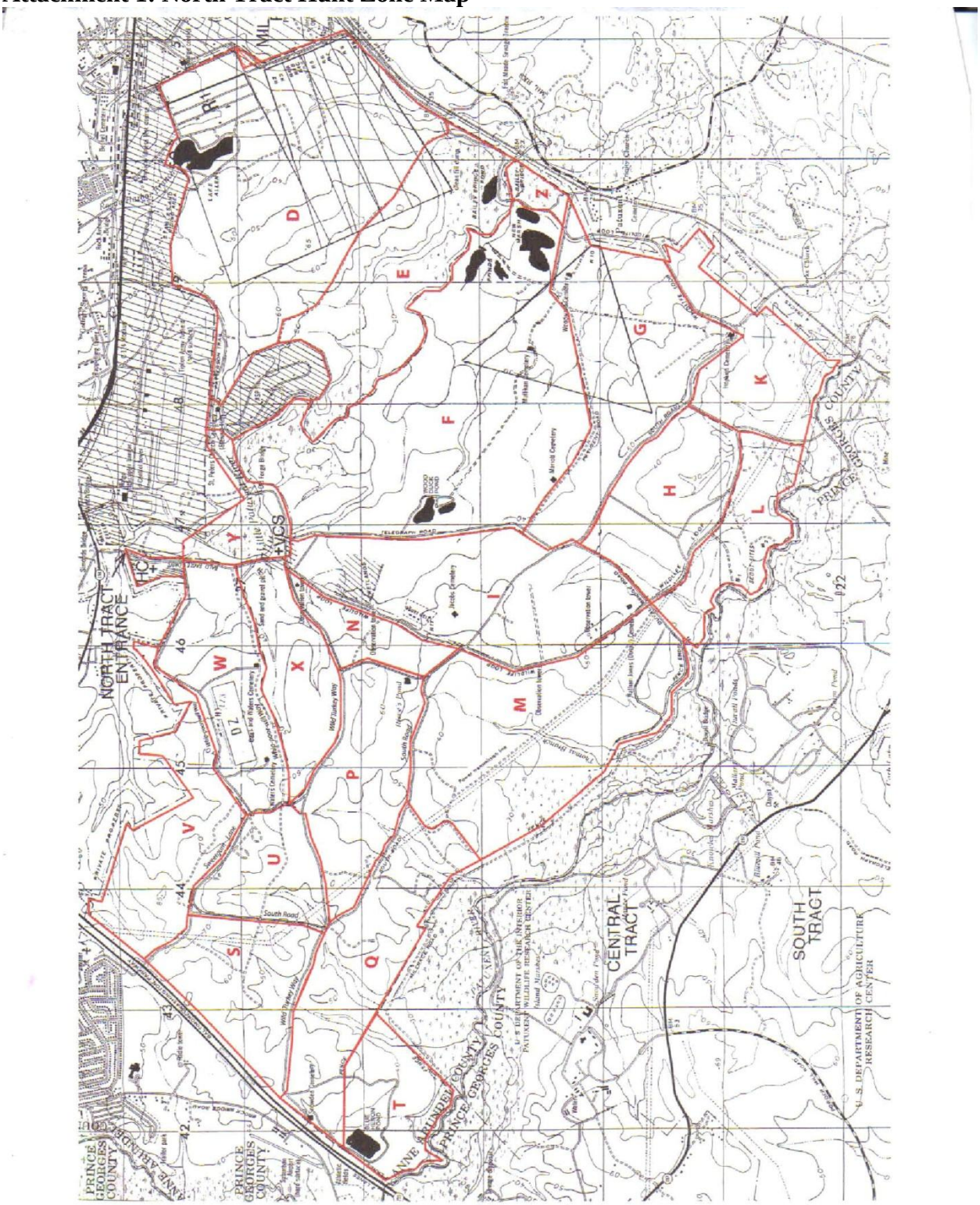
Whittaker, D., and R.L. Knight. 1998. Understanding wildlife responses to humans. Wildlife Society Bulletin 26:312–317.

Williams, G.J. and E. Forbes. 1980. The habitat and dietary preferences of dark-bellied Brant geese and widgeon in relation to agricultural management. Wildfowl 31:151-157.

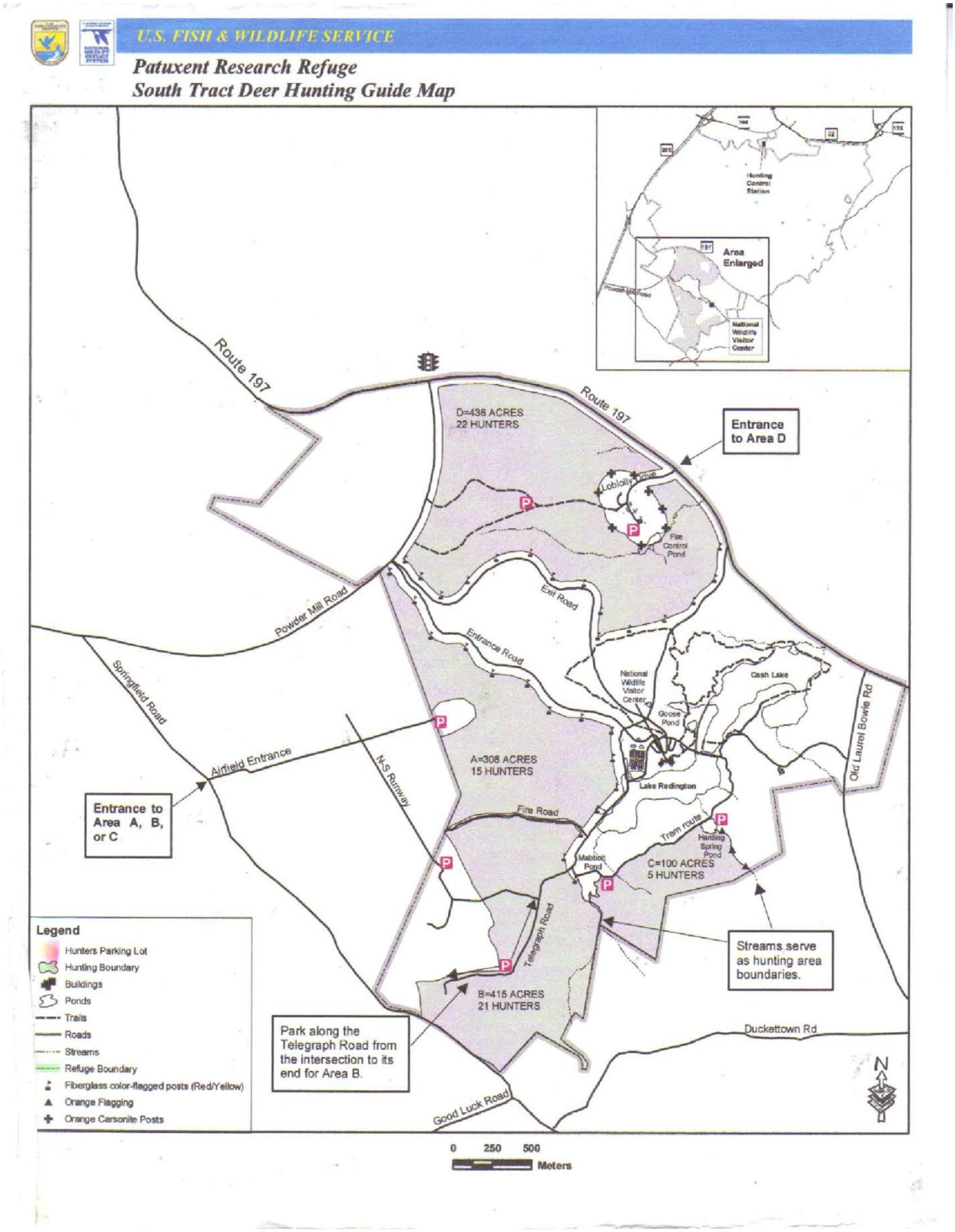
ATTACHMENTS:

Attachment 1: North Tract Hunt Zone Map
Attachment 2: South Tract Hunt Zone Map
Attachment 3: M-R and Schafer Farm Pond Hunt Map

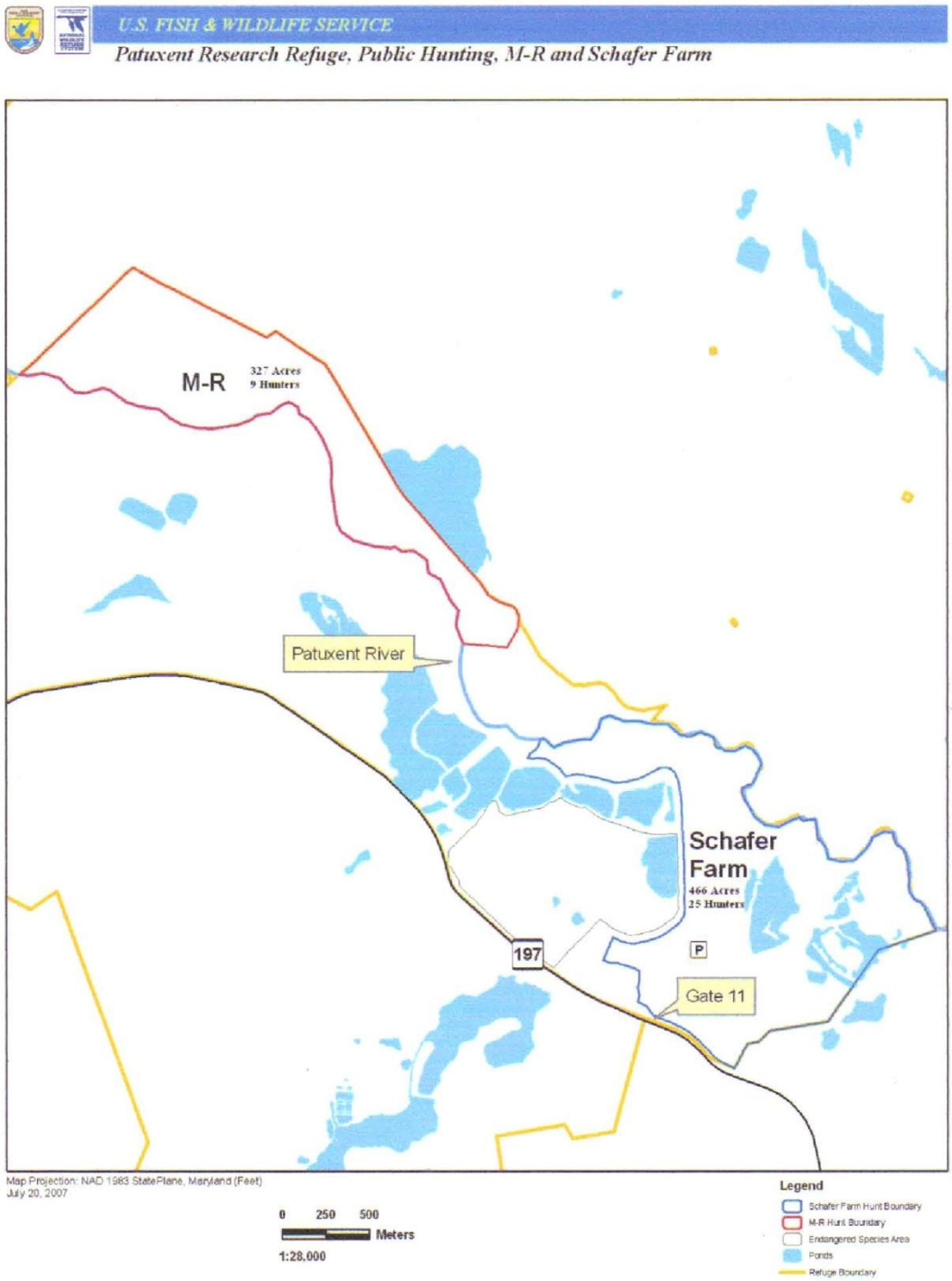
Attachment 1: North Tract Hunt Zone Map



Attachment 2: South Tract Hunt Zone Map



Attachment 3: M-R and Schafer Farm Pond Hunt Map



COMPATIBILITY DETERMINATION

USE:

Public Fishing

REFUGE NAME:

Patuxent Research Refuge

ESTABLISHING AND ACQUISITION AUTHORITIES:

Executive Order 7514, dated December 16, 1936; Executive Order 11724, dated June 27, 1973; 16 U.S.C. 715d, Migratory Bird Conservation Act of 1929; 16 U.S.C. 1534; 16 U.S.C. 667b, dated May 19, 1948 - An Act Authorizing the Transfer of Certain Real Property for Wildlife or other purposes; and Public Law 101-519 Sec. 126, 104 Stat. 2247, dated November 5, 1990.

REFUGE PURPOSES:

1. "...as a wildlife experiment and research refuge" – Executive Order 7514, dated December 16, 1936
2. "…recreation, conservation, wildlife preservation, and related scientific and educational activities" – Executive Order 11724, dated June 27, 1973
3. "...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" – 16 U.S.C. 715d, dated February 18, 1929 (Migratory Bird Conservation Act)
4. "...to conserve fish, wildlife and plants, including those which are listed as endangered species or threatened species – 16 U.S.C. 1534, dated December 28, 1973 (Endangered Species Act)
5. "...particular value in carrying out the national migratory bird management program." – 16 U.S.C. 667b, dated May 19, 1948 (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes)
6. "...(b) The Secretary of the Interior shall administer the property transferred pursuant to subsection (a) consistent with wildlife conservation purposes and shall provide for the continued use of the property by Federal agencies to the extent such agencies are using it on the date of the enactment of this Act." – Public Law 101-519 Sec. 216, 104 Stat. 2247, dated November 5, 1990 (Defense Appropriation Act – including transfer of the North Tract from Fort Meade).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

"To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." 16 U.S.C. 668dd(a)(2) (National Wildlife Refuge System Improvement Act of 1997)

DESCRIPTION OF USE:

What is the use? Is it a priority public use?
Public fishing is the act or sport of catching fish. Fishing is a priority public recreational use of the National Wildlife Refuge System (Refuge System) under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-688ee) and the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57) (Improvement Act). The Improvement Act defines wildlife-dependent recreation and wildlife-dependent recreational use as "a use of a refuge involving hunting, fishing, wildlife observation and photography, and environmental education and interpretation." Of the visitors sampled in the 2011 Visitor Survey, 10 percent of visitors participated in fishing in the last 12 months. In recent years, the refuge has recorded around 3,000 angler visits annually.

Supporting Uses: The use of boats (non-motorized or with electric motors 4 horsepower or less) is allowed only at Cash Lake to support fishing.

Where would the use be conducted?
Public fishing will occur at Patuxent Research Refuge in the following areas:

On the North Tract: New Marsh Pond (5 acres), Lake Allen (13 acres), Cattail Pond (1 acre), Rieve's Pond (3/4 acre), Blue Heron Pond (9.2 acres), Bailey Bridge walkway, and up- and downstream side of Little Patuxent River from Bailey's Bridge. Anglers wanting to partake in this activity on the North Tract must check in and out of the Visitor Contact Station according to the standard operating procedures for North Tract.

On the South Tract: Cash Lake (53 acres) is the only area designated for fishing. Access to Cash Lake will be through Gate 8 located off of Maryland Route 197 (South of Powder Mill Road Intersection-toward Bowie, Maryland).

When would the use be conducted?
On the North Tract, public fishing will be conducted year-round during normal operating hours and/or at other times or locations deemed appropriate by the refuge manager.

On the South Tract, public fishing is allowed on Cash Lake from mid-March through October.

On both the North and South Tract, bodies of water may be temporarily closed to support other priority public uses, wildlife management activities, refuge operational needs, health and safety concerns, and the refuge-specific hunting seasons.

How would the use be conducted?
Public fishing on the refuge will be managed in accordance to Maryland State Fishing Regulations and 50 CFR 32.39, with some additional refuge restrictions, to protect fish, wildlife, and habitat; and to reduce potential public use conflicts and the introduction of invasive species.

All anglers age 16 and older must have an annual refuge fishing and parking pass as well as a valid Maryland fishing license. Permittees under the age of 18 must have a parent or guardian co-sign their permit. Permittees will receive a free fishing and parking pass which must be

displayed in vehicle windshield at Cash Lake. A refuge fishing and parking pass covers the permittee and three youth (15 years old and younger).

Fishing methods include: hook, line, non-toxic sinkers, and tackle permitted by Maryland State law. Per refuge regulations, earthworms are the only live bait allowed, and artificial lures are preferred. Bloodworms and fish or other animals or parts thereof may not be used as bait. Fishing lines must be attended at all times. Wading, for fishing purposes, is permitted only on the stretch of the Little Patuxent River that is open to fishing.

The use of boats for fishing is permitted only at Cash Lake. State boating laws apply, including requirements for personal floatation devices. Only canoes and small car-top boats 14 feet and under are permitted (non-motorized and electric motors of 4 horsepower or less are permitted). Trailers are not permitted, except for handicapped access.

All individuals entering the North Tract property are required to check in and out at the Visitor Contact Station. Visitors will receive an Access Permit which will stipulate:

1. Purpose of their visit;
2. Area restrictions for that activity (due to range use or other public use activity restrictions); and
3. Waiver regarding unexploded ordnance.

Why is the use being proposed?
Public fishing on the refuge accommodates one of the priority public uses of the Refuge System. Public fishing on the South Tract (Cash Lake) was permitted in fiscal year 1991 through the *Federal Register* rulemaking process. The Improvement Act states that, when compatible, the six wildlife-dependent recreational uses are appropriate and legitimate uses of the Refuge System and are the priority general public uses of the Refuge System.

AVAILABILITY OF RESOURCES:

Facilities or materials needed to support fishing at Patuxent Research Refuge include a fully accessible fishing pier at Cash Lake, an accessible spillway and fishing platform at Lake Allen, a fishing walkway on Bailey Bridge, and other smaller impoundments. Refuge law enforcement officers will provide compliance checks.

Costs associated with public fishing are estimated below:

Identifier	Cost
Administration/management to facilitate activity, this includes staff/law enforcement	$58,080/yr
Maintenance of buildings, roadways, trails and parking areas, this includes operation of equipment	$55,000/yr
Supplies and support	$55,000/yr
Operating cost	$105,000/yr
Total Costs	**$273,080/yr**

After review of the refuge budget, there are sufficient funds to sustain this activity.

ANTICIPATED IMPACTS OF THE USE:

Refugewide surveys of fish populations have occurred through electromagnetic shocking and by gathering voluntary angler creel reports to provide some means of assessing fish populations. These surveys will continue to occur as needed. Based upon available documentation, these areas support predominantly bluegill, largemouth bass, catfish, black crappie, pickerel, golden shiner, chub, pumpkinseed, eel, suckers, and warmouth.

Major concerns of any refuge fishing program are accidental or deliberate introductions of non-native fish (used for bait); accidental introduction of invasive plants, pathogens, or exotic invertebrates attached to fishing boats: monofilament line entanglement of wildlife; contamination from lead-based fishing tackle; and over-harvesting. The refuge will continue to provide educational outreach and signage on this subject, and try to minimize impacts associated with nonnative species introductions, if they occur.

We have evaluated the risk of accidental introduction of invasive plants, pathogens, or exotic invertebrates attached to fishing boats. With the exception of a few isolated occurrences of purple loosestrife, refuge waters appear to be relatively free of invasive aquatic plants and mollusks. Periodic aquatic invasive species monitoring has occurred. Impacts of aquatic invasives can be mitigated by continuing invasive plant education and outreach, as well as by initiating an intensive aquatic invasive monitoring program.

Negative impacts to waterfowl and other wildlife from lost fishing gear may include ingestion of lead sinkers, hooks, lures, or litter; or entanglement in fishing line or hooks. Lost fishing tackle may harm waterfowl, eagles, and other birds externally by catching on, and tearing skin. Fishing line may also become wrapped around body parts and hinder movement (legs, wings), impair feeding (bill), or cause a constriction with subsequent reduction of blood flow and tissue damage. Entangled animals may become snagged by an object above or below the water surface, from which they are unable to escape. Birds may also ingest sinkers, hooks, floats, lures, and fishing line. Ingested tackle may be toxic or cause damage or penetration of the mouth or other parts of the digestive tract that may result in impaired functioning or death. There have not been any documented cases of this occurring on the refuge. However, Patuxent Research Refuge will continue to provide education and outreach on the hazards of fishing tackle. The refuge has also placed monofilament recycle bins at Cash Lake, New Marsh, Visitor Contact Station, National Wildlife Visitor Center, and Lake Allen to reduce the probability of wildlife coming in contact with lost fishing gear. Refuge officers assist with this public outreach effort.

Lead in the environment from fishing tackle and ammunition at very low levels of exposure can be toxic, depending on the species and the health and age of an individual. At toxic levels, lead damages the nervous system, causing paralysis and eventual death; at lower levels it is known to cause a variety of sub-lethal effects such as neurological damage, tissue and organ damage, and reproductive impairment.

Hazards of lead fishing sinkers to waterfowl became apparent in the 1970s, when lead was found to poison swans in the United Kingdom. Under certain environmental conditions (e.g., acidic or basic water or soil) lead from shot or tackle can be readily released and taken up by plants or

animals, causing a range of biochemical, physiological, and behavioral effects in some species of invertebrates, fish, amphibians, reptiles, birds, and mammals. Lead is adsorbed or incorporated into food items through the soil (The Wildlife Society 2009). Because of these concerns, use of lead tackle is prohibited on the refuge in the fishing regulations.

The refuge does not permit use of live bait, to prevent the likelihood of introductions of nonnative fish. Another common concern is the reduction or alteration of prey base important to fish-eating wildlife. Bass is the dominant predator species at the refuge and is catch and release only. Earthworms are the only live bait allowed. Artificial lures are preferred. The current fishing program of the refuge follows the state regulations and would adopt any state harvest limits that become applicable to the fish species. These limits are set to ensure that harvest levels do not cumulatively impact native fish resources to the point they are no longer self-sustainable. We also follow recommendations of Service biologists who conduct periodic sampling of refuge ponds. Illegal fishing resulting in over-harvest could also be a concern, but law enforcement presence will reduce this.

Fishing seasons in Maryland coincide, in part, with spring to early summer nesting and brood-rearing periods for many species of aquatic-dependent birds. Anglers may disturb resting and foraging birds by approaching too closely. Flushing may expose eggs to predation or cooling, resulting in egg mortality. The refuge will continue to seasonally close areas around sensitive sites to fishing. Public outreach and placement of warning signs will also be continued.

Depending on slope, bank and trail erosion from human activity (fishing piers, foot traffic) may increase aquatic sediment loads in ponds and lakes, or alter riparian or lakeshore habitat and vegetation in ways harmful to fish or other wildlife. Many of the areas that anglers access are flat, with a sandy or graveled substrate, with no significant topography change that would result in erosion. Boat access will be restricted to designated areas only. The boat launch area at Cash Lake is constructed of concrete pavers that support vehicle use and accommodate vegetation growth. This area is adjacent to a gravel parking lot that provides ample maneuvering space for vehicles to launch a boat without hampering vegetation or aquatic resources. Trails will be monitored and may be modified, restored, or closed, if conditions warrant. Because much of refuge fishing occurs from the shoreline, the refuge will monitor boardwalks and trails adjacent to ponds, lakes, and rivers in order to reduce trail erosion due to fishing-related foot traffic.

We have not observed negative impacts to water quality from human waste and litter. Public outreach and education on littering, proper waste disposal, and the prohibition of gasoline motors will lessen potential negative water quality impacts.

We have not observed nor do we anticipate impacts to terrestrial vegetation or mammals. Very minor disturbance to reptiles and amphibians could occur especially with regard to frogs that are temporarily displaced along the shoreline by anglers.

Soil compaction could occur in very small levels as anglers stand in one location or walk on established paths to access the shoreline.

There are some conflicts between range users and anglers in the form of times when Cash Lake is closed to fishing because of range operations. During those times, anglers are directed to the other refuge fishing areas. There have been no documented conflicts between anglers or between anglers and research uses. Based on interactions with staff and volunteers, anglers enjoy a high quality fishing experience. Increasing fishing hours and access may increase angler visitation, and improve angler experience. If other conflicts should arise, the refuge may need to place additional constraints on public uses to minimize conflicts. Management actions may include but are not limited to: education and outreach and separating user groups, spatially and temporally.

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning process for Patuxent Research Refuge, this compatibility determination will undergo extensive public review, including a comment period of 45 days following the release of the draft Comprehensive Conservation Plan/Environmental Assessment.

DETERMINATION (CHECK ONE BELOW):

____ Use is not compatible
_X_ Use is compatible with the following stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

- The fishing program will be reviewed annually to ensure that the program contributes to refuge objectives in managing the quality of the refuge fishing program and protecting habitats. This may include angler, fish, and habitat surveys.
- All anglers will be required to have a Maryland State Fishing License and a Patuxent Research Refuge fishing and parking pass. Anglers age 17 or younger must be accompanied in the field by an adult, age 21 or older, possessing fishing and parking passes. They will also be provided with a copy of refuge-specific regulations.
- Fishing from the shore will be closely monitored to prevent the disturbance of nesting waterfowl and erosion of the banks of ponds, lakes and rivers. Impacts will be monitored and, if warranted, action will be taken to lessen impacts, including seasonal or permanent closures.
- Waterfowl nesting and resting areas will be seasonally closed to all public use to reduce disturbance.
- Access trails and launches have been constructed and situated in a way that minimizes habitat and wildlife disturbance, as well as siltation effects, and provides for public safety. Impacts will be monitored and access areas will be closed, modified, restored, or moved if there is a problem.
- The refuge will cooperate with state fishery resource agencies in implementing angling regulations and management actions.
- Public outreach and education will be increased in order to minimize conflicts between user groups, help control aquatic invasive species, reduce fish introductions, and minimize disturbance to wildlife and habitat.

- Refuge law enforcement officer(s) will promote compliance with refuge regulations, monitor public use patterns and public safety, and document visitor interactions. Refuge law enforcement personnel will monitor all areas and enforce all applicable State and Federal Regulations. Staff and Service volunteers may also monitor the areas and will pick up litter and report any violations or suspect activity to refuge law enforcement personnel.
- All individuals entering the North Tract property are required to check in and out at the Visitor Contact Station. They will receive an Access Permit which will stipulate:
    1. Purpose of their visit;
    2. Area restrictions for that activity (due to range use or other public use activities restrictions); and
    3. Waiver regarding unexploded ordnance.

JUSTIFICATION:

Public fishing is one of the six priority public uses of the Refuge System and has been determined to be a compatible activity on many refuges nationwide. The Improvement Act instructs refuge managers to seek ways to accommodate these six activities. This use generally does not adversely impact the refuge's research purpose as fishing occurs on the North and South Tract in specified areas (six areas are open to fishing). The Central Tract portion of the refuge is set aside specifically to support research and public use is restricted.

At the scales and level of current angler use, wildlife and habitats are not appreciably negatively affected by this use, based on professional judgment and the consistently high biodiversity observed on the refuge. Seasonal closures of fishing areas, access restrictions, creel limits, and tackle and bait restrictions ensure reduced human impact on wildlife and habitat.

The U.S. Fish and Wildlife Service's policy is to provide expanded opportunities for fishing when compatible and consistent with sound fish and wildlife management and ensure that they receive enhanced attention during planning and management. As listed in the purposes section of this compatibility determination, the refuge was established and subsequently land was acquired for a total of six purposes. Fishing will not materially interfere with or detract from the research purpose of the refuge, because water based wildlife research can occur in areas not open to fishing. Fishing will not materially interfere with or detract from the two purposes related to wildlife conservation, because this use will occur along the shorelines of a limited number of areas that are not high priority habitat areas. In addition, as described above, fishing would have minimal impacts to wildlife resources. Fishing will not materially interfere with or detract from the two purposes related to migratory bird conservation, because fishing seasons are set to avoid waterfowl nesting seasons and high quality waterfowl habitat. This use will not materially interfere with or detract from the endangered species purpose, because there are no federally listed threatened or endangered species that occur on the refuge. Finally, fishing will not materially interfere with or detract from the mission of the U.S. Fish and Wildlife Service, because providing fishing opportunities is a focus of the Refuge System.

SIGNATURE:

REFUGE MANAGER: _____

(signature and date)

CONCURRENCE:

REGIONAL CHIEF: _____

(signature and date)

MANDATORY 15-YEAR REEVALUATION DATE: 2027

REFERENCES:

Code of Federal Regulations. Title 50. Wildlife and Fisheries (50 CFR 32.39)

Lake Umbagog National Wildlife Refuge. 2011. Public Fishing. Compatibility Determination. U.S. Fish and Wildlife Service.

Maryland Department of Natural Resources. 2012. Annual Non-tidal Freshwater Fishing Regulations. Accessed August 2012 at; *http://www.dnr.state.md.us/fisheries/regulations/table.asp?c=recreational&Region=Freshwater.*

North Tract Public Use Areas, Standard Operating Procedures North Tract

Patuxent Research Refuge Fishing Regulations. 2011. (Internal)

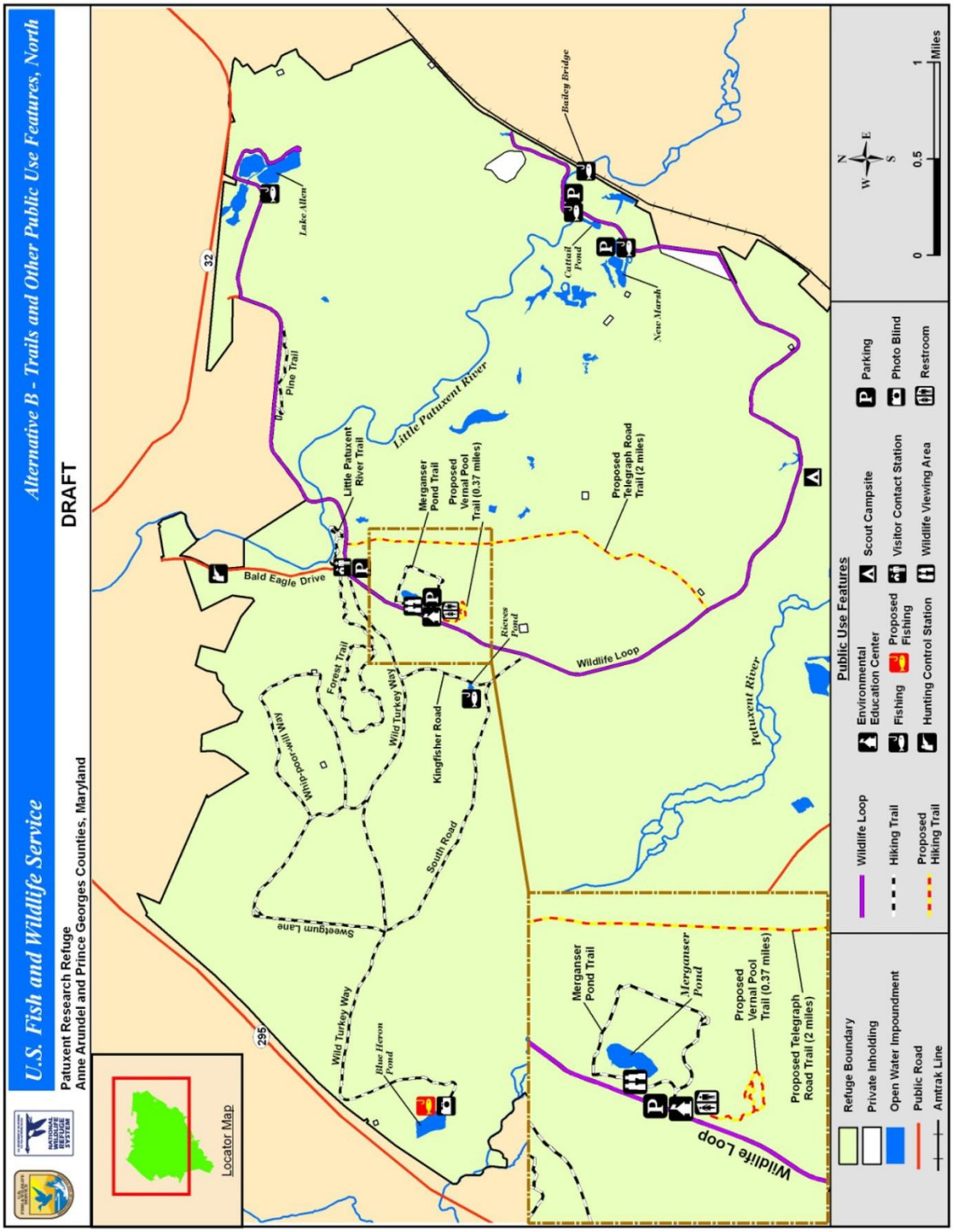
Public Law 101-519, 104 Stat. 2247

The Wildlife Society. 2009. Lead in Ammunition and Fishing Tackle. Position Statement.

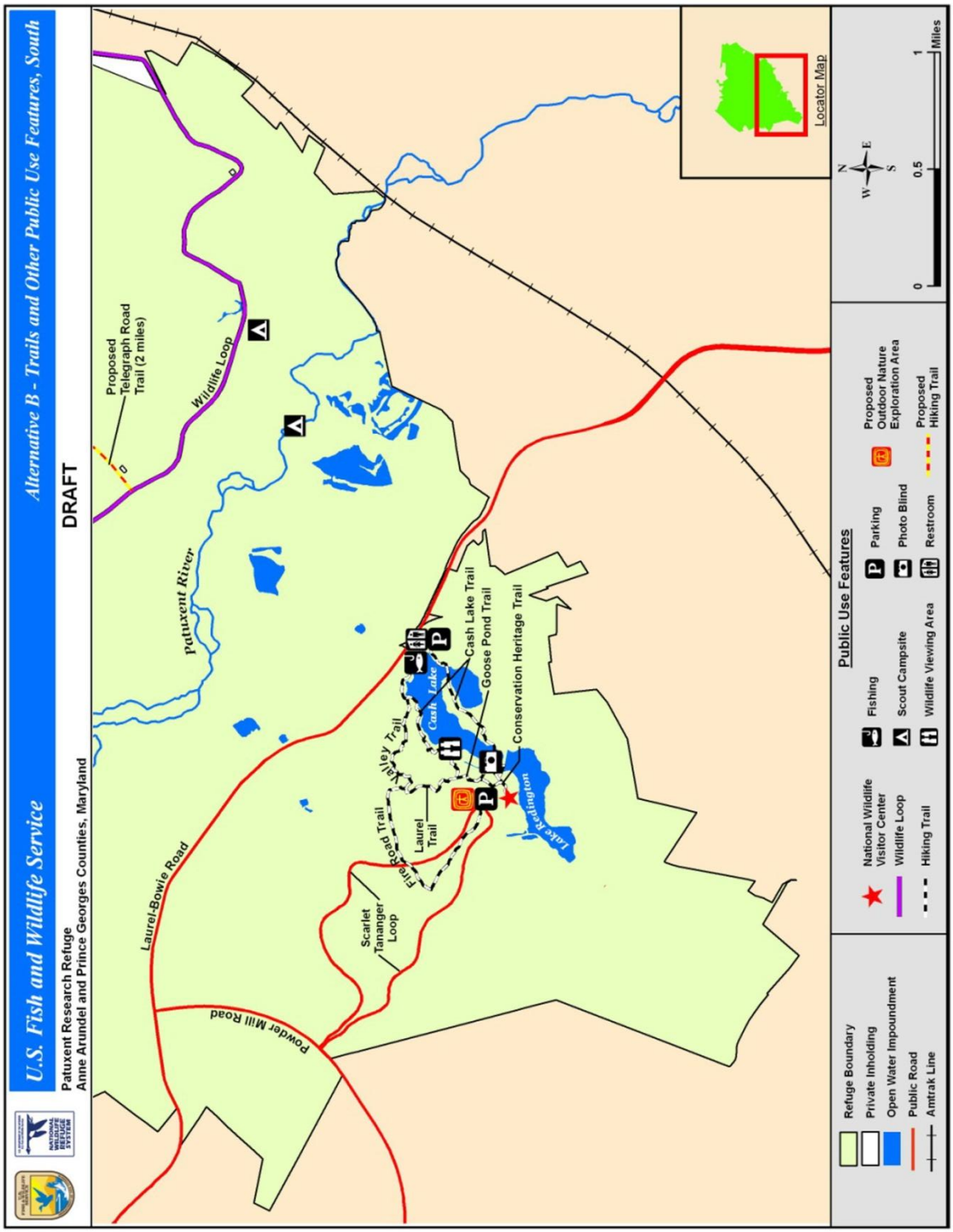
ATTACHMENTS:

Attachment 1: Map Showing Fishing Opportunities on the North Tract
Attachment 2: Map Showing Fishing Opportunities on the South Tract

Attachment 1: Maps Showing Fishing Opportunities on the North Tract. Public Use Features for North Tract Which Highlight Fishing Opportunities.



Attachment 2: Map Showing Fishing Opportunities on the South Tract. Public Use Features for South Tract Which Highlight Fishing Opportunities.



FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Patuxent Research Refuge

Use: Hiking, Biking, Jogging, and Cross-country Skiing

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	✓	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✓	
(d) Is the use consistent with public safety?	✓	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✓	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✓	
(g) Is the use manageable within available budget and staff?	✓	
(h) Will this be manageable in the future within existing resources?	✓	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✓	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✓	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✓ No ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** ✓

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

REFUGE NAME: Patuxent Research Refuge

USE: Hiking, Biking, Jogging, and Cross-country Skiing

NARRATIVE:

The proposed uses are hiking, biking, jogging, and cross-country skiing. Although these uses are not priority public uses, they do support wildlife observation, which is a priority public use. These uses may provide opportunities for visitors to observe and learn about wildlife, habitats and refuge lands firsthand and at their own pace in an unstructured environment. These uses may also enhance the public's appreciation for wildlife conservation and land protection. It is anticipated that participation in these uses will produce a more informed public, with an enhanced stewardship ethic and enhanced support and advocacy for the Service and natural resources as a whole.

These uses are low impact and low cost. The majority of areas where these uses are allowed on the refuge are former military roads with wide gravel bases. In a 2011 survey, hiking was one of the top three activities that participants (51 percent of surveyed visitors) to the refuge engaged in. In addition, 15 percent of surveyed visitors had participated in bicycling within the past 12 months of the survey (Sexton et al. 2011). There have been no documented complaints or conflicts between users of multiple activities.

These uses are consistent with the goals and objectives in the comprehensive conservation plan, particularly goal five, which is to provide for high-quality recreation, environmental education, and interpretive programs to enhance refuge visitors' understanding and appreciation of fish and wildlife conservation. The uses will provide wholesome, safe outdoor recreation in a scenic setting. The hope is that those who come strictly for recreational enjoyment will be enticed to participate in the more educational and wildlife dependent facets of public use programs on the refuge. In addition, these uses promote Let's Go Outside, Connecting People with Nature, and other health-related initiatives that the U.S. Fish and Wildlife Service supports.

COMPATIBILITY DETERMINATION

USE:

Hiking, Jogging, Bicycling, and Cross-country Skiing

REFUGE NAME:

Patuxent Research Refuge

ESTABLISHING AND ACQUISITION AUTHORITIES:

Executive Order 7514, dated December 16, 1936; Executive Order 11724, dated June 27, 1973; 16 U.S.C. 715d, Migratory Bird Conservation Act of 1929; 16 U.S.C. 1534; 16 U.S.C. 667b, dated May 19, 1948 - An Act Authorizing the Transfer of Certain Real Property for Wildlife or other purposes; and Public Law 101-519 Sec. 126, 104 Stat. 2247, dated November 5, 1990.

REFUGE PURPOSES:

1. "...as a wildlife experiment and research refuge" – Executive Order 7514, dated December 16, 1936
2. "…recreation, conservation, wildlife preservation, and related scientific and educational activities" – Executive Order 11724, dated June 27, 1973
3. "...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" – 16 U.S.C. 715d, dated February 18, 1929 (Migratory Bird Conservation Act)
4. "...to conserve fish, wildlife and plants, including those which are listed as endangered species or threatened species – 16 U.S.C. 1534, dated December 28, 1973 (Endangered Species Act)
5. "...particular value in carrying out the national migratory bird management program." – 16 U.S.C. 667b, dated May 19, 1948 (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes)
6. "...(b) The Secretary of the Interior shall administer the property transferred pursuant to subsection (a) consistent with wildlife conservation purposes and shall provide for the continued use of the property by Federal agencies to the extent such agencies are using it on the date of the enactment of this Act." – Public Law 101-519 Sec. 216, 104 Stat. 2247, dated November 5, 1990 (Defense Appropriation Act – including transfer of the North Tract from Fort Meade).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

"To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." 16 U.S.C. 668dd(a)(2) (National Wildlife Refuge System Improvement Act of 1997)

DESCRIPTION OF USE:

What are the uses? Are they priority public uses?
Hiking, jogging, bicycling, and skiing are not priority public uses; however, by allowing these uses, persons engaged will be exposed to the refuge and will foster a better understanding of the mission of the refuge and the National Wildlife Refuge System (Refuge System) (Lyons 1982). In addition, hiking, jogging, and bicycling accommodate priority public uses such as wildlife observation. Hiking, jogging, and bicycling were found compatible in 1992 and skiing was found compatible in 1996. The activities are managed in accordance with standard operating procedures for North Tract Public Use Areas and the National Wildlife Visitor Center Trail System brochure.

Where would the uses be conducted?
Hiking, jogging, bicycling, and skiing are allowed on the following trails and roads: Wildlife Loop (8 miles); South Road (1.7 miles), Wild Turkey Way (3.6 miles), Sweetgum Lane (1.6 miles), Whip-poor-will Way (1.8 miles), Kingfisher Road (0.5 mile), Pine Trail (.75 mile), trail around Lake Allen (1.5 miles), and trail around Rieve's Pond (.5 mile).

The following trails are open to hiking only: Little Patuxent River Trail (.75 mile), Forest Habitats Nature Trail (2.5 miles), trail around Cattail Pond (.5 miles), New Marsh Trail (.75 miles), Loop Trail (.3 miles), Goose Pond Trail (.2 miles), Cash Lake Trail (1.4 miles), Laurel Trail (.4 miles), Valley Trail (.6 miles), Fire Road Trail (.9 miles), Vernal Pool Trail (1.25 miles), and Wildlife Viewing Area Trail (2.5 miles).

The following trails are open to hiking and biking only: Telegraph Road Trail (2.5 miles).

When would the uses be conducted?
The trails and roads found on the North Tract of the refuge are open to the public during normal operational hours which vary seasonally. Hours are posted at the North Tract Visitor Contact Station and available online on the refuge Web site. The South Tract trails and grounds are open to public use from dawn to dusk throughout the year. The refuge trails and grounds on both the North and South Tract are open year-round with the exception of Thanksgiving, Christmas, and New Year's days. Portions of the road and trail system may be temporarily closed to support priority public uses, wildlife management, refuge operational needs, and/or during refuge-specific hunting seasons.

How would the uses be conducted?
The trail system is designed to support the six priority public uses and provide access to a variety of habitat types. Persons engaged in hiking, jogging, biking, and skiing will use existing access points, parking lots, signage, and refuge roads to access the trail system. Trail systems are monitored by staff and volunteers to educate and inform visitors about trail ethics and public regulations, to report safety issues and emergencies, to assist with closing of trails/grounds, and to remove trash and assist with gate closures.

Why are these uses being proposed?
These uses are proposed to provide compatible recreational opportunities for visitors to enjoy the refuge and to gain a better understanding and appreciation for fish and wildlife, ecology and the

relationships of plant and animal populations within various ecosystems, and to better understand wildlife management, the refuge, and the Refuge System. Although these uses are not priority public uses, they do support wildlife observation which is a priority public use. These uses may provide opportunities for visitors to observe and learn about wildlife and refuge lands firsthand and at their own pace in an unstructured environment. These uses may also enhance the public's appreciation for wildlife conservation and land protection. It is anticipated that participation in these uses will produce a more informed public, with an enhanced stewardship ethic and enhanced support and advocacy for the Service and for natural resources. In a 2011 survey, hiking was one of the top three activities that participants (51 percent of surveyed visitors) to the refuge engaged in. In addition, 15 percent of surveyed visitors had participated in bicycling within the past 12 months of the survey (Sexton et al. 2011).

These uses will also provide wholesome, safe outdoor recreation in a scenic setting. The hope is that those who come strictly for recreational enjoyment will be enticed to participate in the more educational facets of the public use program and can then become informed advocates for the Service and for natural resources. In addition, these uses promote Let's Go Outside, Connecting People with Nature, and other health-related initiatives.

AVAILABILITY OF RESOURCES:

In recent years, the refuge has been open to hunting, fishing, wildlife viewing, interpretation, environmental education, and photography. Portions of the trail and roadway system were in existence when the land was transferred to the U.S. Fish and Wildlife Service (Service). Since then, the refuge has expanded the trails and roads in support of priority public uses. There is already existing refuge infrastructure such as parking lots, signage, and other facilities which will serve to accommodate these activities. It is expected that the use of the trail and roadway systems by hikers, joggers, bikers, and skiers will slightly increase the general operating cost for personnel and maintenance of these facilities. To administer, maintain, and monitor the facilities would require 160 staff days (see below).

Cost Breakdown

The following is the list of costs to the refuge required to administer and manage the refuge programs for wildlife observation and photography and environmental education and interpretation.

Identifier	Cost
Administration/management to facilitate activity	$24,300/yr
Maintenance of buildings, roadways, trails and parking areas	$37,400/yr
Office supplies and support	$5,500/yr
Operation of equipment	$22,000/yr
Surveying facilities and law enforcement	$4,400/yr
Total Costs	**$84,800/yr**

After review of the refuge budget, there are sufficient funds to sustain this activity.

ANTICIPATED IMPACTS OF THE USE:

Effects on Wildlife

Disturbances vary with the wildlife species involved and the type, level, frequency, duration, and the time of year such activities occur. The responses of wildlife to human activities include avoidance or departure from the site (Owen 1973, Burger 1981, Kaiser and Fritzell 1984, Korschen et al. 1985, Kahl 1991, Klein 1993, Whittaker and Knight 1998), the use of sub-optimal habitat (Erwin 1980, Williams and Forbes 1980), altered behavior or habituation (Burger 1981, Korschen et al. 1985, Morton et al. 1989, Ward and Stehn 1989, Havera et al. 1992, Klein 1993, Whittaker and Knight 1998), attraction (Whittaker and Knight1998), and an increase in energy expenditure (Morton et al. 1989, Belanger and Bedard 1990). The presence of people hiking, jogging, biking, and skiing on refuge trails and roads can lead to displacement of animals from trails, although disturbance usually is a negligible influence on large mammal distributions and movements (Purdy et al. 1987, Boyle and Samson 1985). Mammals may become habituated to humans, making them easier targets for hunters. Disturbance can have other effects including shifts in habitat use, abandonment of habitat, and increased energy demands on affected wildlife (Knight and Cole 1991). The effects of roads and trails on plants and animals are complex, and not limited to trail width. Trail use can disturb areas outside the immediate trail corridor (Trails and Wildlife Task Force 1998, Miller et al. 2001). Bird communities in this study were apparently affected by the presence of recreational roads and trails, where common species (e.g., American robins) were found near trails and rare species (e.g., grasshopper sparrows) were found farther from trails. Songbird nest failure was also greater near trails. The effects on other forms of wildlife appear to be short-term with the exception of breeding bird communities. A study by Miller, Knight, and Miller (1998) indicates that species composition and nest predation was altered adjacent to trails in both forested and grassland habitats. It appears that species composition changes are due to the presence of humans and not the trail or roadway itself. On the other hand, nest predation does appear to be a function of the trail which allows access to mammalian nest predators.

Several studies have examined the effects of recreationists on birds using shallow-water habitats adjacent to trails and roads through wildlife refuges and coastal habitats in the eastern United States (Burger 1981, Burger 1986, Klein 1993, Klein et al. 1995, Rodgers and Smith 1995, Rodgers and Smith 1997, Burger and Gochfeld 1998). Overall, the existing research clearly demonstrates that disturbances from recreation activities have at least temporary effects on the behavior and movement of birds within a habitat or localized area. Anticipated impacts of hiking, jogging, biking, and skiing on wildlife include temporary disturbances to species using habitat on the trail or directly adjacent to the trail. These disturbances are likely to be short-term. Use of some roads and trails may cause direct mortality to amphibians crossing trails during migration or foraging. There may also be nest abandonment of bird species nesting on, or next to, trails should these uses become too frequent during breeding season. Long-term impacts may include certain wildlife species avoiding trail corridors as a result of this use over time. However, trails open to hiking, biking, jogging, and skiing are located primarily in continuous tracts of hardwood or mixed hardwood/pine forests, with some open meadow areas mixed in. More sensitive and underrepresented wildlife habitats such as riparian and wetland areas were avoided, reducing the potential for wildlife disturbance. Locating these trails in upland forested habitat spreads the disturbance over the largest habitat type on the refuge, minimizing the overall impact on refuge wildlife associated with this habitat.

Effects on Soil
The use of trails and gravel roads could lead to soil compaction, exposure of tree roots, and the modification of plant species 3 to 6 feet on either side of the trail; which is a function of soil compaction, invasive species, and direct trampling of plants (Kuss 1986). The refuge will continue its management practices of using boardwalks, woodchips, erosion control, and user education to protect plant species and habitats along trails and roadways. The refuge will continue management strategies of educating trail and roadway users how their activities affect wildlife and how to modify their use to minimize impacts on wildlife. Potential conflict with priority public uses will be minimized by using trail head signs and other media to inform the various users about current public uses. Some trail and roadway use will be restricted during the refuge-specific hunting seasons, primarily during shotgun season.

The majority of the trails open for hiking, biking, jogging, and skiing are former military roads made up of gravel and sand, or asphalt (Wildlife Loop), were extensively used by military vehicles, and are currently used by refuge and public vehicles. Therefore, soils are generally compacted and less susceptible to additional physical impact and mechanical erosion. The refuge will take all reasonable measures to prevent or minimize any potential negative effects, and will evaluate the roads and trails periodically to assess whether they meet established suitability criteria and to prevent degradation. If evidence of unacceptable adverse impacts appears, the refuge will reroute, curtail, or close trails to this use as deemed appropriate. The refuge will also post and enforce refuge regulations, and establish, post, and enforce closed areas. Based on the information provided above and the current and projected levels of use, the refuge anticipates that there will be minimal adverse impacts to soils, and therefore water quality, associated with hiking, biking, jogging, and skiing.

Effects on Vegetation
The refuge anticipates that there will be minimal adverse impacts to plant communities on designated trails. Most trails designated for hiking, biking, jogging, and skiing use have hardened surfaces where plant communities are sparse or already have a heavy mix of invasive species such as Japanese stiltgrass, garlic mustard, lespedeza, Chinese silvergrass, and others. Users leaving designated trails could have impacts to adjacent vegetation. Where impacts to vegetation are observed, the refuge will take necessary measures, such as remediation and trail closures, to restore plant communities on or adjacent to the affected trail.

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning process for Patuxent Research Refuge, this compatibility determination will undergo extensive public review, including a comment period of 45 days following the release of the draft Comprehensive Conservation Plan/Environmental Assessment.

DETERMINATION (CHECK ONE BELOW):

____ Use is not compatible
_X_ Use is compatible with the following stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

- Refuge staff and volunteers will continue to protect and manage wildlife and their habitat especially breeding and wintering bird communities found on the refuge through the use of education, signage, and trail or roadway closures.
- Refuge staff and volunteers will continue to monitor trail and road conditions to determine their effect on adjacent plant communities and will take all necessary steps to protect habitat. This could include, but is not limited to, protecting soil from compaction, seasonal closure of trails, and relocating trails.
- All hikers, joggers, bikers, and skiers will be restricted to the designated trail and roadway system.
- Refuge staff will develop a step-down plan for Public Use to include a section on the management and administration of hiking, jogging, bicycling, and skiing on the refuge's trail and roadway system.
- Refuge staff and volunteers will continue to close trails as needed during hunting seasons and for other safety concerns to prevent user conflicts and to provide for public safety.

JUSTIFICATION:

The Service and the Refuge System maintain goals of providing opportunities for wildlife viewing and photography. Allowing the use of the trail system by persons engaging in hiking, jogging, bicycling, and skiing for the sake of those activities will create opportunities to view wildlife and their habitats. These users may take the time to learn more about the refuge while they pursue their activity and become more avid supporters of the Refuge System.

These uses generally do not adversely impact the refuge's research purpose since large portions of the refuge are closed to the visiting public. The Central Tract portion of the refuge is set aside specifically to support research. At the scales and level of current visitor use, wildlife and habitats are not appreciably negatively affected by these uses, based on professional judgment and the consistently high biodiversity observed on the refuge.

There have been no documented complaints or conflicts between users of multiple activities. A recent visitor use survey found that 26 percent of visitors sampled felt that biking was an important aspect of their refuge visit. Sixty percent of visitors sampled felt that hiking was an important aspect of their refuge visit. In addition, hiking was one of the top three activities that participants (51 percent of visitors) engaged in on the refuge. (Sexton 2011)

As listed in the purposes section of this compatibility determination, the refuge was established and subsequently land was acquired for a total of six purposes. Wildlife observation, photography, environmental education, and interpretation will not materially interfere with or detract from the research purpose of the refuge, because wildlife research does not generally occur in the vicinity of the locations that these uses occur and the impact will be minimal. These uses will not materially interfere with or detract from the two purposes related to wildlife conservation, because impacts to wildlife species and habitat will be minimal. In addition, the trails used for these activities do not impact core habitat areas. These uses will not materially interfere with or detract from the two purposes related to migratory bird conservation, because

these uses are allowed in areas that are generally not in the vicinity of migratory waterfowl or land bird habitat. These uses will not materially interfere with or detract from the endangered species purpose, because there are no federally listed threatened or endangered species that occur on the refuge. Finally, these activities will not materially interfere with or detract from the mission of the Service, because individuals that participate in these activities will have minor impacts to refuge resources while being exposed to the refuge through signs and interpretive panels.

SIGNATURE:

REFUGE MANAGER: _____

(signature and date)

CONCURRENCE:

REGIONAL CHIEF: _____

(signature and date)

MANDATORY 10-YEAR REEVALUATION DATE: 2022

REFERENCES:

Belanger, L., and J. Bedard. 1990. Energetic cost of man-induced disturbance to staging snow geese. Journal of Wildlife Management 54:36.

Boyle S.A., and F.B. Samson. 1985. Effects of nonconsumptive recreation on wildlife: a review. 13:110-116.

Burger, J. 1981. Effect of human activity on birds at a coastal bay. Biological Conservation 21:231-241.

Burger, J. and M. Gochfeld. 1998. Effects of eco-tourists on bird behavior at Loxahatchee National Wildlife Refuge, Florida. Environmental Conservation 25:13.

Kahl, R. 1991. Boating disturbance of canvasbacks during migration at Lake Poygan, Wisconsin. Wildlife Society Bulletin 19:242-248.

Kaiser, M.S. and E.K. Fritzell. 1984. Effects of river recreationists on green-backed heron behavior. Journal of Wildlife Management 48:561-567.

Klein, M.L. 1993. Waterbird behavioral responses to human disturbance. Wildlife Society Bulletin 21:31-39.

Knight, R.L. and D.N. Cole. 1991. Effects of recreational activity on wildlife in wildlands. Transactions of the 56th North American Wildlife and Natural Resources Conference pp. 238-247.

Korschen, C.E., L.S. George, and W.L. Green. 1985. Disturbance of diving ducks by boaters on a migrational staging area. Wildlife Society Bulletin 13:290-296.

Kuss. F. 1986. A review of major factors influencing plant responses to recreation impacts. Environmental Management 10:638-65.

Lyons, J.R. 1982. Nonconsumptive wildlife-associated recreation in the U.S.: identifying other constituency. Transactions of the 56th North American Wildlife and Natural Resources Conference 47:677-685.

Miller, S.G., Knight R.L., and Miller C.K. 1998. Influence of Recreational Trails on Breeding Bird Communities. Ecological Applications 8(1):162-169.

Patuxent Research Refuge National Wildlife Visitor Center Trail System, Accessed August 2012 at: *http://patuxent.fws.gov/NWVCTrails.html*.

Purdy, Goff, Decker, Pomerantz, Connelly. 1987 A guide to managing human activity on a national wildlife refuge. New York Cooperative Fish and Wildlife Research Unit.

Morton, J.M., A.C. Fowler, and R.L. Kirkpatrick. 1989. Time and energy budgets of American black ducks in winter. Journal of Wildlife Management 53:401-410 (See also corrigendum in Journal of Wildlife Management 54:683).

Owen, M. 1973. The management of grassland areas for wintering geese. Wildfowl 24:123-130.

Rayburn, E. 2001. Personal Communication with Ed Rayburn, West Virginia University Agricultural Extension Office. December 10, 2001.

Rodgers, J.A. and H.T. Smith. 1995. Set-back distances to protect nesting bird colonies from human disturbance in Florida. Conservation Biology 9:89–99.

Rodgers, J.A. and H.T. Smith. 1997. Buffer zone distances to protect foraging and loafing waterbirds from human disturbance in Florida. Wildlife Society Bulletin 25:139–145.

Sexton, N.R., A.M. Dietsch, A.W. Don Carlos, L. Koontz, A. Solomon, and H.M. Miller. 2011. National wildlife refuge visitor survey 2010/2011: individual refuge results. U.S. Geological Survey Data Series 643.

Standard Operating Procedures, Patuxent Research Refuge, North Tract Public Use Areas, 2003.

Standard Operating Procedures, Patuxent Research Refuge, Public Use and Checking In/Out of the North Tract, 7/20/2003.

Whittaker, D. and R.L. Knight. 1998. Understanding wildlife responses to humans. Wildlife Society Bulletin 26:312–317.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Patuxent Research Refuge

Use: Horseback Riding

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	✓	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✓	
(d) Is the use consistent with public safety?	✓	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✓	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✓	
(g) Is the use manageable within available budget and staff?	✓	
(h) Will this be manageable in the future within existing resources?	✓	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✓	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✓	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✓ No ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** ✓

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

REFUGE NAME: Patuxent Research Refuge

USE: Horseback riding

NARRATIVE:

Horseback riding on the refuge is a non-priority use, but it provides an increased opportunity for public visitation to the refuge. It encourages opportunities to engage visitors in some of the six priority public uses, specifically wildlife observation and photography. Due to the length of some trails, horseback riding provides visitors with an opportunity to engage in wildlife-dependent recreation in more remote parts of the refuge that generally receive lower amounts of public use. In addition, individuals are exposed to a variety of habitats and wildlife management strategies which may increase their appreciation of natural resources and the National Wildlife Refuge System.

Horseback riding may provide opportunities for visitors to observe and learn about wildlife and refuge lands firsthand and at their own pace in an unstructured environment. These uses may also enhance the public's understanding and appreciation for the refuge's natural resources, wildlife conservation, and land protection. We anticipate that participation in this use will produce a more informed public, with an enhanced stewardship ethic and enhanced support and advocacy for the U.S. Fish and Wildlife Service and natural resources as a whole. In a 2011 visitor use survey, only two percent of those sampled during the sampling period were participating in horseback riding (Sexton 2012). However, over the past few years, the refuge has documented, on average, approximately 100 equestrian visits annually.

Horseback riding has been allowed on the refuge since the North Tract was obtained in 1991, and was found compatible in 1992, and again in 2007. The refuge has existing infrastructure such as the trail and roadway system, parking lots, signage, and other facilities that support priority public uses, which will also accommodate horseback riding. Horseback riding is limited to designated trails and roadways that accommodate safe passage by these and other users. There have been few documented complaints from other members of the public regarding horseback riding on the refuge.

Horseback riding has therefore been found appropriate because it is consistent with the goals and objectives of the Comprehensive Conservation Plan, in particular goal five which includes providing for high-quality recreation experiences to enhance refuge visitors' understanding and appreciation of fish and wildlife conservation.

COMPATIBILITY DETERMINATION

USE:

Horseback Riding

REFUGE NAME:

Patuxent Research Refuge

ESTABLISHING AND ACQUISITION AUTHORITIES:

Executive Order 7514, dated December 16, 1936; Executive Order 11724, dated June 27, 1973; 16 U.S.C. 715d, Migratory Bird Conservation Act of 1929; 16 U.S.C. 1534; 16 U.S.C. 667b, dated May 19, 1948 - An Act Authorizing the Transfer of Certain Real Property for Wildlife or other purposes; and Public Law 101-519 Sec. 126, 104 Stat. 2247, dated November 5, 1990.

REFUGE PURPOSES:

1. "...as a wildlife experiment and research refuge" – Executive Order 7514, dated December 16, 1936
2. "…recreation, conservation, wildlife preservation, and related scientific and educational activities" – Executive Order 11724, dated June 27, 1973
3. "...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" – 16 U.S.C. 715d, dated February 18, 1929 (Migratory Bird Conservation Act)
4. "...to conserve fish, wildlife and plants, including those which are listed as endangered species or threatened species – 16 U.S.C. 1534, dated December 28, 1973 (Endangered Species Act)
5. "...particular value in carrying out the national migratory bird management program." – 16 U.S.C. 667b, dated May 19, 1948 (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes)
6. "...(b) The Secretary of the Interior shall administer the property transferred pursuant to subsection (a) consistent with wildlife conservation purposes and shall provide for the continued use of the property by Federal agencies to the extent such agencies are using it on the date of the enactment of this Act." – Public Law 101-519 Sec. 216, 104 Stat. 2247, dated November 5, 1990 (Defense Appropriation Act – including transfer of the North Tract from Fort Meade).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

"To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." 16 U.S.C. 668dd(a)(2) (National Wildlife Refuge System Improvement Act of 1997)

DESCRIPTION OF USE:

What is the use? Is it a priority public use?
The use is horseback riding. Horseback riding is not a priority public use within the National Wildlife Refuge System (Refuge System) under the National Wildlife Refuge Systems Administration Act of 1966 (16 U.S.C. 6688dd-668ee) and the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57). However, when conducted responsibly, it can facilitate wildlife-dependent uses such as wildlife observation and photography.

Horseback riding was a traditional use allowed on the North Tract of the refuge when the land was administered by the Department of Defense (DOD). At that time, horseback riding was associated with a DOD equestrian center, but the DOD has since retired the center due to funding and possible disease concerns, such as Eastern Equine Encephalitis.

Where would the use be conducted?
This activity will occur only on the North Tract trail and roadway system. This includes: Wildlife Loop (8 miles shoulder use only), Kingfisher Road (1.3 miles), Wild Turkey Way (3.6 miles), Sweetgum Lane (1.6 miles), Whip-Poor-Will Way (1.8 miles), South Road (1.2 miles), Pine Trail (.75 miles), trail around Lake Allen (1.5 miles), and trail around Rieve's Pond (.5 miles).

These trails were originally constructed in the early 1900s to facilitate Fort Meade training operations, and were built to support a variety of military vehicles such as tanks, half-tracks, and other heavy equipment. These trails are typically 25 to 30 feet wide, with a solid gravel/sand base, with the exception of Wildlife Loop which is asphalt with a gravel and dirt shoulder. The refuge has no documentation of erosion and/or trail damage from equestrian use since obtaining this property from the DOD.

When would the use be conducted?
The use would be conducted during the North Tract's regular public hours, typically 8 a.m. to 4 p.m., with some seasonal variations for later closing hours, depending on staffing. Horseback riding would not be allowed during the annual white-tailed deer shotgun season, when the North Tract is closed to all other public uses.

How would the use be conducted?
All persons wishing to horseback ride on the North Tract are required to check-in, in accordance with the Public Use and Checking In and Checking Out Procedures for the North Tract. This procedure ensures visitors identify the purpose of their visit, educates them to any area closures or restrictions, and requires they sign a statement acknowledging they are aware of the presence of unexploded ordnance in the area. Portions of the road and trail system may be temporarily closed to support priority public uses, wildlife management, refuge operational needs, and some refuge-specific hunting seasons. Persons engaged in horseback riding will use existing access points, parking lots, signage, and refuge roads to access the trail system.

All designated roads and trails have sufficient viewing distance for riders to detect the approach of other users and maneuver to accommodate them. Horses must be accompanied by riders at all times and not tied to trees, staked, or confined in any way. Horseback riding is typically seasonal

with the majority of the use occurring during spring and summer months. To prevent the potential spread of invasive species through horse manure, riders are requested to clean up after their animals and pack out any such material.

Why is the use being proposed?
Horseback riding on the refuge provides increased opportunity for public visitation to the refuge. It also allows for opportunities to engage in some of the six priority public uses, specifically wildlife observation and photography. This use may provide individuals with a connection to the natural world and an increased appreciation of natural resources, in addition to exposing them to the Refuge System.

Horseback riding has been allowed on the refuge since the North Tract was obtained in 1991. There have been few documented complaints from other members of the public regarding horseback riding on the refuge.

AVAILABILITY OF RESOURCES:

The refuge has been open for a number of years to hunting, fishing, wildlife viewing, interpretation, environmental education, and photography. The refuge has existing infrastructure such as the trail and roadway system, parking lots, signage, and other facilities that support priority public uses which will also accommodate horseback riding. It is expected that the use of the trail and roadway system by horseback riders will only slightly increase the general operating cost for the maintenance of these facilities. To administer, maintain, and survey the facilities and the use would require approximately 50 staff days.

Identifier	Cost
Administration/management to facilitate activity, this includes staff/law enforcement and survey facilities	$7,700/yr
Maintenance of buildings, roadways, trails and parking areas	$24,300/yr
Supplies and support	$1,650/yr
Operating cost	$11,000/yr
Total Costs	**$44,650/yr**

These tables represent only a portion of the cost of maintaining the trail and roadway systems. This cost is prorated over various operational needs such as public uses, public safety, and other refuge operations, and includes prorated cost of invasive species management along trails by interns, staff, and volunteers. These costs would be incurred for other activities. Actual costs associated with the administration of horseback riding are a fraction of those presented here.

After review of the refuge budget, there are sufficient funds to sustain this activity.

ANTICIPATED IMPACTS OF THE USE:

Horseback riding has the potential to affect a variety of migratory and resident wildlife and their habitats when in close proximity to the travel routes. Possible negative effects include: disturbing wildlife, removing or trampling vegetation, littering, vandalism, and entering closed areas.

However, visitor use associated with this activity is relatively low, relative to other public uses, with between 90 and 150 visits by horseback riders annually since fiscal year 2007. In a 2011 visitor use survey only two percent of the visitors sampled during the sampling period were participating in horseback riding (Sexton 2012).

Effects on Hydrology and Water Quality

This use has limited potential to have effects on hydrology and/or water quality. The trails where this use is allowed do cross riparian drainages and the Little Patuxent River. However, the roads are gravel/sand or asphalt (Wildlife Loop) and are fairly resistant to erosion that might be expected on trails made out of dirt or more organic parent materials. Horse use has been linked to increased coliform bacteria from fecal contamination in at least one study in wilderness areas (Derlet et al. 2008). However, this research was conducted in areas used heavily by pack horses and in some areas by cattle.

The trails themselves do alter hydrological regimes and interrupt streamflow. A significant emphasis in this comprehensive conservation plan (CCP) is to identify those drainages most impaired by man-made structures and work to restore them to a more natural hydrology where possible. Refuge staff routinely monitors roads and trails for damage and then remediate problem areas as needed. Trail maintenance is conducted to help minimize any negative effects associated with trail use. Refuge staff ensures any potential negative effects are avoided or minimized. Based on the current and projected levels of use, condition of designated routes, and minimization measures employed, adverse effects on water resources because of this use are expected to be minimal.

Effects on Vegetation

Horse travel can impact plants on roads and trails by crushing them. Indirectly, horses can impact plants by compacting soils, thereby diminishing soil porosity, aeration and nutrient availability (Kuss 1986). Hammitt and Cole (1998) note compaction limits the ability of plants to revegetate affected areas. Plants growing in wet or moist soils are the most sensitive to disturbance from trampling effects (Kuss 1986). Weaver and Dale (1978) found horse use caused a greater loss of vegetation cover, wider and deeper roads and trails, and greater soil compaction when compared to hiker use on meadow and forest trail conditions. Some incidental grazing along roads and trails may occur as well. Therefore, it is anticipated that horses will have some impacts on refuge plant communities growing on the designated travel routes. Designated routes for horseback riding consist of former military roads with hardened surfaces, and are located predominately on upland soils to prevent impacts to fragile wetland soils and associated plant communities. Designated routes do not have any known occurrences of rare plant species on their surface that would be affected by this use. The refuge does not allow tethering horses to trees or other vegetation, which will help prevent further damage to vegetation.

Invasive plant species that alter native vegetation may be transported onto the refuge through the presence of exotic plant seeds in feed hay, horse trailers, and horse manure. This concern has initiated strict requirements for weed-free hay in some national parks and forests. Currently, there are no programs to provide for certified weed-free hay in Maryland or surrounding states (Rayburn 2001, 2009). Due to the relatively short time-frame for horseback riding excursions on the refuge, most users do not even bring in supplemental feed. It has not been identified as a

problem to this point by refuge staff. It is anticipated that horse use will cause minimal increases in invasive plants relative to the current presence of invasive plants on the refuge.

The refuge anticipates that there will be minimal adverse impacts to plant communities on designated routes. Most routes designated for horse use have hardened surfaces where plant communities are sparse or already have a heavy mix of invasive species such as Japanese stiltgrass. Users leaving designated trails could have impacts to adjacent vegetation. Where impacts to vegetation are observed, we will take necessary measures, such as remediation and trail closures, to restore plant communities on or adjacent to the affected trail.

Effects on Soils

Horses can cause physical impacts to soil surfaces. Horses may cause trail erosion by loosening the soil and increasing soil particle detachment under both wet and dry trail conditions (Deluca et al. 1998). Horses can also increase soil compaction (Weaver and Dale 1978). All of the trails open for horseback riding are former military roads made up of gravel and sand, or asphalt (Wildlife Loop), were extensively used by military vehicles, and are currently used by refuge and public vehicles. Therefore, soils are generally compacted and less susceptible to additional physical impact and mechanical erosion. The refuge will take all reasonable measures to prevent or minimize any potential negative effects, and will evaluate the roads and trails periodically to assess whether they meet established suitability criteria and to prevent degradation. If evidence of unacceptable adverse impacts appears, the refuge will re-route, curtail, or close trails to this use as deemed appropriate. The refuge staff will also post and enforce refuge regulations, and establish, post, and enforce closed areas. Based on the information provided above and the current and projected levels of use, we anticipate that there will be minimal adverse impacts to soils associated with horse use.

Effects on Wildlife

Disturbances vary with the wildlife species involved and the type, level, frequency, duration, and the time of year such activities occur. The responses of wildlife to human activities include avoidance or departure from the site (Owen 1973, Burger 1981, Kaiser and Fritzell 1984, Korschen et al. 1985, Kahl 1991, Klein 1993, Whittaker and Knight 1998), the use of sub-optimal habitat (Erwin 1980, Williams and Forbes 1980), altered behavior or habituation (Burger 1981, Korschen et al. 1985, Morton et al. 1989, Ward and Stehn 1989, Havera et al. 1992, Klein 1993, Whittaker and Knight 1998), attraction (Whittaker and Knight 1998), and an increase in energy expenditure (Morton et al. 1989, Belanger and Bedard 1990). Mammals may become habituated to humans, making them easier targets for hunters.

Disturbance can have other effects including shifts in habitat use, abandonment of habitat, and increased energy demands on affected wildlife (Knight and Cole 1991). The effects of roads and trails on plants and animals are complex, and not limited to, trail width. Trail use can disturb areas outside the immediate trail corridor (Trails and Wildlife Task Force 1998, Miller et al. 2001). Bird communities in this study were apparently affected by the presence of recreational roads and trails, where common species (e.g., American robins) were found near trails and rare species (e.g., grasshopper sparrows) were found farther from trails. Songbird nest failure was also greater near trails. Several studies have examined the effects of recreationists on birds using shallow-water habitats adjacent to trails and roads through wildlife refuges and coastal habitats

in the eastern United States (Burger 1981, Burger 1986, Klein 1993, Klein et al. 1995, Rodgers and Smith 1995, Rodgers and Smith 1997, Burger and Gochfeld 1998). Overall, the existing research clearly demonstrates that disturbances from recreation activities have at least temporary effects on the behavior and movement of birds within a habitat or localized area.

Anticipated impacts of horseback riding on wildlife include temporary disturbances to species using habitat on the trail or directly adjacent to the trail. These disturbances are likely to be short-term and infrequent as much of the use is concentrated during weekends in the spring and summer. Use of some roads and trails may cause direct mortality to amphibians crossing trails during migration or foraging. There may also be nest abandonment of bird species nesting on, or next to, trails should horse use become heavy enough. Long-term impacts may include certain wildlife species avoiding trail corridors as a result of this use over time.

However, trails open to horseback riding are located primarily in continuous tracts of hardwood or mixed hardwood/pine forests, with some open meadow areas mixed in. More sensitive and/or underrepresented wildlife habitats such as riparian and wetland areas were avoided, reducing the potential for wildlife disturbance. Locating these trails in upland forested habitat spreads the disturbance over the largest habitat type on the refuge, minimizing the overall impact on refuge wildlife associated with this habitat.

The trails open to horseback riding are also open to hiking, biking, hunting, vehicle access (most, not all trails), and jogging, all of which are more common uses than horseback riding. Therefore, disturbance to wildlife due to horseback riding is expected to be far more minimal than disturbance by other user groups.

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning process for Patuxent Research Refuge, this compatibility determination will undergo extensive public review, including a comment period of 45 days following the release of the draft CCP/Environmental Assessment.

DETERMINATION (CHECK ONE BELOW):

____ Use is not compatible
_X_ Use is compatible with the following stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

The refuge will continue to monitor trail and roadway conditions to determine the effects on adjacent plant communities and take necessary steps to protect habitat. This would include, but is not be limited to, protecting soil from compaction, seasonal closure of trails, and relocating trails.

All horseback riders will be restricted to the trail and roads previously identified. No expansion of this use is anticipated.

Free-trailing or loose-herding of horses on trails is prohibited.

Allowing horses to proceed in excess of a slow walk when passing in the immediate vicinity of a moving vehicle or persons on foot or bicycle is prohibited. Horses are not permitted to travel at any time faster than normal walking gait.

Horseback rider group size is encouraged to be no more than 10 persons to promote public safety, reduce conflict with other users, promote a quality experience, and reduce wildlife disturbance. Groups larger than 10 persons must contact the refuge office prior to visiting the trail system so the refuge can determine if a special use permit is needed.

Horses will not be staked, hobbled, tied to trees, or confined on the refuge in any way and must be accompanied by riders at all times.

Horse trailers will be restricted to the Visitor Contact Station parking lot and other designated parking areas nearby if overflow is needed.

Horse manure will be cleaned up from trails and roads, and riders will be requested to pack out any such material.

Potential conflicts with other public uses such as hunting, interpretation, etc. will be minimized by informing visitors about current public use activities as well as which activities are authorized in specific locations throughout the refuge.

This use may be restricted during the fall and winter when the refuge has priority, wildlife-dependent activities (like deer hunting) in progress, to help ensure public safety and minimize user conflicts.

We have a strategy to deal with the introduction of invasive plant species from any source, including potential introduction from horse use. Invasive species management will encompass three objectives: (1) prevent the introduction of new invasive plant species, (2) conduct early treatment of new infestations of invasive plant species, and (3) contain and control established infestations of invasive plant species. The trail and roadway system which will be used for horseback riding are already infested with invasive species such as Japanese Stiltgrass, mile-a-minute, Japanese barberry, spotted knapweed, Chinese silvergrass, and Korean Lespedeza.

JUSTIFICATION:

The U.S. Fish and Wildlife Service and the Refuge System maintain goals of providing opportunities to view wildlife. Allowing the use of the trail system by persons engaging in horseback riding, for the sake of riding, will facilitate wildlife observation. These users may take the time to learn more about the refuge and become avid supporters of the Refuge System.

This use generally does not adversely impact the refuge’s research purpose since large portions of the refuge are closed to the visiting public. The Central Tract portion of the refuge is set aside specifically to support research. Horseback riding supports goal 5 of the CCP which is to provide high-quality recreation, environmental education, and interpretive programs to enhance refuge visitors’ understanding and appreciation of fish and wildlife conservation. At the scales and level of current levels of horseback riding, wildlife and habitats are not appreciably negatively affected

by these uses, based on professional judgment and the consistently high biodiversity observed on the refuge.

Horseback riding will not materially interfere with or detract from the two purposes related to wildlife conservation because impacts to wildlife species and habitat will be minimal. In addition, the trails used for these activities do not impact core habitat areas. This use will not materially interfere with or detract from the two purposes related to migratory bird conservation, because these uses are allowed in areas that are generally not in the vicinity of migratory waterfowl or land bird habitat. This use will not materially interfere with or detract from the endangered species purpose, because there are no federally listed threatened or endangered species that occur on the refuge. Finally, horseback riding will not materially interfere with or detract from the mission of the U.S. Fish and Wildlife Service, because of the limited impacts to refuge resources and the opportunity to reach other users as supporters of the Refuge System.

SIGNATURE:

REFUGE MANAGER: _____

(signature and date)

CONCURRENCE:

REGIONAL CHIEF: _____

(signature and date)

MANDATORY 10-YEAR REEVALUATION DATE: 2022

REFERENCES:

Belanger, L., and J. Bedard. 1990. Energetic cost of man-induced disturbance to staging snow geese. Journal of Wildlife Management 54:36.

Boyle, S.A. and F.B. Samson. 1985. Effects of nonconsumptive recreation on wildlife: a review. 13:110-116.

Burger, J. 1981. Effect of human activity on birds at a coastal bay. Biological Conservation 21:231-241.

Burger, J. 1986. The effect of human activity on shorebirds in two coastal bays in northeastern United States. Biological Conservation 13:123–130.

Burger, J. and M. Gochfeld. 1998. Effects of eco-tourists on bird behavior at Loxahatchee National Wildlife Refuge, Florida. Environmental Conservation 25:13–21.

DeLuca, T.H., W.A.I. Patterson, W.A. Freimund, and D. Cole.1998. Influence of llamas, horse, and hikers on soil erosion from established recreation trails in Western Montana, USA. Environmental Management 22:255-262

Derlet, R.W., K.A. Ger, J.R. Richards, and J.R. Carlson. 2008 Risk factors for coliform bacteria in backcountry lakes and streams in the Sierra Nevada mountains: a 5-year study. Wilderness Environ. Med. 19:82–90.

Erwin, R.M. 1980. Breeding habitat use by colonially nesting waterbirds in two Mid-Atlantic U.S. regions under different regimes of human disturbance. Biological Conservation 18:39-51.

Hammitt, W.E., and D.N. Cole. 1998. Wildlife recreation: ecology and management (2nd edition). John Wiley & Sons, New York. 361 pp.

Kahl, R. 1991. Boating disturbance of canvasbacks during migration at Lake Poygan, Wisconsin. Wildlife Society Bulletin 19:242-248.

Kaiser, M.S. and E.K. Fritzell. 1984. Effects of river recreationists on green-backed heron behavior. Journal of Wildlife Management 48: 561-567.

Klein, M.L. 1989. Effects of high levels of human visitation on foraging waterbirds at J.N. “Ding” Darling National Wildlife Refuge, Sanibel, Florida. Final Report to USFWS. 103 pp.

Klein, M.L. 1993. Waterbird behavioral responses to human disturbance. Wildlife Society Bulletin 21:31-39.

Klein, M.L., S.R. Humphrey, and H.F. Percival. 1995. Effects of ecotourism on distribution of waterbirds in a wildlife refuge. Conservation Biology 9:1454-1465.

Knight, R.L. and D.N. Cole. 1991. Effects of recreational activity on wildlife in wildlands. Transactions of the 56th North American Wildlife and Natural Resources Conference pp. 238-247.

Korschen, C.E., L.S. George, and W.L. Green. 1985. Disturbance of diving ducks by boaters on a migrational staging area. Wildlife Society Bulletin 13:290-296.

Kuss. F. 1986. A review of major factors influencing plant responses to recreation impacts. Environmental Management 10:638-650

Miller, S.G., R.L. Knight, and C.K. Miller. 1998. Influence of recreational trails on breeding bird communities. Ecological Applications 8(1):162-169.

Morton, J.M., A.C. Fowler, and R.L. Kirkpatrick. 1989. Time and energy budgets of American black ducks in winter. Journal of Wildlife Management 53:401-410 (See also corrigendum in Journal of Wildlife Management 54:683).

Owen, M. 1973. The management of grassland areas for wintering geese. Wildfowl. 24:123-130.

Rayburn, E. 2001. Personal communication with Ed Rayburn, West Virginia University Agricultural Extension Office. December 10, 2001.

Rayburn, E. 2009. Personal communication with Ed Rayburn, West Virginia University Agricultural Extension Office. December 7, 2009.

Rodgers, J.A. and H.T. Smith. 1995. Set-back distances to protect nesting bird colonies from human disturbance in Florida. Conservation Biology 9:89–99.

Rodgers, J.A. and H.T. Smith. 1997. Buffer zone distances to protect foraging and loafing waterbirds from human disturbance in Florida. Wildlife Society Bulletin 25:139–145.

Standard Operating Procedures, Patuxent Research Refuge, North Tract Public Use Areas, 2003.

Standard Operating Procedures, Patuxent Research Refuge, Public Use and Checking In/Out of the North Tract, 7/20/2003.

Summer, R. 1986. Geomorphic impacts of horse traffic on montane landforms. Journal of Soil and Water conservation 41:126-128

Weaver, T., and D. Dale. 1978. Trampling effects of hikers, motorcycles and horses in meadows and forests. Journal of Applied Ecology 15:451-457.

Whittaker, D. and R.L. Knight. 1998. Understanding wildlife responses to humans. Wildlife Society Bulletin 26:312–317.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Patuxent Research Refuge

Use: Production of Educational Films; Conducting Photo. Workshops

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	✓	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✓	
(d) Is the use consistent with public safety?	✓	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✓	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✓	
(g) Is the use manageable within available budget and staff?	✓	
(h) Will this be manageable in the future within existing resources?	✓	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✓	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✓	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✓ No ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** ✓

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

REFUGE NAME: Patuxent Research Refuge

USE: Production of Educational Films and Conducting Photography Workshops

NARRATIVE:

The proposed use includes the production of educational films and conducting photography workshops on Patuxent Research Refuge. The emphasis is placed on wildlife and scenic photography. Neither film production nor conducting photography workshops are priority public uses; however, they both support and enhance the priority public uses of environmental education, interpretation, and wildlife photography.

The production of, and involvement with, environmental filming and photography workshops will provide participants with an opportunity to learn about wildlife, habitats, and natural resources, while providing similar experiences to the general populous through educational films. This allows the refuge to educate the public with a low impact secondary activity. By allowing these uses, the visiting public will have a better understanding and appreciation for wildlife, habitats, the cultural history of the refuge, and of the importance of the National Wildlife Refuge System.

These uses are low impact, low cost, and highly controllable. Relatively small areas of the refuge are impacted by these activities. The educational value of these filming productions is very high. Many are marketed through public broadcasting stations reaching a broad spectrum and large number of potential customers. Photography workshops increase the interest in wildlife resources and the awareness for the benefits of refuges nationwide.

COMPATIBILITY DETERMINATION

USE:

Production of Educational Films and Conducting Photography Workshops

REFUGE NAME:

Patuxent Research Refuge

ESTABLISHING AND ACQUISITION AUTHORITIES:

Executive Order 7514, dated December 16, 1936; Executive Order 11724, dated June 27, 1973; 16 U.S.C. 715d, Migratory Bird Conservation Act of 1929; 16 U.S.C. 1534; 16 U.S.C. 667b, dated May 19, 1948 - An Act Authorizing the Transfer of Certain Real Property for Wildlife or other purposes; and Public Law 101-519 Sec. 126, 104 Stat. 2247, dated November 5, 1990.

REFUGE PURPOSES:

1. "...as a wildlife experiment and research refuge" – Executive Order 7514, dated December 16, 1936
2. "…recreation, conservation, wildlife preservation, and related scientific and educational activities" – Executive Order 11724, dated June 27, 1973
3. "...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" – 16 U.S.C. 715d, dated February 18, 1929 (Migratory Bird Conservation Act)
4. "...to conserve fish, wildlife and plants, including those which are listed as endangered species or threatened species – 16 U.S.C. 1534, dated December 28, 1973 (Endangered Species Act)
5. "...particular value in carrying out the national migratory bird management program." – 16 U.S.C. 667b, dated May 19, 1948 (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes)
6. "...(b) The Secretary of the Interior shall administer the property transferred pursuant to subsection (a) consistent with wildlife conservation purposes and shall provide for the continued use of the property by Federal agencies to the extent such agencies are using it on the date of the enactment of this Act." – Public Law 101-519 Sec. 216, 104 Stat. 2247, dated November 5, 1990 (Defense Appropriation Act – including transfer of the North Tract from Fort Meade).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

"To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." 16 U.S.C. 668dd(a)(2) (National Wildlife Refuge System Improvement Act of 1997)

DESCRIPTION OF USE:

What is the use? Is the use a priority public use?
This secondary use is producing educational films and conducting photography workshops on Patuxent Research Refuge. Film productions usually involve two to five people. Photographic workshops usually involve approximately 10 to 20 participants and an instructor. The emphasis is placed on wildlife and scenic photography. Neither film production nor photography workshops are priority public uses; however, they both support and enhance the priority public use of wildlife photography. In addition, the films produced normally support the priority public uses of environmental education and interpretation.

Where would the use be conducted?
This type of filming and photography can take place in a variety of refuge habitats and at varying times of the year, depending on the objectives of the project. Filming is permitted for educational purposes.

When would the use be conducted?
The productions and workshops would be conducted at different times of year depending on the subject matter.

How would the use be conducted?
The filming and photography involved in these types of productions would be conducted in specified areas of the refuge depending on season, number of requests, and possible impacts to the resource. Specific areas of the refuge would be identified for the activity and participants would remain in the specified location. A special use permit with appropriate conditions would be issued each time those activities are allowed.

Why is this use being proposed?
The production of, and involvement with, environmental filming and photographic workshops will allow participants an opportunity to learn about wildlife and natural resources, while providing similar experiences to the general populous through educational films. This allows the refuge to educate the public with a low impact non-priority activity.

AVAILABILITY OF RESOURCES:

Time spent reviewing, issuing, and overseeing permit holders will be minimal for refuge staff, and therefore resources are available.

ANTICIPATED IMPACTS OF THE USE:

Impacts to wildlife would be similar to potential disturbance from other activities which usually are conducted adjacent to some refuge impoundments, such as wildlife observation, hiking, environmental education and interpretation.

Conflicts arise when migratory birds and humans are present in the same areas (Boyle and Samson 1985). The presence of people on refuge trails and roads can lead to displacement of animals from trails, although disturbance usually is a negligible influence on large mammal distributions and movements (Purdy et al. 1987, Boyle and Samson 1985). The effects on other

forms of wildlife appear to be short-term with the exception of breeding bird communities. A study by Miller, Knight, and Miller (1998) indicates that species composition and nest predation was altered adjacent to trails in both forested and grassland habitats. It appears that species composition changes are due to the presence of humans and not the trail or roadway itself. On the other hand, nest predation does appear to be a function of the trail which allows access to mammalian nest predators. The refuge will continue management strategies of educating trail and roadway users how of their activities affect wildlife and how to modify their use to minimize impacts on wildlife.

The use of trails and gravel roads could lead to soil compaction, exposure of tree roots, and the modification of plant species 3 to 6 feet on either side of the trail which is a function of soil compaction, invasive species, and direct trampling of plants (Kuss 1986). The refuge will continue its management practices of the use of boardwalks, woodchips, erosion control, and user education to protect plant species and habitats along trails and roadways. Potential conflict with priority public uses will be minimized by using trail head signs and other media to inform the various users about current public uses and by restricting filming opportunities and photography workshops during critical times. Some trail and roadway use will be restricted during the refuge specific hunting seasons, primarily during shotgun season. Portions of trails and roadways are closed seasonally to reduce human disturbance to wintering and nesting waterfowl and these closures would be adhered to for filming and photography workshop purposes.

People and vehicles can be vectors for invasive plants when seeds or other propagules are moved from one area to another. Once established, invasives can out compete native plants, thereby altering habitats and indirectly impacting wildlife. The threat of invasive plant establishment will always be an issue requiring annual monitoring and, when necessary, treatment. Staff will work to eradicate invasives and educate the visiting public.

Similar types of disturbance related to hiking, wildlife observation, environmental education and interpretation may occur on the refuge when filming and photographic workshops occur. The degree of disturbance will depend on the time of year. Due to the infrequency of these uses and restrictions placed on them, disturbance is expected to be minimal.

The refuge does not support large numbers of migratory waterfowl or shorebirds and as such, filming activities are not expected to significantly impact either migrating or wintering waterfowl or shorebirds any more than would other wildlife dependent uses (e.g., wildlife observation). Filming would not be allowed in sensitive areas where negative impacts to wildlife would be likely. Sensitive areas would include captive breeding areas in the Endangered Species Area. Requests would be carefully coordinated and planned in conjunction with U.S. Geological Survey staff.

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning process for Patuxent Research Refuge, this compatibility determination will undergo extensive public review, including a comment period of 45 days following the release of the draft Comprehensive Conservation Plan/Environmental Assessment.

DETERMINATION (CHECK ONE BELOW):

____ Use is not compatible
_X_ Use is compatible with the following stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

Conducting these activities in areas normally open to the public will be coordinated with refuge staff in advance, to lessen impacts to all wildlife.

Participants and equipment would be restricted to public trails and roads.

These activities require a special use permit that may include additional specific stipulations.

The size and number of photography workshops would be restricted as necessary depending on the time of year and nature of the request.

These activities will be prohibited in areas deemed the most critical for migratory birds and other wildlife depending on the season.

JUSTIFICATION:

By allowing the uses described in this determination, the visiting public will have a better understanding and appreciation for wildlife, the cultural history of the refuge, and the importance of the National Wildlife Refuge System (Refuge System). One of the secondary goals of the Refuge System is to provide opportunities for the public to develop an understanding and appreciation for wildlife wherever those opportunities are compatible. These uses are low impact, low cost, and highly controllable. Relatively small areas of the refuge are impacted by these activities.

Educational filming is a non-wildlife-dependent use that can be used as a tool to educate the public about the mission of the Refuge System, in addition to encouraging participation in wildlife-dependent uses. The act of photography is a priority wildlife-dependent use for the Refuge System through which the public can develop an appreciation for fish and wildlife (Executive Order 12996, March 25, 1996, and the National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57)).

These uses do not adversely impact the refuge's research purpose since large portions of the refuge are closed to the visiting public. The Central Tract portion of the refuge is set aside specifically to support research. At the infrequency of these uses, wildlife and habitats are not appreciably negatively affected by these uses, based on professional judgment and the consistently high biodiversity observed on the refuge.

These uses will not materially interfere with or detract from the two purposes related to wildlife conservation. Refuge staff will determine the locations for these workshops to ensure reduced levels of impacts to wildlife. These uses will not materially interfere with or detract from the two purposes related to migratory bird conservation, because these uses will generally not be allowed

in the vicinity of migratory waterfowl or land bird habitat during sensitive times of year. Filming and photography workshops will not materially interfere with or detract from the endangered species purpose, because there are no federally listed threatened or endangered species that occur in the wild on the refuge. Finally, filming and photography workshops will not materially interfere with or detract from the mission of the Refuge System, because of the limited locations where they will occur on the refuge and the limited number of individuals that will be participating.

SIGNATURE:

REFUGE MANAGER: _____

(signature and date)

CONCURRENCE:

REGIONAL CHIEF: _____

(signature and date)

MANDATORY 10-YEAR REEVALUATION DATE: 2022

REFERENCES:

Boyle, S.A. and F.B. Samson. 1985. Effects of nonconsumptive recreation on wildlife: a review. Wildlife Society Bulletin 13:110-116.

Kuss. F. 1986. A review of major factors influencing plant responses to recreation impacts. Environmental Management. 10:638-665.

Miller, S.G., Knight R.L., and Miller C.K. 1998. Influence of recreational trails on breeding bird communities. Ecological Applications 8(1):162 -169.

Purdy, Goff, Decker, Pomerantz, Connelly. 1987. A guide to managing human activity on a national wildlife refuge. New York Cooperative Fish and Wildlife Research Unit.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Patuxent Research Refuge

Use: Wildlife Research

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	✓	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✓	
(d) Is the use consistent with public safety?	✓	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✓	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✓	
(g) Is the use manageable within available budget and staff?	✓	
(h) Will this be manageable in the future within existing resources?	✓	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✓	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✓	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✓ No ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** ✓

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

REFUGE NAME: Patuxent Research Refuge

USE: Wildlife Research

NARRATIVE:

Pursuant to Executive Order 7514 by President Franklin Roosevelt, the refuge was established on December 16, 1936 to preserve the Nation's wildlife and to conduct wildlife research. Land was acquired under this authority as a national wildlife refuge on which "to effectuate further the purposes of the Migratory Bird Conservation Act" and "as a wildlife experiment and research refuge." By order of the President, the area was to be known as the Patuxent Research Refuge. Dedicated on June 3, 1939, Secretary of Agriculture Henry A. Wallace stated that, "the chief purpose of this refuge is to assist in the restoration of wildlife - one of our greatest natural resources." The original refuge has grown from 2,679 acres in 1936 to 12,842 acres today. Historically, it was the only research facility in the U.S. Fish and Wildlife Service (Service) with a large land base where research could be conducted to support biological management decisions applicable to many refuges and other wildlands throughout the United States. As such, it provides a unique opportunity to integrate biological research and on-the-ground application. Research is conducted by Service and non-Service personnel, with the bulk of the research conducted by the U.S. Geological Survey's (USGS) Patuxent Wildlife Research Center; colleges; Federal, State, and local agencies; non-governmental organizations; and qualified members of the general public.

The purposes of research conducted on the refuge are to further the understanding of natural resources and to improve the management of such resources on the refuge or within the National Wildlife Refuge System (Refuge System). A Memorandum of Agreement signed in 2000 by the Directors of the Service and the USGS, stipulated that the refuge would support "priority research," defined as "those projects that are considered important to agencies of the Department of the Interior, the U.S. Fish and Wildlife Service, the National Wildlife Refuge System, and State Fish and Game Agencies, and that address important management issues or demonstrate techniques for management of species and/or habitats."

Wildlife research supports goal 1 of the CCP which is to maintain and actively promote Patuxent Research Refuge as an "outdoor laboratory," providing a diversity of wildlife and natural resource research opportunities on the refuge in such areas as landscape conservation, habitat fragmentation, climate change, and other emerging issues, as well as the more traditional types of wildlife research, including inventory and monitoring techniques, land management, and understanding ecological processes. Research that supports the overall Service mission, and evaluates the best methods for protecting natural resources throughout the Refuge System and other land management agencies will be a priority. Wildlife research has therefore been found appropriate because it is consistent with the goals and objectives of the CCP and the defining legislation of Patuxent Research Refuge.

COMPATIBILITY DETERMINATION

USE:

Wildlife Research

REFUGE NAME:

Patuxent Research Refuge

ESTABLISHING AND ACQUISITION AUTHORITIES:

Executive Order 7514, dated December 16, 1936; Executive Order 11724, dated June 27, 1973; 16 U.S.C. 715d, Migratory Bird Conservation Act of 1929; 16 U.S.C. 1534; 16 U.S.C. 667b, dated May 19, 1948 - An Act Authorizing the Transfer of Certain Real Property for Wildlife or other purposes; and Public Law 101-519 Sec. 126, 104 Stat. 2247, dated November 5, 1990.

REFUGE PURPOSES:

1. "...as a wildlife experiment and research refuge" – Executive Order 7514, dated December 16, 1936
2. "…recreation, conservation, wildlife preservation, and related scientific and educational activities" – Executive Order 11724, dated June 27, 1973
3. "...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" – 16 U.S.C. 715d, dated February 18, 1929 (Migratory Bird Conservation Act)
4. "...to conserve fish, wildlife and plants, including those which are listed as endangered species or threatened species – 16 U.S.C. 1534, dated December 28, 1973 (Endangered Species Act)
5. "...particular value in carrying out the national migratory bird management program." – 16 U.S.C. 667b, dated May 19, 1948 (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes)
6. "...(b) The Secretary of the Interior shall administer the property transferred pursuant to subsection (a) consistent with wildlife conservation purposes and shall provide for the continued use of the property by Federal agencies to the extent such agencies are using it on the date of the enactment of this Act." – Public Law 101-519 Sec. 216, 104 Stat. 2247, dated November 5, 1990 (Defense Appropriation Act – including transfer of the North Tract from Fort Meade).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

"To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." 16 U.S.C. 668dd(a)(2) (National Wildlife Refuge System Improvement Act of 1997)

DESCRIPTION OF USE:

What is the use? Is the use a priority public use?
Research is a scholarly or scientific investigation or inquiry. Patuxent Research Refuge (refuge) was established as a wildlife experiment and research refuge. Research is not a priority public use on national wildlife refuges, but it directly supports the primary purpose of the refuge (Executive Order 7514, dated Dec. 16, 1936). The research would be conducted by U.S. Fish and Wildlife Service (Service) and non-Service personnel, with the bulk of the research likely conducted by the U.S. Geological Survey (USGS) Patuxent Wildlife Research Center. The purposes of research conducted on the refuge are to further the understanding of natural resources and to improve the management of such resources on the refuge or within the National Wildlife Refuge System (Refuge System). A Memorandum of Agreement signed in 2000 by the Directors of the Service and the USGS, stipulated that the refuge would support "priority research," defined as "those projects that are considered important to agencies of the Department of the Interior, the U.S. Fish and Wildlife Service, the National Wildlife Refuge System, and State Fish and Game Agencies, and that address important management issues or demonstrate techniques for management of species and/or habitats."

Where would the use be conducted?
The location of the research will vary depending on the individual research project that is being conducted. Patuxent Research Refuge is located in the National Capital Region just below the fall line of the Patuxent River valley between the Northern Piedmont and Upper Coastal Plain. The majority of the refuge's 12,841 acres is drained by the Big and Little Patuxent Rivers, which run through the refuge. A small portion of the refuge (southwest corner) is drained by the Anacostia River. Habitat types include old fields, upland deciduous forest, floodplain forest and hardwood bottomland, freshwater nontidal marshes, and impoundments. Rare habitats or plant communities include magnolia bogs and Coastal Plain acidic seeps. The refuge provides habitat for at least 33 mammal species, 49 amphibian and reptile species, 25 orders of insects, and 250 bird species. Although the Central Tract was originally acquired for the research land base and has traditionally provided sites for the majority of the research conducted on the refuge for the past 75 years, other portions of the refuge (North Tract or South Tract) may also be made available for consideration. However, an individual research project is usually limited to a particular habitat type, plant, or wildlife species. On occasion, research projects may encompass an assemblage of habitat types, plants, or wildlife. The research location will be limited to only those areas of the refuge that are necessary to conduct any specific, approved research project.

Much of the ongoing research also occurs in animal colonies and pen complexes, exclusively on the Central Tract. These areas include support infrastructure such as wells, well houses, propagation buildings, storage sheds, maintenance shops, etc. Research in these areas include behavioral and contaminant research and endangered species propagation. Activities, operations, and maintenance within these complexes are governed by Occupancy Agreements established in 2009.

When would the use be conducted?
The timing of the research will depend on the individual research project that is being conducted. Scientific research may be allowed to occur on the refuge throughout the year. An individual research project could be short-term in design, requiring one or two visits over the course of a

few days. Other research projects could be multiple-year studies that require daily visits to the study site. The timing of each individual research project will be limited to the minimum required to complete the project. If a research project occurs during a refuge hunting season, special precautions or limitations are required to ensure the safety of researchers or staff.

Other constraints include active shooting ranges that limit access to approximately 2,500 acres of the North Tract and the presence of unexploded ordnance on the entire 8,100 acres of the North Tract.

How would the use be conducted?

The methods of a research project will depend on the individual project that is being conducted. The senior refuge biologist will evaluate the methods of each research project before it will be allowed to occur on the refuge. Non-Service research proposals that involve the land base must be submitted to the refuge biologist for a special use permit. Any research involving direct handling of animal life must also be reviewed before the Animal Care and Use Committee (ACUC), a joint team comprised of seven voting members, including a permanent USGS employee and a permanent Service employee. No research project will be allowed to occur if it does not have a study plan approved by the refuge manager, deputy manager, refuge biologist, and ACUC committee (if applicable); or if the refuge manager determines the project may adversely affect wildlife, wildlife habitat, on-going or planned refuge management activities, previously approved research programs, approved priority public uses, or public health and safety.

The Service will encourage and support research and management studies on refuge lands that improve and strengthen natural resource management decisions. The refuge manager will encourage and seek research relative to approved refuge objectives that clearly improves land management and promotes adaptive management. Research that informs better management of the Nation's biological resources; is generally considered important to agencies of the Department of the Interior, including the Service, the Refuge System, and State Fish and Game Agencies; and that addresses important management issues or demonstrates techniques for management of species and habitats, will be the priority. The refuge manager may also consider research for other purposes which may not be directly related to refuge-specific objectives, but would contribute to the broader enhancement, protection, use, preservation, and management of populations of fish, wildlife, and plants, and their natural diversity at various landscape scales. These proposals should not substantially interfere with the refuge's purposes of supporting research and wildlife conservation, migratory bird conservation, and endangered species management. The refuge may develop a list of research needs that will be provided to prospective researchers or organizations upon request. Refuge support of research directly related to refuge objectives may take the form of funding, in-kind services such as housing or use of other facilities, direct staff assistance with the project in the form of data collection, provision of historical records, conducting of management treatments, or other assistance as appropriate.

Refuge staff will maintain a database and GIS maps of current research to prevent conflicts; and will impose conditions to prevent negative impacts, such as keeping vehicles on refuge roads, prohibiting intrusive marking of vegetation, or staggering the timing of research at the same locations.

Why is this use being proposed?
This use is being proposed because it is the primary purpose specified for Patuxent Research Refuge. Pursuant to Executive Order 7514 by President Franklin Roosevelt, the refuge was established on December 16, 1936, to preserve the Nation's wildlife and to conduct wildlife research. Land was acquired under this authority as a national wildlife refuge on which "to effectuate further the purposes of the Migratory Bird Conservation Act" and "as a wildlife experiment and research refuge." By order of the President, the area was to be known as the Patuxent Research Refuge. Dedicated on June 3, 1939, Secretary of Agriculture Henry A. Wallace stated that, "the chief purpose of this refuge is to assist in the restoration of wildlife - one of our greatest natural resources." The original refuge has grown from 2,679 acres in 1936 to 12,841 acres today. It was the only research facility in the Service with a large land base where research could be conducted to support biological management decisions applicable to many refuges and other wildlands throughout the United States. As such, it provides a unique opportunity to integrate biological research and on-the-ground application.

Research by non-Service personnel may be conducted by partner agency USGS Patuxent Wildlife Research Center; colleges; Federal, State, and local agencies; non-governmental organizations; and qualified members of the general public.

Past research has included land management activities such as wetland management, grassland and meadow management, population surveys and monitoring techniques, toxicology, and captive propagation of endangered species. Some of this research continues today. However, future research opportunities will likely focus on landscape level conservation issues such as climate change, habitat fragmentation, alternative energy, and urban ecology.

AVAILABILITY OF RESOURCES:

The bulk of the cost for research is incurred in staff time to review research proposals, coordinate with researchers, participate in a review with ACUC members, write special use permits, map the research or study sites, administer some logistics for access, summarize activities for the refuge annual performance plan, and review the research results. In some cases, a research project may only require one day of staff time to write a special use permit. Monitoring of research projects occurs through periodic and annual reporting, opportunistic evaluations of site impacts, flagging and equipment removal, final documentation and reporting of the project. In other cases, a research project may require several days of staff time. Currently, a senior refuge biologist and an assistant biologist spend an average of one day per week, or 52 days a year, each on administration of research projects conducted by outside researchers. Estimated costs in the below table do not reflect costs involving other USGS ACUC team members spent reviewing projects. Other refuge staff periodically provides support with coordination of management activities, scheduling research-related meetings, discussing issues with USGS management, and field support.

Staff Cost		
Task	**Staff Days**	**Cost**
Administration and management to facilitate activity	104 GS 12 Biologist $240/day, 52 days GS-9 Biologist $160/day, 52 days	$20,800/year (2011 values)

Staff Cost		
Task	**Staff Days**	**Cost**
Maintenance of facilities	20	$4,046/year (2007 values)
Surveying facilities (includes law enforcement services)	10	$2,023/year (2007 values)
Total cost for staff		**$26,869/year**

Cost of Supplies/Services (2007 values)	
Maintenance of buildings, roadways, trails, parking areas	$40,000/year
Office supplies and support	$5,000/year
Operation of equipment	$10,000/year
Total cost of supplies and services	**$55,000/year**

Total Cost (Staff + Supplies and Services): $81,869.00

After review of the refuge budget, there are sufficient staff and funds to sustain this activity.

ANTICIPATED IMPACTS OF THE USE:

Compared to the impacts from trails, hunting, and refuge management activities (such as prescribed fire and bush hogging), past research has had minimal impact on refuge resources, such as soils, vegetation and wildlife, with the exception of hydrology. Hydrology has been impacted by past impoundment creation and research, and this may have impacted soils and vegetation within their respective footprints (roughly 300 acres).

Research may have a similar disturbance impact to habitats and wildlife as does public hunting since both activities involve single individuals or small parties walking off trail and infrequently repeated visits. In 2011, public hunting on the refuge, for example, had over 5,000 hunter visits across 75 percent of the refuge acreage over a 5-month period, whereas research involved 23 projects involving 1 to 4 individuals each, or less than 100 individuals, over a similar area but throughout a 12-month period. We estimate that the types of disturbance impacts to wildlife and habitats are similar off trail as on trail both spatially and temporally. Because research visits are not restricted to trails, the reach of disturbance would be greater spatially. Because field visits to research sites are substantially less frequent, shorter duration, or more sporadic than public hunting, the disturbance would be less. The most concerning disturbance is that caused to ground-nesting birds, or winter roosting species that have limited energy reserves. The presence of people on refuge trails and roads can lead to displacement of animals from trails, although disturbance usually is a negligible influence on large mammal distributions and movements (Purdy et al. 1987, Boyle and Samson 1985). The effects on other forms of wildlife appear to be short-term with the exception of breeding bird communities. A study by Miller, Knight, and Miller (1998) indicates that species composition and nest predation was altered adjacent to trails in both forested and grassland habitats. It appears that species composition changes are due to the presence of humans and not the trail or roadway itself. On the other hand, nest predation does appear to be a function of the trail which allows access to mammalian nest predators (Miller, Knight and Miller 1998).

Based on observations of research projects, we have not observed any impacts to water quality, soils, or other wildlife species.

Disturbance to wildlife and vegetation by researchers could occur through observation, a variety of wildlife capture techniques, banding, collecting blood samples, flushing wildlife, and vegetation trampling from accessing the study area by foot or vehicle. It is possible that direct or indirect mortality could result as a by-product of research activities. Mist-netting or other wildlife capture techniques, for example, can cause mortality directly through the capture method or in-trap predation, and indirectly through capture injury or stress caused to the organism. Multiple, concurrent research projects could exacerbate impacts. Additional impacts could result from abandoned research apparatus left in the field. Overall, however, allowing well-designed and properly reviewed research is likely to have very little impact on refuge wildlife populations. If the research project is conducted with professionalism and integrity, potential adverse impacts are likely to be outweighed by the knowledge gained through allowing the research. The refuge maintains a database and GIS maps of current research to prevent conflicts and imposes guidelines (see below) to prevent negative impacts, such as keeping vehicles on refuge roads, prohibiting intrusive marking of vegetation, or staggering the timing of research at same sites. ACUC committee scrutinizes projects involving wildlife handling and to ensure avoidance of unnecessary harm excepting that allowed for the research purposes of the study, such as tissue sampling. Even then, researchers are limited so as not to reduce local populations of targeted species. Most research projects are conducted on small areas; few are refugewide.

Refuge Guidelines Specific to Research Permits

- No nails or other metal fasteners will be driven into trees.
- Tree boring tools are not permitted.
- Permittee will observe refugewide speed limit of 25 mph at all times.
- No pets or any animals may be brought into the refuge.
- Vehicle must stay on refuge roads.
- Respect study plots of other researchers that may be encountered and where flagged.
- No removal of plants or artifacts, animals, fungi, nest, or collecting of any natural resources is permitted unless granted by special provision for the purpose of the study and if permittee provides a valid, current collection permit (State and if a federally listed species, Federal) which must accompany the permit application for animal collection.
- No disturbance of wildlife other than that temporarily caused by your presence. Keep noise to a minimum, footprint of activity to a minimum.
- Plants of rare status must not be disturbed or destroyed. Locations should be brought to the attention of the refuge biologist.
- This permit is non-transferable. If permittee wishes to bring a non-Service person onto the refuge for assistance, permittee must receive approval from the Service and provide name, date of proposed access. Permittee assistants must obtain display the refuge permit vehicle pass provided by the refuge office.
- Permittee must inform refuge biologist if there are any changes in the plan pertaining to this permit.

- Permittee shall flag or mark the research site or equipment left in field using name and permit number. All flagging, field markers, equipment must be removed from the refuge at the conclusion of this permit.
- Permittee must supply a map depicting location(s) of proposed research or surveys, or GPS coordinates or shapefiles of these locations. If the target areas are broad and general, indicate the general areas on the map.

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning process for Patuxent Research Refuge, this compatibility determination will undergo extensive public review, including a comment period of 45 days following the release of the draft Comprehensive Conservation Plan/Environmental Assessment.

DETERMINATION (CHECK ONE BELOW):

___ Use is not compatible
_X_ Use is compatible with the following stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

All researchers will be required to submit a detailed research proposal following Service Policy (USFWS Refuge Manual Chapter 4 Section 6, as amended). If collection or manipulation of wildlife is involved, the proposal must also be submitted to the ACUC by the 15th of the month. ACUC is a joint USGS and Service committee with seven members, including one permanent member each from USGS and the Service.

In most cases, the refuge will be given at least 60 days to review proposals before research begins. Proposals will be prioritized and approved based on need, benefit, compatibility, and funding required.

Special use permits will be issued for all research. The special use permit will list the conditions that the refuge manager determines to be necessary to ensure compatibility. The special use permit will also identify a schedule for progress reports and the submittal of a final report or scientific paper. Regional refuge biologists, other Service Divisions, State agencies or non-governmental organizations, and biologists may be asked to provide additional review and comment on any research proposal.

All researchers will be required to obtain appropriate State and Federal collection permits.

Any research involving ground disturbance may require historic preservation consultation with the Regional Office and/or State Historic Preservation Office. Additionally, any research involving ground disturbance on the North Tract may require a survey for unexploded ordnance.

All researchers are required to submit a final report to the refuge upon completion of their work. If the study is long-term, an interim progress report will be required. Researchers who publish the work in peer-reviewed publications are to provide copies to the refuge. All reports, presentations, posters, articles or other publication will acknowledge the Service and Patuxent

Research Refuge. The acknowledgement recognizes that the research could not have been conducted without the existence of the refuge and its support and cooperation.

Upon completion of a project, researchers are required to remove all research apparatus in the field.

All research related special use permits will contain a statement regarding the Service's policy regarding disposition of biotic specimen. The current Service policy language in this regard is:

> *You may use specimens collected under this permit, any components of any specimens (including natural organisms, enzymes, genetic material or seeds), and research results derived from collected specimens for scientific or educational purposes only, and not for commercial purposes unless you have entered into a Cooperative Research and Development Agreement (CRADA) with us. We prohibit the sale of collected research specimens or other transfers to third parties. Breach of any of the terms of this permit will be grounds for revocation of this permit and denial of future permits. Furthermore, if you sell or otherwise transfer collected specimens, any components thereof, or any products or any research results developed from such specimens or their components without a CRADA, you will pay us a royalty rate of 20 percent of gross revenue from such sales. In addition to such royalty, we may seek other damages and injunctive relief against you (USFWS 1999).*

Any research project may be terminated at any time for non-compliance with the special use permit conditions; or modified, redesigned, relocated or terminated, upon a determination by the refuge manager that the project is causing unanticipated adverse impacts to wildlife, wildlife habitat, approved priority public uses, or other refuge management activities.

JUSTIFICATION:

Executive Order 7514, which originally established Patuxent Refuge, stipulates that the purpose of the refuge is to conduct research. The Service encourages approved research to further understanding and management of refuge natural resources. Research by non-Service personnel adds greatly to the information base for refuge managers to make proper decisions. The Memorandum of Agreement between USGS and the Service reaffirmed the partnership and cooperation between the two agencies, ensured that the research activities on the refuge are consistent with the Refuge Improvement Act of 1997 and other applicable laws and policies, and defined priority research. The refuge and our USGS Patuxent Wildlife Research Center partner will work cooperatively to interpret the research activities so that the public understands the research, and its importance and relevance to current wildlife/natural resource management issues.

Research activities, adhering to the stipulations previously mentioned, authorized through special use permits, and reviewed periodically will not compromise our wildlife conservation purposes. The Central Tract portion (2,670 acres) of the refuge is set aside specifically to support and accommodate the research of the Patuxent Wildlife Research Center. Generally researchers yield to other uses on the refuge (i.e., refuge closed to all uses during certain hunting periods). There is

little to no user conflict between researchers and the general public, or between researchers and wildlife management practices. In addition to the Central Tract, scientists have access to others areas of the refuge to support research and can often go off trail where most of the public does not have access. Compared to impacts from trails, hunting, and refuge management activities (such as prescribed fire, bush hogging), past research has had minimal impact on refuge resources (such as soils, vegetation, and wildlife), with the exception of hydrology. Hydrology has been impacted by past impoundment creation and research, and this may have impacted soils and vegetation within their respective footprints (roughly 300 acres). A benefit to the scientific community and the Refuge System is the accumulation of long-term data. The short-term negative impacts from disturbance by research are off-set by the benefits gained from increasing our knowledge database and understanding of wildlife and habitat relationships, and ecological functions.

Wildlife research will not materially interfere with or detract from the two purposes related to wildlife conservation, because impacts to wildlife species and habitats are expected to be minimal. This use will not materially interfere with or detract from the two purposes related to migratory bird conservation, because research will be timed to avoid large scale impacts to migratory waterfowl or land bird habitat. In addition, at any given time such a small percentage of the refuge will be used for these uses that ample habitat is available for migratory species. Wildlife research will not materially interfere with or detract from the endangered species purpose, because there are no federally listed threatened or endangered species that occur on the refuge. Finally, wildlife research will not materially interfere with or detract from the mission of the Service, because it is intended to add to the knowledge base that will improve refuge and habitat management overall.

SIGNATURE:

REFUGE MANAGER: _____

(signature and date)

CONCURRENCE:

REGIONAL CHIEF: _____

(signature and date)

MANDATORY 10-YEAR REEVALUATION DATE: 2022

REFERENCES:

Federal Register Volume I, Number 198. December 18, 1936. Executive Order (7514) establishing Patuxent Research Refuge signed by President Franklin D. Roosevelt at the White House on December 16, 1936.

Boyle S.A. and F.B. Samson. 1985. Effects of nonconsumptive recreation on wildlife: a review. 13:110-116.

Miller, S.G., R.L. Knight, and C.K. Miller. 1998. Influence of recreational trails on breeding bird communities. Ecological Applications 8(1):162-169.

Purdy, Goff, Decker, Pomerantz, Connelly. 1987 A guide to managing human activity on a national wildlife refuge. New York Cooperative Fish and Wildlife Research Unit.

U.S. Fish and Wildlife Service. 1985. Refuge Manual. Washington, D.C.: U.S. Government Printing Office.

U.S. Fish and Wildlife Service. 1999. Director's Order No. 109: Use of specimens collected on fish and wildlife lands. March 30, 1999.

U.S. Fish and Wildlife Service and U.S.Geological Survey. 2000. Memorandum of agreement for the administration, operations, and maintenance of facilities co-located at the Patuxent Research Refuge.

USGS-USFWS Animal Care and Use Committee (ACUC) Standard Operating Procedures, SOP 007. May 2006.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Patuxent Research Refuge

Use: Primitive Camping for Boy and Girl Scouts and 4-H Groups

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	✓	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✓	
(d) Is the use consistent with public safety?	✓	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✓	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✓	
(g) Is the use manageable within available budget and staff?	✓	
(h) Will this be manageable in the future within existing resources?	✓	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✓	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✓	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✓ No ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** ✓

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

REFUGE NAME: Patuxent Research Refuge

USE: Primitive Camping for Scouts and 4-H Groups

NARRATIVE:

Camping is the act of encamping and living in a tent in a camp or designated site. Scout camping was a traditional use of the North Tract during the administration of the Department of the Army and has been allowed to continue after the transfer of land to the U.S Fish and Wildlife Service. Even though camping is not a priority public use, scout groups having the opportunity to camp on Patuxent Research Refuge could develop a sense of stewardship and an understanding of the National Wildlife Refuge System and its mission (Lyons 1982). Camping will be restricted to members of the Boy Scouts of America, Girl Scouts of America, and 4-H clubs of America which have a Memorandum of Understanding with the U.S. Fish and Wildlife Service (Service Manual 142-144 FW1, Policies and Procedures).

The scout camps are located on the east bank of the Patuxent River on the North Tract. The scout areas and associated lands total approximately 10 acres. The camping will be conducted in Area L which consists of two campsites. Scout site 1 is restricted to a total of 25 people. Scout site 2 is restricted to a total of 15 people. Campers will be furnished with firewood, a fire extinguisher and sand, gate key, portable toilet, and potable water for drinking, cooking, and washing. The check-in procedure for camping groups will follow the established Standard Operating Procedure for Scout Camping and the Public Use and Check In/Out of the North Tract. Camping would be conducted on Patuxent Research Refuge from mid-March through the end of June for approximately 45 days a year. Campers would be allowed to camp in designated areas for no more than three days and two nights (weekends only) in order to further minimize the impact on wildlife.

Camping does not interfere with research purposes or wildlife and habitat management practices provided that regulations and mandates are set and strictly enforced for the purpose of preventing the detrimental effects camping may have on wildlife and habitats. Camping is allowed to occur for a limited portion of the year in designated areas. There has been no documentation of user conflicts. The camping experience helps to facilitate a sense of stewardship by the campers for habitats, wildlife and the U.S. Fish and Wildlife Service mission.

COMPATIBILITY DETERMINATION

USE:

Primitive Camping for Scouts and 4-H groups

REFUGE NAME:

Patuxent Research Refuge

ESTABLISHING AND ACQUISITION AUTHORITIES:

Executive Order 7514, dated December 16, 1936; Executive Order 11724, dated June 27, 1973; 16 U.S.C. 715d, Migratory Bird Conservation Act of 1929; 16 U.S.C. 1534; 16 U.S.C. 667b, dated May 19, 1948 - An Act Authorizing the Transfer of Certain Real Property for Wildlife or other purposes; and Public Law 101-519 Sec. 126, 104 Stat. 2247, dated November 5, 1990.

REFUGE PURPOSES:

1. "...as a wildlife experiment and research refuge" – Executive Order 7514, dated December 16, 1936
2. "…recreation, conservation, wildlife preservation, and related scientific and educational activities" – Executive Order 11724, dated June 27, 1973
3. "...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" – 16 U.S.C. 715d, dated February 18, 1929 (Migratory Bird Conservation Act)
4. "...to conserve fish, wildlife and plants, including those which are listed as endangered species or threatened species – 16 U.S.C. 1534, dated December 28, 1973 (Endangered Species Act)
5. "...particular value in carrying out the national migratory bird management program." – 16 U.S.C. 667b, dated May 19, 1948 (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes)
6. "...(b) The Secretary of the Interior shall administer the property transferred pursuant to subsection (a) consistent with wildlife conservation purposes and shall provide for the continued use of the property by Federal agencies to the extent such agencies are using it on the date of the enactment of this Act." – Public Law 101-519 Sec. 216, 104 Stat. 2247, dated November 5, 1990 (Defense Appropriation Act – including transfer of the North Tract from Fort Meade).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

"To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." 16 U.S.C. 668dd(a)(2) (National Wildlife Refuge System Improvement Act of 1997)

DESCRIPTION OF USE:

Camping is the act of encamping and living in a tent in a camp or designated site. Scout camping was a traditional use of the North Tract during the administration of the Department of the Army and has been allowed to continue after the transfer of land to the U.S Fish and Wildlife Service (Service). Even though camping is not a priority public use, scout groups having the opportunity to camp on Patuxent Research Refuge could develop a sense of stewardship and an understanding of the National Wildlife Refuge System (Refuge System) and its mission (Lyons 1982). Camping will be restricted to members of the Boy Scouts of America, Girl Scouts of America, and 4-H clubs of America, which have a Memorandum of Understanding with the Service (Service Manual 142-144 FW1, Policies and Procedures).

The camps are located on the east bank of the Patuxent River on the North Tract. The areas and associated lands total approximately 10 acres, including access roads to the sites. The camping will be conducted in Area L which consists of two campsites. Site 1 is restricted to a total of 25 people. Site 2 is restricted to a total of 15 people. Campers will be furnished with firewood, a fire extinguisher and sand, gate key, portable toilet, and potable water for drinking, cooking, and washing. The check-in procedure for camping groups will follow the established Standard Operating Procedure for Scout Camping and the Public Use and Check-In/Out of the North Tract. Camping would be conducted on Patuxent Research Refuge from mid-March through the end of June for approximately 45 days a year. Campers would be allowed to camp in designated areas for no more than three days and two nights (weekends only) in order to further minimize the impact on wildlife.

During their camping stay, groups generally participate in other activities such as fishing, wildlife observation and photography, and environmental interpretation. Participation by the groups in each of these secondary activities is reviewed as a part of the individual compatibility determinations for those activities.

AVAILABILITY OF RESOURCES:

Patuxent Research Refuge will furnish a portable toilet, fire extinguisher and sand, and potable water for drinking, cooking, and washing for each campsite. The access roads, signage, Visitor Contact Station and gates used to facilitate the camping program are maintained in order to support priority public use; therefore cost associated with camping is minimal. The campsites themselves were constructed by the Department of the Army so no associated construction cost was funded by the refuge. The coordination for camping will be done by the visitor services manager and designated North Tract and law enforcement personnel requiring10 staff days. Designated refuge staff will compose the rules and regulations for camping on the refuge. North Tract staff will oversee the process of booking, and check-in and check-out of the campers. The maintenance staff will handle general maintenance of campsites, road repair, gate maintenance, and posting of signage. A breakdown of the cost is outlined below.

Staff Cost

Task	Staff Days	Cost
Administration/management of camping activities	10	$2,589 per year
Monitoring camping activities	1	$258 per year

Task	Staff Days	Cost
Maintenance of access routes and camping facilities	3	$773 per year

Total Staff Cost: $3,620 per year

Cost of Supplies and Services

Services/Supplies	Cost
Placement and service of portable toilet	$945 per year
Facilities maintenance	$1,100 per year
Office supplies	$110 per year
Maintenance supplies (paint, signs, lumber, and road materials)	$1,100 per year
Equipment operation and upkeep	$1,100 per year

Total Cost for Supplies and Services: $4,355 per year

Total Cost for Camping Activity: $7,975 per year

After review of the refuge budget, there are sufficient funds to sustain this activity.

ANTICIPATED IMPACTS OF THE USE:

The following are the anticipated short and long term impacts of primitive camping:

- The presence of people camping could result in some disturbance to wildlife located in habitats adjacent to the campsites (Boyle and Samson 1985). In order to minimize this impact, time allowed will be restricted to no more than three days and two nights (weekends only; mid-March through the end of June).
- Vegetation disturbance, compaction and erosion could occur on trails that are frequently used by campers to access the campground. In order to manage for this impact, campers are restricted to designated areas where trails have been previously established and maintained (Kuss 1986).
- Invasive plants gain their first footholds in sunny disturbed areas, along trails or around shelters (Scherer 2001). Campers are required to camp only in designated areas in order to alleviate the creation of newly disturbed areas which may foster invasive plants. As the refuge develops its invasive weed management plan, new control measure may be implemented to lessen the possibility of establishing invasive weed communities.
- Trampled campsites can become dead zones of compacted soil and may lack understory vegetation (Boyle and Samson 1985, Kuss 1986). The refuge will develop a management plan which will close a campsite for a number of years to allow for the regrowth of understory vegetation and regenerative processes to occur. This plan would allow for a rotating cycle of campsite closures.
- Food and other debris may influence small mammal populations by attracting them to the campsite areas (Boyle and Samson 1985). The refuge requires all trash to be packed out

when the campers leave the refuge.The sites are inspected after each visit to ensure trash has been removed from the premise.

- Vegetation changes in and near campgrounds appear to be responsible for the increase of alpha diversity in bird species (Guth 1978). These increases of alpha diversity birds appear to have an affect on forest dwelling species of birds. This effect will be countered by allowing the campgrounds to only be used approximately 45 days a year as well as allowing the campsites to regenerate forest undergrowth through cyclical closures if necessary.
- Camp fires, if not kept under proper supervision, can quickly escalate to an uncontrollable fire resulting in significant wildlife habitat loss. Fires are only allowed in previously established fire rings and only if there is no burn ban in effect. It is required that camp fires never be left unattended and fires are completely extinguished before departure.
- Human waste must be disposed in a proper manner to prevent the contamination of groundwater and nearby waterways. All human waste will be disposed by use of portable toilet since pit latrines are prohibited on the refuge.

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning process for Patuxent Research Refuge, this compatibility determination will undergo extensive public review, including a comment period of 45 days following the release of the draft Comprehensive Conservation Plan/Environmental Assessment.

DETERMINATION (CHECK ONE BELOW):

___ Use is not compatible
_X_ Use is compatible with the following stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

In order to ensure the compatibility of camping with the refuge's current research activities and wildlife/habitat management practices, the following stipulations will be strictly enforced.

- All camping activities will be restricted to designated campsites on North Tract of the refuge. Camping on Patuxent Research Refuge will only be permitted by access permit. Access to other areas outside of operational hours must be approved by the Visitor Contact Station staff.
- Camping opportunities are primitive. Noise and light pollution should be minimal and have little to no impact on wildlife. Campers must use low wattage lighting. Music and other forms of electronic entertainment should be kept down or not used at all to reduce disturbance to wildlife.
- A list of all members of the Scout and 4-H groups and their emergency contact phone numbers must be provided to the Visitor Contact Station.
- Scout site 1 is restricted to a total of 25 people. Scout site 2 is restricted to a total of 15

people. The time restrictions are not to exceed three days and two nights (weekends only) for each camp site.

- Fires are prohibited during high fire conditions. Fires (including propane stoves) will be restricted to the designated areas with established buffer zones. Open fires will be no higher than 2 feet. Fire extinguisher and water/sand buckets will always be kept adjacent to the fire. Campers will be provided with fire wood from the refuge. They are not permitted to bring their own firewood from off-refuge.
- All litter will be packed out. Campsites will be checked by staff upon check-out.
- Swimming, bathing, and washing of articles of clothing or cooking utensils and dishes in the river is prohibited. All washing will take place at least 100 feet from waterways. Only biodegradable soaps or detergents are permitted.
- Pit latrines are prohibited. All human waste will be disposed by use of portable toilet.
- No vegetation will be removed or destroyed. Disturbing and collecting of any natural feature is prohibited including rocks, vegetation, downed trees,or animals. Campers will not attach anything to plants or trees (hanging lanterns, nails, axes, knives, etc.).
- No pets are allowed.
- The refuge's step-down plan for public use will be developed to include a section on the management and administration of camping activities on the refuge.

JUSTIFICATION:

Scout and 4-H group camping was a traditional use of the North Tract during the administration of the Department of the Army and has been allowed to continue after the transfer of land to the Service. Camping is allowed to occur for a limited portion of the year in designated areas. There has been no documentation of user conflicts. The camping experience helps to facilitate a sense of stewardship by the campers for habitats, wildlife and the Refuge System mission.

As listed in the purposes section of this compatibility determination, the refuge was established and subsequently land was acquired for a total of six purposes. Scout and 4-H group camping will not materially interfere with or detract from the research purpose of the refuge, because wildlife research does not generally occur in the vicinity of the locations that these uses occur. This use will not materially interfere with or detract from the two purposes related to wildlife conservation because impacts to refuge lands are minimal. This use will not materially interfere with or detract from the two purposes related to migratory bird conservation, because these uses are allowed in areas that are generally not in the vicinity of migratory waterfowl or land bird habitat. Scout and 4-H group camping will not materially interfere with or detract from the endangered species purpose, because there are no federally listed endangered species that occur on the refuge. Finally, this use will not materially interfere with or detract from the mission of the Service, because the use occurs at low levels in an area of the refuge that does not contain core habitat.

SIGNATURE:

REFUGE MANAGER: _____

(signature and date)

CONCURRENCE:

REGIONAL CHIEF: _____

(signature and date)

MANDATORY 10- YEAR REEVALUATION DATE: 2022

REFERENCES:

Boyle, S.A. and F.B. Samson. 1985. Effects of nonconsumptive recreation on wildlife: a review. 13:110-116.

Kuss. F. 1986. A review of major factors influencing plant responses to recreation impacts. Environmental Management 10:638-650.

Guth, R.W. 1978. Forest and campground bird communities of Peninsula State Park, Wisconsin. Passenger Pigeon 40: 489-493.

Lyons, J.R. 1982. Nonconsumptive wildlife-associated recreation in the U.S.: identifying other constituency. Trans. North American Wildlife and Natural Resources Conference 47:677-685.

Scherer, G. 2001. Backcountry visitor impacts: we have met the enemy, and he is us. American Hiker.

Scout Camping Guidelines; Patuxent Research Refuge

Standard Operating Procedure-Public Use and Checking In/Out on the North Tract

U.S. Fish and Wildlife Service Manual; 054 Youth Programs Part 142-144.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Patuxent Research Refuge

Use: Dog training for waterfowl hunting purposes

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	✓	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✓	
(d) Is the use consistent with public safety?	✓	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✓	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✓	
(g) Is the use manageable within available budget and staff?	✓	
(h) Will this be manageable in the future within existing resources?	✓	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✓	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✓	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✓ No ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** ✓

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

REFUGE NAME: Patuxent Research Refuge

USE: Dog Training for Waterfowl Hunting Purposes

NARRATIVE:

Dog training is a preparatory action taken by hunters to train hunting dogs to respond to a weapon firing, the use of decoys, and to teach the canines to retrieve waterfowl or small game from impounded waters, lakes, and swamps. This use directly supports hunting, one of the six wildlife-dependent public uses identified in the Refuge Improvement Act of 1997.

The refuge requires all migratory game bird hunting parties to "use retrievers when hunting over impounded waters," as stated in the annual Hunting Regulations, U.S. Fish and Wildlife Service, Patuxent Research Refuge (for the North, Central, and South Tracts). These requirements help minimize lost game that cannot be retrieved by the hunter due to deep water, losing it in marsh vegetation, etc.

The use is being proposed to support the requirement that hunters engaged in hunting waterfowl over refuge impoundments must have a retrieving dog with them to minimize lost game. It is reasonable for the refuge to provide an area(s) for waterfowl hunters to train the animals they are required to have in order to hunt over impounded waters. Per 50 CFR 26.21(b), 32.39.A.14, dogs are only lawful on the refuge when under direct control of their owners at all times. Owners training their dogs must ensure they and their dogs are in compliance in order to participate in dog training for waterfowl hunting, so the dogs will not impact refuge wildlife or other users. Dog training for waterfowl hunting purposes is an important aspect of promoting proper hunting ethics and in reducing wasted game. Therefore, we find the use appropriate.

COMPATIBILITY DETERMINATION

USE:
Dog Training for Waterfowl Hunting Purposes

REFUGE NAME:

Patuxent Research Refuge

ESTABLISHING AND ACQUISITION AUTHORITIES:

Executive Order 7514, dated December 16, 1936; Executive Order 11724, dated June 27, 1973; 16 U.S.C. 715d, Migratory Bird Conservation Act of 1929; 16 U.S.C. 1534; 16 U.S.C. 667b, dated May 19, 1948 - An Act Authorizing the Transfer of Certain Real Property for Wildlife or other purposes; and Public Law 101-519 Sec. 126, 104 Stat. 2247, dated November 5, 1990.

REFUGE PURPOSES:

1. "...as a wildlife experiment and research refuge" – Executive Order 7514, dated December 16, 1936
2. "…recreation, conservation, wildlife preservation, and related scientific and educational activities" – Executive Order 11724, dated June 27, 1973
3. "...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" – 16 U.S.C. 715d, dated February 18, 1929 (Migratory Bird Conservation Act)
4. "...to conserve fish, wildlife and plants, including those which are listed as endangered species or threatened species – 16 U.S.C. 1534, dated December 28, 1973 (Endangered Species Act)
5. "...particular value in carrying out the national migratory bird management program." – 16 U.S.C. 667b, dated May 19, 1948 (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes)
6. "...(b) The Secretary of the Interior shall administer the property transferred pursuant to subsection (a) consistent with wildlife conservation purposes and shall provide for the continued use of the property by Federal agencies to the extent such agencies are using it on the date of the enactment of this Act." – Public Law 101-519 Sec. 216, 104 Stat. 2247, dated November 5, 1990 (Defense Appropriation Act – including transfer of the North Tract from Fort Meade).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

"To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." 16 U.S.C. 668dd(a)(2) (National Wildlife Refuge System Improvement Act of 1997)

DESCRIPTION OF USE:

What is the use? Is it a priority public use?
Dog training is a preparatory action taken by hunters to train hunting dogs to respond to a weapon firing, the use of decoys, and to teach the canine(s) to retrieve waterfowl or small game from impounded waters, lakes, and swamps. Dog training is not a priority public use on national wildlife refuges but it directly supports hunting, a priority public use as stated in the National Wildlife Refuge System Improvement Act of 1997.

The refuge requires all migratory game bird hunting parties to "use retrievers when hunting over impounded waters," as stated in the annual Hunting Regulations, U.S. Fish and Wildlife Service (Service), Patuxent Research Refuge, North, Central, and South Tracts. This requirements help minimize game that cannot be retrieved by the hunter due to deep water, losing it in marsh vegetation, etc.

Where would the use be conducted?
Dog training will be allowed at New Marsh (7.1 acres) and at Cattail Pond (2.7 acres). This totals approximately 9.8 acres.

When would the use be conducted?
To avoid user conflict, minimize disturbances to breeding and nesting waterfowl or water birds and their broods, and fish spawning, the use would occur from August 1 through August 31.

How would the use be conducted?
The use would be restricted to those individuals holding a valid Meade Natural Heritage Association hunting permit (refuge hunt permit) and a valid Federal waterfowl hunting stamp. Hunters wishing to train their dogs may only use New Marsh, and Cattail Ponds during the refuge's open hunting seasons.

All individuals would be required to check in and out at the Hunt Control Station, as do all other hunters.

Retrieving dummies is only allowed when training

Blank or dummy cartridges to acclimate dogs to the sound of gunfire may be used. Firearms may be checked by refuge law enforcement to ensure appropriateness.

Why is the use being proposed?
The use is being proposed to support the requirement that hunters engaged in hunting waterfowl over refuge impoundments must have a retrieving dog with them to minimize lost game. It is reasonable for the refuge to provide an area(s) for waterfowl hunters expected to hunt here, to train the animals they are required to have.

This use directly supports hunting, one of the six wildlife-dependent public uses identified in the Refuge Improvement Act of 1997.

AVAILABILITY OF RESOURCES:

Dog training occurs during the month of August. Time spent to administer this use, and to maintain and inspect the dog training areas, is expected to be minimal, and handled by existing refuge staff and volunteers.

ANTICIPATED IMPACTS OF THE USE:

This use could have some negative impacts to wildlife. Total number of waterfowl hunt visits in fiscal year 2011 totaled 446 (September 198, November 134, January 114). This amounts to 7.8 waterfowl hunt visits per day. Since all waterfowl hunters are required to use retrieving dogs there is no difference with respect to impacts on wildlife and habitats between training and working dogs. Since fiscal year 2005, there has been a total of 55 dog training visits, an average of only 7.8 visits annually. All dogs are required to be under owners' control at all times. Impacts to wildlife and habitats may be similar to other public use activities involving dogs, such as dog walking or search and rescue training.

Studies on impacts of recreational dog walking in woodlands demonstrated a 35 percent reduction in bird diversity and 41 percent reduction in abundance, both in areas where dog walking is common and where dogs are prohibited (Banks and Bryant 2007). The higher energy and noise involved in training might be even more disturbing. Free-ranging and uncontrolled dogs can chase and flush ground-nesting or foraging birds and other wildlife, and occasionally prey on reptiles. The season has been set to avoid waterfowl breeding, so the impacts to waterfowl will be minimized. Potential impacts of domestic dogs could be broadly classified as harassment, injury, or death of wildlife. Harassment is the disruption of normal maintenance activities, such as feeding, bedding, or grooming. It can take the form of disrupting, alarming, or even chasing. If dogs chase or pursue wildlife, injuries could be sustained directly or indirectly as a result of accidents that occur during the chase itself rather than direct contact with the dog. Impacts of domestic dogs can also include modification of wildlife behavior.

Another concern is the possibility of disease transmission. Dogs also have endo- and ectoparasites and can contract diseases from, or transmit diseases to, wild animals. Canine Distemper, for example, can be transmitted freely in wild carnivore populations such as wolves, foxes, badgers, and in encounters with raccoons. The best way to prevent this contact is to prevent contact with wildlife. There is variability in dog behavior based on age and training experience. Dogs in the early stages of their training are more apt to run at large than more experienced dogs. This could increase disturbance to wildlife or increase the possibility of disease transmission, but the risk is minimized here because dog trainers are required to maintain control over their dogs at all times.

Training areas are open to public fishing year-round, wildlife observation and photography so some wildlife disturbance may already be occurring. New Marsh and Cattail Pond are in close proximity to the shooting range frequented by the U.S. Secret Service, with gunfire and vehicle disturbances already prevalent. Dog training use is not expected to add significantly to existing disturbances that are caused by these nearby uses or waterfowl hunting. There may be temporary displacement of wildlife, but suitable escape habitat is nearby on the refuge, including the Little Patuxent River, so the disturbances are anticipated to be minimal.

There have been no documented user complaints. However, there is potential for user conflict to occur between multiple public uses, particularly outside of the hunt season. Limiting the time frame and confining the areas to which it can occur will help to mitigate conflicts. Cattail and New Marsh Pond typically receive low amounts of waterfowl hunting, so we do not anticipate hunting and dog training conflicts.

Activity along the shorelines could result in shoreline soil erosion or compaction, and trampling of shoreline vegetation. Changes in water quality are not anticipated. Based on the nature of this training, this is a low impact activity and is likely to have no more of an impact than anglers accessing the shoreline.

The use of training ammunition may cause a temporary sound disturbance to the visiting public and temporary flushing of wildlife.

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning process for Patuxent Research Refuge, this compatibility determination will undergo extensive public review, including a comment period of 45 days following the release of the draft Comprehensive Conservation Plan/Environmental Assessment.

DETERMINATION (CHECK ONE BELOW):

____ Use is not compatible
_X_ Use is compatible with the following stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

The refuge will restrict the time of year this use is allowed to minimize wildlife disturbance. To avoid user conflict, minimize disturbances to breeding and nesting waterfowl or water birds and their broods, and fish spawning, the use would occur from August 1 through 31.

The use is restricted to two impoundments that already receive a fair amount of public use from fishing and wildlife observation. Wildlife in this area may be habituated to on-going multiple disturbances or may have relocated due to disturbances.

The use would be restricted to those individuals holding a valid Meade Natural Heritage Association hunting permit (refuge hunt permit) and a valid Federal waterfowl hunting stamp.

All individuals would be required to check in and out at the Hunting Control or Visitor Contact Station.

Retrieving dummies are allowed when training.

Blank or dummy cartridges to acclimate dogs to the sound of gunfire may be used. Firearms may be checked by refuge law enforcement to ensure appropriateness.

Refuge regulations require dogs to be leashed or under their control at all times, which would

include going to, and coming from, the training sites. Loose or unattended dogs are subject to seizure by refuge law enforcement (refer to 50 CFR 26.21(b), 32.39.A.14). Refuge staff will educate users about these regulations when they check in.

Refuge staff and volunteers will educate users about these regulations when and where able.

JUSTIFICATION:

Dog training is a non-priority public use that supports a priority public use (hunting) on national wildlife refuges. The intent of allowing dog training at on the refuge is to encourage the refuge's hunters to train retrievers in preparation for waterfowl hunting on the refuge.

Recent biological assessments of refuge habitats resulted in the determination to convert many of the open field/meadow habitats into scrub-shrub habitat for neotropical migrant birds, a management practice consistent with the refuge's wildlife and habitat objectives. The area currently used for upland dog training will be eliminated as part of this conversion to scrub/shrub habitat to better support migratory bird populations.

This use has occurred at relatively low levels in recent years, with minimal impacts to other visitors, research, wildlife and habitats. In fiscal year 2011, a total of 446 waterfowl hunt visits were recorded. In addition to being a requirement to participate in waterfowl hunting on the refuge, it is an important part of promoting proper hunting ethics and in reducing wasted game. We do not anticipate impacts to research, wildlife or habitats based on the limited areas dog training is allowed to occur and on the low level of use received.

As listed in the purposes section of this compatibility determination, the refuge was established and subsequently land was acquired for a total of six purposes. Dog training will not materially interfere with or detract from the research purpose of the refuge, because wildlife research does not generally occur in the vicinity of the locations that these uses occur and the vast majority of refuge lands are not impacted by these uses. These uses will not materially interfere with or detract from the two purposes related to wildlife conservation, because impacts to refuge wildlife and habitat are minimal. In addition, the level of use is very low (averaging 7.8 visits per year). This use will not materially interfere with or detract from the two purposes related to migratory bird conservation, because the use occurs at such low levels as not to impact migratory bird populations. Dog training will not materially interfere with or detract from the endangered species purpose, because there are no federally listed threatened or endangered species that occur on the refuge. Finally, the use will not materially interfere with or detract from the mission of the U.S. Fish and Wildlife Service because of the low levels of use that occur annually.

SIGNATURE:

REFUGE MANAGER: _____

(signature and date)

CONCURRENCE:

REGIONAL CHIEF: _____

(signature and date)

MANDATORY 10-YEAR REEVALUATION DATE: 2022

REFERENCES:

Banks, P.B. and J.V. Bryant. 2007. Dog walking impacts on wildlife Biology Letters 3: 611–613.

Ittner, R. et al. 1978. Recreational impacts on wildlands. U.S. Forest Service 157.

Sime, C.A. 1999. Domestic dogs in wildlife habitats. In: Effects of Recreation on Rocky Mountain Wildlife: A Review of Montana (Joslin, G. and H. Youmans, coordinators), pp. 8.1-8.17. Montana Chapter of The Wildlife Society, Committee on Effects of Recreation on Wildlife. 307 pp.

Thompson, P. 1985. Thompson's Guide to Freshwater Fishes. Houghton Mifflin Company P. 159.

U.S. Fish and Wildlife Service. 1992. Fish and Wildlife Service Manual, 631 FW 5.

U.S. Fish and Wildlife Service. 2010-2011 Hunting Regulations, Patuxent Research Refuge, North, Central, and South Tracts.

U.S. Fish and Wildlife Service. Public Use and Checking In/Out of the North Tract-Standard Operating Procedures-Patuxent Research Refuge North Tract.

U.S. Fish and Wildlife Service. Dog Training Guidelines-Standard Operating Procedures-Patuxent Research Refuge North Tract.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Patuxent Research Refuge

Use: Dog Walking

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	✓	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✓	
(d) Is the use consistent with public safety?	✓	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✓	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✓	
(g) Is the use manageable within available budget and staff?	✓	
(h) Will this be manageable in the future within existing resources?	✓	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✓	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✓	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✓ No ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** ✓

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

REFUGE NAME: Patuxent Research Refuge

USE: Dog Walking

NARRATIVE:

The proposed use is dog walking on designated trails and with dogs on a leash. This use is not a priority public use, however, it may provide opportunities for visitors to observe and learn about wildlife, habitats, and refuge lands firsthand and at their own pace in an unstructured environment. This use may also enhance the public's appreciation for wildlife conservation and land protection. It is anticipated that participation in this use will produce a more informed public, with an enhanced stewardship ethic and enhanced support and advocacy for the U.S. Fish and Wildlife Service and natural resources as a whole.

Dog walking is an existing use on Patuxent Research Refuge public trails and has occurred without incident. Dog walking is a very popular activity which encourages public visitation, exposure to the refuge and the mission of the National Wildlife Refuge System. Dog walking is strictly enforced on the refuge, and regulations require dogs to be on a leash of 6-foot or less. Dog owners are also required to immediately pick up, and properly dispose of, dog waste. Dog walking is restricted to public use trails on both the North and South Tracts. These regulations minimize impact to wildlife and their habitats.

Patuxent Research Refuge is located in a highly urban to suburban area. The majority of the trails that are used for dog walking are former military roads. Impacts associated with dog walking given the setting and type of trails that are used, combined with the history of dog use on the lands, lead us to consider dog walking as an appropriate use of Patuxent Research Refuge.

COMPATIBILITY DETERMINATION

USE:

Dog Walking

REFUGE NAME:

Patuxent Research Refuge

ESTABLISHING AND ACQUISITION AUTHORITIES:

Executive Order 7514, dated December 16, 1936; Executive Order 11724, dated June 27, 1973; 16 U.S.C. 715d, Migratory Bird Conservation Act of 1929; 16 U.S.C. 1534; 16 U.S.C. 667b, dated May 19, 1948 - An Act Authorizing the Transfer of Certain Real Property for Wildlife or other purposes; and Public Law 101-519 Sec. 126, 104 Stat. 2247, dated November 5, 1990.

REFUGE PURPOSES:

1. "...as a wildlife experiment and research refuge" – Executive Order 7514, dated December 16, 1936
2. "…recreation, conservation, wildlife preservation, and related scientific and educational activities" – Executive Order 11724, dated June 27, 1973
3. "...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" – 16 U.S.C. 715d, dated February 18, 1929 (Migratory Bird Conservation Act)
4. "...to conserve fish, wildlife and plants, including those which are listed as endangered species or threatened species – 16 U.S.C. 1534, dated December 28, 1973 (Endangered Species Act)
5. "...particular value in carrying out the national migratory bird management program." – 16 U.S.C. 667b, dated May 19, 1948 (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes)
6. "...(b) The Secretary of the Interior shall administer the property transferred pursuant to subsection (a) consistent with wildlife conservation purposes and shall provide for the continued use of the property by Federal agencies to the extent such agencies are using it on the date of the enactment of this Act." – Public Law 101-519 Sec. 216, 104 Stat. 2247, dated November 5, 1990 (Defense Appropriation Act – including transfer of the North Tract from Fort Meade).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

"To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." 16 U.S.C. 668dd(a)(2) (National Wildlife Refuge System Improvement Act of 1997)

DESCRIPTION OF USE:

What is this use? Is it a priority public use?
The use is dog walking. Dog walking is not a priority public use of the National Wildlife Refuge System (Refuge System) under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. § 668dd-668ee), as amended by the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57).

Where would the use be conducted?
Dog walking would be allowed on all current public trails located on Patuxent Research Refuge's North and South Tract.

When would the use be conducted?
The use would be conducted year-round, during refuge hours of operation. As with other uses, a temporary closure or restriction of these activities could be implemented for various reasons such as during hunting seasons, or for public safety.

How would the use be conducted?
Visitors enter the refuge, park in the visitor parking lots, and proceed to the open trails on the South Tract. On the North Tract, visitors must first check in at the Visitor Contact Station to learn which trails are open to the public on any given day. Dogs must be kept on a leash no longer than 6 feet in length. This leash regulation will be strictly enforced to minimize wildlife and visitor disturbance. Owners will be required to immediately clean up after their dogs and pack out any waste. Refuge signs regarding dog walking will be developed and placed when and where necessary to help regulate this activity. Refuge staff patrols by foot and vehicle will be conducted to advise visitors of regulations, monitor visitor activity, and, as necessary, to enforce the regulations.

Why is this use being proposed?
Visitors can participate in wildlife-dependent recreation while walking a dog. There is a current demand for this use on the refuge, therefore, we plan to continue with our existing policy on dog walking to better meet the needs of our public and minimize wildlife disturbances. This use may provide individuals with a connection to the natural world and an increased appreciation of natural resources, in addition to exposing them to the Refuge System.

AVAILABILITY OF RESOURCES:

Permitting this use is within the resources available to administer our visitor services program. There is no additional staff or material costs incurred to the refuge. Compliance with the leash law is within the regular duties of the law enforcement officer.

ANTICIPATED IMPACTS OF THE USE:

Potential Impacts to Birds
The presence of dogs and pedestrians on the refuge, either on trails or off trails, is likely to cause temporary disturbance to birds. A study done in Colorado (Miller et al. 2001) found that robins, representing forest species, and western meadowlarks and vesper sparrows, representing grassland species, flushed when approached by dogs on and off leash. Dogs alone generally

resulted in less disturbance than when pedestrians were present, either alone or holding a leashed dog. The authors surmised that because dogs resemble coyotes and foxes, which are not considered significant predators of songbirds (Leach and Frazier 1953, Andelt et al. 1987), they may not have been perceived as an important threat. Disturbance was generally greater off trails than on trails. Dogs alone are not likely to cause significant disturbance beyond that caused by foxes and coyotes. Any disturbance would be temporary and should not lead to loss of migratory birds or their habitats.

Potential Impacts to Threatened and Endangered Species

There are no federally listed species known to occur on the refuge. Several State-listed species of dragonflies and damselflies have been documented on the refuge, but, for the most part, they are located in small gravel pit/open water areas far from these public use trails. There are also a variety of State-listed darkling beetle species on the refuge, in the vicinity of the savannah restoration area in the northwest corner of the refuge, adjacent to Whip-Poor-Will Way and Sweetgum Way.

Potential Impacts to Wetlands

It is unlikely that dogs will enter refuge wetlands due to trail location and refuge regulations. All dogs must be on leash and regulations state that visitors must remain on public trails.

Potential Impacts to Other Fish and Wildlife Resources

There can be an increase in wildlife disturbance from dog walking simply due to normal dog behavior (i.e., jumping, barking, running off a leash). At some level, domestic dogs maintain instincts to hunt and/or chase. Given the appropriate stimulus, those instincts can be triggered in many different settings. Even if the chase instinct is not triggered, dog presence in and of itself has been shown to disrupt many wildlife species (Sime 1999). Sime presents some effects of disturbance, harassment, and displacement on wildlife attributable to domestic dogs that accompany recreationists. Sime states that authors of many wildlife disturbance studies concluded that dogs with people, dogs on-leash, or loose dogs provoked the most pronounced disturbance reactions from their study animals. Dogs extend the zone of human influence when off-leash. Many ungulate species demonstrated more pronounced reactions to unanticipated disturbances, as a dog off-leash would be. In addition, dogs can force movement by ungulates (avoidance or evasion during pursuit), which is in direct conflict with overwinter survival strategies which promote energy conservation. Sime continues to highlight that dogs are noted predators for various wildlife species in all seasons. Domestic dogs can potentially introduce diseases (distemper, parvovirus, and rabies) and transport parasites into wildlife habitats. While dog impacts to wildlife likely occur at the individual scale, the results may still have important implications for wildlife populations. For most wildlife species, if a “red flag” is raised by pedestrian-based recreational disturbance, there could also be problems associated with the presence of domestic dogs. Recent extensive research has shown that human walkers (without dogs) can induce anti-predator responses in birds including vigilance and early flight, which may lead to a cascade of related responses that negatively affect birds (Blumstein and Daniel 2005). In a study by Banks and Bryant (2007), results reveal that even dogs restrained on leads can disturb birds sufficiently to induce displacement. Responses to transient human disturbance are well known (Blumstein et al. 2005) and predicted to lead to population-level impacts on some birds species (Hill et al. 1997). One study found no net difference in bird diversity or abundance between areas with and without regular dog walking receiving the same treatment, suggesting

that long-term impacts in that area may be small (Banks and Bryant 2007). The amplitude of this type of impact would be greater if ground nesting birds were disturbed to the extent that they would stop returning to their nest, or if nests, eggs, or young were to be trampled by foot traffic, especially since handlers or trainer are more likely to be focusing on their dogs, not the ground. Off-lead dog walking can also disturb some species of breeding shorebirds from their nests (Lord et al. 2001). To minimize these potential impacts, dogs are required to be on a leash of 6 foot or less at all times, and in control of the owner. In addition, trails that accommodate dog walking do not traverse wetlands or areas that support shorebird nesting. Lastly, dog waste can create sanitation issues and an unsightly environment to other refuge visitors. Therefore, dog owners are required to immediately pick up after their pets and pack out waste.

Studies on impacts of recreational dog walking in woodlands demonstrated a 35 percent reduction in bird diversity and 41 percent reduction in abundance, both in areas where dog walking is common and where dogs are prohibited (Banks and Bryant 2007). Free-ranging and uncontrolled dogs can chase and flush ground-nesting or foraging birds and other wildlife, and occasionally prey on reptiles. Potential impacts of domestic dogs could be broadly classified as harassment, injury, or death of wildlife. Harassment is the disruption of normal maintenance activities, such as feeding, bedding, or grooming. It can take the form of disrupting, alarming, or even chasing. If dogs chase or pursue wildlife, injuries could be sustained directly or indirectly as a result of accidents that occur during the chase itself rather than direct contact with the dog. Impacts of domestic dogs can also include modification of wildlife behavior.

However, the proposed use of dog walking would be restricted to public trails where disturbance may already occur due to other public use activities. In addition, the requirement for dogs to be kept on a 6-foot leash will minimize the impacts to other users and wildlife. We do not anticipate any impacts to water quality, soils, or vegetation other than those impacts from normal trail use as described in our wildlife observation compatibility determination. We do not expect a substantial increase in the cumulative effects of visitor use over the 15-year timeframe of this plan. Staff, in collaboration with volunteers, will monitor and evaluate the effects of these priority public uses to discern and respond to any unacceptable impacts on wildlife or habitats.

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning process for Patuxent Research Refuge, this compatibility determination will undergo extensive public review, including a comment period of 45 days following the release of the draft Comprehensive Conservation Plan/Environmental Assessment.

DETERMINATION (CHECK ONE BELOW):

____ Use is not compatible
_X_ Use is compatible with the following stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

Dogs must be on a leash, no longer than 6 feet in length, and must be prevented from entering closed areas. Dog owners must also pick up after their pets and pack out waste. Visitors and their leashed dogs must remain on public trails.

JUSTIFICATION:

Although dogs can increase disturbance to wildlife, the refuge will strictly enforce a leash law to keep dogs and disturbances localized with the pedestrian. This is an existing use at Patuxent Research Refuge, with no history of significant negative impacts. There are no documented incidents of domestic dog-wildlife disturbances, nor of dog-human conflicts. The majority of dog walkers are local residents who regularly visit the Refuge for wildlife dependent recreation and who understand our policy. The U.S. Fish and Wildlife Service and the Refuge System maintain goals of providing opportunities to view wildlife. Allowing the use of the trail system by persons engaging in dog walking, may facilitate wildlife observation. These users may take the time to learn more about the refuge and become avid supporters of the Refuge System.

As listed in the purposes section of this compatibility determination, the refuge was established and subsequently land was acquired for a total of six purposes. Dog walking will not materially interfere with or detract from the research purpose of the refuge, because wildlife research does not generally occur on the trails where these uses occur and the impact will be minimal. Dog walking will not materially interfere with or detract from the two purposes related to wildlife conservation because the impacts to wildlife species and habitats will be minimal. This use will not materially interfere with or detract from the two purposes related to migratory bird conservation, because these uses are allowed in areas that are generally not in the vicinity of migratory waterfowl or land bird habitat. Dog walking will not materially interfere with or detract from the endangered species purpose, because there are no federally listed threatened or endangered species that occur on the refuge. Finally, dog walking will not materially interfere with or detract from the mission of the U.S. Fish and Wildlife Service, because of the limited locations where it will occur on the refuge.

SIGNATURE:

REFUGE MANAGER: _____

(signature and date)

CONCURRENCE:

REGIONAL CHIEF: _____

(signature and date)

MANDATORY 10-YEAR REEVALUATION DATE: 2022

REFERENCES:

Andelt, W.F., J.G. Kie, F.F. Knowlton, and K. Cardwell. 1987. Variation in coyote diets associated with season and successional changes in vegetation. Journal of Wildlife Management 51:273-277.

Banks, P.B. and J.V. Bryant. 2007. Four-legged friend or foe? Dog walking displaces native birds from natural areas. Biology Letter 3:611–613.

Blumstein, D.T. and J.C. Daniel. 2005. The loss of anti-predator behaviour following isolation on islands. Proc. R. Soc. B 272: 1663–1668.

Blumstein, D.T., E. Ferna´ndez-Juricic, P.A. Zollner, and S.C. Garity. 2005. Inter-specific variation in avian responses to human disturbance. Journal of Applied Ecology 42: 943–953.

Hill, D., D. Hockin, D. Price, G. Tucker, R. Morris, and J. Treweek. 1997. Bird disturbance: improving the quality and utility of disturbance research. Journal of Applied Ecology 34: 275–288.

Leach, H.R. and W.H. Fraizer. 1953. A study of the possible extent of predation on heavy concentrations of valley quail with special reference to the bobcat. California Fish and Game 39:527-538.

Lord, A., J.R. Waas, J. Innes, and M.J. Whittingham. 2001. Effects of human approaches to nests of northern New Zealand dotterels. Biological Conservation 98:233–240.

Miller, S.G., R.L. Knight, and C.K. Miller. 2001.Wildlife responses to pedestrians and dogs. Wildlife Society Bulletin 29(1):124-132.

Sime, C.A. 1999. Domestic dogs in wildlife habitats. In: Effects of recreation on Rocky Mountain wildlife: A Review for Montana (Joslin, G. and H. Youmans, coordinators), pp. 8.1-8.17. Montana Chapter of The Wildlife Society, Committee on Effects of Recreation on Wildlife. 307 pp.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Patuxent Research Refuge

Use: Search and Rescue Training for Canine Teams

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	✓	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✓	
(d) Is the use consistent with public safety?	✓	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✓	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✓	
(g) Is the use manageable within available budget and staff?	✓	
(h) Will this be manageable in the future within existing resources?	✓	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✓	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✓	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✓ No ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** ✓

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

REFUGE NAME: Patuxent Research Refuge

USE: Search and Rescue Training for Canine Teams

NARRATIVE:

The use is allowing periodic training exercises by certified canine search and rescue (SAR) teams on refuge property. This use involves simulating a search and rescue for a missing person by using scent-oriented training techniques for SAR dogs. Allowing this use will provide a service to local SAR teams that require continuous and variable training to keep their teams performing at peak levels. It provides a "wilderness" or "remote area" scenario to the cadre of sites such teams like to utilize. The use would be conducted at remote locations, away from other public use areas, to avoid disruption to the general public and to keep the SAR teams from being distracted by other activities. Typically, the use has occurred in the fields and wooded edges of the Old Beltsville Airport located on the South Tract. Other areas could include the retired stables area on the North Tract and the retired agricultural fields on the South Tract. Dogs must be under immediate control of their owners at all times (50 CFR 26.21(b)).

Time-of-year restrictions and infrequent use will curtail impacts to wildlife, habitats, and research purposes of the refuge. The proposed use fosters a partnership with local SAR teams that will benefit the refuge should a need for such a service arise. Refuge staff may also benefit from exposure to this type of training, particularly refuge law enforcement officers. The refuge is just one of other local sites being used by SAR organizations, and this minimizes the demand on the refuge.

There are several specialized uses which, as long as found to be appropriate and compatible with a given refuge, could be allowed on refuge property by permit. We review each request on a case-by-case basis and the availability of other local sites is considered. Examples include fire safety training, search and rescue training and boat operations safety training. Law enforcement training exercises in support of refuge management activities are usually appropriate (603 FW 1.10 D(5)). These uses assist local government agencies by allowing health, safety, and rescue training operations. We reviewed this SAR use as to its appropriateness for Patuxent Research Refuge as defined in 603 FW 1.11 and will develop an appropriate special use permit containing conditions to ensure compatibility with the refuge purposes and mission.

COMPATIBILITY DETERMINATION

USE:

Search and Rescue Training for Canine Teams

REFUGE NAME:

Patuxent Research Refuge

ESTABLISHING AND ACQUISITION AUTHORITIES:

Executive Order 7514, dated December 16, 1936; Executive Order 11724, dated June 27, 1973; 16 U.S.C. 715d, Migratory Bird Conservation Act of 1929; 16 U.S.C. 1534; 16 U.S.C. 667b, dated May 19, 1948 - An Act Authorizing the Transfer of Certain Real Property for Wildlife or other purposes; and Public Law 101-519 Sec. 126, 104 Stat. 2247, dated November 5, 1990.

REFUGE PURPOSES:

1. "...as a wildlife experiment and research refuge" – Executive Order 7514, dated December 16, 1936
2. "…recreation, conservation, wildlife preservation, and related scientific and educational activities" – Executive Order 11724, dated June 27, 1973
3. "...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" – 16 U.S.C. 715d, dated February 18, 1929 (Migratory Bird Conservation Act)
4. "...to conserve fish, wildlife and plants, including those which are listed as endangered species or threatened species – 16 U.S.C. 1534, dated December 28, 1973 (Endangered Species Act)
5. "...particular value in carrying out the national migratory bird management program." – 16 U.S.C. 667b, dated May 19, 1948 (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes)
6. "...(b) The Secretary of the Interior shall administer the property transferred pursuant to subsection (a) consistent with wildlife conservation purposes and shall provide for the continued use of the property by Federal agencies to the extent such agencies are using it on the date of the enactment of this Act." – Public Law 101-519 Sec. 216, 104 Stat. 2247, dated November 5, 1990 (Defense Appropriation Act – including transfer of the North Tract from Fort Meade).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

"To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." 16 U.S.C. 668dd(a)(2) (National Wildlife Refuge System Improvement Act of 1997)

DESCRIPTION OF USE:

What is the use? Is the use a priority public use?
The use is allowing periodic training exercises by certified canine search and rescue (SAR) teams on refuge property. It involves simulating a search and rescue for a missing person by using scent-oriented training techniques for SAR dogs. This is not a priority public use of the National Wildlife Refuge System (Refuge System) under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee), and the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57).

Where would the use be conducted?
The use would be conducted at remote locations, away from other public use areas, to avoid disruption to the general public and to keep the SAR teams from being distracted by other activities. Typically, the use has occurred in the fields and wooded edges of the Old Beltsville Airport located on the South Tract. Other areas could include the retired stables area on the North Tract and the retired agricultural fields on the South Tract.

When would the use be conducted?
This use would typically occur on weekend days during the non-hunting season and on Sundays during hunting season. The use would be conducted during daylight hours on days where hunting is not occurring on the refuge and may be further restricted to outside of the breeding season depending on the site.

South Tract: to protect grassland breeding birds in the retired agricultural fields on the South Tract, one of the refuge's prime grassland habitats, the SAR activity will be restricted to any day from August 15 to September 30, Sundays only from October 1 to January 31, and any day from February 1 to April 15. Breeding season for ground nesting grassland birds is currently regarded as April 15 to August 15 to encompass nest site selection at the beginning of the season and fledgling growth and development near the end of the season. Grassland birds are most likely to be affected by this activity, especially if conducted in the retired agricultural fields.

North Tract: SAR activities may be conducted at the retired stable areas during daylight hours on days where hunting is not occurring, typically on weekdays outside of the North Tract's hunt season, September 15 to January 31 and spring gobbler season (variable dates, but about mid-April to late May), and on Sundays when hunting is not allowed. These time restrictions prevent conflicts with refuge public hunting and biological goals for breeding landbirds.

We generally only receive about three requests annually and do not expect to receive more than six requests annually. The per-day training duration is about 6 hours.

How would the use be conducted?
The use would be conducted by local SAR teams and their trained dogs. Dogs are under their handlers' control at all times. Dogs are trained to respond to human scent only, and do not respond to wildlife scent. An air-scenting search dog is trained to scan the air currents for a the scent of a human being. Dogs are also trained to respond to trailing scents (a specific human). The dog locates the source of the scent and indicates it to the handler. The dogs can work well in areas that have been "contaminated" by previous searchers. They can search day or night in most

kinds of weather, including rain and snow. In addition to wilderness and undeveloped tracts, the dogs can be effective in rural or suburban areas. They can search groves of trees, overgrown vacant lots and fields, abandoned buildings, junkyards, and city parks. They are especially effective where human sight is most limited - in the dark, in dense woods, heavy brush, trash, or debris.

Vehicles will be required to remain on refuge roads. Only dogs and trainer personnel will be allowed to exercise on off-road areas. Duration of SAR exercises is generally about 6 hours. Group sizes average 8 to 10 dogs plus their handlers and the trainer(s) (on average 8 to 10 people). Search teams use primarily wooded areas, adjacent to their parking area. The area is divided into multiple sections, trainers and dogs are then sent to their specified area to seek out one individual who is waiting in the respective area. SAR exercises may range from 15 minutes or take up to 4 to 5 hours.

Why is this use being proposed?
The use is being proposed to provide a service to local SAR teams that require continuous and variable training to keep their teams performing at peak levels. The refuge is one of several sites used by such teams. It provides a “wilderness” or “remote area” scenario to the cadre of sites such teams like to utilize.

AVAILABILITY OF RESOURCES:

Refuge staff will be required to issue special use permits to allow SAR requests. Requests are not expected to exceed six per year, but it has generally never been more than three requests annually. Depending on location, refuge staff may have to guide SAR teams to the site. Staff time is estimated to be 12 to 24 hours annually for coordinating this use. After review of the refuge budget, there are sufficient staff and funds to sustain this activity.

ANTICIPATED IMPACTS OF THE USE:

The anticipated impacts to the refuge are minimal. There may be temporary displacement of wildlife from SAR activities, but suitable escape habitat is adjacent to the areas where the use would be occurring. The dogs are extremely disciplined and trained to focus only on their scent goal; they are not allowed to chase wildlife.

The most likely impact will be disturbance to wildlife that will be flushed as dogs and handlers approach. Recent extensive research has shown that human walkers (without dogs) can induce anti-predator responses in birds including vigilance and early flight, which may lead to a cascade of related responses that negatively affect birds (Blumstein and Daniel 2005). In a study by Banks and Bryant (2007), results reveal that even dogs restrained on leads can disturb birds sufficiently to induce displacement and cause a depauperate local bird fauna. These effects were in excess of significant impacts caused by human disturbance, which also caused to decline in diversity and abundance. Responses to transient human disturbance are well known (Blumstein et al. 2005) and predicted to lead to population-level impacts on some birds species (Hill et al. 1997). Another study found no net difference in bird diversity or abundance between areas with and without regular dog walking receiving the same treatment, suggesting that long-term impacts in this area may be small. (Banks and Bryant 2007). The level of this type of impact would be greater if ground nesting birds were disturbed to the extent that they would stop returning to their

nest, or if nests, eggs, or young were to be trampled by foot traffic, especially since handlers or trainer are more likely to be focusing on their dogs, not the ground. For this reason in areas where there is heightened sensitivity or concern, we limit SAR activity to non-breeding season, when young birds are less vulnerable. In winter, this activity could flush birds from a resting site resulting in higher energy expenditures, but the footprint of this disturbance would be a very localized and temporary. SAR activities occur on only one day, one location and the time intervals between scheduled visits on the refuge can be months because of the availability of other sites. Moreover, SAR activities typically do not utilize grassland or open field areas.

Another anticipated impact of the use is trampling of vegetation in an area that we are trying to restore. We expect this to be minor to none because of the time of year restrictions and the resiliency of the grasses and forb vegetation in this area. We do not anticipate impacts to water quality or soils based on the low level of use and dispersed nature of the activity.

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning process for Patuxent Research Refuge, this compatibility determination will undergo extensive public review, including a comment period of 45 days following the release of the draft Comprehensive Conservation Plan/Environmental Assessment.

DETERMINATION (CHECK ONE BELOW):

____ Use is not compatible
_X_ Use is compatible with the following stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

- SAR exercises require a special use permit and must follow the permit conditions. This includes following time-of-year restrictions (i.e., to protect breeding ground nesting birds).
- All SAR activities will be conducted in areas away and out of view from other public activities.
- All training exercises will be conducted in a manner that “leaves no trace” on the refuge. This includes litter, flagging, and other items/materials that may be used to simulate a SAR scenario.
- Dogs will be attended and under handlers’ control at all times.

JUSTIFICATION:

SAR uses generally do not adversely impact the refuge’s research purpose since uses are coordinated through a special use permit and work around research needs. In addition, the Central Tract portion of the refuge is set aside specifically to support research.

As listed in the purposes section of this compatibility determination, the refuge was established and subsequently land was acquired for a total of six purposes. Search and rescue exercises will not materially interfere with or detract from the research purpose of the refuge, because wildlife

research does not generally occur in the vicinity of the locations that these uses occur. This use will not materially interfere with or detract from the two purposes related to wildlife conservation, because the impacts described above will be minimal. In addition, SAR exercises will not materially interfere with or detract from the two purposes related to migratory bird conservation, because these uses are allowed in areas that are generally not in the vicinity of migratory waterfowl or land bird habitat. This use will not materially interfere with or detract from the endangered species purpose, because there are no federally listed threatened or endangered species that occur on the refuge. At the scales and level of current and anticipated SAR use, research, or wildlife and habitat purposes are not appreciably negatively affected by these uses. Low frequency of use (less than six times per year) and time of year restrictions further limit the impacts to refuge purposes. Finally, this use will not materially interfere with or detract from the mission of the U.S. Fish and Wildlife Service, because of the low levels of use.

The proposed use fosters a partnership with local SAR teams that will benefit the refuge should a need for such service arise. The refuge is just one of other local sites area being used by SAR organizations, and this minimizes the demand on refuge.

SIGNATURE:

REFUGE MANAGER: _____

(signature and date)

CONCURRENCE:

REGIONAL CHIEF: _____

(signature and date)

MANDATORY 10-YEAR REEVALUATION DATE: 2022

REFERENCES:

Banks, P.B. and J.V. Bryant. 2007. Four-legged friend or foe? Dog walking displaces native birds from natural areas. Biology Letter 3:611–613.

Blumstein, D. T. and J.C. Daniel. 2005. The loss of anti-predator behaviour following isolation on islands. Proc. R. Soc. B 272:1663–1668.

Blumstein, D.T., E. Fernandez-Juricic, P.A. Zollner, and S.C. Garity. 2005 Inter-specific variation in avian responses to human disturbance. Journal of Applied Ecology 42:943–953.

Hill, D., D. Hockin, D. Price, G. Tucker, R. Morris, and J. Treweek. 1997. Bird disturbance: improving the quality and utility of disturbance research. Journal of Applied Ecology 34: 275–288.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Patuxent Research Refuge

Use: U.S. Secret Service Training Exercises at the National Wildlife Visitor Center

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	✓	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✓	
(d) Is the use consistent with public safety?	✓	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✓	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✓	
(g) Is the use manageable within available budget and staff?	✓	
(h) Will this be manageable in the future within existing resources?	✓	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?		✓
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✓	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ___ No ✓

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** ✓

Refuge Manager:_____ Date:_____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:_____ Date:_____

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

JUSTIFICATION FOR A FINDING OF APPROPRIATENESS OF A REFUGE USE

REFUGE NAME: Patuxent Research Refuge

USE: U.S. Secret Service Training Exercises in the National Wildlife Visitor Center

NARRATIVE:

The use is allowing periodic training exercises by the adjacent James J. Rowley Secret Service Training Center (JJRTC) to occur in the National Wildlife Visitor Center (NWVC). This training typically involves 12 to 15 graduating agents, and up to a dozen U.S. Secret Service (USSS) instructors and role-players utilizing the building for visiting dignitary protection and physical security training scenarios. Each session would involve 2 days of pre-exercise scouting and planning (4 to 6 hours a day), followed up on occasion by the actual training scenario on the third day (2 to 3 hours in length).

The use is being proposed to provide a convenient location for this critical training for another Federal agency. The JJRTC is immediately adjacent to the NWVC. USSS already has a positive working relationship with the refuge through the use of a firing range on the North Tract. The close proximity to the JJRTC saves training time and travel costs for the USSS. The NWVC is only one of several facilities that USSS uses for this training and provides a unique venue they have expressed is “perfect” for this occasional training need. In the past 10 years, reported conflicts with this use have been minimal, and typically have had to do with temporary confusion related to volunteer or staff access to a particular room. Additionally, the refuge is often visited by mid- to upper-level government officials and dignitaries; gaining some exposure to this type of training helps prepare staff for such events.

While this use does not directly contribute to the public’s understanding and appreciation of resources, it does not detract from the refuge fulfilling their establishing purposes of supporting research, habitats and wildlife. This use should pose no impacts to vegetation, wildlife, or soil, as the entire exercise will be conducted inside the NWVC.

COMPATIBILITY DETERMINATION

USE:

U.S. Secret Service Training Exercises in the National Wildlife Visitor Center

REFUGE NAME:

Patuxent Research Refuge

ESTABLISHING AND ACQUISITION AUTHORITIES:

Executive Order 7514, dated December 16, 1936; Executive Order 11724, dated June 27, 1973; 16 U.S.C. 715d, Migratory Bird Conservation Act of 1929; 16 U.S.C. 1534; 16 U.S.C. 667b, dated May 19, 1948 - An Act Authorizing the Transfer of Certain Real Property for Wildlife or other purposes; and Public Law 101-519 Sec. 126, 104 Stat. 2247, dated November 5, 1990.

REFUGE PURPOSES:

1. "...as a wildlife experiment and research refuge" – Executive Order 7514, dated December 16, 1936
2. "…recreation, conservation, wildlife preservation, and related scientific and educational activities" – Executive Order 11724, dated June 27, 1973
3. "...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" – 16 U.S.C. 715d, dated February 18, 1929 (Migratory Bird Conservation Act)
4. "...to conserve fish, wildlife and plants, including those which are listed as endangered species or threatened species – 16 U.S.C. 1534, dated December 28, 1973 (Endangered Species Act)
5. "...particular value in carrying out the national migratory bird management program." – 16 U.S.C. 667b, dated May 19, 1948 (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes)
6. "...(b) The Secretary of the Interior shall administer the property transferred pursuant to subsection (a) consistent with wildlife conservation purposes and shall provide for the continued use of the property by Federal agencies to the extent such agencies are using it on the date of the enactment of this Act." – Public Law 101-519 Sec. 216, 104 Stat. 2247, dated November 5, 1990 (Defense Appropriation Act – including transfer of the North Tract from Fort Meade).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

"To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." 16 U.S.C. 668dd(a)(2) (National Wildlife Refuge System Improvement Act of 1997)

DESCRIPTION OF USE:

What is the use? Is the use a priority public use?
The use is allowing periodic training exercises by the adjacent James J. Rowley Secret Service Training Center (JJRTC) to occur in the National Wildlife Visitor Center (NWVC). This training typically would involve 12 to 15 graduating agents and up to a dozen U.S. Secret Service (USSS) instructors and role-players utilizing the building for visiting dignitary protection and physical security training scenarios. Each session would involve 2 days of pre-exercise scouting and planning (4 to 6 hours a day), followed up on occasion by the actual training scenario on the third day (2 to 3 hours in length). This is not a priority public use of the National Wildlife Refuge System under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee), and the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57).

Where would the use be conducted?
The use would be conducted within the confines of the NWVC. Vehicles would be parked in the public parking lot that serves the NWVC.

When would the use be conducted?
The use would occur on low visitation weekdays throughout the year. The requests would not be accommodated on dates where major conferences, school groups, or similar activities have been previously scheduled.

How would the use be conducted?
The use would be allowed through a special use permit between the refuge and the JJRTC. The use will be closely coordinated between NWVC staff and the cadre of USSS instructors. Specific rooms may be set aside to serve the training needs, which include a briefing room, “meet and greet” rooms, and a “safe-room,” to simulate where a VIP would be escorted to in the event of a threat to their safety. Access to and from the NWVC would be coordinated so as not to interfere with staff, volunteer, and public needs and operations.

Why is this use being proposed?
The use is being proposed to provide a convenient location for this critical training for another Federal agency. The JJRTC is immediately adjacent to the NWVC and USSS already has a positive relationship with the refuge through the use of one of the shooting ranges on the North Tract.

AVAILABILITY OF RESOURCES:

Initial coordination with USSS may require two to three staff days and providing floor plans or blueprints of the NWVC. Staff support, which is available, to USSS would be minimal after that, generally in responding to scheduling and minor coordination on the actual training days. After review of the refuge budget, there are sufficient staff and funds to sustain this activity.

ANTICIPATED IMPACTS OF THE USE:

There may be minimal impact to staff and visiting public on the pre-visit days, with more likelihood of minor disruptions on the day of the scenario, if members of the public inquire what

is going on or attempt to view the training. This disruption is anticipated to be minimal.

There should be no impacts to vegetation, wildlife, water, or soil, as the entire exercise will be conducted inside the NWVC.

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning process for Patuxent Research Refuge, this compatibility determination will undergo extensive public review, including a comment period of 45 days following the release of the draft Comprehensive Conservation Plan/Environmental Assessment.

DETERMINATION (CHECK ONE BELOW):

____ Use is not compatible
_X_ Use is compatible with the following stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

- Training sessions will be conducted on days of anticipated low visitation and minimal use of conference facilities to minimize exposure to the general public.
- Role-playing exercises will be isolated from the general public, other than the potential walking tour scenario. This simulation may involve a walk-through of the NWVC display area.
- No scenarios involving bomb squads, hostage extraction, or use of force will be permitted.
- Agents and students will not have loaded firearms in their possession while on-site.
- Scheduling of USSS training exercises will be of lower priority than scheduling of U.S. Fish and Wildlife Service and the National Wildlife Refuge System mission-related activities such as environmental education, teacher workshops, and science conferences.

JUSTIFICATION:

The refuge has previously issued a special use permit with USSS for this indoor training use at the NWVC. The close proximity to the USSS Training Center saves training time and travel costs for the USSS. The NWVC is only one of several facilities that USSS uses for this training and provides a unique venue they have expressed is “perfect” for this occasional training need. In the past 10 years, reported conflicts with this use have been minimal, and typically have had to do with temporary confusion related to volunteer or staff access to a particular room. Additionally, the refuge is often visited by mid- to upper-level government officials and dignitaries; gaining some exposure to this type of training helps prepare staff for such events. Indoor training opportunities receive a lower priority level when scheduling the use of the NWVC in order to promote and accommodate refuge purposes first and foremost.

As listed in the purposes section of this compatibility determination, the refuge was established and subsequently land was acquired for a total of six purposes. This indoor training will not

materially interfere with or detract from the research purpose of the refuge, because wildlife research does not occur inside the visitor center. This use will not materially interfere with or detract from the two purposes related to wildlife conservation, because this indoor training will not impact any wildlife. These training exercises will not materially interfere with or detract from the two purposes related to migratory bird conservation, because these uses are allowed indoors and will not impact migratory waterfowl or land bird habitat. This use will not materially interfere with or detract from the endangered species purpose, because there are no federally listed threatened or endangered species that occur on the refuge. Finally, USSS training will not materially interfere with or detract from the mission of the National Wildlife Refuge System because the use occurs only within the NWVC and will be scheduled to minimize impacts to other users.

SIGNATURE:

REFUGE MANAGER: _____

(signature and date)

CONCURRENCE:

REGIONAL CHIEF: _____

(signature and date)

MANDATORY 10-YEAR REEVALUATION DATE: 2022

COMPATIBILITY DETERMINATION

USE:

Continuing Maintenance of Baltimore Gas and Electric Overhead Electric Transmission Right-of-Way on the North Tract

REFUGE NAME:

Patuxent Research Refuge

ESTABLISHING AND ACQUISITION AUTHORITIES:

Executive Order 7514, dated December 16, 1936; Executive Order 11724, dated June 27, 1973; 16 U.S.C. 715d, Migratory Bird Conservation Act of 1929; 16 U.S.C. 1534; 16 U.S.C. 667b, dated May 19, 1948 - An Act Authorizing the Transfer of Certain Real Property for Wildlife or other purposes; and Public Law 101-519 Sec. 126, 104 Stat. 2247, dated November 5, 1990.

REFUGE PURPOSES:

1. "...as a wildlife experiment and research refuge" - Executive Order 7514, dated December 17, 1936
2. "…recreation, conservation, wildlife preservation, and related scientific and educational activities" – Executive Order 11724, dated June 27, 1973
3. "...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" - 16 U.S.C. 715d, February 18, 1929 (Migratory Bird Conservation Act)
4. "...to conserve fish, wildlife, and plants, including those which are listed as endangered species or threatened species" 16 U.S.C. 1534, December 28, 1973 (Endangered Species Act)
5. "...particular value in carrying out the national migratory bird management program." 16 U.S.C. 667b, May 19, 1948 (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes)
6. "...(b) The Secretary of the Interior shall administer the property transferred pursuant to subsection (a) consistent with wildlife conservation purposes and shall provide for the continued use of the property by Federal agencies to the extent such agencies are using it on the date of the enactment of this Act." Public Law 101-519, Sec. 216, 104 Stat. 2247, dated November 5, 1990 (Defense Appropriations Act including the transfer of North Tract from Fort Meade)

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

"To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." 16 U.S.C. 668dd(a)(2) (National Wildlife Refuge System Improvement Act of 1997)

DESCRIPTION OF USE:

What is the use? Is the use a priority public use?
The use is the maintenance of an overhead electric transmission line on the North Tract of Patuxent Research Refuge, owned and managed by Baltimore Gas and Electric (BG&E). The North Tract was conveyed to the Service with this 50 year right-of-way (ROW) easement through a Transfer of Military Property from the Department of Defense to the Department of the Interior in 1991. This 300-foot wide ROW serves 230KV and 500KV overhead electric transmission lines, running approximately 5.5 miles through the refuge, encompassing approximately 230 acres. Maintenance activities include working on the power line infrastructure itself, as well as management of the vegetation beneath the wire zone and border zone to prevent vegetation-caused outages.

The maintenance of a ROW easement is not a priority use of the National Wildlife Refuge System (Refuge System) under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee) and the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57). However, certain vegetation management practices will support some of the establishing purposes of the refuge, particularly the research purpose, as it will allow for studies on wildlife response to various vegetation management techniques under a major powerline corridor. The current ROW permit is for 50 years from the date of signature, which was August 16, 1972, expiring in 2022. To date, BG&E has complied with the terms and conditions of the ROW easement, with very minor exceptions. When these exceptions occurred, we developed closer communication with and scrutiny of the BG&E staff or contractors, which resulted in greater compliance. The vegetation management plan is currently undergoing revisions, in cooperation with BG&E, the U.S. Fish and Wildlife Service (Service) Ecological Services program, and IVM, a non-profit consulting company, focusing on greater control of invasive species, while promoting reestablishment and regrowth of native forbs, grasses, an shrubs.

Long-term easements such as this are re-evaluated for compatibility every 10 years to ensure compliance with the terms and conditions of the easement, and to ensure there is no net loss of habitat, per 16 U.S.C. 668dd(d)(3)(B)(vii).

Where would the use be conducted?
The ROW begins at the Amtrak railroad line on the eastern end of the refuge and ends at the Baltimore-Washington Parkway (MD 295) ramp on the north end of the refuge. There are 34 towers in the ROW. The tower spans are an average of 1,000 feet in length. Each span totals about 300,000 square feet, or about 6.875 acres.

When would the use be conducted?
BG&E staff and contractors would coordinate with refuge staff prior to requesting access for non-emergency, planned vegetation control activities. This would involve checking in at the North Tract Visitor Contact Station upon arrival and upon departure. This is especially important during hunting season, which begins in September. Non-emergency, planned vegetation management and control activities would occur only outside of the bird breeding season, which runs from April 15 to August 15. There may be exceptions for the treatment of invasive plant species, which mature during this time and control efforts would not be as effective outside this

timeframe. In such cases, BG&E staff and contractors will coordinate with the refuge senior biologist for permission to conduct agreed upon treatments.

It may be necessary for emergency repairs and inspections to be done at any hour of the day, any time of year. Coordination with refuge staff would be expected to occur as soon as is reasonably possible in these instances.

How would the use be conducted?
Infrastructure maintenance will vary widely depending on the nature of the repair and replacement of towers, tower pads, and wires. It will be done in accordance with BG&E policies and procedures, but with special consideration for the unique situation of being located on a national wildlife refuge. Access will be coordinated with refuge staff ahead of time for routine maintenance, and as soon as possible before, during and after emergency responses. There has been minimal need for this type of activity in the 20 years the refuge has owned the underlying property.

Vegetation management within the ROW will be conducted using the principles of integrated pest management (IPM), and will not conflict with new requirements established by the Federal Energy Regulatory Commission (FERC) in 2008-2009. These revised requirements require more aggressive control of vegetation height under ROW wire zones, increasing the desired distance between vegetation and the wires from 12 feet to 15 feet. IPM principles include minimal use of herbicides approved by the refuge manager or Regional Office, avoidance of sensitive habitats such as wetlands or bogs, mechanical control as necessary using power saws, bush hogs, and other similar power equipment, and hand control where feasible. Please refer to the Stipulations section for further details.

Vegetation management would occur both within the wire zone and the border zone. The wire zone is the area of the ROW directly beneath the conductors and extending 20 feet outside of the last conductor toward the ROW edge. The border zone is everything from this point to the woods line. The height restriction within the wire zone varies according to line voltage and clearance from the conductor to the ground. Generally, no vegetation above 15 feet in height would be allowed to grow anywhere within the wire zone, except where clearances are greater than normal, such as a ravine. Vegetation in the border zone can be taller so long as it does not jeopardize the flashover distance of the voltage, taking into consideration wind and sway of trees and wires. Species are generally restricted to shrub and scrub growth, with such species as mountain laurel, blackberry, blueberry, viburnum, and some low stature trees like serviceberry, sumac, and dogwood.

Why is the use being proposed?
The use is being proposed to continue allowing maintenance of this transmission ROW, in a manner that is fully protective of refuge habitats. The agreed-upon vegetation management plan will help the refuge achieve goal 3 in the Comprehensive Conservation Plan (CCP): “Manage refuge non-forested upland communities to provide ecological structure, composition, and function to support native plants and wildlife, including species of conservation concern.” It will provide an early successional stage habitat of grasses, forbs, and low shrubs beneficial to such bird species as gray catbird, ruby-crowned kinglet and prairie warbler, and a host of pollinating

insects and native bee species. Through successful vegetation management, the presence of invasive species under and adjacent to the ROW will decline, including autumn olive, lespedeza, and mile-a-minute, and be replaced with native flora. Management of this regionally declining habitat will be nearly entirely at BG&E's expense.

AVAILABILITY OF RESOURCES:

Refuge staff time will be required to coordinate, develop, and issue special use permits; review site operations and safety plans; and to attend and participate in annual meetings, site visits, or phone calls with BG&E representatives. Under the current term of this compatibility determination and ROW easement, the majority of vegetation management expenses will be the responsibility of BG&E personnel and contractors to keep the vegetation within Federal Energy Regulatory Committee (FERC) height restrictions and for invasive and undesirable species control. Some refuge staff time will be required to review management plans and assess habitat quality pre- and post-vegetation treatments and other maintenance activities, process and approve pesticide use proposals, and to monitor invasive plant species.

Task	Staff Days	Cost/year
Review annual vegetation management plan	2 days/year, supervisory biologist GS12	$480/year
Visual habitat and vegetation monitoring	4 days/year, supervisory biologist GS12 bio-tech GS 5/6/7	 $960/year $563/year
Write, process pesticide use proposals	2 days/year, assistant biologist GS-9	 $311/year
Invasive species treatment	4 days/year, supervisory biologist GS12 bio-tech GS 5/6/7 2 interns	 $960/year $563/year $334/year
Total Staff Cost		**$4,171/year**

Supplies/Services	Cost
Maintenance of buildings, roadways, and parking areas	$1,100
Office supplies	$110
Equipment and herbicide	$550
Total Cost of Supplies and Services	**$1,760**

Total Annual Cost: $5,931.00

After review of the refuge budget, there are sufficient staff and funds to sustain this activity.

ANTICIPATED IMPACTS OF THE USE:

Through the agreed upon vegetation management plan, the ROW is undergoing natural succession, requiring selective management with shorter stature vegetation comprised of trees,

shrubs, forbs, and grasses. A one-lane, dirt access road running throughout most of the wire zone also results in sparseness, or no vegetation, and invites invasive species establishment. However, this road is necessary to allow proper minimal access for required vegetation control under FERC guidelines.

Short-term direct impacts to wildlife, soils, and vegetation may result from vegetation removal, tower and cable maintenance, and periodic safety inspections and testing. Impacts to wildlife include temporary flushing of birds and other wildlife. Impacts to soils include moderate, localized soil compaction and erosion (depending on equipment used). Occasional mortality of reptiles and amphibians in the path of vehicles and equipment could occur.

Shrub and early succession habitat provide benefits to numerous species of birds of conservation concern; provide high quality food and cover resources for migrating and fledging bird; and provide species, age, and structural diversity of plant-life for a variety of invertebrates, which are integral to the food web. Shrub vegetation cover types provide structural and species diversity to a forest. The refuge forest community will gain from the juxtaposition of shrub and early succession habitat. Forest interior-dwelling bird species, such as scarlet tanager, seek such habitats for rearing their young. Forest openings, which the ROW mimics, serve as forage areas for forest bats, box turtles, pollinators, and herbivorous native insects, and the whip-poor-will, a declining species in the state of Maryland (personal communication with Dr. Sam Droege, Dr. Daniel Bystrak, USGS, and Dr. Timothy Jones, USFWS).

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning process for Patuxent Research Refuge, this compatibility determination will undergo extensive public review, including a comment period of 45 days following the release of the draft CCP/Environmental Assessment.

DETERMINATION (CHECK ONE BELOW):

____ Use is not compatible
_X_ Use is compatible with the following stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

The use would be conducted continually under these specific terms and conditions referenced in 50 CFR 29.21-4, 29.21-8, and 50 CFR 26.41 (c), 1 October, 1990:

1. By accepting the ROW, the holder has agreed to such terms and conditions as may be prescribed by the Regional Director in the granting document. In this case, these include the ROW conditions issued in 1972 and the stipulations listed below, unless waived in part by the Regional Director, and may include additional special stipulations at his or her discretion. (50 C.F.R. 29-21-4(b).

Per the existing ROW, BG&E or its representatives:

1. Shall comply with State and Federal laws applicable to the project within which the ROW was granted, and to the lands which are included in the ROW, and lawful existing regulations thereunder.

2. Shall ensure and maintain adequate spacing between energized lines both vertically and horizontally, as specified by the Joint Avian Protection Guidelines of Edison Institute and the Service to prevent electrocution by large raptors, particularly bald and golden eagles, which are protected species under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. Sixty horizontal inches will accommodate wrist-to-wrist distance for an eagle, and 48 vertical inches will accommodate an eagle's standard height. Compliance with these requirements is a basic preventative measure and will not immunize BG&E from liability for any violation of the bird laws.
3. Shall release the Service and the U.S. Government from any liability and indemnify and hold them harmless for any incidents involving unexploded ordnance (UXO) encountered on the ROW premises or during access to the ROW. Signage and materials notifying all visitors to the North Tract of the presence of UXO is provided along the North Tract entrance, and at the Visitor Contact Station on Bald Eagle Drive. It shall be the responsibility of BG&E to notify contractors and representatives.
4. Shall manage vegetation in ROW area in the manner directed by the refuge manager and dispose of all vegetative and other material cut, uprooted, or otherwise accumulated during the construction and maintenance of the project in a manner which decreases the fire hazard and also is in accordance with such instructions as the refuge manager may specify.
5. Shall prevent the disturbance or removal of any public land survey monument or project boundary monument unless and until the applicant has requested and received from the Regional Director approval of measures the applicant will take to perpetuate the location of aforesaid monument.
6. Shall prevent soil erosion and conditions leading to stream down-cutting resulting from road maintenance and use or related construction and maintenance activities as the refuge staff in charge may request.
7. Shall do everything reasonably within its power, both independently and on request of any duly authorized representative of the United States, to prevent and suppress fires on, or near, lands to be occupied under the easement or permit area, including making available such construction and maintenance forces as may be reasonably obtainable for the suppression of such fires (50 CFR § 29.21-4(b)(5)).
8. Shall rebuild and repair such roads, fences, structures, and trails as may be destroyed or injured by construction work and, upon request by the refuge manager, build and maintain necessary and suitable crossings and culvert for all roads and trails that intersect the works constructed, maintained, or operated under the ROW. Holder shall be responsible for maintenance and repair of access roads serving the ROW (50 CFR § 29.21-4(b)(6)).
9. Shall notify promptly the refuge manager of the amount of merchantable timber, if any, which will be cut, removed, or destroyed in the construction and maintenance of the project, and to pay the United States in advance of construction and maintenance such sum of money as the project manager may determine to be the full stumpage value of the timber to be so cut, removed, or destroyed. (50 CFR § 29.21-4(b)(8)).

10. Shall restore the land to its original condition to the satisfaction of the refuge manager so far as it is reasonably possible to do so upon revocation or termination of the easement, or following land disturbance resulting from repairs and construction, unless this requirement is waived in writing by the Regional Director (50 CFR 29.21–4(b)(10)). Termination also includes permits or easements that terminate under the terms of the grant.
11. Shall keep the refuge manager informed at all times of its address, and, in case of corporations, of the address of its principal place of business and the names and addresses of its principal officers (50 CFR § 20.21–4(b)(11)).
12. Shall not, when hiring for work on the ROW, discriminate against any employee or applicant for employment because of race, creed, color, or national origin and shall require an identical provision to be included in all subcontracts.
13. Shall not unduly interfere with the management, administration, or disposal by the United States of the land affected thereby. The easement holder agrees and consents to the occupancy and use by the United States, its grantees, permittees, or lessees of any part of the easement or permit area not actually occupied for the purpose of the granted rights to the extent that it does not interfere with the full and safe utilization thereof by the holder. The holder of the easement also agrees that authorized representatives of the United States shall have the right of access to the easement or permit area for the purpose of making inspections and monitoring the construction, operation, and maintenance of facilities, and other refuge-authorized business or activities provided that they do not interfere with the holder's rights.
14. Shall modify or adapt any facility if found to be necessary by the refuge manager, without liability or expense to the United States, so that such facility will not conflict with the use and occupancy of the land for any authorized works which may hereafter be constructed thereon under the authority of the United States. Any such modification will be planned and scheduled so as not to interfere unduly with or to have minimal effect upon continuity of energy and delivery requirements.
15. Shall not construe the permit to include the further right to authorize any other use within the easement or permit area unless approved in writing by the Regional Director.
16. Shall report immediately any cultural or paleontological resources (historic or prehistoric site or object including burials or skeletal material) discovered by the easement holder, or any person working on its behalf, on public or Federal land to the refuge manager. BG&E, or its representative, shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the authorized officer. An evaluation of the discovery will be made by the authorized officer or a Service-approved Archaeologist to determine appropriate actions to take pursuant to the provisions of law, including 36 FRCFR 800.7 (resources discovered during construction) to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation. Any decision as to proper mitigation measures will be made by the authorized officer after consulting the holder.
17. Shall not collect any plants, wildlife, or artifacts from refuge property.
18. Shall not bring any pets or other animals onto the ROW or any refuge property.

19. Shall not transport, deliver, transfer, store, or use any hazardous materials or fuels in the ROW except as authorized by the refuge manager. All transport, delivery, transfer, storage, and use of such materials and fuels authorized shall comply with all applicable Federal and State law and regulations.
20. Shall notify the refuge manager as soon as possible, and no later than 12 hours, after learning of any accident or other event in the ROW that could result in damage to the resources, values, or purposes of the refuge. In the event of such accidents or other events, the holder shall take all reasonable steps to prevent or mitigate damage to the resources, values, or purposes of the refuge at the direction of the refuge manager.
21. Shall immediately report any problems with wildlife to the refuge manager or senior biologist.
22. Shall limit ingress and egress to the ROW to vehicular use on existing and maintained roadways of the refuge, and on the ROW access road. No off-road vehicular access is authorized, unless necessary for maintenance needed to remain in compliance with FERC requirements. The holder will obtain permission from the refuge manager before such off-road use occurs.
23. Shall not leave unattended vehicles, equipment, or materials parked or stored in the ROW without prior written authorization from the refuge manager.
24. Shall post no signage that is not authorized by permit in the ROW except for appropriate signs, barricades, and other warnings to notify the public of any danger posed by the permitted use or permitted facilities.
25. Shall protect, in accordance with the rules prescribed in the National Electric Safety Code, at crossings and at places in proximity to its transmission lines on the ROW authorized, all government and other telephone, telegraph, and power transmission lines from contact and all highways and railroads from obstructions and maintain its transmission lines in such manner as not to menace life or property (50 C.F.R. § 29.21-8(a)).
26. Shall remain legally liable for causing inductive (electromagnetic field) or conductive (contact) interference between any project transmission line or other project works constructed, operated, or maintained by the holder on the servient lands, and any radio installation, telephone line, or other communication facilities now or hereafter constructed and operated by the United States or any agency thereof (50 C.F.R. § 29.21-8(b)).
27. Shall conduct vegetation control and maintenance in accordance with a mutually agreed upon vegetation management plan. There is currently an interim vegetation management plan being developed, in cooperation with BG&E, the Service Ecological Services program, and IVM, a non-profit consulting company. It embraces the concepts of IPM, mentioned previously in the, “How would the use be conducted” section. The following stipulations apply to BG&E and its contractors:
    - Coordinate with refuge staff prior to requesting access for non-emergency, planned vegetation control activities.
    - Check in at the North Tract Visitor Contact Station upon arrival and upon

departure. This is especially important during hunting season, which begins in September.

- Work during daylight hours when staff is available to monitor permits and compliance unless in the case of needed emergency repairs.
- Conduct non-emergency, planned vegetation monitoring and control activities only outside of the bird breeding season, April 15 to August 15. There may be exceptions for the treatment of invasive plant species which mature during this time and would thus not be available for treatment earlier. In such cases, BG&E and its contractors will coordinate with the refuge senior biologist for permission to conduct spot treatments.
- Debris from brush-cutting or tree top removal shall not be left in piles, but mulched in place and distributed so as not to cause an accumulation of thatch and produce a fire hazard or interfere with plant germination 50 CFR § 29.21-4(b)(2). Small amounts of debris cuttings may be left in place for decomposition.
- Ensure that heavy equipment and vehicles are free of weed seeds or propagating plant parts before being brought onto the job site. Workers shall also be vigilant against transporting weed seeds from other job sites on footwear, tools, and equipment. The refuge reserves the right to inspect such tools and equipment to confirm compliance with this condition.
- Annually notify the refuge senior biologist of intent to use herbicides and provide a list of intended herbicides that includes trade name, active ingredient, target species, method of application, and rate of application. The refuge shall prepare a pesticide use permit for each herbicide, to be approved at refuge manager or regional office level, and in accordance with U.S. Environmental Protection Agency label directions. No herbicides may be applied without an approved PUP from the refuge. Notify senior refuge biologist 60 days in advance for additional herbicides intended.

JUSTIFICATION:

The refuge is surrounded by high-density urban and suburban development. A powerline ROW through the refuge provides an opportunity to supply a habitat type (shrub and early successional forest) on a scale that would otherwise be difficult for the refuge to accomplish and maintain on its own. Proximity of early succession habitat with large blocks of forest provides benefits for forest interior-dwelling species and priority edge species, such as forest bats, whip-poor-will, prairie warbler, and eastern box turtle.

Over the past 20 years, BG&E has been in compliance with the terms and conditions of the ROW easement, with minor exceptions. Some vegetation control was conducted prior to coordinating with the refuge. These occurrences were followed up with increased communication and coordination with BG&E and its contractors.

There has been long-term maintenance of open grass and shrub-scrub communities, which are habitats in decline in the region. The evolving vegetation management plan will result in fewer invasive species being present on this 230 acres of the refuge, and will encourage the presence of

native flora and fauna.

As listed in the purposes section of this compatibility determination, the refuge was established and subsequently land was acquired for a total of six purposes. The maintenance of this ROW will not materially interfere with or detract from the research purpose of the refuge, because wildlife research does not generally occur in the vicinity of the locations that these uses occur and the cast majority of refuge lands are not impacted by these uses. The habitat that is maintained in the ROW may provide additional research opportunities. This use will not materially interfere with or detract from the two purposes related to wildlife conservation, because the scrub-shrub habitat that is maintained under the power line provides valuable habitat to refuge wildlife. This use will not materially interfere with or detract from the two purposes related to migratory bird conservation, because these areas provide foraging habitat for migratory species. Maintenance of the ROW will not materially interfere with or detract from the endangered species purpose, because there are no federally listed threatened or endangered species that occur on the refuge. Finally, this use will not materially interfere with or detract from the mission of the Refuge System, because the amount of land that is impacted is a minor portion of the refuge and the land still provides viable wildlife habitat.

SIGNATURE:

REFUGE MANAGER: _____

(signature and date)

CONCURRENCE:

REGIONAL CHIEF: _____

(signature and date)

MANDATORY 10-YEAR REEVALUATION DATE: 2022

REFERENCES:

Edison Electric Intsitute Avian Powerline Interactive Committee and the U.S. Fish and Wildlife Service. April 2005. Avian protection plan (APP) guidelines: a joint document.

Droege, S., D. Bystrak (USGS), and T. Jones (USFWS). 2011. Personal communication.

COMPATIBILITY DETERMINATION

USE:

Continued Maintenance of Toro Energy Underground Gas Line Right-of-way Easement through Patuxent Research Refuge, South Tract

REFUGE NAME:

Patuxent Research Refuge

ESTABLISHING AND ACQUISITION AUTHORITIES:

Executive Order 7514, dated December 16, 1936; Executive Order 11724, dated June 27, 1973; 16 U.S.C. 715d, Migratory Bird Conservation Act of 1929; 16 U.S.C. 1534; 16 U.S.C. 667b, dated May 19, 1948 - An Act Authorizing the Transfer of Certain Real Property for Wildlife or other purposes; and Public Law 101-519, Sec.216 104 Stat. 2247, dated November 5, 1990.

REFUGE PURPOSES:

1. "...as a wildlife experiment and research refuge" – Executive Order 7514, dated December 16, 1936
2. "…recreation, conservation, wildlife preservation, and related scientific and educational activities" – Executive Order 11724, dated June 27, 1973
3. "...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds - 16 U.S.C. 715d, February 18, 1929 (Migratory Bird Conservation Act)
4. "...to conserve fish, wildlife, and plants, including those which are listed as endangered species or threatened species16 U.S.C. 1534, December 28, 1973 (Endangered Species Act)
5. "...particular value in carrying out the national migratory bird management program." 16 U.S.C. 667b, May 19, 1948 (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes)
6. "...(b) The Secretary of the Interior shall administer the property transferred pursuant to subsection (a) consistent with wildlife conservation purposes and shall provide for the continued use of the property by Federal agencies to the extent such agencies are using it on the date of the enactment of this Act." – Public Law 101-519, Sec. 216, 104 Stat. 2247, dated November 5, 1990 (Defense Appropriation Act including the transfer of North Tract from Fort Meade)

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

"To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." 16 U.S.C. 668dd(a)(2) (National Wildlife Refuge System Improvement Act of 1997)

DESCRIPTION OF USE:

Toro Energy of Maryland, LLC currently has a 30-year right-of-way (ROW) (expiration 2032) easement for a 10-inch, underground polyethylene pipeline in the southwest corner of Patuxent Research Refuge (refuge). This pipeline was constructed in 2002, after the refuge completed its compatibility determination and found the use compatible. The pipeline continues to transport methane from the closed Sandy Hill Landfill to fire boilers at the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center. The pipeline follows the eastern boundary of the refuge, crosses the refuge, follows Good Luck Road off the refuge to the south, and terminates at NASA Goddard Space Flight Center. The pipeline is buried 48 inches below ground. The dimension of the ROW is 30 feet by 2,520 feet long, occupying 1.91 acres in mostly upland forested habitat.

There are no long-term maintenance concerns for this ROW because, after immediate soil stabilization, the area was left to re-vegetate naturally on its own. Toro Energy has no concerns of tree roots growing into the pipe because thick walled polyethylene pipes are not susceptible to this problem. The long-term maintenance essentially consists of monitoring the pipeline for any break that may occur, which is an extremely slight chance.

The alignment was chosen in an already disturbed former ROW with a long history of vegetation and soil compaction disturbance prior to refuge ownership. Recovery of vegetation is nearly complete.

AVAILABILITY OF RESOURCES:

No direct refuge funds or equipment support or resources are anticipated. At most, refuge staff may want to walk the pipeline location annually to check for invasive species, human debris, and proper signage. After review of the refuge budget, there are sufficient staff and funds to sustain this activity.

ANTICIPATED IMPACTS OF THE USE:

The site is primarily upland hardwood forest, which had been partially cleared by Western Union as a utility ROW. Some remnant utility poles are still present, and tree saplings younger than the adjacent forest have grown up in the ROW.

There is no maintenance of the utility ROW; therefore, no impacts to research, public use, wildlife, public uses, vegetation, soil, or water are anticipated. A letter dated May 22, 2000, from Toro Energy of Maryland, LLC states, “Because the line would be maintenance free, our presence would only be required if the refuge would prefer Toro to maintain the easement from fallen trees or debris.” The refuge’s preference was for Toro to not do any tree or debris removal, allowing the ROW to return to as natural condition as possible. This design for natural re-vegetation of the ROW is appropriate to avoid resource impacts and ensure that there is no net loss of habitat quantity or quality (50 CFRC.F.R. 26.41 21(c)).

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning process for Patuxent Research Refuge, this compatibility determination will undergo extensive public review, including a comment period

of 45 days following the release of the draft Comprehensive Conservation Plan/Environmental Assessment.

DETERMINATION (CHECK ONE BELOW):

____ Use is not compatible
_X_ Use is compatible with the following stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

The following stipulations must be followed to ensure compatibility:

1. Provide and maintain adequate signage to indicate location of pipeline.
2. Continue to allow native forest vegetation to regenerate. Monitor and control invasive plant species.

See Attachment A, "Limited Right-of-Way Permit," for additional stipulations that relate both to the construction phase (completed in 2002) and the ongoing ROW easement.

JUSTIFICATION:

Toro Energy of Maryland, LLC, has agreed there is no ongoing maintenance necessary due to the nature of the pipeline construction and location.

A categorical exclusion from further National Environmental Policy Act review as provided by 516 DM 6 (appendix 1) was signed in April 2002 by the U.S. Fish and Wildlife Service's Regional Director.

The alignment follows a former ROW with a long history of vegetation clearing, soil compaction from maintenance vehicles, and adjacent sand and gravel mining, prior to the land becoming part of the National Wildlife Refuge System. The continued presence of the easement does not compromise the refuge's research purpose or any wildlife conservation purposes of the refuge. The maintenance-free design for this buried pipeline will not materially interfere with, or detract from, the fulfillment of the National Wildlife Refuge System mission or any of the refuge purposes listed at the beginning of this document.

SIGNATURE:

REFUGE MANAGER: _____
(signature and date)

CONCURRENCE:

REGIONAL CHIEF: _____
(signature and date)

MANDATORY 10-YEAR REEVALUATION DATE: 2022

Attachment A. Limited Right-of-Way Permit

LIMITED RIGHT-OF-WAY PERMIT (30 Years)

This permit authorizes the placement and maintenance of a 10" underground polyethylene pipeline along the former Western Union Telegraph Right-of-Way in the southwest corner of the Patuxent Research Refuge (P-2). The pipeline will transport methane gas from the closed Sandyhill Landfill along the eastern boundary of the Refuge, cross the Refuge, follow Goodluck Road off Refuge to the south, and terminate at NASA Goddard Space Flight Center.

THE SECRETARY OF THE INTERIOR, by her authorized representative, the Regional Director, U.S. Fish and Wildlife Service, in accordance with applicable authorities, and regulations published December 19, 1969, 50 CFR Part 29, Subpart B, for and in consideration of the sum of ($9,720.00) Nine Thousand Seven Hundred and Twenty dollars and other valuable considerations hereby grants a permit to Toro Energy of Maryland, LLC, herein referred to as the permittee, to use and occupy certain lands of the Patuxent Research Refuge for a period of Thirty (30) years, over, across, in, and upon lands of the United States described as follows:

The hereinafter-described two (2) tracts of land are located in the State of Maryland, Prince George's County, northeast of Springfield Road, northwest of the Duckettown Road, and south of State Highway Route 197, situate approximately 2.0 miles northeasterly of Huntington, and encumber a portion of UNITED STATES (TRACT 100) and UNITED STATES (TRACT 146), and are more particularly described as follows:

These two (2) descriptions are based on the Maryland State Plane Coordinate System, NAD83. Distances are GROUND Distances.

TRACT (P100)

BEING a natural gas line easement, thirty (30) feet in width, through lands of the UNITED STATES (TRACT 100), [(TRACT 100) having been conveyed from Edward E. Perkins and Margaret B. Buchanan to the United States of America by Warranty Deed, dated April 9, 1936 and recorded April 17, 1936, in Liber 447 at Folio 313, on file in the Land Records of Prince George's County, Maryland]; the center line of said easement being more particularly described as follows:

BEGINNING at Corner 7 of UNITED STATES (TRACT 100), [being the beginning of the 7th or N 51° 16' 30" W, 769.58 foot course of the aforesaid Liber 447 Folio 313],

thence N 51° 22' 24" W, along the easterly edge of Springfield Road and UNITED STATES (TRACT 100), 172.30 feet to the TRUE POINT OF BEGINNING;

thence through land of the UNITED STATES (TRACT 100) the following four (4) courses:

1) N 43° 15' 38" E, 63.44 feet to a point;
2) thence N 18° 49' 56" E, 167.28 feet to a point;
3) thence N 65° 20' 27" E, along an abandoned Telegraph Line, 631.95 feet to a point;
4) thence N 64° 31' 58" E, along said abandoned Telegraph Line, 599.48 feet to UNITED STATES (TRACT 146) and the END POINT, from which Corner 1 of UNITED STATES (TRACT 146) bears S 26° 24' 06" W, 217.05 feet; said End Point being also the True Point of Beginning for UNITED STATES TRACT (P146).

UNITED STATES TRACT (P100) contains 1.0070 acres, more or less.

TRACT (P146)

BEING a natural gas line easement, thirty (30) feet in width, through lands of the UNITED STATES (TRACT 146), [(TRACT 146) having been conveyed from the Potomac Electric Power Company, a District of Columbia, and Virginia corporation, to the United States of America by Warranty Deed, dated April 11, 1963 and recorded April 18, 1963, in Liber 2807 at Folio 535, on file in the Land Records of Prince George's County, Maryland]; the center line of said easement being more particularly described as follows:

BEGINNING at Corner 1 of UNITED STATES (TRACT 146), now or formerly a sandstone monument with standard disc, marked "1404 COR 8 TR 100 PERKINS BROWN";

thence N 26° 24' 06" E, along land of the UNITED STATES (TRACT 100), 217.05 feet to the TRUE POINT OF BEGINNING;

thence through land of the UNITED STATES (TRACT 146) the following four (4) courses:

5) N 64° 31' 58" E, along an abandoned Telegraph Line, 1,051.57 feet to a point;
6) thence N 10° 21' 16" E, 154.46 feet to a point;
7) thence N 09° 33' 36" E, 91.71 feet to a point;
8) thence N 70° 57' 02" E, 17.09 feet to land, now or formerly, of Prince George's County, (as conveyed in Liber 6860 Folio 744, on file in the Land Records of Prince George's County, Maryland) and the END POINT, from which a stone monument, being Corner 7 of UNITED STATES (TRACT 146), bears S 09° 33' 36" W, 100.00 feet, (said monument also being at the beginning of the 1st or N 76° 24' 02" E, 346.74 foot line of the lands conveyed by Marc H. Berman and Meryl F. Berman to James K. Fletcher and Cynthia J. Rapp by Deed dated December 11, 1998, and recorded in Liber 12684, Folio 455, on file in the Land Records of Prince George's County, Maryland).

UNITED STATES TRACT (P146) contains 0.9055 acres, more or less.

The above-described two (2) tracts of land, containing, in the aggregate, 1.9125 acres, more or less, are delineated on a map designated the *"Plat Of Easement For Gas Pipeline Right Of Way, Through Property Of United States Of America, Patuxent National Wildlife Refuge"*, dated January, 2002, prepared by R. C. Kelly & Associates, Inc., of Silver Springs, Maryland, and of record in the files of the Department of the Interior, Fish and Wildlife Service, Office of Realty, located at 300 Westgate Center Drive, Hadley, Massachusetts 01035-9589.

By accepting this permit the permittee agrees to the following terms and conditions:

(1) To comply with State and Federal laws applicable to the project within which the right-of-way is granted, and to the land which are included in the right-of-way, and lawful existing regulations thereunder.

(2) To clear and keep clear the lands within the right-of-way to the extent and in the manner directed by the refuge manager; and to dispose of all vegetative and other material cut, uprooted, or otherwise accumulated during the construction and maintenance of the project in such a manner as to decrease the fire hazard and also in accordance with such instruction as the refuge manager may specify.

(3) To prevent the disturbance or removal of any public land survey monument or project boundary monument unless and until the applicant has requested and received from the Regional Director approval of measures the applicant will take to perpetuate the location of aforesaid monument.

(4) To take such soil and resource conservation and protection measures, including weed control on the land covered by the rights-of-way as the refuge manager may request.

(5) To do everything reasonable with his/her power, both independently and on request of any duly authorized representative of the United States, to prevent and suppress fires on or near lands to be occupied under the rights-of-way, including making available such construction and maintenance forces as may be reasonably obtainable for the suppression of such fires.

(6) To rebuild and repair such roads, fences, structures and trails as may be destroyed or altered by construction work and to build necessary and suitable crossings for all roads and trails that intersect the works constructed, maintained, or operated under the rights-of-way.

(7) To pay the United States the full value for all damages to the lands or other property of the United States caused by him/her or by his/her employees, contractors, or employees of the contractors, and to indemnify the United States against any liability for damages to life, person, or property arising from the occupancy or use of the lands under the rights-of-way, except where a right-of-way is granted hereunder to a State or other governmental agency which has no legal power to assume such a liability with respect to damages caused by it to lands or property, such agency in lieu thereof agrees to repair all such damages. The holder of this permit, or its

employees, contractors, or agents of the contractors, shall be liable for injuries incurred in connection with the right-of-way.

(8) To notify promptly the refuge manager of the amount of merchantable timber, if any, which will be cut, removed, or destroyed in the construction and maintenance of the project, and to pay the United States in advance of construction such sum of money as the refuge manager may determine to be the full stumpage value of the timber to be so cut, removed, or destroyed.

(9) That all of any part of the rights-of-way granted may be terminated by the Regional Director, Fish and Wildlife Service for failure to comply with any or all of the terms or conditions of this grant, or for nonuse for a 2-year period, or abandonment of the rights-of-way granted. In the event of noncompliance such non-use, or abandonment, the Regional Director will notify the permittee in writing of her intent to suspend or terminate the permit unless corrective action is taken within 60 days. However, in the event of extenuating circumstances such as adverse weather conditions, disturbance of wildlife during periods of peak concentrations, or other compelling reasons, the Regional Director may grant an extension of time which in his/her judgment is reasonably necessary. In the event of termination of an easement or permit for noncompliance, nonuse, or abandonment, a written notice of termination will be furnished to the permittee.

(10) To restore the land to its original condition to the entire satisfaction of the Regional Director, so far as it is reasonably possible to do so upon revocation and termination of the permit, unless this requirement is waived in writing.

(11) If the Refuge Manager determines that an immediate temporary suspension of activities within a right-of-way or permit area is necessary to protect public health and safety or the environment, he may issue an emergency suspension order to abate such activities prior to an administrative proceeding. The Regional Director must make a determination and notify the holder in writing within 15 days from the date of suspension as to whether the suspension should continue and list actions needed to terminate the suspension. Such suspension shall remain in effect for only so long as an emergency condition continues.

(12) To keep the refuge manager informed at all times of his/her address, and, in case of corporations, of the address of its principal place of business and the names and addresses of its principal officers.

(13) That in the construction, operation, and maintenance of the project, he/she shall not discriminate against any employee or applicant for employment because of race, creed, color, or national origin and shall require an identical provision to be included in all subcontracts.

(14) That the allowance of the rights-of-way shall be subject to the express condition that the exercise thereof will not unduly interfere with the management, administration, or disposal by the United States of land affected thereby, and that the permittee agrees and consents to the occupancy and use by the United States, its grantees, permittees, or lessees of any part of the

rights-of-way not actually occupied or required by the permittee for the purpose of the granted rights or the full and safe utilization thereof. The permittee also agrees that authorized representatives of the United States shall have the right of access to the permit area for the purpose of making inspections and monitoring the construction, operation, and maintenance of facilities.

(15) That the rights-of-way herein granted shall be subject to the express covenant that any facility constructed thereon will be modified or adapted if such is found by the Regional Director, Fish and Wildlife Service, to be necessary, without liability or expense to the United States, so that such facility will not conflict with the use and occupancy of the land for any authorized works which may hereafter be constructed thereon under the authority of the United States.

(16) That the rights-of-way herein granted shall be for the specific use described and may not be construed to include the further right to authorize any other use within the rights-of-way unless approved in writing by the Regional Director.

(17) Right-of-way grants will be subject to the special requirements of Section 28 of the Mineral Leasing Act of 1920 (30 U.S.C. §185), as amended.

(18) Permittee agrees to design, construct, and operate all proposed facilities in accordance with the provisions of parts 192 and/or 195 of Title 49 of the CFR and in accordance with the Occupational Safety and Health Act of 1970, Pub. L. 91-596, including any amendments thereto.

(19) The permittee agrees to undertake the following activities to ensure: restoration, revegetation and curtailment of erosion of the surface; air and water quality standards established by law; and control or prevention of damage to the environment including damage to fish and wildlife habitat, public or private property:

a) Maintain an average 15' wide construction zone corridor.

b) Flush cut only those trees necessary to install the underground pipeline. Make brush piles adjacent to the construction zone using all flush cut trees.

c) Install and maintain silt fencing adjacent to all soil disturbed areas.

d) Use "Ditch Witch" trenching machine to minimize root impact to trees. Reinstall soil in the trench in the same manner at it was removed to preserve the soil horizon.

e) Use tunneling equipment (jack and bore) to burrow under wetland tributaries and primary lateral roots of larger trees. Wetland hydrology will not be altered.

f) If major tree roots need to be cut, use a Vermeer Wheel or vibratory knife to

provide a clean cut. Side dress the wound with root stimulator fertilizer.

g) Cease work during rain or periods of soil saturation, to reduce soil compaction and overtaxing erosion control devises.

h) Perform core aeration and fertilization in soil compacted areas around mature mast trees to minimize the effects of soil compaction.

i) Plant soil disturbed areas with short-lived, non-persistent nurse crops to stabilize soil and reduce establishment of exotic and invasive plant species. A nurse crop seed mixture of 20 pounds/acre of winter wheat, annual ryegrass, winter rye, red top grass, and deer tongue grass will be used. The rationale for this seed mixture is to immediately stabilize the soil with fast growing annuals and minimize the establishment of the invasive Japanese Stilt Grass *(Microstegium sp.)* As the annuals die back, the native perennials such as red top and deer tongue will remain to re-vegetate the area longer term.

j) Replant tree removal zones with ½" or greater caliper native trees to re-forest the disturbed area as quickly as possible.

k) Prepare an Emergency Response Plan with contingencies in the event of a break in the underground pipeline.

20) Each right-of-way or permit shall reserve to the Regional Director the right to grant additional rights-of-way or permits for compatible uses on or adjacent to rights-of-way or permit areas granted under this section after giving notice to the holder and an opportunity to comment.

Special terms and conditions may be added to those listed above as determined by the Service.

The Service has made an initial determination that this action is covered as a categorical exclusion under NEPA. However, if during construction any problems arise or it becomes apparent that the impact to the environment is greater than what was anticipated, the Service has the right to halt the project and in order to allow it to timely complete an Environmental Assessment.

IN WITNESS WHEREOF, I have hereunto set my hand this day of 2002.

THE UNITED STATES OF AMERICA

SEAL

By _____
Regional Director
U.S. Fish and Wildlife Service

ACKNOWLEDGMENT

STATE OF _____)
) SS
COUNTY)

I, , a Notary Public in and for County, Massachusetts, do hereby certify that , Regional Director, United States Fish and Wildlife Service, Department of the Interior, party to a certain permit bearing the date of day of , 2002, and hereto annexed, personally appeared before me, the said , Regional Director, being personally well known to me as the person and officer who executed said permit, and acknowledged the same to be her act and deed, for purposes therein expressed.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal this day of , 2002.

_____
Notary Public
_____ County, MA.
(SEAL) My commission expires:_____

IN WITNESS WHEREOF, I, _____ have executed this instrument in behalf of the permittee herein on this day of 2002.

WITNESS: Toro Energy of Maryland LLC

_____ _____

This instrument was prepared by Betty Jarous, U.S. Fish and Wildlife Service, 300 Westgate Center Drive, Hadley, Massachusetts 01035.

COMPATIBILITY DETERMINATION

USE:

Issuance of New Permit to Potomac Electric Power Company for Overhead Electric Transmission Line on Existing Right-of-way with Expired U.S. Department of Agriculture Permits on the Central Tract and South Tract

REFUGE NAME:

Patuxent Research Refuge

ESTABLISHING AND ACQUISITION AUTHORITIES:

Executive Order 7514, dated December 16, 1936; Executive Order 11724, dated June 27, 1973; 16 U.S.C. 715d, Migratory Bird Conservation Act of 1929; 16 U.S.C. 1534; 16 U.S.C. 667b, dated May 19, 1948 - An Act Authorizing the Transfer of Certain Real Property for Wildlife or other purposes; and Public Law 101-519 Sec. 126, 104 Stat. 2247, dated November 5, 1990.

REFUGE PURPOSES:

1. "...as a wildlife experiment and research refuge" – Executive Order 7514, dated December 16, 1936
2. "…recreation, conservation, wildlife preservation, and related scientific and educational activities" – Executive Order 11724, dated June 27, 1973
3. "...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" – 16 U.S.C. 715d, dated February 18, 1929 (Migratory Bird Conservation Act)
4. "...to conserve fish, wildlife and plants, including those which are listed as endangered species or threatened species– 16 U.S.C. 1534, dated December 28, 1973 (Endangered Species Act)
5. "...particular value in carrying out the national migratory bird management program." – 16 U.S.C. 667b, dated May 19, 1948 (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes)
6. "...(b) The Secretary of the Interior shall administer the property transferred pursuant to subsection (a) consistent with wildlife conservation purposes and shall provide for the continued use of the property by Federal agencies to the extent such agencies are using it on the date of the enactment of this Act." – Public Law 101-519 Sec. 216, 104 Stat. 2247, dated November 5, 1990 (Defense Appropriation Act – including transfer of the North Tract from Fort Meade).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

"To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." 16 U.S.C. 668dd(a)(2) (National Wildlife Refuge System Improvement Act of 1997)

DESCRIPTION OF USE:

What is the use? Is it a priority public use?
The use is the issuance of a new permit to Potomac Electric Power Company (PEPCO) for overhead electric transmission line on existing right-of-way (ROW) with expired U.S. Department of Agriculture (USDA) permits on the Central Tract and South Tract. PEPCO, Inc. is a major supplier of electrical power in the area. The transmission line ROW consists of approximately 76 acres along a 3-mile-long corridor. A deed of easement was granted by the USDA to PEPCO, on September 25, 1959. That easement was for a 250-foot ROW totaling 16.66 acres for a period of 50 years from September 25, 1959. A second easement was granted August 18, 1961, for a 250-foot ROW totaling 59.23 acres and lying to the north or west of Route 197, also for 50 years. PEPCO owns a perpetual easement in another part of the refuge that is not included in this compatibility determination. PEPCO timely applied to the U.S. Fish and Wildlife Service (Service) for a new permit to continue using the ROW before the USDA permits expired in 2009 and 2011. This compatibility determination is part of our process for reviewing the permit application.

The granting of a ROW permit is not a priority use of the National Wildlife Refuge System (Refuge System) under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee) and the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57). However, certain vegetation management practices employed within the ROW by PEPCO and its contractors may support some of the purposes and goals of the refuge. Long-term ROWs that apply for reauthorization are analyzed based on the existing conditions with the use in place, not based on the original, pre-use conditions (603 FW 2.11.H(3)).

Where would the use be conducted?
The use would be conducted along the existing PEPCO transmission line ROW that crosses the Central Tract and the South Tract (see attached map).

When would the use be conducted?
Pepco staff and contractors would coordinate with refuge staff prior to requesting access for non-emergency, planned vegetation control activities. Non-emergency, planned vegetation management and control activities would occur only outside of the bird breeding season, which runs from April 15 to August 15. There may be exceptions for the treatment of invasive plant species, which mature during this time and control efforts would not be as effective outside this timeframe. In such cases, PEPCO staff and contractors will coordinate with the refuge senior biologist for permission to conduct agreed upon treatments.

It may be necessary for emergency repairs and inspections to be done at any hour of the day, any time of year. Coordination with refuge staff would be expected to occur as soon as is reasonably possible in these instances.

How would the use be conducted?
Infrastructure maintenance will vary widely depending on the nature of the repair and replacement of towers, tower pads, and wires. It will be done in accordance with PEPCO policies and procedures, adapted to meet the stipulations listed below that are required to protect the wildlife refuge. It will be done with special consideration for the unique situation of being

located on a national wildlife refuge. This will include seasonal restrictions, pesticide restrictions, etc. to minimize impacts to wildlife and habitat. Access will be coordinated with refuge staff ahead of time for routine maintenance, and as soon as possible before, during and after emergency responses. (Note: there has been minimal need for this type of activity in the 20 years the refuge has owned the underlying property.)

Vegetation management within the ROW will be conducted using the principles of Integrated Pest Management (IPM) (USFWS 2012), and will not conflict with new requirements established by the Federal Energy Regulatory Commission (FERC) in 2008-2009. These revised requirements allow for somewhat more aggressive control of vegetation height under ROW wire zones, increasing the desired distance between vegetation and the wires from 12 feet to 15 feet. IPM principles include minimal use of herbicides approved by the refuge manager or Regional Office, avoidance of sensitive habitats such as wetlands or bogs, mechanical control as necessary utilizing power saws, bush hogs, and other similar power equipment, and hand control where feasible. Please refer to the IPM citation above, and the "Stipulations" section for further details.

Vegetation management would occur both within the wire zone and the border zone. The wire zone is the area of the ROW directly beneath the conductors and extending 20 feet outside of the last conductor toward the ROW edge. The border zone is everything from this point to the woods line. The height restriction within the wire zone varies according to line voltage and clearance from the conductor to the ground. Generally, no vegetation above 15 feet in height would be allowed to grow anywhere within the wire zone, except where clearances are greater than normal, such as a ravine. Vegetation in the border zone can be taller so long as it does not jeopardize the flashover distance of the voltage, taking into consideration wind and sway of trees and wires. Species in both zones are generally restricted to shrub or scrub growth, with such species as mountain laurel, blackberry, blueberry, viburnum, and some low stature trees like serviceberry, sumac and dogwood.

Why is the use being proposed?
The use is being proposed to replace the recently expired 50-year USDA permit for this transmission line ROW. Chapter 1 of the draft Comprehensive Conservation Plan and Environmental Assessment (CCP/EA) summarizes the Service's consideration of environmental factors in continuing this refuge use. The agreed-upon vegetation management plan (USFWS 2012) will help the refuge achieve goal 4 in the CCP: "Manage refuge non-forested upland communities to provide ecological structure, composition, and function to support native plants and wildlife, including species of conservation concern."

It will provide an early successional stage habitat of grasses, forbs, and low shrubs beneficial to such bird species as gray catbird, ruby-crowned kinglet and prairie warbler, and a host of pollinating insects and native bee species. Through successful vegetation management, the presence of invasive species under and adjacent to the ROW will decline, including autumn olive, lespedza, and mile-a-minute, and be replaced with native flora. Management of this regionally declining habitat will be nearly entirely at PEPCO's expense.

AVAILABILITY OF RESOURCES:

Refuge staff time will be required to coordinate, develop, and issue special use permit(s)

annually; review site operations and safety plans; and to attend and participate in annual meetings, site visits, and phone calls with PEPCO representatives. Under the current term of this compatibility determination and ROW permit, the majority of vegetation management expenses will be the responsibility of PEPCO personnel and contractors to keep the vegetation within FERC height restrictions and for invasive and undesirable species control. Some refuge staff time will be required to review management plans and assess habitat quality pre- and post-vegetation treatments and other maintenance activities, process and approve pesticide use proposals (PUPs), and to monitor invasive plant species.

Task	Staff Days	Cost/year
Review annual vegetation management plan	2 days/year Supervisory biologist GS12	 $480/year
Visual habitat/vegetation monitoring	4 days/year Supervisory biologist GS12 Bio-tech GS 5/6/7	 $960/year $563/year
Write, process PUPs	2 days/year Assistant biologist GS-9	 $311/year
Invasive species treatment	4 days/year Supervisory biologist GS12 Bio-tech GS 5/6/7 2 Interns	 $960/year $563/year $334/year
Total Staff Cost		**$4,171/year**

Supplies/Services	Cost
Maintenance of buildings, roadways, and parking areas	$1100
Office supplies	$110
Equipment and herbicide	$550
Total Cost of Supplies and Services	**$1,760**

Total Annual Cost: $5,931

The refuge has adequate resources for this proposed use.

ANTICIPATED IMPACTS OF THE USE:

Effects on Vegetation and Wildlife

The powerline ROW occupies approximately 76 acres of what would otherwise have been interior forest. After development of the ROW in the late 1950s, the forest was replaced, through natural succession and selective management, with shorter stature vegetation comprised of trees, shrubs, forbs, and grasses. The change in mature forest canopy changed the sunlight-to-soil and ground moisture dynamics of the forest floor. Different plants have and will continue to establish and replace those unable to adapt to the new regime, and over 50 years this has evolved into a quite different plant community. The current plant communities are expected to persist over the next 50 years under the current management activities.

The powerline ROW through the refuge provides a habitat type (shrub and early successional

forest) on a moderate scale. Proximity of early succession habitat with large blocks of forest provides benefits for forest-interior-dwelling species and priority edge species, such as forest bats, whip-poor-will, prairie warbler, and eastern box turtle, and numerous species of conservation concern. Shrub and early succession habitat provide high-quality food and cover resources for migrating and fledging bird; and provide species, age, and structural diversity of plant-life for a variety of invertebrates. Shrub vegetation cover types also mitigate the fragmenting results of an opening such as a ROW, providing structural and species diversity to the forest. The refuge forest community will benefit from the juxtaposition of shrub and early succession habitat; forest interior dwelling bird species, such as scarlet tanager, seek such habitats for rearing their young. Also, such openings in the forest are necessary for forage areas for forest bats, box turtles, pollinators and herbivorous native insects, and whip-poor-wills, a declining species in the State of Maryland.

The presence of contrasting adjoining habitats can influence each habitat along their shared borders. An example of contrasting habitats would be a mature hardwood forest bordering shrub and early succession habitat. The transition between these two habitat types often results in a "soft edge." In this case, there will be an increase in vegetation density, complexity of structure, and plant species diversity along this edge, creating a "soft edge" of early successional species of trees, shrubs, herbaceous plants. Often this "soft edge" effect is viewed by wildlife managers as beneficial because of the increased food and cover provided for species that use such edge. It also reduces negative edge effects, such as encroachment by non-native plants, accessibility to the forest interior by predators (snakes, feral cats, fox, raccoons, crows, jays, brown-headed cowbirds), and by penetrating light and wind. Habitats contrasting sharply with forests, also known as "hard edges" made by lawns, roads, and parking lots, do not provide such benefits and make adjacent forests vulnerable to negative edge effects. Thus, all the acreage within a certain distance of an edge, be it a forest, grassland, or wetland habitat, will be edge habitat. Just how far the edge effect extends is variable and recommendations for buffering interior habitat vary from 50 meters (164 feet) (Paton 1994) to about 90 meters (300 feet) (Robbins et al. 1989, Brittingham and Temple 1983, Jones et al. 2000).

Disturbances vary with the wildlife species involved and the type, level, frequency, duration, and the time of year such activities occur. The responses of wildlife to human activities include avoidance or departure from the site (Owen 1973, Burger 1981, Kaiser and Fritzell 1984, Korschen et al. 1985, Kahl 1991, Klein 1993, Whittaker and Knight 1998), the use of sub-optimal habitat (Erwin 1980, Williams and Forbes 1980), altered behavior or habituation (Burger 1981, Korschen et al. 1985, Morton et al. 1989, Ward and Stehn 1989, Havera et al. 1992, Klein 1993, Whittaker and Knight 1998), attraction (Whittaker and Knight 1998), and an increase in energy expenditure (Morton et al. 1989, Belanger and Bedard 1990). Infrequent visits to the area by maintenance workers could cause limited impacts to wildlife in the form of these behavioral changes.

Disturbance can have other effects including shifts in habitat use, abandonment of habitat, and increased energy demands on affected wildlife (Knight and Cole 1991). The effects of roads and trails on plants and animals are complex, and not limited to, trail width. Trail use can disturb areas outside the immediate trail corridor (Trails and Wildlife Task Force 1998, Miller et al. 2001). Bird communities in this study were apparently affected by the presence of recreational

roads and trails, where common species (e.g., American robins) were found near trails and rare species (e.g., grasshopper sparrows) were found farther from trails. Songbird nest failure was also greater near trails. Several studies have examined the effects of recreationists on birds using shallow-water habitats adjacent to trails and roads through wildlife refuges and coastal habitats in the eastern United States (Burger 1981, Burger 1986, Klein 1993, Klein et al. 1995, Rodgers and Smith 1995, Rodgers and Smith 1997, Burger and Gochfeld 1998). Infrequent visits to the area by maintenance workers could cause limited impacts to wildlife in the form of these behavioral changes.

Invasive plants gain their first footholds in sunny disturbed areas, along trails or around shelters (Scherer 2001). Through successful vegetation management, the presence of invasive species under and/or adjacent to the ROW will decline, including autumn olive, lespedza, and mile-a-minute, and be replaced with native flora. Impacts to wildlife from this use are expected to be minimal. The dirt access road is used only periodically for vegetation management and maintenance of the ROW. Having an established ROW through the refuge has actually been beneficial to neo-tropical migrants by providing much need foraging and resting areas. Patuxent staff and volunteers use the ROWs to band and monitor neo-tropical migrants utilizing these spaces. Early successional stage habitat of grasses, forbs, and low shrubs are beneficial to such bird species as gray catbird, ruby-crowned kinglet and prairie warbler, and a host of pollinating insects and native bee species.

Effects on Soil
A one-lane, dirt access road runs beneath some segments of the wire zone and results in sparseness or no vegetation, and may also cause some minor soil erosion and run-off. Run-off, if any were to occur, would be filtered by well-established vegetation on either side of the dirt access road.

Effects on Hydrology and Water Quality
This use has limited potential to have effects on hydrology and/or water quality over the next 50 years. Maintaining scrub shrub and early succsessional forest will serve as a natural filter for water and any run-off that may be associated with the ROW.

Effects on Priority Public Uses
This use will not affect priority public uses, as the ROW transects areas that are not open to public use.

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning process for Patuxent Research Refuge, this compatibility determination will undergo extensive public review, including a comment period of 45 days following the release of the draft CCP/EA.

DETERMINATION (CHECK ONE BELOW):

____ Use is not compatible
_X_ Use is compatible with the following stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

The use would be conducted continually under the specific terms and conditions referenced in the Service regulations, including without limitation 50 CFR 29.21-4, 29.21-8, and 50 CFR 26.41 (c), 1 October, 1990.

1. ROW permit will be subject to any outstanding rights of third parties (50 CFR 29.21-4(a)).
2. By accepting the ROW permit, the holder agrees to such terms and conditions as may be prescribed by the Service's Regional Director (50 CFR 29.21-4(b)).

Such terms and conditions shall include the following conditions below, unless waived in part by the Regional Director, and may include additional special stipulations at his or her discretion.

PEPCO and its representatives (the permit holder):

1. Shall comply with State and Federal laws applicable to the project within which the permit was granted, and to the lands which are included in the ROW, and lawful existing regulations thereunder (50 CFR § 29.21-4(b)(1)).
2. Shall manage vegetation in ROW area in the manner directed by the refuge manager and dispose of all vegetative and other material cut, uprooted, or otherwise accumulated during the construction and maintenance of the project in a manner which decreases the fire hazard and also is in accordance with such instructions as the refuge manager may specify (50 CFR § 29.21-4(b)(2)).
3. Shall prevent the disturbance or removal of any public land survey monument or project boundary monument unless and until the applicant has requested and received from the Regional Director approval of measures the applicant will take to perpetuate the location of aforesaid monument (50 CFR § 29.21-4(b)(3)).
4. Shall take such soil and resource conservation and protection measures, including weed control on the land covered by the easement or permit as the project manager in charge may request (50 CFR § 29.21-4(b)(4)).
5. Shall do everything reasonably within its power, both independently and on request of any duly authorized representative of the United States, to prevent and suppress fires on, or near, lands to be occupied under the permit, including making available such construction and maintenance forces as may be reasonably obtainable for the suppression of such fires (50 CFR § 29.21-4(b)(5)).
6. Shall rebuild and repair such roads, fences, structures, and trails as may be destroyed or injured by construction work and, upon request by the refuge manager, build and maintain necessary and suitable crossings and culvert for all roads and trails that intersect the works constructed, maintained, or operated under the ROW. Holder shall be responsible for maintenance and repair of access roads serving the ROW (50 CFR § 29.21-4(b)(6)).
7. Shall pay the United States the full value for all damages to the lands or other property of the United States caused by it or its employees, contractors, or employees of the contractors, and indemnify the United States against any liability for damages to life,

person, or property arising from the occupancy or use of the lands under the permit Because the permit involves special hazards we will impose liability without fault for injury and damage to the land and property of the United States up to a specified maximum limit commensurate with the foreseeable risks or hazards presented. The amount of no-fault liability for each occurrence is hereby limited to no more than $1,000,000.00 (50 CFR § 29.21-4(b)(7)).

8. Shall notify promptly the refuge manager of the amount of merchantable timber, if any, which will be cut, removed, or destroyed in the construction and maintenance of the project, and to pay the United States in advance of construction and maintenance such sum of money as the project manager may determine to be the full stumpage value of the timber to be so cut, removed, or destroyed (50 CFR § 29.21-4(b)(8)).
9. All or any part of the ROW permit may be terminated by the Regional Director, for failure to comply with any of the permit terms and conditions, or for abandonment of the ROW (50 CFR § 29.21-4(b)(9)).
10. Shall restore the land to its original condition to the satisfaction of the refuge manager so far as it is reasonably possible to do so upon revocation or termination of the permit, or following land disturbance resulting from repairs and construction, unless this requirement is waived in writing by the Regional Director. Termination also includes permits that terminate under the terms of the grant (50 CFR § 29.21-4(b)(10)).
11. Shall keep the refuge manager informed at all times of its address, and, in case of corporations, of the address of its principal place of business and the names and addresses of its principal officers (50 CFR § 20.21-4(b)(11)).
12. Shall not, when hiring for work on the ROW, discriminate against any employee or applicant for employment because of race, creed, color, or national origin and shall require an identical provision to be included in all subcontracts (50 CFR § 29.21-4(b)(12)).
13. Shall not unduly interfere with the management, administration, or disposal by the United States of the land affected thereby. The permit holder agrees and consents to the occupancy and use by the United States, its grantees, permittees, or lessees of any part of the permit area not actually occupied for the purpose of the granted rights to the extent that it does not interfere with the full and safe utilization thereof by the holder. The holder of the permit also agrees that authorized representatives of the United States shall have the right of access to the permit area for the purpose of making inspections and monitoring the construction, operation, and maintenance of facilities, and other refuge-authorized business or activities provided that they do not interfere with the holder's rights (50 CFR § 29.21-4(b)(13)).
14. Shall modify or adapt any facility if found to be necessary by the refuge manager, without liability or expense to the United States, so that such facility will not conflict with the use and occupancy of the land for any authorized works which may hereafter be constructed thereon under the authority of the United States. Any such modification will be planned and scheduled so as not to interfere unduly with or to have minimal effect upon continuity of energy and delivery requirements (50 CFR § 29.21-4(b)(14)).

15. Shall not construe the permit to include the further right to authorize any other use within the easement or permit area unless approved in writing by the Regional Director (50 CFR § 29.21-4(b)(15)).
16. Shall report immediately any cultural or paleontological resources (historic or prehistoric site or object including burials or skeletal material) discovered by the permit holder, or any person working on its behalf, on public or Federal land to the refuge manager. PEPCO or its representative shall suspend all operations in the immediate area of such discovery until written authorization to proceed is issued by the authorized officer. An evaluation of the discovery will be made by the authorized officer or a Service-approved Archaeologist to determine appropriate actions to take pursuant to the provisions of law including 36 CFR 800.7 (resources discovered during construction) to prevent the loss of significant cultural or scientific values. The holder will be responsible for the cost of evaluation. Any decision as to proper mitigation measures will be made by the authorized officer after consulting the holder.
17. Shall protect, in accordance with the rules prescribed in the National Electric Safety Code, at crossings and at places in proximity to its transmission lines on the ROW authorized, all government and other telephone, telegraph, and power transmission lines from contact and all highways and railroads from obstruction and maintain its transmission lines in such manner as not to menace life or property (50 C.F.R. § 29.21-8(a)).
18. Shall remain legally liable for causing inductive (electromagnetic field) or conductive (contact) interference between any project transmission line or other project works constructed, operated, or maintained by the holder on the servient lands, and any radio installation, telephone line, or other communication facilities now or hereafter constructed and operated by the United States or any agency thereof (50 C.F.R. § 29.21-8(b)).
19. Shall ensure and maintain adequate spacing between energized lines both vertically and horizontally, as specified by the Joint Avian Protection Guidelines of Edison Institute and the Service to prevent electrocution by large raptors, particularly bald and golden eagles, which are protected species under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. Sixty horizontal inches will accommodate wrist-to-wrist distance for an eagle, and 48 vertical inches will accommodate an eagle's standard height.
20. Shall not collect any plants, wildlife, or artifacts from refuge property.
21. Shall not bring any pets or other animals onto the ROW or any refuge property.
22. Shall not transport, deliver, transfer, store, or use any hazardous materials or fuels in the ROW except as authorized by the refuge manager. All transport, delivery, transfer, storage, and use of such materials and fuels authorized shall comply with all applicable Federal and State law and regulations.
23. Shall notify the refuge manager as soon as possible, and no later than 12 hours, after learning of any accident or other event in the ROW that could result in damage to the resources, values, or purposes of the refuge. In the event of such accidents or other events, the holder shall take all reasonable steps to prevent or mitigate damage to the

resources, values, or purposes of the refuge at the direction of the refuge manager.

24. Shall immediately report any problems with wildlife to the refuge manager or senior biologist.
25. Shall limit ingress and egress to the ROW to vehicular use on existing and maintained roadways of the refuge, and on the ROW access road. No off-road vehicular access is authorized, unless necessary for maintenance needed to remain in compliance with FERC requirements. The holder will obtain permission from the refuge manager before such off-road use occurs.
26. Shall not leave unattended vehicles, equipment, or materials parked or stored in the ROW without prior written authorization from the refuge manager.
27. Shall post no signage that is not authorized by permit in the ROW except for appropriate signs, barricades, or other warnings to notify the public of any danger posed by the permitted use or permitted facilities.
28. Shall conduct vegetation control and maintenance in accordance with a mutually agreed upon vegetation management plan. There is currently an interim vegetation management plan being developed, in cooperation with PEPCO, the Service Ecological Services program, and IVM, a non-profit consulting company. It embraces the concepts of IPM (USFWS 2012), mentioned previously in the "How would the use be conducted" section. The following additional stipulations apply to PEPCO and its contractors in connection with the vegetation management plan:
    - Coordinate with refuge staff prior to requesting access for non-emergency, planned vegetation control activities.
    - Work during daylight hours when staff is available to monitor permits and compliance unless in the case of needed emergency repairs.
    - Conduct non-emergency, planned vegetation monitoring and control activities only outside of the bird breeding season, April 15 to August 15. There may be exceptions for the treatment of invasive plant species which mature during this time and would thus not be available for treatment earlier. In such cases, PEPCO or its contractors will coordinate with the refuge senior biologist for permission to conduct spot treatments.
    - Debris from brush-cutting or tree top removal shall not be left in piles, but mulched in place and distributed so as not to cause an accumulation of thatch and produce a fire hazard or interfere with plant germination (50 CFR § 29.21-4(b)(2)). Small amounts of debris cuttings may be left in place for decomposition.
    - Ensure that heavy equipment and vehicles are free of weed seeds or propagating plant parts before being brought onto the job site. Workers shall also be vigilant against transporting weed seeds from other job sites on footwear, tools, and equipment. The refuge reserves the right to inspect such tools and equipment to confirm compliance with this condition.
    - Annually, notify the refuge senior biologist of intent to use herbicides and provide a list of intended herbicides that includes trade name, active ingredient, target

species, method of application, and rate of application. The refuge shall prepare a PUP for each herbicide, to be approved at refuge manager or regional office level, and in accordance with Environmental Protection Agency label directions. No herbicides may be applied without an approved PUP from the refuge. Notify senior refuge biologist 60 days in advance for additional herbicides intended.

JUSTIFICATION:

The refuge is surrounded by high-density urban and suburban development. A powerline ROW through the refuge provides an opportunity to supply a habitat type (shrub and early successional forest) on a scale that would otherwise be difficult for the refuge to accomplish and maintain on its own. Proximity of early succession habitat with large blocks of forest provides benefits for forest-interior-dwelling species and priority edge species, such as forest bats, whip-poor-will, prairie warbler, and eastern box turtle.

Over the past 20 years, PEPCO has been in compliance with the terms and conditions of the ROW easement, with minor exceptions. Some vegetation control was conducted prior to coordinating with the refuge. These occurrences were followed up with increased communication and coordination with PEPCO and its contractors. When such an incident has occurred, it has generally resulted in improvements to the vegetation management techniques. An example is relying more on basal herbicide treatments to woody vegetation rather than broadcast spraying.

There will be no net loss of habitat, but a conversion of forested communities to shrub scrub and early successional communities, which are habitats in decline in the region. The evolving vegetation management plan will result in fewer invasive species being present on this 76 acres of the refuge, and will encourage the presence of native flora and fauna.

As listed in the purposes section of this compatibility determination, the refuge was established and subsequently land was acquired for a total of six purposes. The maintenance of this ROW will not materially interfere with or detract from the research purpose of the refuge, because wildlife research does not generally occur in the vicinity of the ROW. However, the habitat that is maintained in the ROW may provide research opportunities, such as monitoring and sampling pollinator species, studying vegetation changes, and monitoring neo-tropical migrant species. This use will not materially interfere with or detract from the two purposes related to wildlife conservation, because the scrub-shrub habitat that is maintained under the power line provides valuable habitat to refuge wildlife. This use will not materially interfere with or detract from the two purposes related to migratory bird conservation, because these areas provide foraging habitat for migratory species. Maintenance of the ROW will not materially interfere with or detract from the endangered species purpose, because there are no federally listed, threatened or endangered that occur in the wild on the refuge. Finally, this use will not materially interfere with or detract from the mission of the Refuge System, because the land will provide viable wildlife habitat. Therefore, we find that the issuance of a new ROW permit, and its ongoing necessary maintenance and operations will not materially interfere with, or detract from, the fulfillment of the Refuge System mission or the purposes of the refuge.

SIGNATURE:

REFUGE MANAGER: _____

(signature and date)

CONCURRENCE:

REGIONAL CHIEF: _____

(signature and date)

MANDATORY 10-YEAR REEVALUATION DATE: 2022

REFERENCES:

Belanger, L. and J. Bedard. 1990. Energetic cost of man-induced disturbance to staging snow geese. Journal of Wildlife Management 54:36.

Brittingham, M.D. and A. Temple. 1983. Have cowbirds caused forest songbirds to decline. BioScience 33:31-35.

Burger, J. 1981. Effect of human activity on birds at a coastal bay. Biological Conservation 21:231-241.

Erwin, R.M. 1980. Breeding habitat use by colonially nesting waterbirds in two Mid-Atlantic U.S. regions under different regimes of human disturbance. Biological Conservation 18:39-51.

Havera, S.P., L.R. Boens, M.M. Georgi, and R.T. Shealy. 1992. Human disturbance of waterfowl on Keokuk Pool, Mississippi River. Wildlife Society Bulletin 20:290-298.

Jones, C., J. McCann, S. McConville. 2000. A guide to conservation of forest interior dwelling birds in the Chesapeake Bay critical area. Critical Area Commission for the Chesapeake and Atlantic Coastal Bays.

Kahl, R. 1991. Boating disturbance of canvasbacks during migration at Lake Poygan, Wisconsin. Wildlife Society Bulletin 19:242-248.

Kaiser, M.S. and E.K. Fritzell. 1984. Effects of river recreationists on green-backed heron behavior. Journal of Wildlife Management 48: 561-567.

Klein, M.L. 1993. Waterbird behavioral responses to human disturbance. Wildlife Society Bulletin 21:31-39.

Korschen, C.E., L.S. George, and W.L. Green. 1985. Disturbance of diving ducks by boaters on a migrational staging area. Wildlife Society Bulletin 13:290-296.

Morton, J.M., A.C. Fowler, and R.L. Kirkpatrick. 1989. Time and energy budgets of American black ducks in winter. Journal of Wildlife Management 53:401-410 (See also corrigendum in Journal of Wildlife Management 54:683).

Owen, M. 1973. The management of grassland areas for wintering geese. Wildfowl 24:123-130.

Paton, P.W.C. 194. The effect of edge on avian nest success: how strong is the evidence? Conservation Biology 8.1:17-26.

Robbins, C.S., D.K. Dawson, and B.A. Dowell. 1989. Habitat Area Requirements of breeding forest birds of the Middle Atlantic States. Wildlife Monograph no. 103. Wildlife Society. Blacksburg, VA.

Scherer, G. March 2001. Backcountry visitor impacts: we have met the enemy, and he is us. American Hiker.

U.S. Fish and Wildlife Service. 2012. Integrated pest management for PEPCO right-of-way on Patuxent Research Refuge (draft). Laurel, MD.

Ward, D.H. and R.A. Stehn. 1989. Response of brant and other geese to aircraft disturbance at Izembek Lagoon, Alaska. U.S. Fish and Wildlife Service, Alaska Fish and Wildlife Research Center. Final report to the Minerals Management Service, Anchorage, AK. pp.193.

Williams, G.J. and E. Forbes. 1980. The habitat and dietary preferences of dark-bellied brant geese and widgeon in relation to agricultural management. Wildfowl 31:151-157.

COMPATIBILITY DETERMINATION

USE:

Use of Softball Fields at North Tract, Patuxent Research Refuge

REFUGE NAME:

Patuxent Research Refuge

ESTABLISHING AND ACQUISITION AUTHORITIES:

Executive Order 7514, dated December 16, 1936; Executive Order 11724, dated June 27, 1973; 16 U.S.C. 715d, Migratory Bird Conservation Act of 1929; 16 U.S.C. 1534; 16 U.S.C. 667b, dated May 19, 1948 - An Act Authorizing the Transfer of Certain Real Property for Wildlife or other purposes; and Public Law 101-519 Sec. 126, 104 Stat. 2247, dated November 5, 1990.

REFUGE PURPOSES:

1. "...as a wildlife experiment and research refuge" – Executive Order 7514, dated December 16, 1936
2. "…recreation, conservation, wildlife preservation, and related scientific and educational activities" – Executive Order 11724, dated June 27, 1973
3. "...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" – 16 U.S.C. 715d, dated February 18, 1929 (Migratory Bird Conservation Act)
4. "...to conserve fish, wildlife and plants, including those which are listed as endangered species or threatened species – 16 U.S.C. 1534, dated December 28, 1973 (Endangered Species Act)
5. "...particular value in carrying out the national migratory bird management program." – 16 U.S.C. 667b, dated May 19, 1948 (An Act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes)
6. "...(b) The Secretary of the Interior shall administer the property transferred pursuant to subsection (a) consistent with wildlife conservation purposes and shall provide for the continued use of the property by Federal agencies to the extent such agencies are using it on the date of the enactment of this Act." – Public Law 101-519 Sec. 216, 104 Stat. 2247, dated November 5, 1990 (Defense Appropriation Act – including transfer of the North Tract from Fort Meade).

NATIONAL WILDLIFE REFUGE SYSTEM MISSION:

"To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." 16 U.S.C. 668dd(a)(2) (National Wildlife Refuge System Improvement Act of 1997)

DESCRIPTION OF USE:

What is the use? Is the use a priority public use?
The use is continuing to permit the National Security Agency's (NSA) Civilian Welfare Fund (CWF) to use four softball fields located off of Bald Eagle Drive on the North Tract of Patuxent Research Refuge (refuge). This is not a priority public use of the National Wildlife Refuge System (Refuge System) under the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee), and the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57) and because it is not wildlife-dependent recreation as defined in 16 U.S.C. 668ee (2).

Where would the use be conducted?
The use has been conducted at the existing softball fields, obtained by the refuge in 1991-92 from Fort Meade when lands were transferred from the Department of Defense to the Department of the Interior. The four softball fields are located at the intersection of Maryland State Highway 198 and Bald Eagle Drive.

When would the use be conducted?
This use has occurred from mid-April through August on weekday evenings from 3:30 p.m. to 8 p.m., with some tournaments allowed on Fridays and Saturdays.

How would the use be conducted?
The use has been authorized through a special use permit to the CWF. A copy of the most recent special use permit is included for reference. Up to 36 teams, comprised of NSA employees, utilize the fields annually.

Why is this use being proposed?
This use was a pre-existing use of the land when Public Law 101-519 transferred the property from the Department of Defense to the Department of the Interior in 1991-92. Section 126(b) of this law states that, "The Secretary of the Interior shall administer the property transferred pursuant to subsection (a) consistent with wildlife conservation purposes and shall provide for the continued use of the property by Federal agencies to the extent such agencies are using it on the date of the enactment of this Act, including activities of the Department of Defense that are consistent with the recommendations of the Base Realignment and Closure Commission." The use has been permitted by the refuge since 1992, without any determination whether it is compatible with the refuge purposes and the Refuge System mission.

AVAILABILITY OF RESOURCES:

Approximately five staff days are required each year for coordination and communication with CWF, regarding scheduling and obtaining visitor use statistics from NSA staff (number of people visiting ball fields including spectators, maintenance crews, etc.). The refuge has the available resources to continue this coordination if we find that the use is otherwise compatible.

ANTICIPATED IMPACTS OF THE USE:

The anticipated impacts to the refuge are significant on this particular piece of refuge property. The 10.3 acres encumbered by the softball fields are essentially turf grass, exposed soil, and

gravel parking lot, offering minimal value to wildlife. Canada geese, both resident and migratory populations, and white-tailed deer may occasionally be observed grazing and loafing on the grounds, but neither species is dependent on the existence of these ball fields.

The presence of contrasting adjoining habitats can influence each habitat along their shared borders. An example of contrasting habitats would be a mature hardwood forest bordering a short-stature grassland. In this case, should the border be unmanaged (i.e., un-mowed), there will be an increase in vegetation density, complexity of structure, and plant species diversity along this edge, creating a "soft edge" of early succession species of trees, shrubs, herbaceous plants. Often this "soft edge" effect is viewed by wildlife managers as beneficial because of the increased food and cover provided for species that use such edge. It also reduces negative edge effects, such as encroachment by non-native plants, accessibility to the forest interior by predators (snakes, feral cats, fox, raccoons, crows, jays, brown-headed cowbirds), and by penetrating light and wind. Protection against accessibility can also be achieved by expansion of forest acreage through conversion of adjacent open habitats into more forest. Habitats contrasting sharply with forests, also known as "hard edges" made by lawns, roads, parking lots, do not provide such benefits and make adjacent forests vulnerable to negative edge effects. Thus, all the acreage within a certain distance of an edge, be it a forest, grassland, or wetland habitat, will be edge habitat. Just how far the edge effect extends is variable and conservation design recommendations vary from 50 meters (164 feet) (Paton 1994) to about 90 meters (300 feet) (Robbins et al 1989, Brittingham and Temple 1983, Jones et al. 2000).

We equate the ball field with a lawn, since it is kept mowed short right up to the border of the refuge forest and as such, would be considered a sharply contrasting habitat affording high opportunities for negative edge effects. The most generous estimate of the area of adjacent refuge forest impacted by the ballfield would be almost 13 acres, more than double the size of the ballfield, using the 90 meter (164 feet) distance factor. (This calculation uses only the east and south edge of the ballfield that borders on refuge forest. Its western and northern sides border on roads or highways.)

Access along Bald Eagle Drive, the only public access to the North Tract of the refuge, is often compromised due to vehicles parked along the road that are associated with the softball games, including players and spectators. Enforcement of parking violations has helped but it is difficult to have a consistent law enforcement presence given other high priority law enforcement matters. This can lead to frustration among other visitors to the refuge who participate in a wildlife-dependent activity, such as wildlife observation or fishing.

If this use were to be discontinued, the refuge could expect to have an additional 10.3 acres of wildlife habitat established within three to four years in the form of grassland or scrub shrub habitat. Eventually the area would revert to Virginia pine or mixed hardwood forest over time, based on surrounding habitat types. In addition to this increase of 10.3 acres of suitable wildlife habitat, the surrounding 300 foot buffer (12.8 acres) of habitat would then become more attractive to forest interior dwelling bird species, which are focal species in the Comprehensive Conservation Plan (CCP), particularly supported by goal 2, objective 2.2 which encourages upland deciduous, pine and mixed forest associations Upland forest communities provide both nesting and migration habitat for bird species listed by regional conservation plans, including the

Bird Conservation Region 30 Implementation Plan, Partners in Flight 44 Bird Conservation Plan, and the Maryland Wildlife Diversity Conservation Plan, as well as international plans like Saving Our Shared Birds, Partners in Flight Tri-National Vision for Landbird Conservation.

Discontinuing this use and allowing the area to re-vegetate with native shrubs and trees will offer greater protection from highway runoff entering the Little Patuxent River, which is within approximately 150 yards of the ball fields. Forested buffers are some of the most effective nutrient and sediment buffers in nature. Runoff may be particularly excessive because much of the ball fields surface is hard-packed topsoil, to remain level and to support the low-growing grass species desirable for an active athletic field of this type. The fields are also fertilized once a year, in the fall, to promote growth of the grass. Potential exists for this fertilizer to run off into the Little Patuxent River as well.

The forested area that lies between the ballfield and Tipton Airport is almost completely edge habitat (using the 90 meter distance factor), and in two places the managed ballfield is as close as 142 feet to 171 feet to the Little Patuxent River. Positive impacts would be realized for both forest and river should the ballfield be converted to forest. It would increase the effective interior of the forested area that lies east of the Little Patuxent River and bounded by Route 198 and Bald Eagle Drive and would enhance its corridor or connectivity value. Frequently recommended buffer widths for maximum benefits to riparian species and aquatic habitat function (water quality) vary depending on adjacent land uses and conservation objectives, but range from greater than 30 meters (100 feet) to greater than 500 meters (1,640 feet) (Fischer and Fischenich 2000, Bentrup 2008). Terrestrial salamanders need at least 165 meters of buffer around wetlands to maintain viable population. Far greater widths may be required to adequately address nutrient load and high volume stormwater (Houlihan and Findlay 2004).

PUBLIC REVIEW AND COMMENT:

As part of the comprehensive conservation planning process for Patuxent Research Refuge, this compatibility determination will undergo extensive public review, including a comment period of 45 days, following the release of the draft CCP/Environmental Assessment.

DETERMINATION (CHECK ONE BELOW):

__X__ Use is not compatible
_____ Use is compatible with the following stipulations

STIPULATIONS NECESSARY TO ENSURE COMPATIBILITY:

There are no stipulations that could make this use compatible because the grooming and use of the fields will prevent them from functioning as habitat.

JUSTIFICATION:

Public Law 101-519 states that the transferred lands are to be administered consistent with wildlife conservation purposes. This use conflicts with the refuge purposes in that it creates an unnatural environment that is used for softball games and associated parking. Granting this use will adversely impact the refuge's research purpose because it minimizes the suitability of this parcel of land to conduct wildlife research. In addition, use of the ball fields materially interferes

with and detracts from the migratory bird purposes, because these highly impacted lands, and associated buffer lands, provide little to no habitat value for migratory birds. Since there are no threatened or endangered species known to use the area around the fields, this use would not materially interfere with the endangered species purpose of the refuge. This use will also materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission, because use of the ball fields will prevent this portion of the refuge from supporting wildlife conservation.

SIGNATURE:

REFUGE MANAGER: _____

(signature and date)

CONCURRENCE:

REGIONAL CHIEF: _____

(signature and date)

MANDATORY 10-YEAR REEVALUATION DATE: 2022

REFERENCES:

Bentrup, G. 2008. Conservation buffers: design guidelines for buffers, corridors, and greenways. Gen. Tech. Rep. SRS-109. U.S. Department of Agriculture, Forest Service, Southern Research Station, Asheville, NC. 110 p.

Bird Conservation Region (BCR) 30 Implementation Plan.

Brittingham, M.D. and A. Temple. 1983. Have cowbirds caused forest songbirds to decline. BioScience 33:31-35.

Fischer, R.A. and J.Craig Fischenich. 2000. Design recommendations for riparian corridors and vegetated buffer strips. Army Corps of Engineers.

Houlihan, J.E. and C.S. Findlay. 2004. Estimating the 'critical' distance at which adjacent land use degrades wetland water and sediment quality. Landscape Ecology 19:677-690.

Jones, C., J. McCann, S. McConville. 2000. A guide to conservation of forest Interior dwelling birds in the Chesapeake Bay critical area. Critical Area Commission for the Chesapeake and Atlantic Coastal Bays.

Maryland Department of Natural Resources (MD DNR). 2005a. Maryland wildlife diversity conservation plan. Maryland Department of Natural Resources, Annapolis, MD.

Paton, P.W.C. 1994. The effect of edge on avian nest success: how strong is the evidence? Conservation Biology 8.1:17-26.

Robbins, C.S., D.K. Dawson, and B.A. Dowell. 1989. Habitat Area Requirements of breeding forest birds of the Middle Atlantic States. Wildlife Monograph no. 103. Wildlife Society. Blacksburg, VA.

Rosenberg, K.V, R.W. Rohrbaugh, Jr., S.E. Barker, J.D. Lowe, R.s. Hames, and A. A. Dhondt. 1999. A land managers guide to improving habitat for scarlet tanager and other forest interior birds. Cornell Lab of Ornithology**.**

Watts. 1999. Partners in Flight (PIF). Bird conservation plan for the Mid-Atlantic Coastal Plain (Physiographic Area 44), Version 1.0. American Bird Conservancy, Williamsburg, VA.

Appendix D.

USFWS

Construction at Patuxent Research Refuge

Refuge Operation Needs System and Service Asset Maintenance Management System Projects

Refuge Operation Needs and Service Asset Maintenance Management Systems

Patuxent Research Refuge (refuge) budget requests contained in the Refuge Operating Needs System (RONS) and Service Asset Maintenance Management System (SAMMS) databases include a wide variety of new projects and maintenance needs. The RONS and SAMMS lists are regularly updated to include priority projects. Contact the refuge for the most current RONS and SAMMS lists.

Table D-1. Current Projects in RONS Database for Patuxent Research Refuge

Station Priority Rank	Project Description	Estimated One-time Cost	Recurring Base Cost	Total First Year Need	FTE†	Alternatives
1	Maintenance worker (grounds)	-	$82,967	$82,967	1.0	B
2	Provide resource, facility, and visitor protection (law enforcement)	-	$150,000	$150,000	1.0	B
3	Enhance visitor services program in the area	-	$128,072	$128,072	1.0	B
4	Develop range design to restore 2,000 acres of refuge habitat	$100,000	-	$100,000	-	B
5	Maintenance worker (buildings)	-	$82,967	$82,967	1.0	B
6	Park ranger (interpretation)	-	$105,858	$105,858	1.0	B
7	Conduct forest health assessment and provide enhanced forest management (forester)	-	$153,506	$153,506	1.0	C
8	Provide enhanced habitat management (biologist)	-	$105,858	$105,858	1.0	B
9	Develop two cultural and historical interactive touch-screen kiosks	-	$80,000	$80,000	-	B
10	Global climate change and its effects on forested habitats	$250,000	$10,000	$260,000	-	B
11	Control invasive plant species along the floodplain	$70,000	$22,000	$130,815	1.0	B
12	Conduct a watershed assessment of the Patuxent Research Refuge	$200,000	-	$200,000	-	B
13	Restore riparian habitat	$200,000	-	$200,000	-	B
14	Phragmites control through floating islands at NWVC tertiary treatment ponds	$150,000	-	$150,000	-	C
15	Restore 60 acres of crop lands and a lysimeter test site	$250,000	-	$250,000	-	C
	Totals	**$1,220,000**	**$921,228**	**$2,180,043**	**8.0**	

†FTE = Full-time equivalent (i.e., full-time staff position)

Table D-2. Current Projects in SAMMS Database for Patuxent Research Refuge

Project Number	Project Description	Cost
01111639	Rehabilitate Quarters 2	$148,000
2007732191	Replace Wells in Endangered Species Area	$232,498
01111037	Rehabilitate Captive Propagation Laboratory	$176,000
01112836	Rehabilitate Gabrielson for Fire/ Life Safety	$522,000
01111029	Replace Gabrielson Single Pane Windows	$522,000
2007732185	Replace Utility Lines on Well #5	$0
01113329	Remove and Replace Quarters 162	$568,000
2007732204	Rehabilitate Crane Pen Storm Drain	$381,364
98109897	Rehabilitate Central Tract Gravel	$522,000
99104968	Rehabilitate Loblolly Pine Road	$43,000
01111687	Replace Culvert at Mill Race Road by "M" Pond	$47,000
2007732007	Remove and Replace Fishing Pier/Boardwalk, Cash Lake	$181,250
01110813	Remove Military Storage Buildings	$12,600
2005225288	FY09 CE Rehab Bald Eagle Road (Rte. 014)	$0
2007732041	Replace Culverts on Roque Harbor at North Tract	$157,500
01111034	Rehabilitate Service Garage	$148,000
01111641	Replace Heating, Ventilation and Air Conditioning at Gabrielson Lab	$71,000
2007729501	Remove and Replace Quarters 161	$379,000
2007720146	Rehabilitate Route 197 Fencing and Culverts PX DM (parent)	$845,000
01111644	Remove Vegetation Under Powerline at Central Tract	$130,000
2007732182	Rehabilitate Water Filtration System by Replacing Pump	$0
04134325	Rehabilitate Visitor Center by Replacing Roof - Phase 2	$61,531
99104957	Replace Refuge Boundary Fences, Signs and Path	$516,000
2008857576	Replace Water Control Structure on Bluegill	$81,800
2007731581	Rehabilitate Merriam HVAC System Phase II	$0
01113323	Rehabilitate Quarters 65	$342,000
01112857	Rehabilitate Gabrielson Building Egress for Life Safety	$264,000
01112937	Replace Carpeting in Gabrielson	$167,000
01111624	Rehabilitate Vet Hospital	$52,000
01113328	Rehabilitate Quarters 161	$123,000
2007732013	Replace Spillway and Culvert on Hance Pond I	$98,500
04134354	Rehabilitate Visitor Center by Conducting Condition Assessment	$37,000
2007732038	Rehabilitate Water Control Structure on Blue Heron Pond at North Tract	$18,900
2007732005	Remove and Replace Charlie Gate Culverts at North Tract	$141,750
03130645	Rehabilitate Cash Lake Dam	$26,000
2007731203	Remove Quarters 50 (Apartment #1,2,3,4)	$0
01111629	Rehabilitate Merriam Garage	$214,000
2008859866	Rehabilitate Service Building Garage Roof	$0
98121508	Replace Telegraph Road Culvert and Central Tract Gravel Road - Phase II	$522,000
2011205862	Rehabilitate Visitor Center Ventilation and Air Conditioning Phase IV - Contract	$331,000
01110816	Remove Military Fallout Shelter	$9,500

Project Number	Project Description	Cost
2007732019	Rehabilitate Dike on Wood Duck Ponds	$179,580
97104967	Rehabilitate Snowden Spillway Bridge	$29,000
99104944	Replace Snowden Gate Valve	$33,000
2007732024	Replace Dike, Earth, Uhler 2 at Central Tract	$394,000
01113325	Rehabilitate Quarters 80	$167,000
01111623	Rehabilitate Captive Propagation Shop	$263,000
2007732193	Replace Endangered Species Reservoir, CT	$578,736
01113327	Remove and Replace Quarters 160	$255,000
2007731592	Rehabilitate Boat Garage	$21,000
01111788	Replace Knowles II Water Control Structures	$116,554
2005199799	Rehabilitate Route 197 Fencing and Culverts	$745,000
2012218582	Replace Culvert/Headwalls at Duvall Bridge Road Gate (d)	$37,600
01111684	Replace Culvert/Headwalls at Duvall Bridge Road Gate	$399,300
2005221075	Rehab Bald Eagle Drive (Rte. 014)	$0
01110812	Remove Military Utilities - Waterline, Telephone Poles and Fences	$418,000
2007732009	Rehabilitate Floating Walkways	$32,745
04134293	Rehabilitate Merriam - Facility's Roof, Plumbing Electrical and Windows	$704,000
2007731584	Rehabilitate Merriam ADA Restroom	$142,000
2007731586	Repair and Rehabilitate Quarters 49	$279,000
03126575	Replace Quarters 50 with a Duplex - Phase II	$614,000
01113319	Repair and Rehabilitate Quarters 51	$240,000
2007732200	Replace Pumping Station, by Replacing Pump	$225,807
01112967	Rehabilitate Gabrielson Exterior Drainage and Utilities	$80,000
02120078	Repair Storage Building 165	$243,000
01111797	Replace Concrete Culverts along Loblolly Pine Road	$47,000
2007726671	Rehabilitate Cash Lake Dam	$66,000
04134302	Rehabilitate Merriam HVAC System	$749,000
04134316	Rehabilitate Merriam for OSHA and ADA	$671,000
01111643	Rehabilitate Quarters 48	$144,000
01112932	Rehabilitate Gabrielson for ADA Access	$211,000
01111627	Rehabilitate Coburn Annex	$306,000
2007732011	Rehabilitate Dike on Hobbs Pond Impoundment E.S. Area	$63,040
2011205860	Rehabilitate Visitor Center Ventilation and Air Conditioning Phase III	$591,460
2005225290	FY09 CE Rehab Visitor Contact Station Parking Lot (Rte. 908)	$0
2007732017	Rehabilitate Dike on New Marsh at North Tract	$179,580
2007729509	Remove and Replace Quarters 64	$354,000
01112899	Rehabilitate Electrical System at Gabrielson	$457,000
2005199823	Replace Water Control Structure at Knowles III	$77,000
04134327	Rehabilitate Visitor Center by Replacing Flat Roof	$1,485,731
2005221077	Rehab VCS Parking Lot (Rte. 908)	$0
2007726670	Rehabilitate Lake Allen Spillway	$20,000
	Total:	**$19,711,326**

Appendix E.

USFWS

Snowden Hall

Memorandum of Agreement between the Service, USGS, and the Maryland Historical Trust Regarding the Demolition of Structures at Patuxent Research Refuge

MEMORANDUM OF AGREEMENT
BETWEEN
U.S. FISH AND WILDLIFE SERVICE, U.S. GEOLOGICAL SURVEY
AND
THE MARYLAND HISTORICAL TRUST
REGARDING
THE DEMOLITION OF STRUCTURES
AT
PATUXENT RESEARCH REFUGE
PRINCE GEORGE'S COUNTY, MARYLAND

WHEREAS, the U.S. Fish and Wildlife Service (USFWS) owns the Patuxent Research Refuge (Patuxent), including all the buildings located in Prince George's County, Maryland, and illustrated on Exhibit 1; and

WHEREAS the U.S. Geological Survey (USGS) uses some of the buildings to conduct wildlife research at the refuge; and

WHEREAS, the refuge contains the following two historic districts listed on the Maryland Inventory of Historic Properties in 2000, and agreed by the USFWS and the Maryland State Historic Preservation Office (MD SHPO) to be eligible for inclusion in the National Register of Historic Places:

A. Patuxent Research Refuge Historic District (PG: 64-13), with 43 historic structures including the Holst Log Cabin (PG: 64-007) and Snowden Hall (PG: 64-1) shown on Exhibits 2, 3, and 4; and

B. South Tract Forest Service Historic District (PG: 64-15), with 8 historic structures, shown on Exhibit 5; and

WHEREAS, many of the buildings at Patuxent have aged to the point of requiring an extensive amount of maintenance and utility consumption while the USFWS seeks to reduce its impacts on climate and wildlife habitat, to control future energy costs, and to adopt alternative sources of energy in its operations at Patuxent; and

WHEREAS, many of the buildings at Patuxent were designed to support specific operations connected to the wildlife research and experiments of the past and no longer support the type and methods of research needed today; and

WHEREAS, the USFWS and USGS are implementing a Facility Modernization Plan (FMP) and other cost saving measures over the next 10 years which will preserve 16 historic buildings (listed in Attachment A) but will adversely affect the two historic districts by demolishing 35 historic structures (listed in Attachment B) over the next 10 years (Undertaking); and

WHEREAS, the Undertaking includes the immediate demolition of 12 of the 35 historic structures and later demolition of the remaining 23 historic structures post-2010, as funding becomes available (also shown on Attachment B); and

WHEREAS, the Undertaking includes the demolition of 38 non-historic structures in 2010 and 11 additional non-historic structures within the next 10 years (all listed in Attachment C); and

WHEREAS, the USFWS, in consultation with the MD SHPO, designed the Undertaking to avoid and minimize impacts to archaeological sites that could potentially be affected by activities associated with the demolition of fiscal year 2010 historic and non-historic structures; and

WHEREAS, the maps in Exhibits 2-5 show the locations of the buildings slated for demolition by the Undertaking, along with the affected historic districts; and

WHEREAS, the USFWS has determined that the Undertaking will have an adverse effect on the Patuxent Research Refuge Historic District and on the South Tract Forest Service Historic District and has consulted with the MD SHPO pursuant to 36 CFR 800, the regulations implementing Section 106 of the National Historic Preservation Act (16 USC 470f); and

WHEREAS, the USFWS provided opportunities for appropriate public notice and involvement stated in 36 CFR 800.6(a)(4) through a combination of public notification and meetings during the development of the FMP; and

WHEREAS, the USFWS identified and consulted with the Prince George's County Planning Department/Maryland National Capital Park and Planning Commission (M-NCPPC) in the Section 106 Process;

WHEREAS, the USFWS has notified the Advisory Council on Historic Preservation (ACHP) of its adverse effect determination providing the specified documentation in accordance with 36 CFR Part 800.6(a)(1) and the ACHP has chosen not to participate in the consultation pursuant to 36 CFR Part 800.6(a)(1)(iii), in a letter dated May 12, 2010; and

NOW, THEREFORE, the USFWS and the MD SHPO agree that the Undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the Undertaking on historic properties.

STIPULATIONS

USFWS and USGS shall ensure that the following measures are carried out:

A. RETENTION OF HISTORIC STRUCTURES

USFWS shall retain the historic structures listed in Attachment A, which are contributing resources to the Patuxent Research Refuge Historic District (PG: 64-13). Subject to the availability of funds, USFWS shall ensure the appropriate rehabilitation and adaptive reuse of the structures in accordance with the *Secretary of the Interior's Standards for Treatment of Historic Properties* (36 CFR Part 68), specifically using the *Guidelines for Rehabilitation of Historic Buildings*. USFWS shall consult with the MD SHPO regarding any future actions proposed for the historic structures in accordance with the standard Section 106 process (36 CFR 800.3 through 800.7).

B. TREATMENT OF ARCHAEOLOGICAL SITES - PREVENTION OF ARCHAEOLOGICAL IMPACTS DURING DEMOLITION OF STRUCTURES

USFWS shall ensure that particular care is taken during earth-disturbing activities of the Undertaking and shall implement the measures in Attachment D to avoid adverse effects to as yet undiscovered archeological sites during building demolition. Should the demolition actions uncover any unanticipated archaeological resources, USFWS shall implement the consultation process specified in Stipulation H.

C. RECORDATION OF HISTORIC STRUCTURES SLATED FOR DEMOLITION IN THE PATUXENT RESEARCH REFUGE HISTORIC DISTRICT (PG: 64-13) AND THE SOUTH TRACT FOREST SERVICE HISTORIC DISTRICT (PG:64-15)

1. Immediate Demolition of Historic Structures: USFWS and USGS may proceed with the Undertaking for the historic properties slated for immediate demolition listed in Attachment B, provided that USFWS ensures that the recordation measures in Attachment F are carried out prior to the demolition of those historic properties. USFWS shall submit the recordation products for buildings to be immediately demolished to the MD SHPO in final form for review and acceptance no later than March 31, 2011. If the MD SHPO does not provide comments on the recordation package within 30 calendar days of receipt, USFWS may assume acceptance of the recordation package and demolition will proceed.

2. Demolition of Historic Structures post-2010: Prior to the demolition of structures listed in Attachment B slated for removal post-2010, USFWS shall consult with the MD SHPO to determine the level and kind of recordation required for the properties. USFWS shall submit the agreed upon recordation products for buildings to be demolished post-2010 to the MD SHPO in final form for review and approval prior to the demolition of historic properties. If the MD SHPO does not provide comments on the recordation package within 30 calendar days of receipt, USFWS may assume acceptance of the recordation package and proceed with demolition.

D. TREATMENT OF THE HOLST LOG CABIN (PG: 64-007)

1. Marketing: USFWS shall temporarily retain the historic Holst Log Cabin (Cabin) (PG:64-007) for 2 years from the date of signing of this Memorandum of Agreement (Agreement) in order to afford the opportunity to market the structure for relocation or salvage to a new location off the refuge. If the marketing is successful, USFWS will retain the Cabin for a third year to facilitate relocation or salvage, as needed. USFWS will develop a marketing plan for relocation of the Cabin off site, in consultation with the MD SHPO and M-NCPPC. The plan shall include the following elements:

- An information package about the Cabin;
- Current photographs of the Cabin interior and exterior;
- Information on the Cabin's historic significance;
- A distribution list of potential purchasers or transferees;
- An advertising plan and schedule;
- A schedule for receiving and reviewing offers;
- Discussion of any relevant local requirements and incentives;

Upon the MD SHPO's agreement with the marketing plan, USFWS shall implement the plan. USFWS shall review all offers in consultation with the MD SHPO and M-NCPPC prior to making a decision on the acceptance of an offer.

2. Recordation: In accordance with Stipulation C.2 of this Agreement, USFWS shall develop a recordation package for the Cabin in consultation with the MD SHPO and M-NCPPC, and submit the recordation to MD-SHPO for approval and M-NCPPC for comment within 2 years of signing this agreement and before moving or demolishing the Cabin. USFWS shall submit copies of the final documentation with photographs to the MD SHPO and M-NCPPC.

3. Salvage: Should the search for a new location for the Cabin be unsuccessful, USFWS shall offer the sound architectural elements for potential reuse, public interpretation, or educational purposes and if such a reuse is found, make salvage of sound architectural elements of the structure a part of the demolition contract. USFWS shall ensure that items thus selected for salvage are removed from the structure by the demolition contractor in a manner that minimizes damage and are given over with legal title to the recipient(s).

E. PUBLIC INTERPRETATION

1. Video: USFWS shall prepare a 30 minute film about the history of the Patuxent Research Center historic resources, its wildlife research, and the context and significance of the two historic districts affected by the demolition by July 30, 2011. On December 23, 2010, the Service submitted a draft product outline to the

MD SHPO for review and comment. The film will be offered for viewing on a daily basis in the main auditorium of the refuge's National Wildlife Visitor Center, made available to other USFWS facilities as a loan through the USFWS's National Conservation Training Center, and made available to Maryland Public Television for broadcast by December 31, 2011. USFWS will make copies of the video available to the MD SHPO, M-NCPPC, county and State historical societies, local public libraries and schools.

2. Exhibit: USFWS shall prepare a topographic relief map exhibit showing land use and buildings at Patuxent, and highlighting the refuge's historic districts and their important contributing buildings. The exhibit will be on permanent display in the National Wildlife Visitor Center. The exhibit shall relate the importance of the buildings to the history of wildlife research on the refuge. On December 23, 2010, the Service submitted a draft product outline to the MD SHPO for review and comment. The exhibit shall be completed by December 31, 2011.

3. Guided Tours: USFWS shall periodically (circa once a year) provide the public with a guided tour of the Headquarters Area on the Central Tract of the refuge. The tour will focus on the historic buildings and sites, as well as wildlife research and land management at the refuge.

4. Booklet: USFWS shall use the results of the recordation efforts conducted pursuant to Stipulations C.1 and C.2 in a booklet that will be available at the public entry points on the refuge (the National Wildlife Visitor Center and the North Tract Visitor Contact Station). Information in the booklet will include the history of the development of the refuge and the history of the wildlife research conducted there. USFWS shall provide a copy of the booklet to the MD SHPO and M-NCPPC.

F. DEMOLITION OF NON-HISTORIC STRUCTURES

USFWS may demolish all non-historic structures listed in Attachment C without further coordination with the MD SHPO, provided the provisions in Attachment D are implemented.

G. MODIFICATIONS TO ATTACHMENTS B AND C

USFWS may propose changes to the list of structures slated for demolition (Attachments B and C) and will coordinate any proposed changes with the MD SHPO. Upon the mutual written agreement of USFWS and the MD SHPO, the USFWS shall produce revised and dated copies of Attachments B and C, as relevant, which shall replace the version(s) included in the original Agreement.

H. UNEXPECTED DISCOVERY OF HISTORIC PROPERTIES

Should historic properties be unexpectedly encountered during the implementation of the Undertaking, USFWS shall ensure that reasonable efforts are made to avoid, minimize or

mitigate adverse effects to such properties and shall consult with the MD SHPO to resolve any unavoidable adverse effects pursuant to 36 CFR 800.6.

I. AMENDMENTS

1. Any party to this Agreement may request that it be amended, whereupon all parties will consent pursuant to 36 CFR Part 800.6(C)(7) to consider such amendment.

2. No amendment to this Agreement will be valid unless all parties have agreed to it in writing.

J. DISPUTE RESOLUTION

1. Should any party to this Agreement object in writing to any action carried out or proposed in connection with the implementation of this Agreement, the signatories shall consult with the objecting party to resolve the objection. If, after initiating such consultation, USFWS determines that the objection cannot be resolved through consultation, the USFWS shall forward all documentation relevant to the objection to the ACHP for comment.

2. USFWS shall take into account any ACHP recommendation or comment provided in accordance with this stipulation with reference only to the subject of the objection; the responsibility of the USFWS to carry out all actions under this Agreements that are not the subjects of the objection shall remain unchanged.

3. If the ACHP does not provide its advice regarding the dispute within the thirty (30) day time period, the USFWS may make a final decision on the dispute and proceed accordingly. Prior to reaching such a final decision, the USFWS shall prepare a written response that takes into account any timely comments regarding the dispute from the signatories to the Agreement, and provide them and the ACHP with a copy of such written response.

K. STANDARD CLAUSES AND TERMINATION

1. **ANTI-DEFICIENCY ACT**: Pursuant to the Anti-Deficiency Act, 31 U.S.C. §1341(a)(1) (1994), nothing contained in this Agreement shall be construed as binding the United States to expend any sum in excess of appropriations made by Congress for the purposes of this Agreement, or as involving the United States in any contract or other obligation for the further expenditure of money in excess of such appropriations.

2. Any party to this Agreement may terminate it for cause by providing thirty (30) days notice to the other parties, provided that the parties will consult during the period prior to termination to seek agreement on amendments or other actions that would avoid termination.

3. In the event of termination, and prior to work continuing on the undertaking, the USFWS must either: (a) execute a MOA pursuant to 36 CFR 800.6, or (b) request, take into account, and respond to the comments of the ACHP under 36 CFR 800.7. USFWS shall notify the signatories as to the course of action it will pursue.

L. ANNUAL REVIEW

The USFWS and the MD SHPO shall review this Agreement every January for the Agreement's duration to review the status of implementation and determine whether any amendments to the document may be needed. The review may take place via conference call, in a physical meeting or in writing as needed. Reviews of this document shall occur until the successful completion of the mitigation measures stipulated in this document.

M. DURATION

This Agreement shall be null and void if its terms are not carried out within ten (10) years from the date of the last signature on this Agreement, unless the signatories agree in writing to an extension for carrying out its terms. At any time in the period prior to expiration, the USFWS may request in writing that the MD SHPO consider an extension or other modification. No such extension or other modification shall be valid unless agreed to by all signatory parties.

Execution of this MOA by the USFWS, USGS, MD SHPO, and implementation of its terms, will serve as evidence that the USFWS has afforded the ACHP an opportunity to comment on the Undertaking and its effects on historic properties, and that the USFWS has taken into account the effects of the Undertaking on historic properties.

U.S. FISH AND WILDLIFE SERVICE

BY: _____ DATE: 7/11/11

Acting Marvin E. Moriarty, Regional Director, U.S. Fish and Wildlife Service

MARYLAND STATE HISTORIC PRESERVATION OFFICER

BY: _____ DATE: 2-10-11

J. Rodney Little, Director/State Historic Preservation Officer, Maryland Historical Trust

Memorandum of Agreement
USFWS Demolition
Page 8 of 9

CONCURRING PARTY:

U.S. GEOLOGICAL SURVEY

BY: _____ DATE: 23 June 2011
Gregory J. Smith, Patuxent Research Center Director, U.S. Geological Survey

LIST OF EXHIBITS

1. USGS Map – Areas of Potential Effect
2. Patuxent Research Refuge Historic District–Historic Structures Slated for Demolition (1 of 3)
3. Patuxent Research Refuge Historic District–Historic Structures Slated for Demolition (2 of 3)
4. Patuxent Research Refuge Historic District–Historic Structures Slated for Demolition (3 of 3)
5. South Tract Forest Service Historic District–Historic Structures Slated for Demolition

LIST OF ATTACHMENTS

A. Historic Resources Proposed for Retention
B. Historic Resources Proposed for Demolition
C. Non-Historic Resources Proposed for Demolition
D. Archaeological Protection Procedures
E. Statement of Services Historic Resources Proposed for Demolition in 2010 – Recordation Report

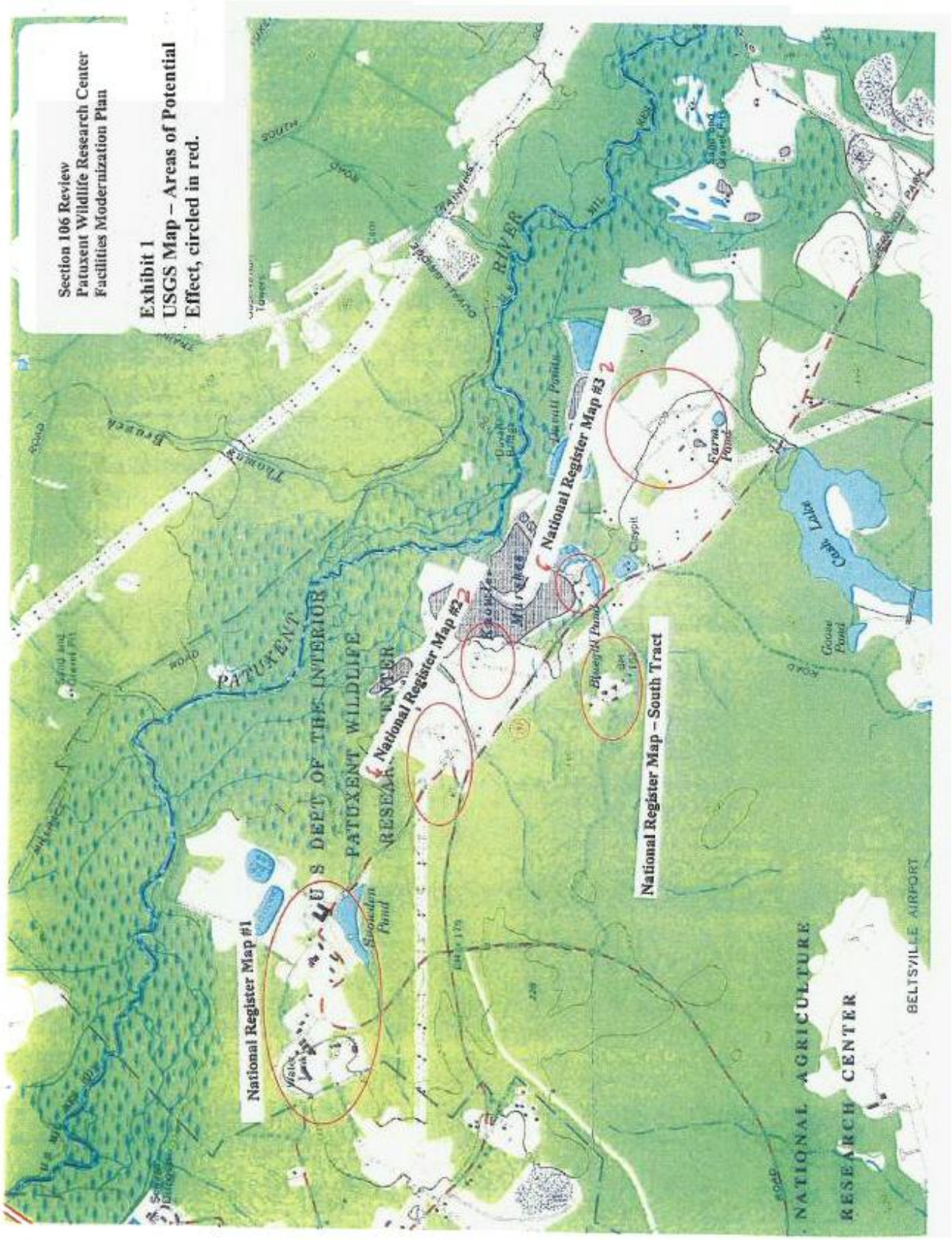
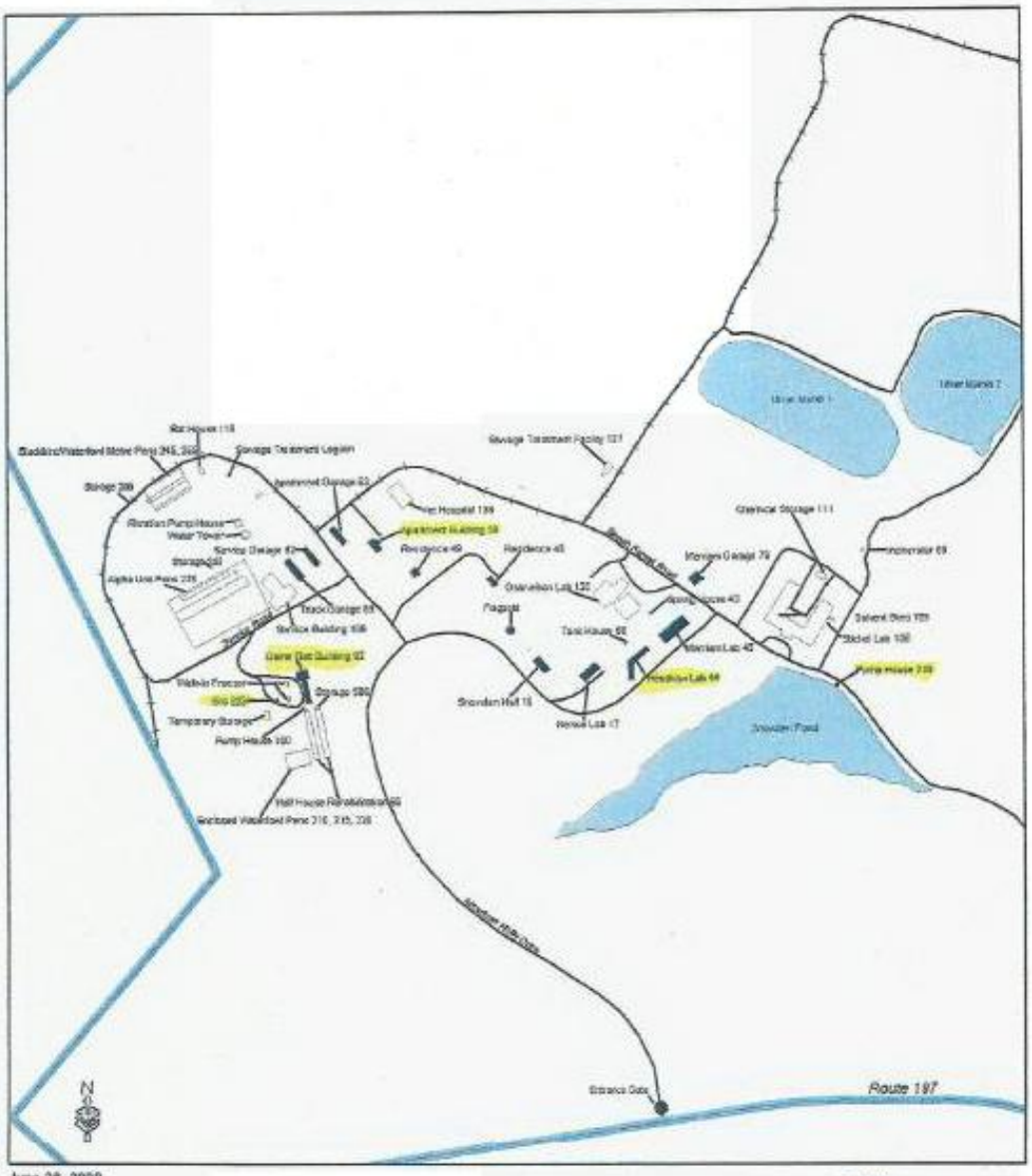

Section 106 Review
Patuxent Wildlife Research Center
Facilities Modernization Plan
Exhibit 1
USGS Map – Areas of Potential
Effect, circled in red.
National Register Map #1
National Register Map #2
National Register Map #3
National Register Map – South Tract
U S DEPT OF THE INTERIOR
PATUXENT WILDLIFE
RESEARCH CENTER
PATUXENT
RIVER
Cedar Lake
NATIONAL AGRICULTURE
RESEARCH CENTER
BELTSVILLE AIRPORT

Exhibit 2
Patuxent Research Refuge Historic District – Historic Structures Slate for Demolition (1 of 3)

U.S. FISH & WILDLIFE SERVICE

National Register Eligible Buildings at Patuxent Research Refuge (1 of 3)



June 26, 2009

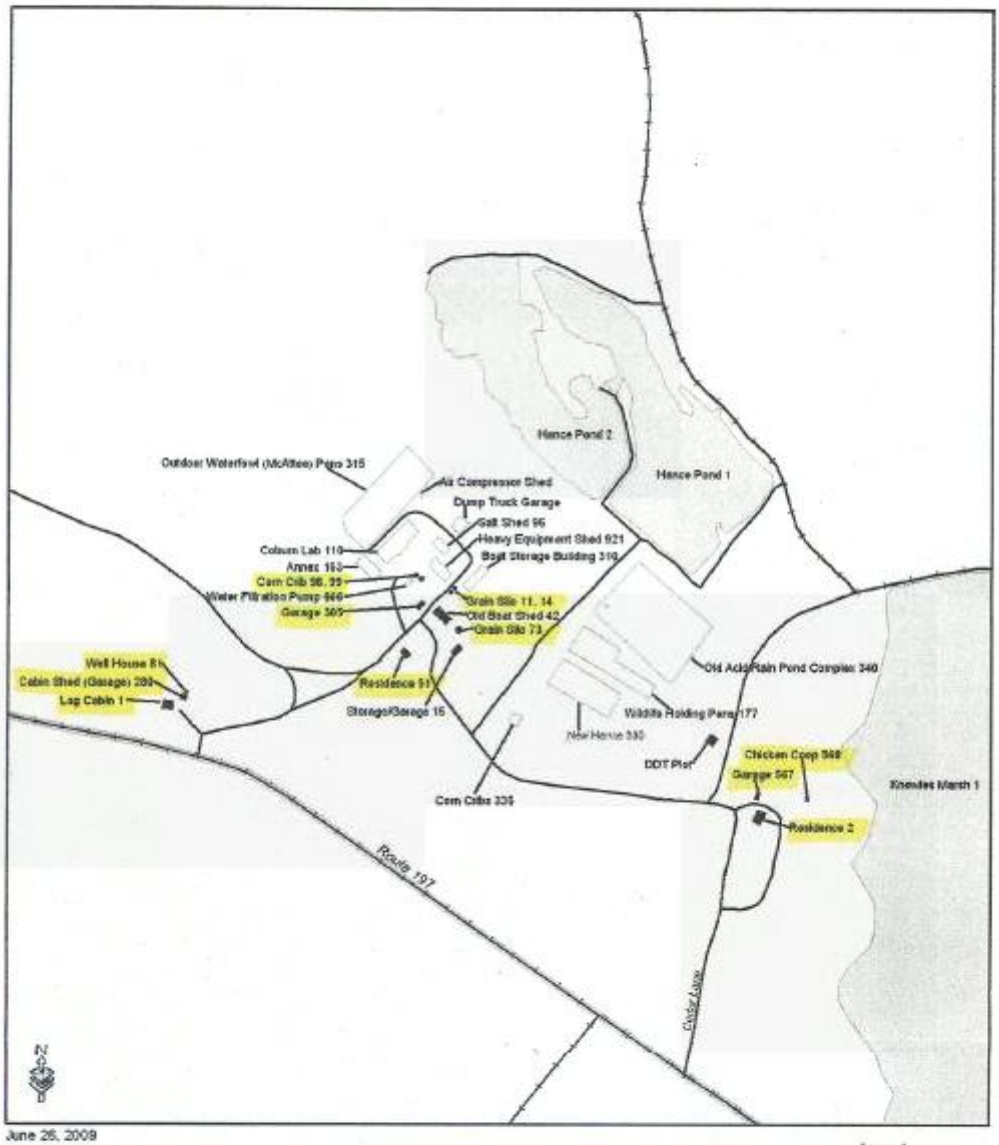
0 50 100 Meters
0 50 100 Yards
1:7,000

Legend

Exhibit 3
Patuxent Research Refuge Historic District – Historic Structures Slate for Demolition (2 of 3)

U.S. FISH & WILDLIFE SERVICE

National Register Eligible Buildings at Patuxent Research Refuge (2 of 3)



June 26, 2009

Historic structures slated for demolition are highlighted in yellow

Section 106 Review
Patuxent Wildlife Research Center
Facilities Modernization Plan

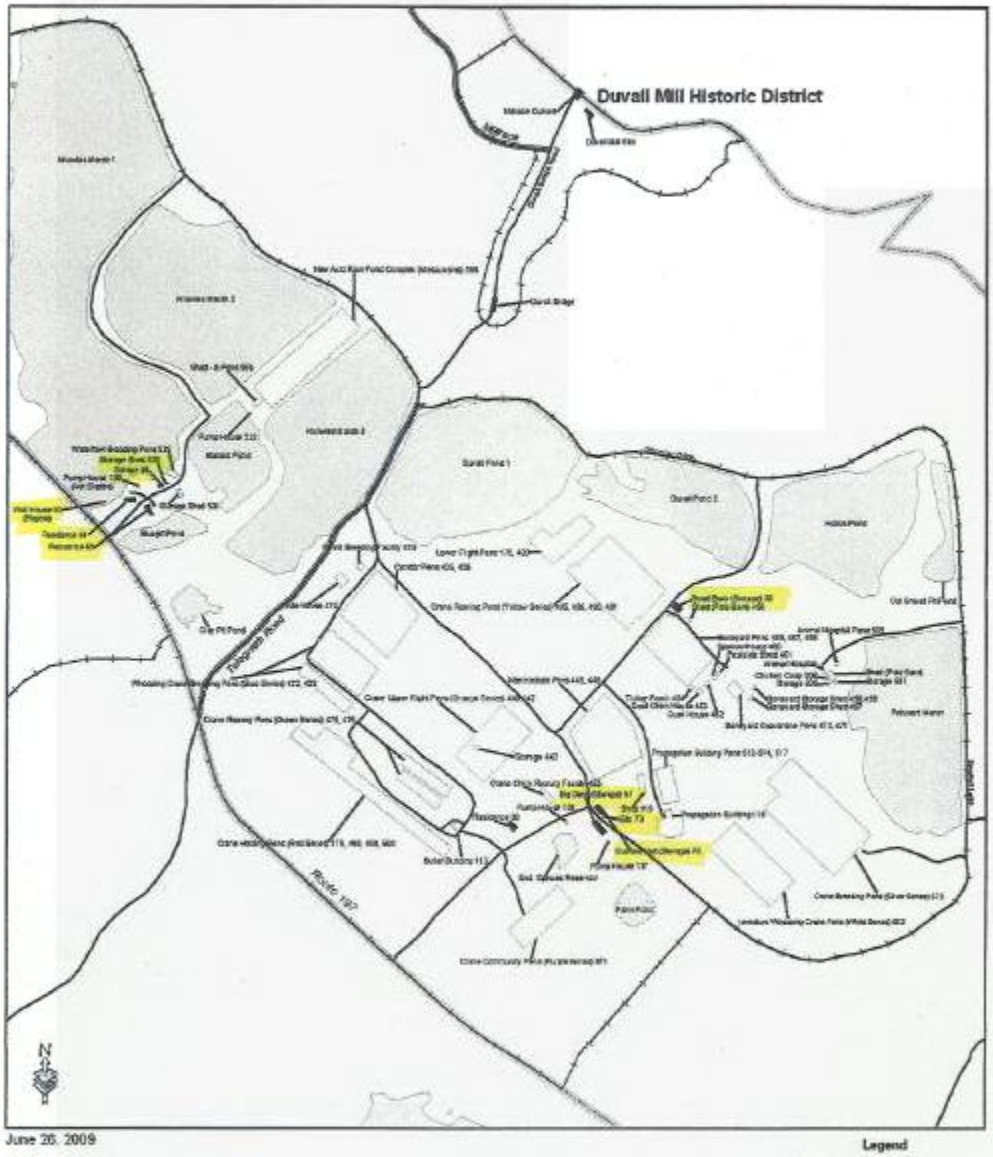
0 50 100 Meters
0 50 100 Yards
1:5,700

Legend
Refuge Boundary - CY
District Boundary
Roads
Ponds
Buildings
Eligible for the National Register
Not Eligible for the National Register

Exhibit 4
Patuxent Research Refuge Historic District – Historic Structures Slate for Demolition (3 of 3)

U.S. FISH & WILDLIFE SERVICE

National Register Eligible Buildings at Patuxent Research Refuge (3 of 3)



June 26, 2009

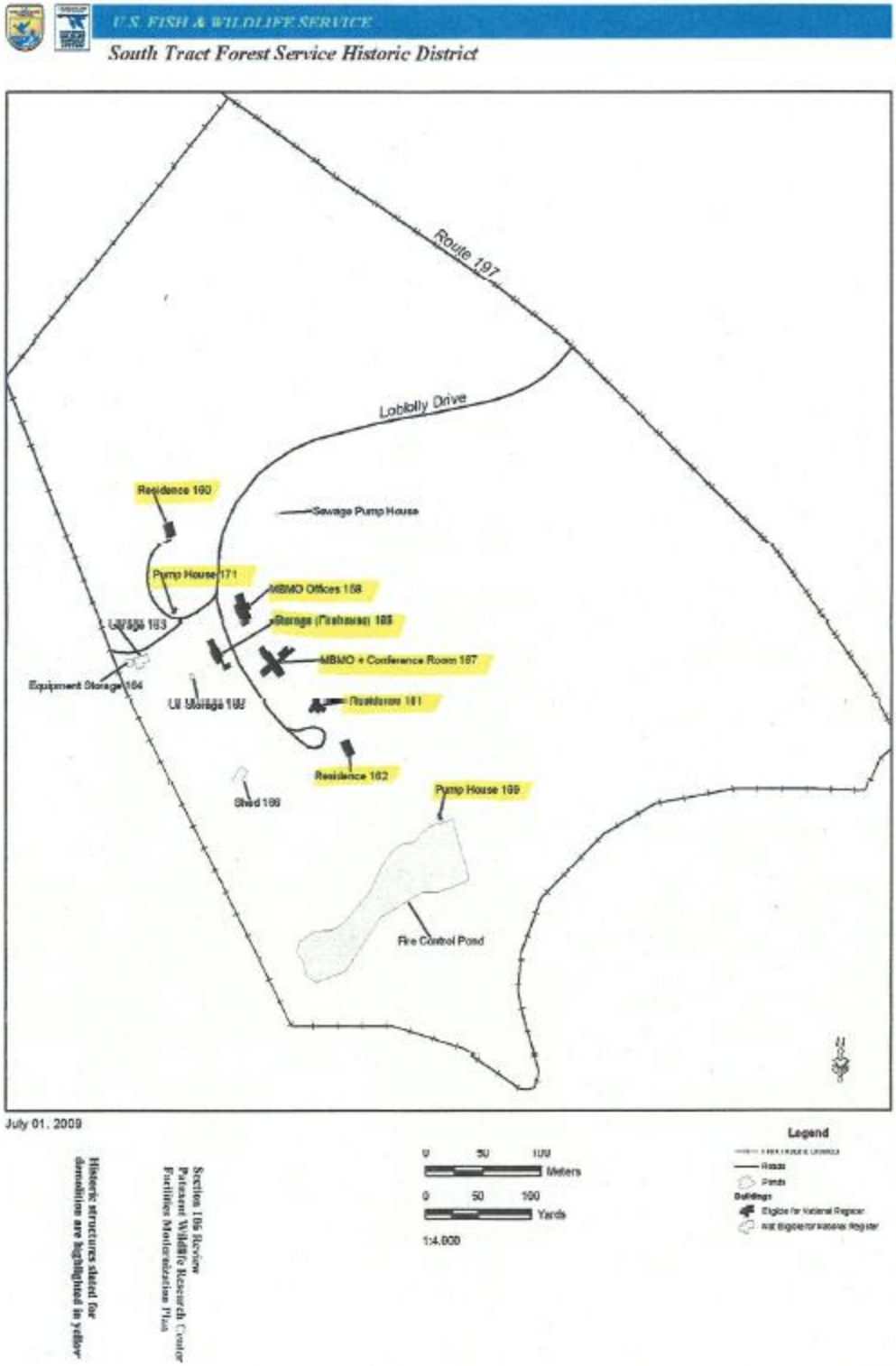
0 50 100
Meters
0 50 100
Yards
1:8,800

Legend
Refuge Boundary - CT
District Boundary
Roads
Historic Roads
Ponds
Buildings
Eligible for National Register
Not Eligible for National Register

Historic structures slated for demolitions are highlighted in yellow

Section 106 Review
Patuxent Wildlife Research Center
Facilities Modernization Plan

Exhibit 5
South Tract Forest Service Historic District Historic Structures Slated for Demolition



Attachment A. Patuxent Research Refuge
Historic Resources Proposed for Retention*
Listed by RPI# November 15, 2010

RPI#	MIHP#	Structure Name	Structure Location
n/a		Entrance Gate	Headquarters Area
n/a		Flagpole	Headquarters Area
15		Storage Garage	B Farm Area
16		Snowden Hall	Headquarters Area
17		Nelson Laboratory	Headquarters Area
42		Old Boat Shed	B Farm Area
43		Springhouse	Headquarters Area
45		Merriam Laboratory	Headquarters Area
48		Superintendent's Residence	Headquarters Area
49		Assistant Superintendent's Residence	Headquarters Area
52		Service Garage	Headquarters Area
53		Apartment Building Garage	Headquarters Area
56		Tank House	Headquarters Area
79		Merriam Garage	Headquarters Area
80		Flock Manager's House	Endangered Species Area
89		Truck Storage Garage	Headquarters Area

*Does not include Duvall Mill Historic District, which is not part of the FMP

Attachment B. Patuxent Research Refuge - Historic Resources Proposed for Demolition
Listed numerically by RPI#, November 15, 2010

Project #	RPI #	MIHP#	Structure Name	Structure Location	Proposed Date of Removal
1	1	PG-64-7	Holst Cabin	B Farm Area	Post-2010
2	2	PG-64-13	Red Cedar Lane Quarters	Bluegill Pond Area	Post-2010
3	11	PG-64-13	B Farm Silo II	B Farm Area	Immediately
4	14	PG-64-13	B Farm Silo III	B Farm Area	Immediately
5	44	PG-64-13	Henshaw Laboratory	Headquarters Area	Immediately
6	50	PG-64-13	Apartment Building	Headquarters Area	Immediately
7	51	PG-64-13	Coburn Residence	B Farm Area	Post-2010
8	54 (923)	PG-64-13	Game Bird Yard Silo	Headquarters Area	Immediately
9	57	PG-64-13	Upper (White) Barn	Endangered Species Area	Immediately
10	64	PG-64-13	Residence 64	Bluegill Pond Area	Post-2010
11	65	PG-64-13	Residence 65	Bluegill Pond Area	Post-2010
12	66	PG-64-13	Bluegill Garage	Bluegill Pond Area	Post-2010
13	70	PG-64-13	Lower Barn	Endangered Species Area	Post-2010
14	73	PG-64-13	Upper Barn Silo	Endangered Species Area	Immediately
15	74	PG-64-13	B Farm Silo	B Farm Area	Immediately
16	76	PG-64-13	Quonset Hut	Endangered Species Area	Immediately
17	81	PG-64-13	Well #3/Pump	B Farm Area	Post-2010
18	82	PG-64-13	Game Bird Building	Headquarters Area	Post-2010
19	93	PG-64-13	Well No. 11 Pump/Springhouse	Bluegill Pond Area	Post-2010
20	98	PG-64-13	Corn Crib	B Farm Area	Immediately
21	99	PG-64-13	Corn Crib	B Farm Area	Immediately
22	158	PG-64-15	DMBM Office	South Tract	Post-2010
23	160	PG-64-15	Residence 160	South Tract	Post-2010
24	161	PG-64-15	Residence 161	South Tract	Post-2010
25	162	PG-64-15	Residence 162	South Tract	Post-2010
26	165	PG-64-15	Garage & Tool House	South Tract	Post-2010
27	167	PG-64-15	DMBM Office II	South Tract	Post-2010
28	169	PG-64-15	Fire Pond Pump Station	South Tract	Post-2010
29	171	PG-64-15	Well No. 9 Pump/Filter House	South Tract	Post-2010
30	230	PG-64-13	Snowden Pond Pump Station #1	Headquarters Area	Post-2010
31	280	PG-64-13	Holst Cabin Garage	B Farm Area	Post-2010
32	305	PG-64-13	B Farm Garage (Old Boat Shed)	B Farm Area	Post-2010
33	530	PG-64-13	Bluegill Chicken Coop	Bluegill Pond Area	Immediately
34	567	PG-64-13	Garage	Bluegill Pond Area	Post-2010
35	568	PG-64-13	Red Cedar Lane Chicken Coop	Bluegill Pond Area	Post-2010

Attachment C. Patuxent Research Refuge - *Non-Historic* Resources Proposed for Demolition Listed by RPI#, November 15, 2010

RPI#	Structure	Location
83	Headquarters Sewage Treatment Lagoon	Headquarters Area
95	Game Bird Yard Half Houses	Headquarters Area
96	Salt Shed	B Farm Area
111	Chemical Storage Building	Headquarters Area
116	Bat House	Headquarters Area
119	E.S. Area Shop	Endangered Species Area
153	Coburn Annex	B Farm Area
163	South Tract Garage	South Tract
164	Tool House	South Tract
166	Boat Garage	South Tract
180	Bluegill Pump Station & Filter House	Bluegill Pond Area
205	Duck Shed	Headquarters Area
210	Enclosed Waterfowl Pens	Headquarters Area
215	Enclosed Waterfowl Pens	Headquarters Area
220	Enclosed Waterfowl Pens	Headquarters Area
245	Duck Slabs	Headquarters Area
255	Duck Slabs	Headquarters Area
275	Alpha Unit Pens Shed	Headquarters Area
285	Alpha Unit Pens Shed	Headquarters Area
300	B Farm Chicken Coop	B Farm Area
335	Zoo Cages/Condor Pens	B Farm Area
410	Kite House	Endangered Species Area
415	Parrot Breeding House	Endangered Species Area
455	Crane Chick Rearing	Endangered Species Area
456	Small Pole Shed	Endangered Species Area
457	E.S. Bone Yard Shed	Endangered Species Area
458	E.S. Bone Yard Shed	Endangered Species Area
459	E.S. Bone Yard Shed	Endangered Species Area
460	Bird Breeding Facilities	Endangered Species Area
461	Bird Breeding Facilities	Endangered Species Area
462	Bird Breeding Facilities	Endangered Species Area
463	Bird Breeding Facilities	Endangered Species Area
464	Turkey Porch	Endangered Species Area
470	E.S. Bone Yard/Quarantine Pens	Endangered Species Area
471	E.S. Bone Yard/Quarantine Pens	Endangered Species Area
505	Old Vet Hospital Holding Pens	Endangered Species Area
506	Old Vet Hospital Shed	Endangered Species Area
507	Old Vet Hospital Shed	Endangered Species Area
508	Old Vet Hospital Shed	Endangered Species Area
531	Bluegill Shed	Bluegill Pond Area
535	Game Bird Yard Shed	Headquarters Area
556	Canvasback Shed	Bluegill Pond Area
560	Old Vet Hospital Trailer	Endangered Species Area
566	Game Bird Yard Storage Shed	Headquarters Area
615	Sewage Facility Pump House	South Tract
666	Water Filtration Pump Building	B Farm Area
---	Dump Truck Garage	B Farm Area
---	Old Veterinary Hospital Pole Barn	Endangered Species Area
---	Zoo Cages	B Farm Area
---	Sewage Facility Pumphouse	Headquarters Area

ATTACHMENT D

ARCHAEOLOGICAL PROTECTION

The buildings to be demolished are located in areas likely to contain important archaeological sites. These sites are the remains of past people's activities and can consist of artifacts in the ground and the soil itself. In order to preserve these sites through the demolition of the buildings and structures, the contractor shall take precautions to avoid disturbing the soil. Except for an area within four feet of the foundation of the building, there shall be no ground disturbance at the site. The contractor shall not grade the site.

1. Concrete foundation material located below existing grade may be removed to a depth of two feet. Concrete foundation material located above existing grade shall be demolished and removed from the site. It is intended that once each building has been demolished and removed, no grading or other ground disturbance will take place. Following completion of demolition, no portion of the building structure (including the concrete foundation) shall be visible above grade.

2. For buildings with basements, the basement cavity shall be filled to existing grade with fill obtained off site. The basement concrete floor slab shall be broken up as required to allow water drainage through the foundation. Ground disturbance shall be confined to within four feet of the existing foundation.

3. For structures without basements, completely demolish and remove each building, including the concrete slab (if there is one). Concrete footings and walls located below the existing grade line shall be removed to about two feet below the surface. Confine ground disturbance to within four feet of the piers or slab.

Attachment E
Statement of Services
U.S. Fish and Wildlife Service
Patuxent Research Refuge

Historic Resources Proposed for Demolition in 2010 - Recordation Report

The U.S. Fish and Wildlife Service (Service) is seeking a cost proposal for the production of a report that will record 12 historic resources at the Patuxent Research Refuge (Refuge) that are slated for demolition in 2010. The undertaking will cause adverse effect to these 12 structures, and the report will serve as one mitigation treatment. The report will be submitted as a draft to the Service for review before a final product is submitted. Photographs and Determination of National Register Eligibility Forms of the 12 structures are attached to this Statement of Services. The Service can provide maps of the Historic Districts with the buildings noted by number as .pdf or .jpg files.

Recordation Report Format

The report will have the following items, as well as the documentation listed in the table on page 2:

- Cover Sheet: Project name, location, date, agencies involved, and author
- Project Summary: History of the project and the process by which the demolition of the buildings were determined to be appropriate
- Description: Description of the refuge and the general locations of the 12 pertinent structures
- Statement of Significance: History of the refuge, its relation to historical contexts, and the importance of the 12 pertinent structures to the refuge.
- Maps: Location maps, including an 11" x 17" sketch map and USGS map, indicating the location of the pertinent structures
- Photographic Index: Numbered index to sketch map and photographs
- Historic photographs, if available for each structure
- Set of plans, if called for. The Service can provide tiff files of plans for Henshaw, building 44, and the apartment Building, 50.
- The project will be considered complete when the report is accepted by the Service.

The recordation report will also have the following photographic documentation:

- There will be 3 photographic prints produced for each image, and all photographs will be 8x10 black and white glossy digital images.
- Digital images will have a minimum pixel depth or dimension of 3,000 x 2,000 and a minimum dpi of 300
- Photographs will be executed according to the Maryland Historic Trust standards, which are described on page 36 of the *Standards and Guidelines for Architectural and Historical Investigations in Maryland* (http://mht.maryland.gov/documents/PDF/Survey_standards_architecture_web.pdf), and in the *Standards for Submission of Digital Images to the Maryland Inventory of Historic Properties* (http://mht.maryland.gov/documents/PDF/Survey_DigitalPhotos_2008.pdf).

- Photographic prints will be labeled on the back with a soft pencil. Labels will include Photograph#, RPI#, structure name, view description, photographer, and date photo taken as well as any required MHT information.
- All photographs and text will be saved on 75-year CD's, the photographs in .tiff and .jpg format. Three CD's will be submitted. Photographic files will be labeled by structure name and RPI#.

Recordation for Mitigation Schedule Table

Listed by RPI#

RPI#	Structure Name	Photographic Documentation	Written Documentation
11	B Farm Silo II	(1) view of setting (2) ¾-view photos	1 paragraph architectural description 1 paragraph history of structure including importance of structure to Refuge
14	B Farm Silo II	(1) view of setting (2) ¾-view photos	1 paragraph architectural description 1 paragraph history of structure including importance of structure to Refuge
44	Henshaw Laboratory	(1) view of setting (4) ¾ view photos interior and exterior views of significant features as appropriate	Detailed exterior architectural description Detailed interior architectural description History of structure including importance of structure to Refuge 1 set building plans
50	Apartment Building	(1) view of setting (4) ¾ view photos interior and exterior views of significant features as appropriate	Detailed exterior architectural description Detailed interior architectural description History of structure including importance of structure to Refuge 1 set building plans
54 (923)	Game Bird Yard Silo	(1) view of setting (2) ¾-view photos	1 paragraph architectural description 1 paragraph history of structure including importance of structure to Refuge
57	Upper Barn	(1) view of setting (4) ¾-view exterior photos (8) interior photos depicting the structure of the building	2 paragraphs architectural description 1 paragraph history of structure including importance of structure to Refuge
73	Upper Barn Silo	(1) view of setting (2) ¾-view photos	1 paragraph architectural description 1 paragraph history of structure including importance of structure to Refuge
74	B Farm Silo	(1) view of setting (2) ¾-view photos	1 paragraph architectural description 1 paragraph history of structure including importance of structure to Refuge
76	Quonset Hut	(1) view of setting (2) ¾-view photos	1 paragraph architectural description 1 paragraph history of structure including importance of structure to Refuge
98	Corn Crib	(1) view of setting (2) ¾-view photos	1 paragraph architectural description 1 paragraph history of structure including importance of structure to Refuge
99	Corn Crib	(1) view of setting (2) ¾-view photos	1 paragraph architectural description 1 paragraph history of structure including importance of structure to Refuge

530	Bluegill Chicken Coop	(1) view of setting (2) ¾-view photos	1 paragraph architectural description 1 paragraph history of structure including importance of structure to Refuge

Suggested Historical Resources:

- Annual reports of the Patuxent Research Refuge
- Oral histories of former and longtime employees
- "A Report on the History and Development of the Patuxent Research Refuge" by Dr. Leland C. Morley (http://www.pwrc.usgs.gov/history/cronhist/Morley4.pdf)
- "The Evolution of Patuxent as a Research Refuge and as a Wildlife Research Center" by Matt Perry (http://www.pwrc.usgs.gov/history/cronhist/PatuxentHistory_Perry.pdf)

Submittal Requirements

Drafts

The draft recordation report (text and photos) may be submitted in electronic format to the Service's Architectural Historian at Paula_Sagerman@fws.gov

Final Product

- One 3-ring binder, including all text, photographic prints, and maps.
- Photographic prints in archival-quality plastic sleeves
- One CD of each report, including all text, photographic prints, and scanned/digital maps.
- Photographic submission to MHT standards

Project Schedule

Draft Report Due 6 weeks after contract award
Final Report Due 1 week after receiving comments from the U.S. Fish and Wildlife Service

Additional Information

The cost proposal will be due by 4:00 pm on May 7, 2010 at the following address:
U.S. Fish and Wildlife Service
300 Westgate Center Dr.
Hadley, MA 01035
Attn: Gary Dupuis, Contracting Officer

Questions regarding this proposal may be directed to Paula Sagerman, Architectural Historian, 413-253-8271, Paula_Sagerman@fws.gov.

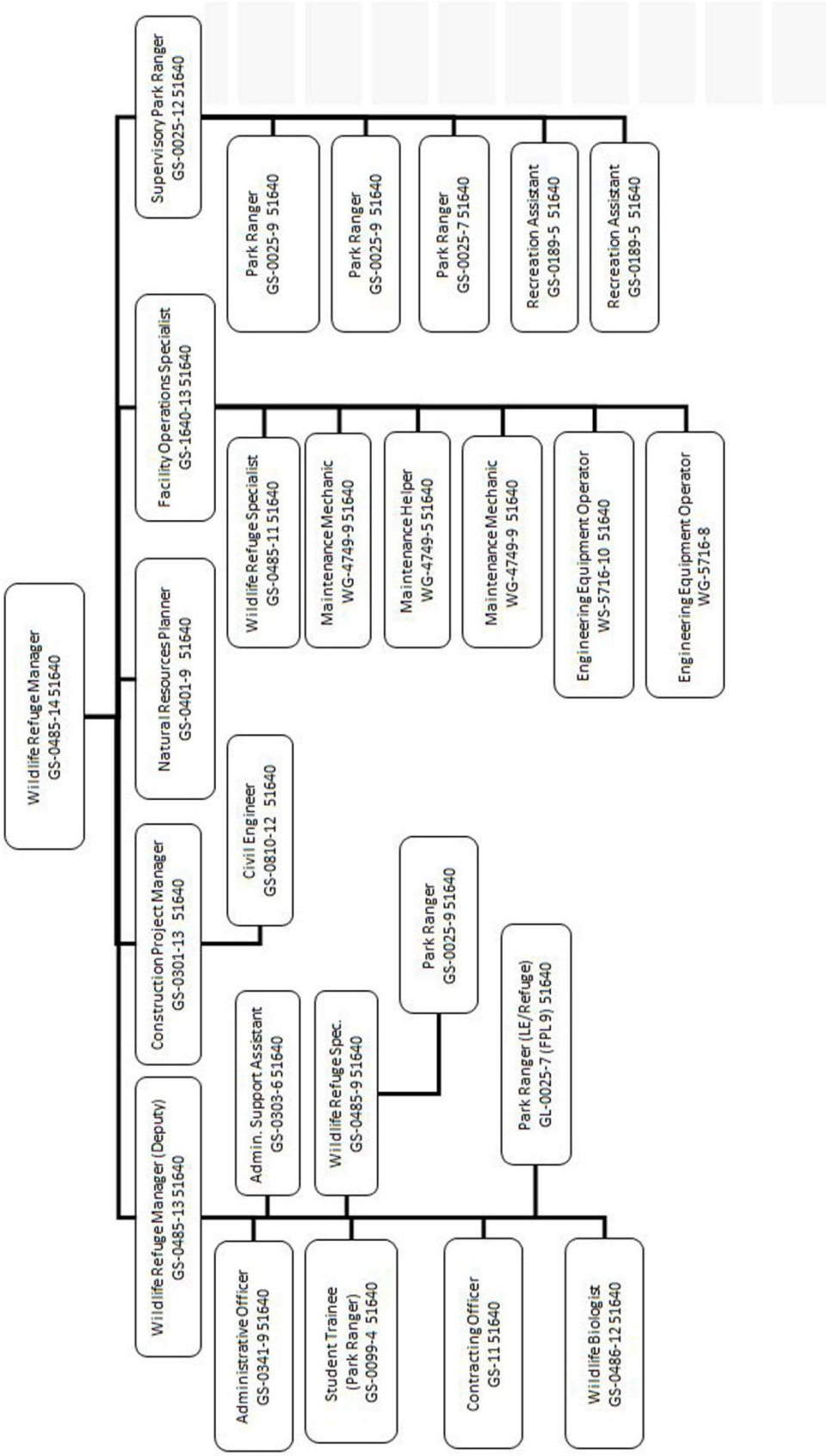
Appendix F.

USFWS

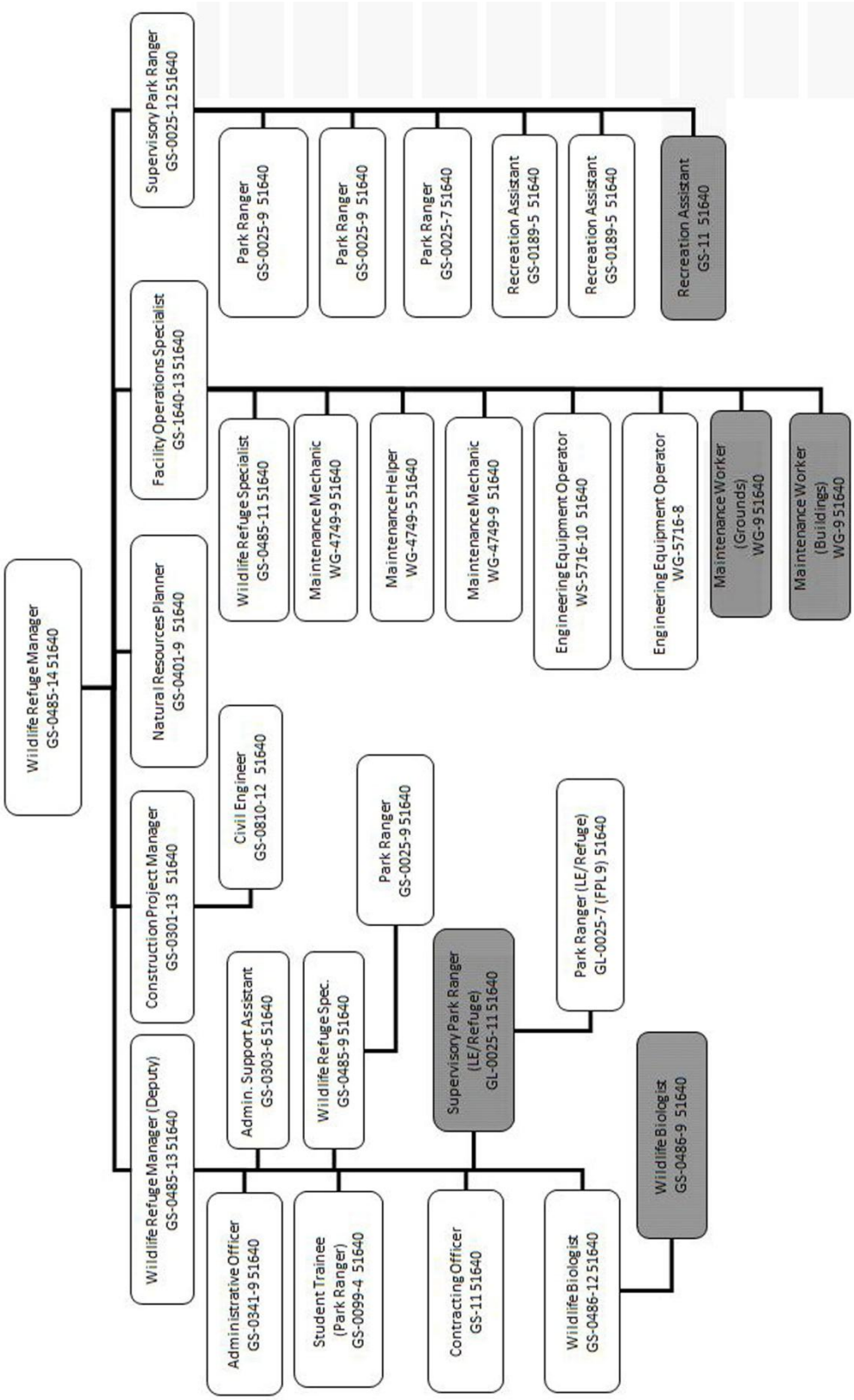
Refuge Staff with Visitor

Staffing Charts

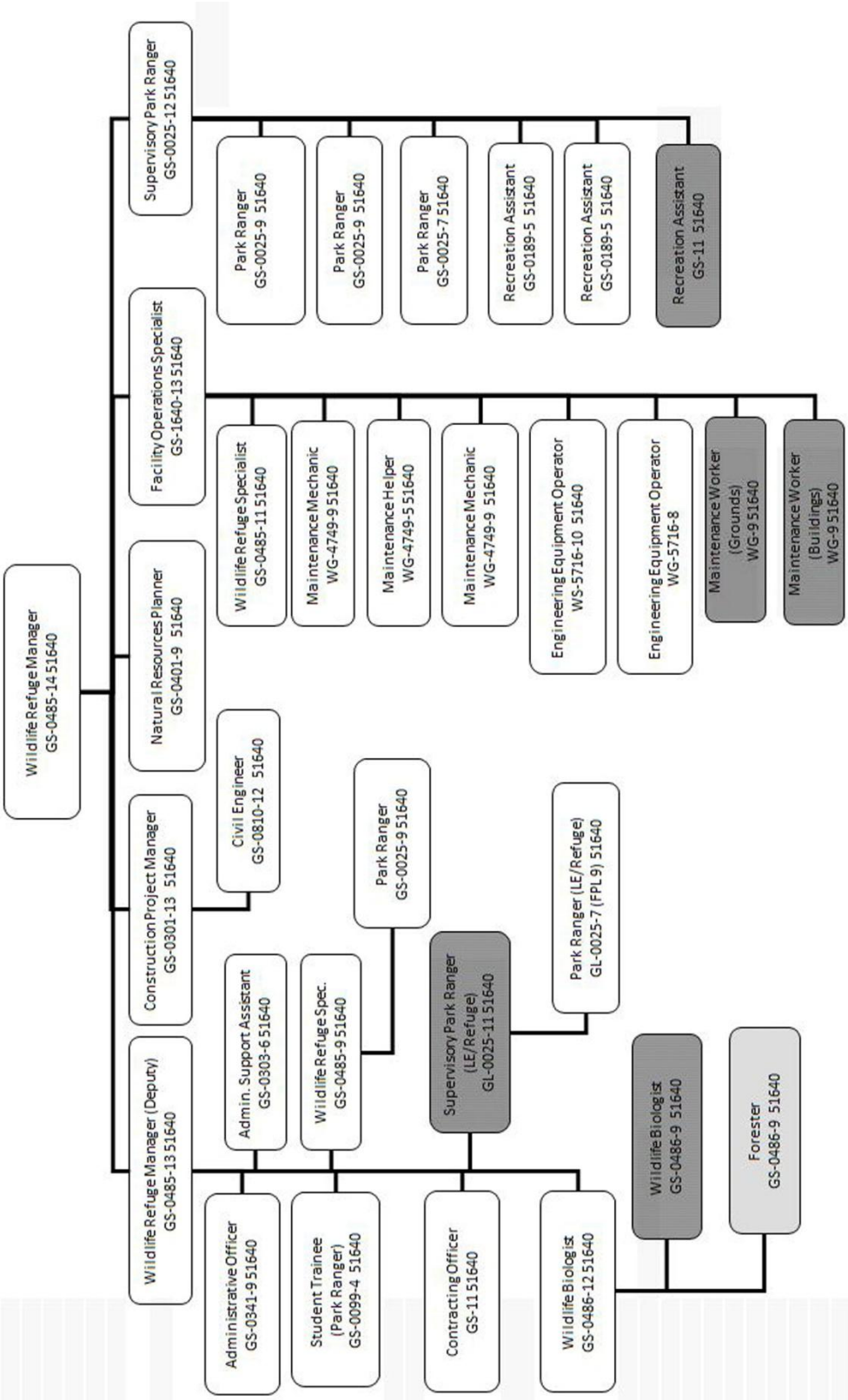
Alternative A – Current Staffing Chart



Alternative B – Proposed Staffing



Alternative C – Proposed Staffing



Appendix G.

Patuxent Research Refuge Impoundment Structured Decision-making Summary Report

March 30, 2012

Table of Contents

1. Introduction G-2

2. Comprehensive Conservation Plan Objectives G-3

3. Objectives for the Wetland Decision Analysis G-6

4. Measuring Objectives G-9

5. Evaluation Measures for the Objectives G-11

6. Value Functions for Objectives G-14

7. Management Alternatives G-16

8. Costs G-17

9. Putting it all Together – The Analysis G-17

10. Use of SDM results in the CCP G-25

Appendix 1 – Workshop Participants G-25

Abstract

Summary report of structured decision-making meetings held at Patuxent Research Refuge November 2010 to May 2011. The refuge staff and invited experts reviewed and discussed the future management of the refuge's artificial wetlands.

1. Introduction

While developing the Comprehensive Conservation Plan (CCP), the staff at Patuxent Research Refuge (refuge) developed a process to determine the best management option for refuge impoundments that will achieve refuge objectives. Patuxent Research Refuge manages both natural and artificial wetlands, with and without water control structures (WCS). The scope of the decision for this Structured Decision-making (SDM) workshop was discussed and the group determined to focus on artificial wetlands with and without water control structures. A decision timeframe of 15 years was set, to coincide with the timeframe of the refuge's CCP.

The workshop participants determined the problem statement to be:

What is the best management strategy to achieve the highest resource contribution for each artificial wetland?

To provide workshop participants with a first-hand view of the different types of artificial wetlands and some of the problems the refuge staff is facing, a few of the impoundments were visited. The group looked at impoundments with water control structures, wetlands with artificial barriers, impoundments designed for research, and constructed wetlands.

The purpose of this report is to explain and document the steps taken for this decision process and to provide an outline which could be applied at other refuges to support resource allocation decisions. SDM is a strategic approach to decision-making involving the following five steps:

1. Specify wetland objectives and scales for measuring achievement.
2. Develop management action alternatives that could achieve the objectives.
3. Determine how well all of the management action alternatives achieve the wetland objectives for each impoundment.
4. Consider tradeoffs among the alternatives.
5. Select the alternative that best achieves the wetland objectives for each impoundment, taking into account constraints.

2. Comprehensive Conservation Plan Objectives

The impoundments of Patuxent Research Refuge have been established since its origin. Several impoundments were created through gravel pits, while many were created for waterfowl research and mitigation efforts. During the workshop, the current biological objectives were reviewed along with other objectives to assist with determining future management options. The biological objectives may change or be altered due to the discussions and outcomes of the meetings and analysis. Below are the draft CCP goals and objectives related to impoundment management at the time of the meeting:

Goal 1: Maintain and actively promote Patuxent Research Refuge as an "outdoor laboratory," providing a diversity of wildlife and natural resource research opportunities on the refuge in such areas as landscape conservation, habitat fragmentation, climate change, and other emerging issues, as well as the more traditional types of wildlife research, including inventory and monitoring techniques, land management, and understanding ecological processes. Research that supports the overall Service mission, and evaluates the best methods for protecting natural resources throughout the National Wildlife Refuge System and other land management agencies will be a priority.

Objective 1.1 Inventory and Monitoring
Maintain and restore native floodplain forest communities along the Patuxent and Little Patuxent Rivers with less than 10 percent invasive species to provide mature bottomland floodplain forests dominated by American beech, sweetgum, tuliptree, sycamore, red maple, and pin oak to provide breeding, nesting and migratory stopover habitat for migratory bird species of conservation concern; including Acadian flycatcher, cerulean warbler, Kentucky warbler, Louisiana waterthrush, and prothonotary warbler and also to benefit eastern red bat and eastern box turtle. Provide diverse upland forest habitat with:

- Dense underbrush along streams and nesting snags (range average height of 3 to 6 feet and a dbh of at least 6 inches) for prothonotary warbler;
- Closed forest canopy (greater than 80 percent), sparse herbaceous canopy cover (less than 25 percent) and sparse to moderate shrub canopy cover (75 percent) for Louisiana waterthrush;
- A slightly open canopy, dense understory, and well-developed ground cover for Kentucky warbler;
- Canopies 5 to 20 feet above the ground; and
- Open underneath for summer roosting of eastern red bats.

Objective 1.2 Research and Scientific Assessments (Local, National, and International)
Maintain and restore native upland forest communities with less than 10 percent invasive species overall to provide mature upland forests dominated by American beech, northern red oak, white oak, tuliptree, southern red oak, and black oak to provide breeding, nesting and migratory stopover habitat for Acadian flycatcher, cerulean warbler, eastern wood-pewee, Louisiana waterthrush, wood thrush, worm-eating warbler and also to benefit silver-haired bat and eastern spadefoot toad. Provide diverse upland forest habitat with:

- Closed canopy and dense understory for Acadian flycatchers;
- Forest canopy cover (greater than 85 to 90 percent, not less than 65 percent), large trees (greater than 12 inches dbh), and subcanopy cover (65 to 70 percent, not less than 45 percent) for cerulean warblers;
- Incomplete or sparse canopy layer with understories to 15 to 20.5 feet height, providing the broken canopy layer is sufficiently high above the understory for eastern wood-pewee;
- Minimum snag densities of eight per acre for silver-haired bat roosts; and
- Vernal pools for breeding and foraging habitat for eastern spadefoot.

Goal 2: Protect, maintain, and restore, where possible, the biological integrity, diversity, and environmental health of forested ecological communities to provide habitat for species of conservation concern, including migratory birds, mammals, amphibians, reptiles, and invertebrates.

Objective 2.1 Floodplain Forest and Swamp, to also include Depressional Forests and Shrub Wetlands

Maintain, protect, and restore the aquatic habitat of the Patuxent, Little Patuxent, and Anacostia River watersheds within the refuge, to provide spawning, nursery, foraging, and cover habitat for aquatic resources of conservation concern; including American brook lamprey, American eel, American and hickory shad, blueback herring, comely shiner, glassy darter, stripeback darter and also to benefit other species of conservation concern, such as eastern box turtle, and triangle floater. Provide a variety of substrates including:

- Pea gravel for spawning American brook lamprey;
- Fine sand and muck for American brook lamprey larvae;
- Stony riffles for spawning stripeback darter;
- Gravel, sand, and detritus for spawning alewife; and
- Streams with a pH greater than 6.4, turbidity less than 15 NTU, and depths less than 20 inches for glassy darter.

Objective 2.2 Upland Deciduous, Pine, and Mixed Forest and Associated Wetlands

Maintain and restore the upland forest communities to provide mature upland forests dominated by American beech, northern red oak, white oak, tuliptree, southern red oak, and black oak to provide breeding, nesting and migratory stopover habitat for migratory bird species of conservation concern including; Acadian flycatcher, cerulean warbler, eastern wood-pewee, Kentucky warbler, Louisiana waterthrush, prothonatary warbler, wood thrush, worm-eating warbler and also to benefit eastern red bat and eastern spadefoot toad.

Goal 3: Protect, maintain, and restore, where possible, the biological integrity, diversity, and environmental health of refuge aquatic habitats, including the Patuxent, Little Patuxent, and Anacostia River watersheds, and impoundments, to provide habitat for migratory bird species of conservation concern; including American black duck, solitary sandpiper, green heron, greater and lesser yellowlegs

and also to benefit other species of conservation concern, such as eastern spadefoot, and elfin skimmer. Restore impoundments where greater conservation values result from restoration to natural hydrology.

- Provide a mix of shallow water (less than 6 inches water depth) and mudflats, by allowing exposed mudflats to increase to maximum exposure to provide for foraging habitat from mid-April to mid-May to support migrating shorebirds and wading birds.
- Maintain approximately 50 percent open water and floating vegetation coverage, initiating draw down by June 21 when floating vegetation coverage of pond lily, water shield, and spatter dock exceeds 50 percent and reflooding to 6 to 12 inches immediately after first frost or by the end of October.
- Provide seeds and roots of red-rooted sedge, barnyard grass, and smartweed for waterfowl during peak migration in mid-November by reflooding to 6 to 12 inches of water depth immediately after first frost or by the end of October.
- Provide restored forested wetland communities with a mostly closed to semi-open canopy along the reaches of gently sloping streams with a vegetation mosaic of small shrubs and trees including blackgum, swamp azalea, sweetbay magnolia, highbush blueberry, and dangleberry with open, sedge and graminoid dominated patches.

Objective 3.1 Coastal Plain River and Coastal Plain Stream Habitats
Manage the 5.5-mile Baltimore Gas and Electric and 3.5-mile Pepco powerline right-of-ways to provide scrub-shrub breeding, nesting and migratory stopover habitat for migratory bird species of conservation concern; including American woodcock, brown thrasher, field sparrow, prairie warbler, and white-eyed vireo and also to benefit eastern spadefoot and Indian skipper.

- Provide berry-producing trees, shrubs and vines, such as dogwood, ciborium, hawthorn, crabapple, blueberry, raspberry, sumac, and grape for food, interspersed with small open areas for foraging brown thrashers.
- Provide low shrubs and small trees for nesting birds, including brown thrashers (to 12 feet), prairie warbler (1 to 10 feet), and white-eyed vireo (1 to 8 feet).
- Provide areas of low to moderate shrub density with 50 to 75 percent of shrubs less than 5 feet, and shrub cover between 15 to 35 percent for field sparrows.
- Provide young tree and shrubs species alder, hawthorns, dogwood, spicebush, and viburnum on moist soils for feeding, daytime cover, and nesting for American woodcock.

Objective 3.2 Impoundments of Open Water, Emergent, Shrub, and Forest
Manage grasslands in large blocks (greater than 25 acres), dominated by native species with a mix of cool and warm season grasses, less than 20 percent forbs and less than 3 percent shrub cover, to provide resting and foraging habitat for migrating and wintering bird species of conservation concern; including eastern meadowlark, eastern kingbird, field sparrow, and grasshopper sparrow and to benefit pollinating insects. Allow the remaining fields (less than 25 acres) to revert to forest habitat, unless mowing is required for administrative purposes, environmental education, public use, or public viewing.

- Provide short- to medium-height bunch grasses interspersed with patches of bare ground, shallow litter layer, scattered forbs, and few shrubs for foraging grasshopper sparrows.
- Provide open habitat adjacent to nearby perches for foraging passerine birds, including the eastern kingbird.
- Provide a mix of flowering plant species for pollinating insects.

Objective 3.3 Emergent Wetlands (Freshwater, Nontidal)
Manage the 32 constructed impoundments with water control structures to provide managed habitat for migratory bird species of conservation concern; including American black duck, solitary sandpiper, greater and lesser yellowlegs and also to benefit for other species of conservation concern, such as eastern spadefoot and elfin skimmer.

Goal 4: Manage refuge non-forested upland communities to provide ecological structure, composition, and function to support native plants and wildlife, including species of conservation concern. Where appropriate, restore the biological integrity and diversity of these habitats.

Objective 4.1 Shrub/Early Succession Forest Habitat
Manage the 5.5-mile Baltimore Gas and Electric and 3.5-mile Pepco powerline right-of-ways to provide scrub-shrub habitat to provide breeding, nesting and migratory stopover habitat for migratory bird species of conservation concern; including brown thrasher, field sparrow, prairie warbler, and white-eyed vireo and also to benefit eastern spadefoot and Indian skipper.

Objective 4.2 Grasslands/Old Fields
Maintain grassland in large (greater than 25 acres) parcels and in close proximity, dominated by native species with a mix of cool and warm season grasses, less than 20 percent forbs and less than 3 percent shrub cover, to provide nesting and foraging habitat to benefit migratory bird species of conservation concern; including American woodcock, eastern kingbird, and grasshopper sparrow and also to benefit pollinating insects.

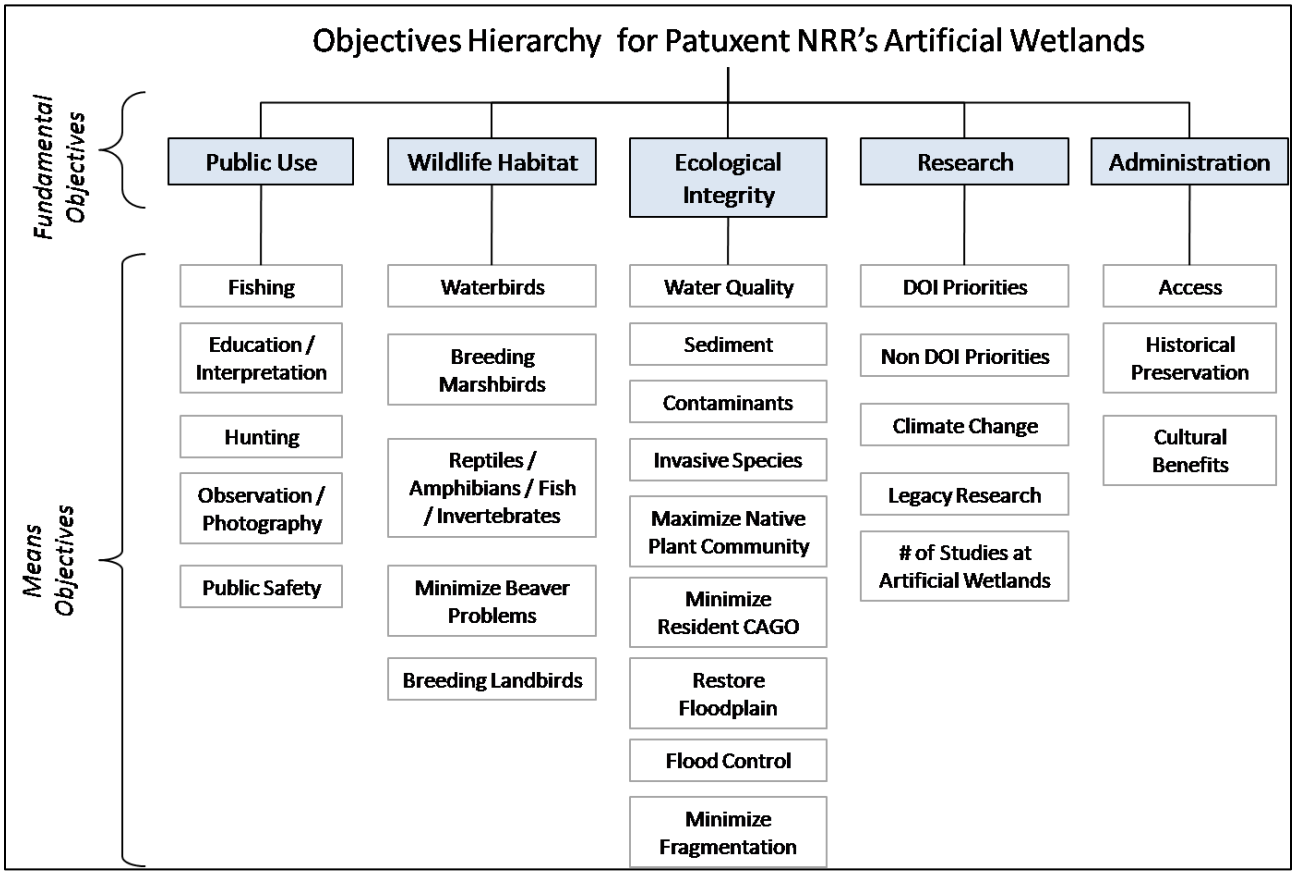
3. Objectives for the Wetland Decision Analysis

For the purposes of the SDM workshop, participants discussed the management objectives they wanted to achieve through management of artificial wetlands to meet the CCP goals and objectives. Below is the initial list of objectives (potential metrics for some in parentheses), which were then used to develop an objectives hierarchy (figure G-1) for artificial wetlands.

1. Fishing opportunities (conduct angler surveys, determine # of repeat anglers)
2. Education - demonstrate research and management techniques, show examples of how wetlands are managed (determine success, interaction with visitors, number of visitors, visitor feedback)
3. Waterfowl hunting opportunity (number fishing permits issued, review hunter reports)

4. Research opportunity - conduct research that meets the U.S. Department of the Interior priority topics, i.e., effects of management, invasives, non-target species, etc. (number of projects)
5. Waterbird habitat (waterfowl, shorebirds, waders, and raptor surveys)
6. Amphibian/reptile/fish/invertebrate habitat
7. Wildlife observation and photography
8. Water quality, sediment control - minimize contaminant issues as related to the biological integrity and diversity and environmental health policy (BIDEH)
9. Climate change concerns, connectivity
10. Historical preservation
11. Minimize forest fragmentation (BIDEH)
12. Minimize resident Canada goose population (BIDEH)
13. Minimize beaver problems
14. Flood control
15. Maintain/maximize native wetland plant communities. (BIDEH)
16. Human access
17. Management costs/efficiency
18. Breeding habitat for marshbirds
19. Restoration of bottomland floodplain forest. (BIDEH)
20. Restore natural hydrology (BIDEH)
21. Mitigation

Figure G-1. Initial Objectives Hierarchy



Subsequent to identifying the initial list of 21 wetland objectives, each individual objective was critically evaluated as to whether it was a:

1. Critical Objective – Actions related to this objective are sufficiently important that management of impoundments may be altered in order to achieve the objective.

2. Correlated Objective – Actions related to this objective may also achieve another objective. Combine these objectives into one.

3. Null Objective – Actions related to this objective are of equal value to all the alternatives. If the objective was equal at all wetlands, then it did not need to be considered within the decision process.

4. Constraint - Is the objective actually a constraint? If the action has equal impact to the management of all wetlands and limits the alternatives, it is a constraint and is not used in this aspect of the decision process.

Extensive discussion occurred for each of the means objectives. As a result, the initial list of 21 objectives was reduced to 6 final objectives that influence refuge wetland management decisions. The following objectives fell into the above categories, and were therefore removed from the wetland decision-making process. The bullets below provide a summary of the discussion which led to dropping them from the final objectives hierarchy.

- Minimize Beaver Problems, Minimize Resident Canada Goose and Invasive Species – These were found to be impediments that require strategies to correct, rather than objectives of wetland management.

- Water Quality, Sediment, and Contaminants - Water quality is very important in meeting refuge objectives, as well as, larger landscape environmental quality concerns. While the refuge's impoundments seem small in size, if converted to forest, their filtering and buffering effect may serve a significant role due to their location. While the wetlands may have a benefit to landscape water quality, that of a riparian or forested habitat may have an even greater benefit to water quality. It is not likely that water quality at the larger landscape would be impaired if some of the refuges wetlands were eliminated. The potential for contaminants within bottom sediment would be examined to ensure that they would not be flushed into the river system.

Additionally, three of the initially identified fundamental objectives (public use, research and administration) were determined to not directly enter into the decisions regarding the management of refuge wetlands for biological resources.

- Public Use and Research are not drivers of wetland management decisions, but rather are dependent upon achieving wetland resource objectives. For example, targeted research is conducted to understand uncertain outcomes of management

decisions. Appropriate Public Use is a secondary decision and is determined after wetland management decisions are made.

- Administrative concerns were discussed and identified as important constraints that need to be considered for each wetland, after initial resource management decisions have been made.

4. Measuring Objectives

Five final means objectives were selected to continue with the decision process. Below, each objective has a short justification for including it along with the metrics that were identified to evaluate each wetland with.

1. **Breeding Forest Landbirds**
   A large portion of the refuge is comprised of floodplain forest that benefits a variety of breeding forest landbirds. Through the refuge's habitat management planning process it was determined that the refuge can make a significant contribution to this group of birds. It was also identified that many of the refuge's artificial wetlands are contributing to forest fragmentation that adversely impacts this group of birds.

   a. Level of fragmentation

2. **Waterbirds**
   During recent years wetland management practices have been undertaken to study habitat for waterbird groups such as shorebirds and wading birds. Due to the large number and variety of artificial wetlands found at the refuge, it is felt that some of these wetlands can provide valuable habitat to wetland dependent wildlife.

   a. Number of individuals using wetlands
   b. Species richness using wetlands (amphibians, reptiles, etc.)

3. **Fish Populations**
   Fish populations on the refuge provide opportunities for public fishing and food for other animals including wading birds. Healthy fish populations contribute to the natural systems on the refuge. Not all of the impoundments support fish populations.

   a. Wetland size
   b. Depth
   c. Hydrology
   d. Connectivity

4. **Odonata**
   Patuxent Research Refuge has been identified as being very important for a large number of odonata (dragonflies and damselflies). Richard Orr, a local

entomologist, has been monitoring odonata at the refuge for a number of years. Presently 105 species have been identified to use refuge wetlands, with many of these being very rare S1 or S2 species, some of which are found nowhere else within the State of Maryland. Odonata were added to the objectives hierarchy.

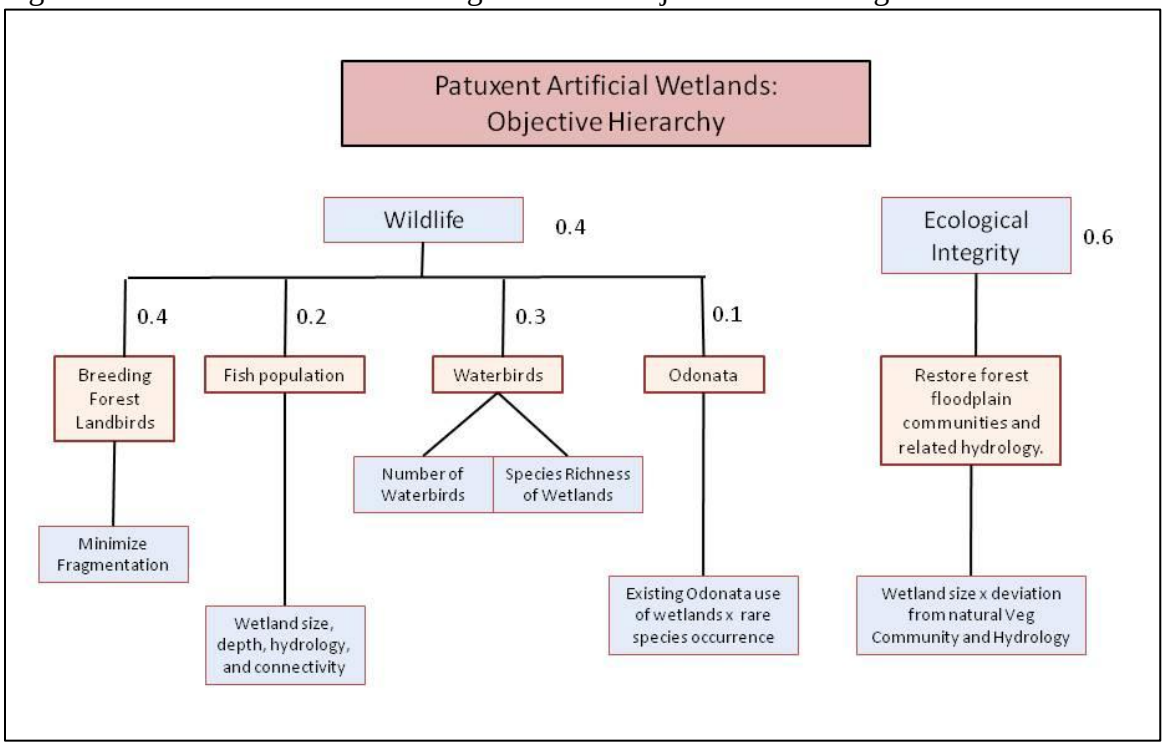
a. Existing odonata use of wetlands
b. Rare species occurrences

5. **Ecological Integrity**
The refuge identified restoration of ecological integrity as an important objective that allows the refuge to achieve its natural intrinsic value to wildlife resources. The objective is to improve the refuge's contribution toward landscape ecological integrity. Ecological integrity was defined as allowing natural processes that shape ecosystems to occur, along with provision of the biological communities that would historically be found within a site.

a. Wetland size
b. Deviation from natural vegetation community
c. Hydrology

Each objective was weighted to determine relative importance (figure G-2.) Objective weights are critical to the analysis process when determining various management alternatives for each wetland, and which objective should be prioritized, given that all objectives cannot be met within any given wetland.

Figure G-2. Patuxent Research Refuge Wetland Objectives and Weights



5. Evaluation Measures for the Objectives

For each of the objectives there needs to be a way to measure and determine success in meeting that objective. Each of the five final objectives was evaluated and metrics identified to determine how well each artificial wetland may contribute toward the respective objective. Workshop participants developed evaluation measures for each objective.

1. **Breeding Forest Landbirds**
   To determine the extent each wetland contributes toward forest fragmentation, the GIS program Fragstats was used. Each wetland was compared to surrounding vegetation communities, and an overall score was determined as to the wetlands contribution to refugewide fragmentation.

   Fragstats was developed to describe landscape level characteristics. For this exercise, we examined the level of fragmentation caused by the impoundments. It assigned a numerical value to the fragmentation from each impoundment, based upon characteristics such as size and adjacent habitat.

2. **Waterbirds**
   Existing contribution of each refuge artificial wetland was evaluated using refuge waterbird survey data. Wetlands were scored on numbers of waterbirds using each wetland, as well as, number of individual species that annually use each wetland.

   a. Numbers of Waterbirds: Refuge staff surveyed waterbird use of wetlands from 1996 to 2009. For each year, the maximum number of waterbirds counted during any single survey was determined. This maximum number for each year was averaged across all years. The average number of maximum bird use per wetland was identified as the contribution of each individual wetland towards waterbird use.

      To project waterbird use given different management scenarios within each wetland, the same data were analyzed for wetlands where the following management regimes were undertaken during different years; water level drawdowns, static annual water regime, and green-tree reservoir management. For those wetlands where no data were available, we projected waterbird use given possible management regimes and wetland acreage.

   b. Wetland waterbird species richness: It was identified that wetlands with greater numbers of species using the wetland provide more varied habitat and a greater contribution toward the waterbird community. Waterbird species richness was calculated as the maximum number of individual species that used each wetland during a year. Maximum number of species using a wetland was then averaged across years from 1996 to 2009. Projections of waterbird species richness under different management

alternatives were made similar to the above maximum number of waterbird use of a wetland.

3. Fish Populations

The refuge had little information or data on fish populations using the various wetlands. As a result, we projected fish population values of each wetland using the following formula:

Fish Pop Value = ((S + D + C) * H))

S= Wetland Size
- 1= <2acres
- 2= 2-10acres
- 3= >10 acres

D= Wetland Depth
- 1= <5ft
- 2=>5ft

C=Connectivity
- 1=isolated wetland
- 2=wetland connected to other wetlands, water bodies via stream.

H= Hydrology
- 0= temporary wetland, dries-up during summer
- 1= dries up only during severe drought
- 2= can maintain static water level throughout year

Wetlands that are periodically subjected to drought and isolated from other wetlands were automatically given a fish population score of 0. Whereas wetlands that periodically are subjected to drought, but are connected to other wetlands were scored using the above formula.

4. Odonata

To rank refuge wetland value to odonata, Richard Orr tabulated his historical data and provided each wetland a score from low to high as to odonata diversity with the wetland. He also identified lists of rare S1 or S2 species if they occurred within a wetland. Thus, the following was used to develop an odonata value for each wetland:

Each wetland was given a score of low, medium, high, as to its value to odonata diversity.
- Low = 1
- Med = 2
- High= 3

If S1 or S2 odonata were found within a wetland, the score was multiplied by the number of S1/S2 species found within the wetland.

Odonata life cycles generally require permanent water regimes, whereas refuge wetlands are periodically managed with a dynamic water regime of conducting drawdowns. During these drawdowns the majority of water is drained, however small pools will remain within the wetland. Thus, odonata value of a wetland under dynamic water regime was projected to be 75 percent of its static water regime value. Wetlands which may be restored to a natural floodplain hydrology were projected to have no value for odonata.

5. Ecological Integrity

The refuge identified restoration of ecological integrity as an important objective that allows the refuge to achieve its natural intrinsic value to wildlife resources. Ecological integrity was defined as allowing natural processes that shape ecosystems to occur, along with provision of the biological communities that should normally be found within a site.

The objective is to improve the refuge's contribution toward landscape ecological integrity. To achieve greater ecological integrity of the refuge landscape each artificial wetland was evaluated as to its deviation from a natural hydrological regime and vegetation communities that are not a part of the North Atlantic Coastal Plain Stream and River Ecological System (CES 203.070).

Formula to calculate a wetland's contribution toward ecological integrity under different management scenarios:

Integrity Score = Wetland size category x Integrity value

Size Categories:

1 = 1-2 acres
2 = 2-10 acres
3 = 10-20 acres
4 = >20 acres

Integrity values:

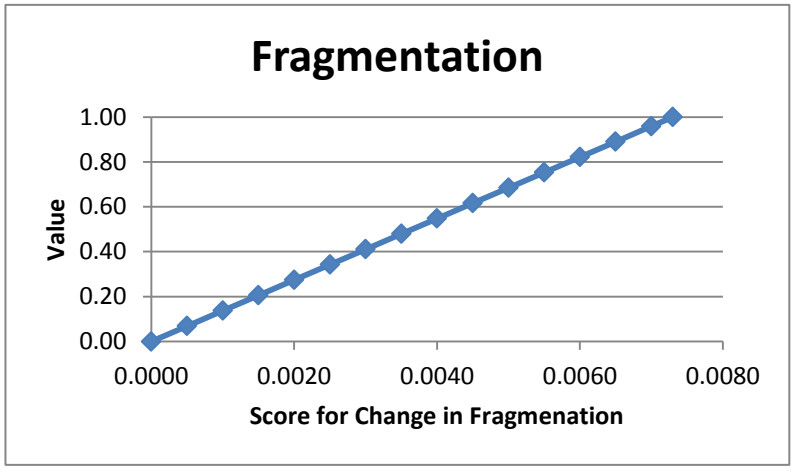
Value	Integrity Value Description
0	Wetland managed with static water regime and altered vegetation community that is not associated with the ecological system.
1	Wetland managed with modified hydrology (dynamic water levels within impoundments) and altered vegetation community that is not associated with the ecological system.
2	Wetland managed with modified hydrology and vegetation community that is part of the ecological system.
3	Wetland restored to natural occurring hydrology and vegetation community that is part of the ecological system.

6. Value Functions for Objectives

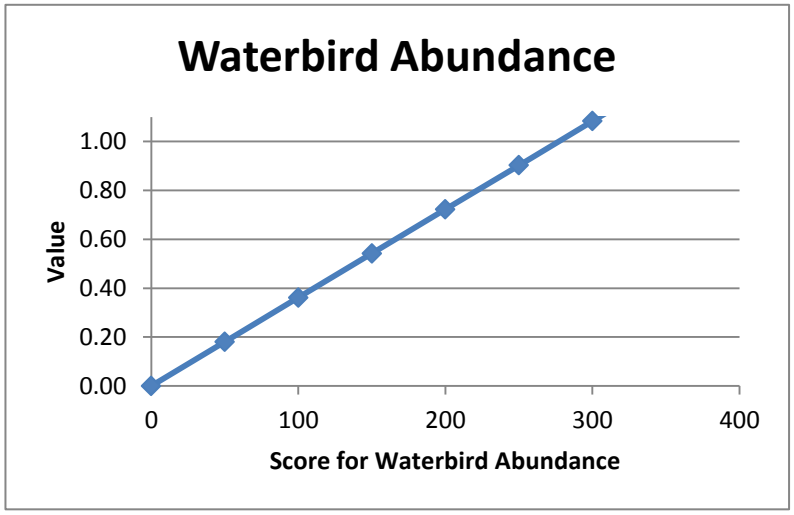
For this decision, we have five objectives we are trying to achieve for each wetland. This is therefore called a multiobjective analysis. To conduct a multiobjective analysis, is it necessary to determine a value function, which combines the evaluation measures of the five objectives into a single measure of the overall value of each of the alternatives for a wetland.

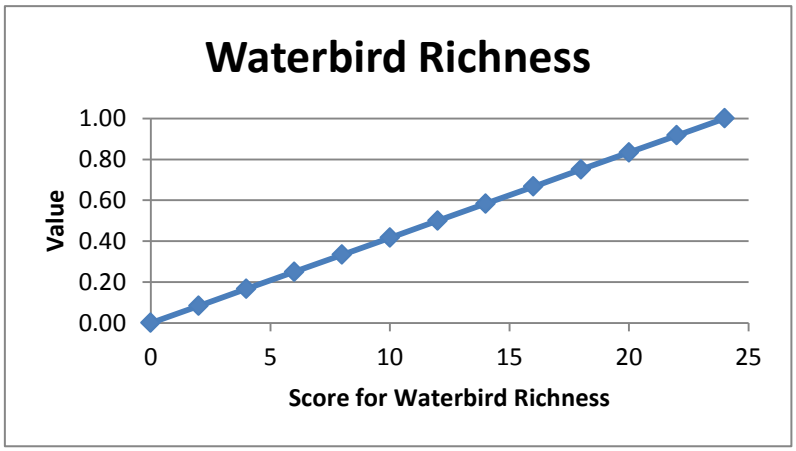
Each objective has a unique evaluation measure, a unique score. For instance, integrity is a combination of wetland size (1 to 4) and an integrity value (1 to 3), while waterbird use is the averaged maximum number of waterbirds surveyed over a 14-year period (0 to 350). The objective scores need to be transformed into a common scale that can equally represent how 'good' or 'poor' an alternative is in relation to another alternative. To do this, a value function is determined for each objective. Value functions are a scale of 0 to 1, where 0 is the least-preferred objective score and 1 is the most-preferred objective score.

1. **Breeding Forest Landbirds**

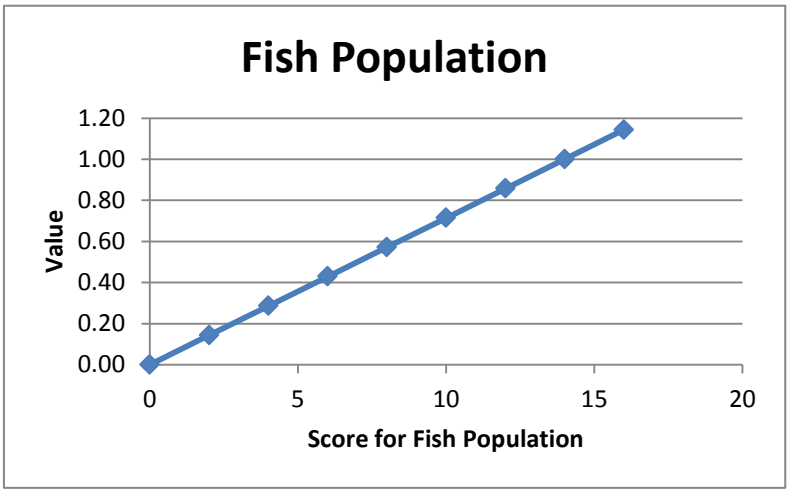


2. **Waterbirds**

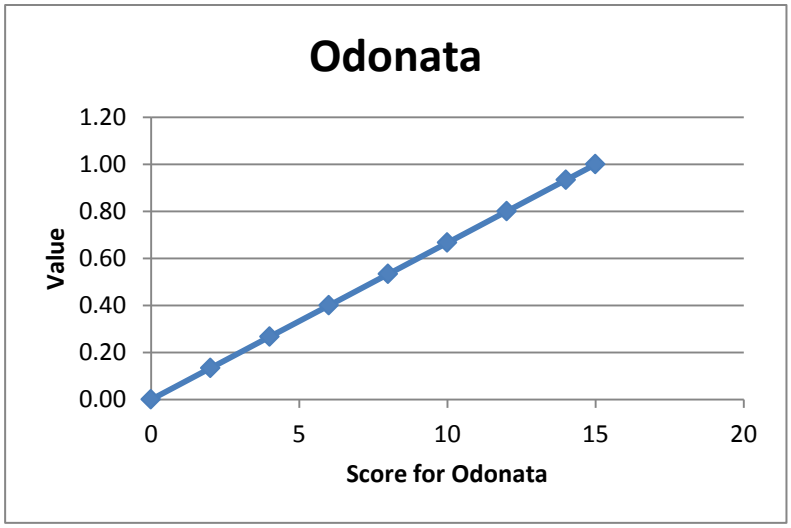




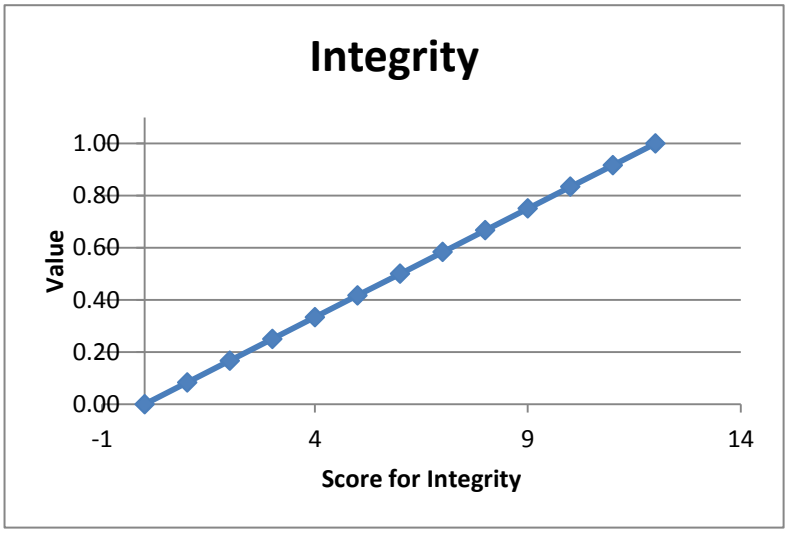
3. Fish



4. Odonata



5. **Ecological Integrity**



7. Management Alternatives

The structured decision-making workshop was oriented toward developing a decision process that will allow the refuge to determine the best management options for each artificial wetland. Workshop participants discussed possible alternative management actions relative to current management and developed the following list:

1. **Restore wetland back to natural habitat.**
   This could include any of the following:
   a. Remove water control structure
   b. Remove dike
   c. Install culverts or water control structure
   d. Restore natural hydrology
   e. Revegetate with native plants
   f. Control invasives
   g. Fill wetland and restore back to natural topography

2. **Manage wetland as a "wetland."**
   Wetlands are sometimes dry and sometimes wet. This alternative will provide shallow wetlands conducive to waterbirds, amphibians, etc.
   1. Dynamic water levels
   2. Control invasives
   3. Combine impoundments to create larger unit

3. **Manage for static water levels.**
   This meets the fishing and other public use objectives.

4. **Convert to green-tree reservoir.**
   This is a hybrid between alternative 1 and 2. It will move the refuge toward BIDEH by restoring forested wetlands. But also provide for the needs of waterfowl and amphibians, by being able to manipulate hydrology during the annual cycle.

5. **No active management.**

The above management alternatives were used in the consequence table in the "Management Actions" column. They are used to list the different potential management scenarios for a particular artificial wetland. For each individual wetland, feasible alternative management strategies were discussed. Refuge staff only identified alternative management scenarios that could feasibly be accomplished within any particular wetland. In some instances, constraints on what was feasible within a wetland resulted in a "no management option" and thus the wetland was eliminated from the decision process. In other situations, only one or two management alternatives were feasible, while some wetlands had a wide variety of alternatives.

The cost of implementing each management alternative within a wetland was also determined.

8. Costs

Along with determining the management option with the highest management benefit for Patuxent Research Refuge impoundments, it was necessary to balance this against the costs in order to determine the optimum option (portfolio) that was also fiscally achievable. With this in mind, a relatively generic, high level cost estimate was developed for each management alternative by attributing actions to each alternative and assigning applicable unit costs per action.

9. Putting it all Together – The Analysis

Overview

A multi-objective decision analysis was conducted for 33 artificial wetlands to select a portfolio of management actions which result in the highest management benefit given funding constraints. To do this, the anticipated response from management actions for each of the wetlands was scored based on five objectives. The scores were combined into one overall management benefit rating by converting objective scores into value functions and applying objective weights. Using the management benefit rating along with start up and annual costs, a portfolio of management actions was generated by the Excel analysis tool solver. One management action alternative was selected for each wetland resulting in a portfolio where the combined management actions provide the highest management benefit for the refuge.

The Steps

1. **Determine Wetlands for the Decision Analysis**
   There are 59 wetland units on Patuxent Research Refuge. Not all of the wetlands were suited for this decision process due to lack of control, no reasonable management alternatives, etc. Thirty-three wetlands were selected for the decision analysis.

PONDS OF PATUXENT RESEARCH REFUGE Removed from SDM JANUARY 2011					COMMENTS
Note: **Y** = Man made with some water level control					
X = Natural/beaver affected or man made gravel pit with no water control structuers					
Y	North Tract	Blue Heron Pond	9.46		Mitigation pond
X	North Tract	Dragonfly Pond		0.85	Old clay pit; no mgmt. capabilities
Y	North Tract	Lake Allen	22.77		Fishing area
Y	North Tract	Merganser Pond	2.01		Mitigation pond
X	North Tract	Midway Branch Marsh		1.72	Fish ladder on east side of rd; no WCS but i
Y	North Tract	New Marsh		10.51	Fishing area; old ox bow; no working WCS
Y	North Tract	Bailey Bridge ~~Pond~~ Marsh	1.90		Maybe replace culvert to working condition
X	North Tract	Bullfrog Pond		5.29	Possibly a gravel pit; leaving on list b/c may
Y	North Tract	Cattail ~~Marsh~~ Pond	2.38		Used for fishing; formerly used for dog trainir
X	North Tract	Gravel Pit Pond		0.43	Just as the name says....
X	North Tract	Kingfisher Pond		4.41	Same as Bullfrog Pond
X	North Tract	New Swamp		5.62	Nothing can be done with this area
X	North Tract	Powerline Swamp		3.90	Culvert but no WCS; Impounded by rd; goe

2. **Determine Wetland Management Objectives**
   As discussed in section 3, the five wetland objectives are: breeding forest landbirds, waterbird use and richness, fish, odonata, and ecological integrity.

3. **Determine What to Measure for the Objectives**
   As discussed in section 4:

Objective	Measurement
Breeding Forest Landbirds	Level of Fragmentation
Waterbird Use	# of Individuals
Waterbird Richness	Species Richness
Fish	Wetland Size, Depth, Hydrology, Connectivity
Odonata	# of Species, Rare Species Occurrences
Ecological Integrity	Wetland Size, Deviation from Natural Communities, Hydrology

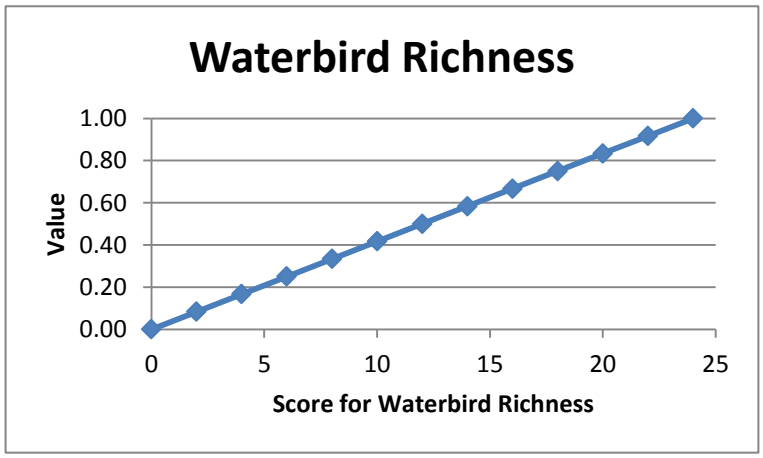
4. **Develop Evaluation Measures for the Objectives**
   As discussed in section 5:

Objective	Measurement	Evaluation Measure
Breeding Forest Landbirds	Level of fragmentation	FRAGSTAT results
Waterbird Use	# of individuals	Avg. # of birds (1996-2009)
Waterbird Richness	Species richness	Avg. max.. waterbird species (1996-2009)
Fish	Fish pop. value = *((S + D + C) * H))*	
	Wetland size (S)	1=<2acres; 2 = 2to10a; 3 = >10a

Objective	Measurement	Evaluation Measure
	Depth (D)	1 = < 5 ft.; 2 = > 5 ft.
	Connectivity (C)	1 = isolated; 1 = connected
	Hydrology (H)	0 = temporary; 1 = dries in drought; 3 = maintains static water level
Odonata	Odonata score = *species category* X *# of S1/S2*	
	# of species (categories)	low = 1; med = 2; high = 3
	Rare species occurrences	# of S1/S2 species that occur in the wetland
Ecological Integrity	Integrity score = *wetland size* X *integrity value*	
	Wetland size	1 = 1-2acres; 2 = 2-10a; 3 = 10-20a; 4 = > 20a
	Deviation from natural communities	Integrity value = 0–3 based on the descriptions with a range of ecological system and hydrologic conditions
	Hydrology	Used to determine integrity value

5. Develop Value Functions for the Objectives

As discussed in section 6, the value function for waterbird richness:



6. Develop Management Alternatives

Alternatives	Techniques
Restore wetland back to natural habitat	Remove water control structure
	Remove dike
	Install culverts or water control structure
	Restore natural topography
	Revegetate with native plants
	Control invasives
	Fill wetland and restore back to natural topography

Alternatives	Techniques
Manage wetland as a “wetland”	Dynamic water levels
	Control invasives
	Combine impoundments to create larger unit
Manage for static water levels	Maintain water control structure
	Keep water levels constant throughout the year
Convert to green-tree reservoir	Maintain water control structure
	Revegetate with water tolerant tree species
	Dynamic water levels
No active management	No water control structure in place
	Water levels dependent upon natural precipitation

Each wetland was reviewed and given two or more management alternatives:

Wetland	Mgmt Action
Millrace Pond	1.Manage wetland as a "wetland" (static water) tree removal, clean culverts, beaver mgmt.
Millrace Pond	2.Restore wetland back to natural hydrology. Install bottomless pipe arch culverts
Millrace Pond	3.Manage wetland as "wetland" (repair road to function as a dike & remove culverts, install agr
Millrace Pond	4.Convert to green-tree reservoir. (repair road to function as dike, install agridrain to manage
Millrace Pond	5.Convert to green-tree reservoir (repair road to function as dike, install agridrain to manage wa
Dragonfly Pond	1.No action.
Dragonfly Pond	2.Restore to natural topography, (fill gravel pit)
Salamander Pond	1.No action.
Salamander Pond	2.Restore to natural topography, (Fill)
Wood Duck Pond	1.Manage wetland as a "wetland" (static water) and do nothing,
Wood Duck Pond	2.Restore wetland back to natural hydrology. Install bottomless pipe arch culverts
Wood Duck Pond	3.Remove Center Dike & install 1 agridrain at NE corner
Bluegill Pond	1.Restore wetland back to natural hydrology. (remove wcs and dike)
Bluegill Pond	2.No active management
Bluegill Pond	3.Manage wetland as a "wetland" (dynamic water levels)

7. **Calculate Scores for the Alternatives**
   Using the evaluation measures, scores were calculated for each of the management alternatives for a wetland. Calculating the scores was time consuming, not only due to the number of alternatives and complexity of some of the formulas, but also because estimates needed to be made for conditions that don’t currently exist. Whenever possible, data from known conditions was applied to estimate similar future conditions.

SCORES (APPLES AND ORANGES)

Wetland	Mgmt Action	Integrity	WB Abund	WB Rich	Odonata	Fish	Frag	FragDiff
Millrace Pond	1.Manage wetland as a "wetland" (static water) tree removal, clean culverts, beaver mgmt.	0	71	10	3	6	0.3146	0.0000
Millrace Pond	2.Restore wetland back to natural hydrology. Install bottomless pipe arch culverts	12	0	0	0	0	0.3073	0.0073
Millrace Pond	3.Manage wetland as "wetland" (repair road to function as a dike & remove culverts, install agric	4	64	11	2.25	6	0.3146	0.0000
Millrace Pond	4.Convert to green-tree reservoir. (repair road to function as dike, install agridrain to manage wa	8	165	7	0	0	0.3073	0.0073
Millrace Pond	5.Convert to green-tree reservoir (repair road to function as dike, install agridrain to manage wat	8	165	7	0	0	0.3073	0.0073
Dragonfly Pond	1.No action.	0	17	6	1.01	0	0.3146	0.0000
Dragonfly Pond	2.Restore to natural topography, (fill gravel pit)	3	0	0	0	0	0.3145	0.0001
Salamander Pond	1.No action.	0	3	3	1.01	0	0.3146	0.0000
Salamander Pond	2.Restore to natural topography, (Fill)	3	0	0	0	0	0.3143	0.0003
Wood Duck Pond	1.Manage wetland as a "wetland" (static water) and do nothing,	0	46	11	1	0	0.3146	0.0000
Wood Duck Pond	2.Restore wetland back to natural hydrology. Install bottomless pipe arch culverts	0	0	0	0	0	0.3129	0.0017
Wood Duck Pond	3.Remove Center Dike & install 1 agridrain at NE corner	0	0	0	0	0	0.3129	0.0017

8. Calculate Weighted Values for Alternatives

In this step, the objective scores are transformed into comparable scales by using the value functions. This is also where the objective weights are used. Ecological Integrity was given a weight of .6 and Wildlife .4 (weights needs to sum to 1.0). There are five wildlife objectives, and each of these are given a weight based on the overall Wildlife weight of .4 and the weights that were assigned to them in the objectives hierarchy. The table below shows the breakdown of the weights, the bottom row shows the weights that were used in the calculations.

Wildlife					**Ecological Integrity**	
.4					.6	= 1
Waterbird Abundance	Waterbird Richness	Odonata	Fish	Fragmentation		
.3		.1	.2	.4		= 1
.06	.06	.04	.08	.16	.6	= 1

Using the calculation features of Excel, a formula is developed to apply the value functions and weights resulting in the table below. Note that the objectives are now on a scale of 0 to 1.

9. Calculate Management Benefit

WEIGHTED VALUES (ALL APPLES)

Wetland	Mgmt Action	Integrity	WB Abund	WB Rich	Odonata	Fish	FragDiff
Millrace Pond	1.Manage wetland as a "wetland" (static water) tree removal, clean culverts, bea	0.000	0.015	0.025	0.008	0.034	0.000
Millrace Pond	2.Restore wetland back to natural hydrology. Install bottomless pipe arch culver	0.600	0.000	0.000	0.000	0.000	0.160
Millrace Pond	3.Manage wetland as "wetland" (repair road to function as a dike & remove culve	0.200	0.014	0.028	0.006	0.034	0.000
Millrace Pond	4.Convert to green-tree reservoir. (repair road to function as dike, install agridrai	0.400	0.036	0.018	0.000	0.000	0.160
Millrace Pond	5.Convert to green-tree reservoir (repair road to function as dike, install agridrair	0.400	0.036	0.018	0.000	0.000	0.160
Dragonfly Pond	1.No action.	0.000	0.004	0.015	0.003	0.000	0.000
Dragonfly Pond	2.Restore to natural topography, (fill gravel pit)	0.150	0.000	0.000	0.000	0.000	0.002
Salamander Pond	1.No action.	0.000	0.001	0.008	0.003	0.000	0.000
Salamander Pond	2.Restore to natural topography, (Fill)	0.150	0.000	0.000	0.000	0.000	0.007
Wood Duck Pond	1.Manage wetland as a "wetland" (static water) and do nothing,	0.000	0.010	0.028	0.003	0.000	0.000
Wood Duck Pond	2.Restore wetland back to natural hydrology. Install bottomless pipe arch culvert	0.000	0.000	0.000	0.000	0.000	0.037
Wood Duck Pond	3.Remove Center Dike & install 1 agridrain at NE corner	0.000	0.000	0.000	0.000	0.000	0.037
Bluegill Pond	1.Restore wetland back to natural hydrology. (remove wcs and dike)	0.150	0.000	0.000	0.000	0.000	0.007
Bluegill Pond	2.No active management	0.000	0.002	0.013	0.005	0.000	0.000
Bluegill Pond	3.Manage wetland as a "wetland" (dynamic water levels)	[illegible]	0.002	0.013	0.003	[illegible]	[illegible]

Each objective contribution for a management alternative is summed across rows to determine the management benefit of a selected wetland and management alternative.

WEIGHTED VALUES (ALL APPLES)								
Wetland	Mgmt Action	Integrity	WB Abund	WB Rich	Odonata	Fish	FragDiff	Management Benefit
Millrace Pond	1.Manage wetland as a "wetland" (static water) tree removal, clean culverts, bea	0.000	0.015	0.025	0.008	0.034	0.000	0.083
Millrace Pond	2.Restore wetland back to natural hydrology. Install bottomless pipe arch culver	0.600	0.000	0.000	0.000	0.000	0.160	0.760
Millrace Pond	3.Manage wetland as "wetland" (repair road to function as a dike & remove culv	0.200	0.014	0.028	0.006	0.034	0.000	0.282
Millrace Pond	4.Convert to green-tree reservoir. (repair road to function as dike, install agridrai	0.400	0.036	0.018	0.000	0.000	0.160	0.613
Millrace Pond	5.Convert to green-tree reservoir (repair road to function as dike, install agridrair	0.400	0.036	0.018	0.000	0.000	0.160	0.613
Dragonfly Pond	1.No action.	0.000	0.004	0.015	0.003	0.000	0.000	0.021
Dragonfly Pond	2.Restore to natural topography, (fill gravel pit)	0.150	0.000	0.000	0.000	0.000	0.002	0.152
Salamander Pond	1.No action.	0.000	0.001	0.008	0.003	0.000	0.000	0.011
Salamander Pond	2.Restore to natural topography, (Fill)	0.150	0.000	0.000	0.000	0.000	0.007	0.157
Wood Duck Pond	1.Manage wetland as a "wetland" (static water) and do nothing,	0.000	0.010	0.028	0.003	0.000	0.000	0.040
Wood Duck Pond	2.Restore wetland back to natural hydrology. Install bottomless pipe arch culvert	0.000	0.000	0.000	0.000	0.000	0.037	0.037
Wood Duck Pond	3.Remove Center Dike & install 1 agridrain at NE corner	0.000	0.000	0.000	0.000	0.000	0.037	0.037
Bluegill Pond	1.Restore wetland back to natural hydrology. (remove wcs and dike)	0.150	0.000	0.000	0.000	0.000	0.007	0.157
Bluegill Pond	2.No active management	0.000	0.002	0.013	0.005	0.000	0.000	0.019
Bluegill Pond	3.Manage wetland as a "wetland" (dynamic water levels)	[illegible]	[illegible]	[illegible]	0.003	[illegible]	[illegible]	[illegible]

10. Calculate Costs

Each management alternative for each impoundment was assigned a cost estimate based on the individual actions attributed to each alternative. An initial construction estimate as well as an annual maintenance estimate was determined for each alternative. The costing model assumes that any initial construction work is performed in the first year and the maintenance cost applies to all 15 years of the decision timeframe. Cost figures were based on industry standard published databases such as RS Means or the Maryland State Highway Administration quarterly reports. Quantities were determined using known data if available and if not available, take-offs from aerial photography was used.

Wetland	Acres	WCS	Mgmt Actions	Upfront Cost	Maintenance Cost, per year
Millrace Pond	50.83	N	1.Manage wetland as a "wetland" (Static Water) tree removal, clean culverts, beaver mgmt.	$ -	$ 2,565.00
	50.83	N	2.Restore wetland back to natural habitat. Remove Dike	$ 274,500.00	$ -
	50.83	N	3.Restore wetland back to natural habitat.	$ -	$ -
	50.83	N	4.Manage wetland as a "wetland" (dynamic water levels), install WCS, repair dike.	$ 5,000.00	$ 1,365.00
	50.83	N	5.Convert to green-tree reservoir (allow trees to establish)	$ 5,000.00	$ 1,365.00
	50.83	N	6.Convert to green-tree reservoir. (plant trees)	$ 467,807.15	$ 1,365.00
Dragonfly Pond	0.85	N	1.No action.	$ -	$ 500.00
	0.85	N	2.Restore to natural topography, (fill gravel pit)	$ 110,000.00	$ -
	0.85	N	3.Restore to natural topography & convert to green tree reservoir (plant trees)	$ 117,739.25	$ -
Bailey Bridge Marsh	1.90	Y	1.No action.	$ -	$ 500.00
			2.Restore to natural topography,		

11. Conduct Benefit/Cost Analysis

An optimization procedure is then used, with constraints of capital and annual maintenance costs, to select the optimum portfolio of management alternatives for all wetlands to maximize refuge contribution toward wetland objectives. The portfolio of management alternatives is the list of all wetlands, with the recommended management action for each. The management action alternative with a 1 in the "Portfolio" column is the selected alternative for that wetland.

Optimization

Wetland	Mgmt Action	Porfolio	Mgmt Benefit	Startup $	Annual $ (15 yr)
Millrace Pond	1.Manage wetland as a "wetland" (static water) tree removal, clean culverts, bea	0	0.083	$0	$56,500
Millrace Pond	2.Restore wetland back to natural hydrology. Install bottomless pipe arch culver	1	0.760	$42,000	$54,000
Millrace Pond	3.Manage wetland as "wetland" (repair road to function as a dike & remove culve	0	0.282	$15,000	$20,500
Millrace Pond	4.Convert to green-tree reservoir. (repair road to function as dike, install agridra	0	0.613	$15,000	$20,500
Millrace Pond	5.Convert to green-tree reservoir (repair road to function as dike, install agridrair	0	0.613	$477,807	$20,500
Dragonfly Pond	1.No action.	0	0.021	$0	$0
Dragonfly Pond	2.Restore to natural topography, (fill gravel pit)	1	0.152	$110,000	$0
Salamander Pond	1.No action.	1	0.011	$0	$0
Salamander Pond	2.Restore to natural topography, (Fill)	0	0.157	$326,000	$0
Wood Duck Pond	1.Manage wetland as a "wetland" (static water) and do nothing,	1	0.040	$0	$20,500
Wood Duck Pond	2.Restore wetland back to natural hydrology. Install bottomless pipe arch culvert	0	0.037	$70,000	$90,000
Wood Duck Pond	3.Remove Center Dike & install 1 agridrain at NE corner	0	0.037	$91,995	$20,500
Bluegill Pond	1.Restore wetland back to natural hydrology. (remove wcs and dike)	1	0.157	$7,150	$0
Bluegill Pond	2.No active management	0	0.019	$0	$0
Bluegill Pond	3.Manage wetland as a "wetland" (dynamic water levels)	0	0.111	$3,000	$18,800
Clay Pit Pool (Basin)	1.No action.	1	0.059	$0	$0
Clay Pit Pool (Basin)	2.Restore to natural topography, (fill gravel pit)	0	0.152	$130,000	$0

12. Resulting Portfolio

Wetland	Management Action
Millrace Pond	Restore wetland back to natural hydrology. Install bottomless pipe arch culverts
Dragonfly Pond	Restore to natural topography, (fill gravel pit)
Salamander Pond	No action
Wood Duck Pond	Manage wetland as a "wetland" (static water) and do nothing,
Bluegill Pond	Restore wetland back to natural hydrology (remove water control structure and dike)
Clay Pit Pool (Basin)	No action
Duvall Pond 1	Restore wetland back to natural hydrology (remove dike)
Duvall Pond 2	Convert to green-tree reservoir (install agridrain, manage water levels & allow trees to establish)
Hance Pond 1	Convert to green-tree reservoir (use water control structure to manage water levels and allow trees to establish)
Hance Pond 2	Convert to green-tree reservoir (use water control structure to manage water levels and allow trees to establish)

Wetland	Management Action
Hobbs Pond	Convert to green-tree reservoir (install agridrain, manage water levels and allow trees to establish)
Knowles Marsh 1	Convert to green-tree reservoir (install agridrain, manage water levels and allow trees to establish)
Knowles Marsh 2	Convert to green-tree reservoir (install agridrain, manage water levels and allow trees to establish)
Knowles Marsh 3	Convert to green-tree reservoir (install agridrain, manage water levels and allow trees to establish)
Mallard	Restore wetland back to natural hydrology (install bottomless pipe arch culvert)
Patuxent Marsh	Manage as a green-tree reservoir
Schafer Farm Ponds	No action, maintain as is
Schafer Lake	No action, maintain as is
Snowden Pond	Convert to green-tree reservoir (install agridrain, manage water levels and allow trees to establish)
Sundew Pond	No action
Uhler Marsh 1	Convert to green-tree reservoir (install agridrain, manage water levels and allow trees to establish)
Uhler Marsh 2	Restore wetland back to natural hydrology (install bottomless pipe arch culvert)
Old Gravel Pit Pond	No action
Borrow Pit Ponds	Restore to natural topography (reset culverts, increase size or number of culverts)
Fire Control Pond	Convert to green-tree reservoir (install agridrain, remove water control structure, manage water levels, and plant trees)
Goose Pond	Restore wetland back to natural hydrology (open water control structure permanently)
Harding Spring Pond	Manage wetland as a “wetland” (dynamic water levels)
Lake Redington	Restore wetland back to natural hydrology (open water control structure permanently and remove spillway)
Mabbott Pond	Restore wetland back to natural hydrology (open water control structure permanently)
Bullfrog Pond	No action
Gravel Pit Pond	Restore to natural topography (fill gravel pit)
Kingfisher Pond	No action
Telegraph Swamp	Manage wetland as a "wetland" (static water) and do nothing, except maintain dike

10. Use of SDM results in the CCP

Within the refuge CCP, there will be several alternatives for management of the refuge. It is recommended that under the no action management alternative, that the refuge identifies their current wetland management objectives and strategies. Within the preferred CCP alternative, the refuge can select the optimum portfolio of wetland management strategies to meet revised wetland objectives as identified within this SDM process. This optimum portfolio of management strategies will have a capital and annual management costs associated with it.

Appendix 1 – Workshop Participants

Name	Agency	Email
John R. Sauer	USGS	jrsauer@usgs.gov
Nell Baldacchino	USFWS – Patuxent NRR	nell_baldacchino@fws.gov
Bill Perry	USFWS – Planning	bill_perry@fws.gov
Steve Henry	USFWS – Great Swamp NWR	steven_s_henry@fws.gov
Jim Lyons	USFWS – Migratory Birds	james_lyons@fws.gov
Christopher Wicker	USFWS – Patuxent NRR	christopher_wicker@fws.gov
Peter Blank	USGS	pblank@usgs.gov
Jennifer Hill	USFWS – Patuxent NRR	jennifer_hill@fws.gov
Nancy McGarigal	USFWS – Planning	nancy_mcgarigal@fws.gov
John French	USGS	jbfrench@usgs.gov
Nancy Morrissey	USFWS – Patuxent NRR	nancy_morrissey@fws.gov
Brad Knudsen	USFWS – Patuxent NRR	brad_knudsen@fws.gov
Melainie Steinkamp	USFWS – Atlantic Joint Venture	melainie_steinkamp@fws.gov
Hal Laskowski	USFWS – Refuges	harold_laskowski@fws.gov

U.S. Fish & Wildlife Service
Patuxent Research Refuge
10901 Scarlet Tanger Loop, Laurel, MD 20708
(301) 437-5580
northeastplanning@fws.gov
http://www.fws.gov/northeast/patuxent/

Federal Relay Service
for the deaf and hard-of-hearing
1 800/877 8339

U.S. Fish & Wildlife Service
http://www.fws.gov

For Refuge Information
1 800/344 WILD

October 2012